DEVELOPMENT AND VALIDATION OF THE COMPOSITE CATASTROPHIZING MEASURE – SHORT FORM

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ABSTRACT

Pain-related cognitions play an important role in the pain experience. Several different pain cognitions are frequently assessed in both research and clinical evaluation. Among them, pain catastrophizing has been shown to be particularly predictive of a number of pain outcomes. The Pain Catastrophizing Scale (PCS) is the most widely used measure of pain catastrophizing and shows good reliability and validity. However, research suggests that catastrophizing may not be fully captured by the three scales comprising the PCS. The goal of this study was to develop and validate a new measure of pain catastrophizing. The new measure, The Composite Catastrophizing Measure – Short Form (CCM-SF), was developed from data collected on 73 items from the PCS and other related measures (N=220). These items were subjected to factor analyses and 14 were selected to represent two scales: pain preoccupation and pain worry. The new measure was administered to 223 undergraduate students prior to and after a cold pressor task (CPT) to assess both dispositional and situational pain cognitions. The CCM-SF showed good internal consistency for both the dispositional (α=.92) and situational (α=.91) administrations. Correlation analyses showed that both administrations of the CCM-SF were predictive of pain outcomes (pain intensity, unpleasantness, and tolerance) from the experimental pain task. Confirmatory factor analysis indicated that its factor structure remained consistent over time. Analyses also revealed that, when evaluated individually, the pain preoccupation subscale was a better predictor than the pain worry subscale of pain outcomes related to the CPT. It is hypothesized that the pain worry subscale will contribute more to the assessment of clinical pain samples than experimental pain samples. The CCM-SF seems to be psychometrically comparable to current gold standard measurements of pain catastrophizing. Beyond this, the CCM-SF offers unique subscales that allow for the versatile assessment of pain across domains

(e.g. experimental, chronic, and acute). Future research should explore the summative and subscale scores from the CCM-SF in clinical samples.

DEDICATION

This dissertation is dedicated to the people who supported me during the long days and even longer nights that were put into it. First, to my parents, who taught me the value of education, the importance of delayed gratification, and the ability to persevere through difficulties. Second, to my dear friend, Beth DiNapoli, who commiserated with me through it all. Finally, to my partner, Jesse McPherron, who picked up the slack when I could not.

LIST OF ABBREVIATIONS AND SYMBOLS

N	Number of participants in the sample
α	Cronbach's index of internal consistency
F	Fisher's F ratio: A ration of two variances
M	Mean: the sum of a set of measurements divided by the number of measurements in the set
SD	The average distance of the scores from the mean of the probability distribution
p	Probability associated with the occurrence under the null hypothesis of a value as extreme as or more extreme than the observed value
r	Pearson product-moment correlation
χ^2	Computed value of a χ^2 test
t	Computed value of a t test
$<$	Less than
$\leq$	Less than or equal to
$>$	Greater than
$\geq$	Greater than or equal to
$=$	Equal to

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INTRODUCTION

It is well documented that the way one thinks about and evaluates situations influences their experience (Beck, 1967; Beck, 1979; Lazarus & Folkman, 1984). Our thoughts and evaluations have been found to be uniquely influential with regard to health outcomes (Fisher, Thorpe, McEvoy-DeVellis, & DeVellis, 2007; Perlis & Lichstein, 2003; Smith, Perlis, Carmody, Smith, & Giles, 2001; Thorn, 2004). In many cases, cognitions are as influential in the perceptual experience as actual physical stimuli; this is particularly true in the case of pain. The way one thinks about pain is strongly associated with the way one perceives the experience of pain (Thorn, 2004). Indeed, negative pain-related cognitions have been found to be robust predictors of pain intensity, unpleasantness, tolerance, and disability (Sullivan, Bishop, & Pivik, 1995; Sullivan & D'Eon, 1990; Sullivan, Tripp, & Santor, 2000). Additionally, self-appraisal of one's ability to cope with a painful experience is associated with pain outcomes like tolerance, severity, and daily functioning (Jackson et al., 2005; Pence, Thorn, Day, & Shelby, 2011; Sanford, Kersh, Thorn, Rich, & Ward, 2002; Unruh & Ritchie, 1998). Pain-related thoughts have been examined in the form of pain appraisals, general emotional vulnerability, coping strategies, and pain catastrophizing. Of these, pain catastrophizing has garnered much attention due to its strong correlations with pain outcomes.

Despite agreement on the importance of thoughts and evaluations, there is debate in the literature about the best way to define catastrophizing (i.e. extreme negative thoughts and evaluations) and its particular components. Current definitions of catastrophizing do not provide specific criteria for how to distinguish catastrophizing from other forms of negative thinking

(e.g. depressive ideation, worry, anxiety, threat/loss appraisals, etc.). Even though catastrophizing has been established in the literature as being unique from depression and anxiety (Arnow et al., 2011; Noel, Francis, Williams-Outerbridge, & Fung, 2012), many of the measures traditionally used to assess pain catastrophizing contain items that seem to capture depressive ideation and anxiety. Given the lack of conceptual clarity in instruments that measure catastrophizing, the current project was an attempt to refine the characterization and measurement of catastrophizing by synthesizing existing measures of negative pain-related cognitions.

Catastrophizing

General, non-pain-specific, catastrophizing is one type of negative thinking that has been examined extensively in the literature. It is often described in terms of cognitions, appraisals, and coping styles (Beck, 1967; Sullivan et al., 1995; Lazarus & Folkman, 1984). However, there is wide variation in the way catastrophizing is conceived and, therefore, several definitions of catastrophizing exist. In general, catastrophizing refers to a cognitive pattern that fosters negative, pessimistic evaluations of a situation.

Early definitions, presented by Beck (1967), characterized catastrophizers as individuals with negative patterns of thinking who habitually generate potential worst case scenarios and exaggerate the likelihood and consequences of these types of outcomes. Such definitions suggest that catastrophizing can be considered a cognitive style of evaluation (i.e. appraisal) with a focus on worst case scenarios and evaluations of those catastrophic outcomes as likely to happen (Peterson, Seligman, Yurko, Martin, & Friedman, 1998). In regards to coping, this view of catastrophic thinking indicates a belief that one is unable to cope and reflects a lack of

confidence in one's ability to cope. This lack of confidence seems to be guided by the exaggerated negative evaluation of the possible outcomes and the exaggerated consequences of a failure to cope adaptively (Lazarus & Folkman, 1984).

Davey and Levy (1999) identified four factors contributing to the construct of catastrophizing: (1) doubt about problem solving ability, (2) belief of personal inadequacy, (3) helplessness belief, and (4) need to continually analyze a problem. Riskind and Williams (1999) characterized catastrophizers as feeling the potential for inevitable harm. These definitions also seem to suggest a pattern of negative focus and preoccupation with the situation. The current state of thinking regarding catastrophizing describes it as comprised of several psychological components including a generally negative cognitive style that places particular emphasis on pessimistic appraisals of the situation, the likelihood of worst case scenarios, and lack of confidence in one's ability to cope with those scenarios. However, while there seems to be a general theme of negativity in definitions of catastrophizing, researchers have not agreed upon one definition of the construct and it seems to be comprised of several unique components.

Definitions of pain-specific catastrophizing are similarly disparate. Catastrophizing about pain and painful events is a specific case of catastrophizing that can be best understood by considering it in parallel with the components of general catastrophizing. In the general catastrophizing literature there is a consistent focus on the components of worry, preoccupation, and imagining the worst-case scenario. Similar to general catastrophizing, pain catastrophizing occurs when one worries about pain, generates catastrophic potential outcomes to pain, and feels unable to cope with these outcomes. Pain catastrophizing has been defined as, "a negative pain-related cognition and can be considered to be an instantiation of the threat value of the pain" (p. 32; Crombez, Eccleston, Van den Broek, Van Doudenhove, & Goubert, 2002) and a "negative

mental set about anticipated or actual pain" (Sullivan et al., 2001). These broad definitions of the construct leave much room for debate as to what specifically makes up this "negative mental set."

Regardless of the definition, the importance of this negative evaluation of pain is clear. Pain catastrophizing has been linked to pain outcomes, accounting for 7-31% of variance in pain ratings (Sullivan et al., 2001). Further, the relationship between catastrophizing and pain outcomes has been well established in clinical and nonclinical populations, including those exposed to experimental pain tasks (Sullivan, Bishop, & Pivik, 1995; Sullivan & D'Eon, 1990; Sullivan, Tripp, & Santor, 2000). The effect of pain catastrophizing is not only linked to poor primary pain outcomes (e.g. intensity, unpleasantness, tolerance, disability, etc.) but also secondary pain-related outcomes (e.g. anxiety & depression).

Pain catastrophizing has been evaluated as both a dispositional characteristic and as a situational response to a particular pain stimulus. For situational pain catastrophizing scores, variation in individual pain sensitivity may be responsible for variation in catastrophizing scores. Even when exposed to the same nociceptive stimulus (via an experimental pain task), participants' actual experiences may differ such that those with greater pain sensitivity experience more pain and engage in greater levels of catastrophic thinking (Campbell et al., 2010). This type of evaluation implies that changes in pain responsivity (i.e. higher intensity and unpleasantness ratings and lower tolerance) precede increases in catastrophic thinking. However, this is not necessarily the case. In fact, pain catastrophizing could influence the degree to which someone is sensitive to pain. Campbell et al. (2010), have preliminary evidence suggesting that changes in pain response may actually follow changes in catastrophic thinking. Specifically, they found that high catastrophizers had a delayed response to the analgesic effects

of distraction tasks (which seemingly reduced the pain preoccupation component of catastrophizing) in comparison to low catastrophizers when asked to rate experimental pain every five minutes over approximately 65 minutes. High catastrophizers maintained higher pain ratings over longer periods of time in spite of distraction. Therefore, since high catastrophizers required longer periods of distraction before experiencing reduction in pain, there is evidence that catastrophizing inhibits the pain reducing effects of distraction, and therefore that catastrophizing actually produces the increased perception of pain. Correlations between pain responsivity and catastrophizing are well documented (France et al., 2004; Keefe et al., 2004; Sullivan & D'Eon, 1990; Sullivan et al., 1998; Sullivan, Tripp, & Rogers, 2000). However, the Campbell data lend support to the idea that higher levels of pain catastrophizing may cause higher pain ratings, and other indicators of the experience of pain.

Measuring Catastrophizing

There are several current measures of catastrophizing. The Pain Catastrophizing Scale (PCS; Sullivan et al., 1995) is the most commonly used measure devoted solely to the assessment of pain catastrophizing. However, several measures exist with subscales devoted to the assessment of pain catastrophizing and even more scales evaluate constructs that seem to be related to catastrophizing. The Cognitive Coping Strategies Inventory (CCSI; Butler, Bamarin, Beaulieu, Schwebel, & Thorn, 1989), the Coping Strategies Questionnaire (CSQ; Rosentiel & Keefe, 1983), and the Cognitive Errors Questionnaire (CEQ; Lefebvre, 1980) all contain catastrophizing subscales. Further, the threat appraisal subscale of the Pain Appraisal Inventory (PAI; Unruh & Ritchie, 1998), the fear and cognitive anxiety subscales of the Pain Anxiety Symptom Scale (PASS; McCracken, Zayfert, & Gross, 1992), and items on the Inventory of

Negative Thoughts in Response to Pain (INTRP; Gil, Williams, Keefe, & Beckham, 1990) all seem to represent negative cognitive sets and coping styles related to catastrophizing.

These existing measures evaluate catastrophizing from similar perspectives but have identified various specific components of catastrophizing. For example, the CSQ (Rosentiel & Keefe, 1983) contains three factors and seven subscales. The four factors represented are Cognitive Coping, Suppression, Helplessness, and Diverting Attention. Catastrophizing is evaluated as a subscale of the helplessness factor. This characterization links catastrophizing primarily with a factor traditionally associated with depressive ideation. The PCS (Sullivan et al., 1995) is solely devoted to the evaluation of pain catastrophizing and identifies three components of catastrophizing: magnification, rumination, and helplessness. The PCS also includes components of depressive ideation, like the CSQ, but also evaluates pain catastrophizing in terms of preoccupation (i.e. rumination) and exaggeration (i.e. magnification). As we can see, just as there are multiple ways to define catastrophizing, there are also multiple ways to measure it. There have been many attempts to measure negative cognitive reactions to pain. While some have isolated the cognition referred to as catastrophizing, there are still many other measures that seem to address the same processes but are identified by different names. Even more still continue to incorporate components of depressive ideation in spite of empirical data suggesting that these two constructs are unique. The literature is clouded by this ambiguity and much research may be repetitious given the overlap between these measures, which purport to be assessing separate constructs.

The Pain Catastrophizing Scale (PCS)

While discrepancies exist in the definition and measurement of catastrophizing, the PCS is the most common measure of pain catastrophizing. It is widely used in both clinical and experimental pain research and practice and its factor structure is widely accepted and established in the literature. The PCS is a 13-item questionnaire that was developed from existing structured pain catastrophizing interviews (Spanos, Radtke-Bodorik, Ferguson, & Jones, 1979; Spanos, Brown, Jones, & Horner, 1981) and items from the Coping Strategies Questionnaire (CSQ; Rosenstiel & Keefe, 1983; Sullivan et al., 1995). The standard instructions of the PCS state "We are interested in the types of thoughts and feelings that you have when you are in pain." Later it requests that participants use the rating scale to "indicate the degree to which you have these thoughts and feelings when you are experiencing pain." (see Appendix for complete instructions) Participants rate the 13 statements on a scale from 0 (not at all) to 4 (all the time). The PCS is composed of three subscales: rumination, helplessness, and magnification (Sullivan, et al., 1995). The rumination subscale contains four items that focus on worry, rumination, and lack of control over pain-related cognitions. The helplessness scale is composed of six items that reflect a lack of confidence in one's own ability to cope with pain. The magnification subscale contains three items that reflect an exaggerated evaluation of pain. In the original validation study, The PCS showed good internal consistency with a Cronbach's alpha of .87. The rumination and helplessness subscales demonstrated acceptable to good internal consistency with Cronbach's alpha scores of .87 and .79 respectively, and the magnification subscale achieved a Cronbach's alpha score of .60 (Sullivan, et al., 1995). Another study reported reliability coefficients for the PCS subscales ranging from .75 to .93 (Osman et al.,

2000). Finally, the PCS has been shown to be stable over 10 and 6 week time periods with test-retest reliability yielding scores between r=.70 and r=.75, respectively (Sullivan et al., 1995).

Problems with the PCS

Although the introduction of the PCS ushered in a robust period of pain catastrophizing research, there are five substantive problems with the PCS as it exists today. First, the magnification scale shows poor internal consistency that could be attributed to the small number of items it includes. This scale only contains three items: "I wonder whether something serious may happen," "I become afraid that the pain may get worse," And "I think of other painful experiences."

Second, although each scale contains a different number of items, each item contributes equally to the overall score. This indicates that the three scales contribute differentially to the total PCS score giving some scales more weight than others. Additionally, these scales are rarely evaluated or utilized individually so the division of the total measure into three scales artificially imposes a relatively unexplored, and perhaps not valid, division of the overall PCS score.

The third problem with the PCS is that several of the items to which participants must respond include compound statements. For example, item three states, "It's terrible and I think it's never going to get any better." Item four states, "It's awful and I feel that it overwhelms me." These two items, both from the helplessness subscale, each contain multiple concepts that force participants to respond to two components with only one rating. On item three, it is possible for a participant to believe the pain is terrible but to also feel that it *will* get better. A person with this cognitive pattern would be forced to provide a response that inaccurately reflects his or her perspective. Similarly, item eight of the rumination subscale states "I anxiously want

the pain to go away." A person may want the pain to go away but not feel anxious about their desires. Thus, wording on certain items of the PCS leaves room for misinterpretation and error in assessment.

The fourth problem is that with the exception of two items (items 12 and 13), PCS items are presented to the respondent grouped by scales. Items 1-5 (and 12) represent the helplessness scale, items 6 and 7 (and 13) represent the magnification scale, and items 8-11 represent the rumination scale. Such item clustering (i.e. presenting all items of a subscale together), can lead to less variation for responses to items within the scale, artificially inflating the statistical reliability of the subscale (Bradlow, & Fitzsimons, 2001).

Finally, research suggests that catastrophizing may not be fully captured by these three scales, as the construct of catastrophizing has evolved since the development of the PCS. Turner and Aaron (2001) suggest that assessment of pain catastrophizing would benefit from including items that represent worry about worst-case scenarios. For example, items like, "I will not be able to support my family," and "I might become totally disabled" might add incremental validity as this "worst-case scenarios" subscale would include an additional component of catastrophizing not captured in the PCS (Turner & Aaron, 2001).

Dispositional vs. Situational Measurement of Catastrophizing

The instructions for filling out the PCS have been varied from their standard form in an attempt to measure both dispositional and situational pain catastrophizing (Dixon, et al. 2004). Pain catastrophizing has traditionally been measured by asking the respondent to use a rating scale to "indicate the degree to which you have these thoughts and feelings when you are in pain." Measuring pain catastrophizing using these instructions has sometimes been referred to as

measuring “trait” or “dispositional” catastrophizing (Campbell, et al., 2010). Since pain catastrophizing has been shown to be stable over time, there is some support for dispositional characteristics of catastrophizing (Turner, Mancle, & Aaron, 2004). Dispositional evaluations of catastrophizing (i.e. PCS administration prior to or without exposure to an identifiable pain stimulus) have been found to be significantly related to pain responsivity variables (i.e. intensity, unpleasantness, and tolerance; Sullivan et al., 1995; Dixon, et al., 2004), suggesting that pain catastrophizing may reflect more of a dispositional characteristic or style. Nonetheless, there is some debate about the utility of the dispositional measure of pain catastrophizing for measuring actual catastrophizing during a painful experience. The dispositional administration of the PCS may indirectly elicit responses based on selected painful events from the past to refer to while responding to the items, thus allowing for immense variety in the type of painful experience being evaluated as well as the intensity of the experience. For example, some may select a memory of a painful paper cut while others may refer to being injured in a car crash with fatalities. Because pain catastrophizing, intensity, unpleasantness, emotional valence, and personality are closely linked, respondents who select events with greater pain intensity and/or higher emotional valence are likely to have higher catastrophizing scores than those who select experiences with less pain intensity or emotional valence. Therefore, the selected referent could account for some variability in ratings. Additionally, pain experiences differ in cause, duration, and suspected consequences. Respondents who imagine pain from a nonlethal injury would likely have drastically different cognitions related to their pain than those imagining pain from a chronic illness (e.g. Crohn’s Disease) which may have infinite duration. In fact, context of the pain experience has already been shown to be significantly related to catastrophizing scores (Kapoor, Thorn, Bandy, & Clements, 2013).

There is also some debate as to whether the dispositional administration of the PCS actually evaluates a dispositional tendency to catastrophize or merely serves as a retrospective evaluation of situational pain, in essence serving as a less specific situational administration. Both personality traits and emotions have been shown to be influential in memory processing which could lead to bias in retrospective evaluation such as those that may be elicited in the dispositional administration of the PCS (Merens, Van der Does, & Spinhoven, 2007). While these are valid concerns, for the purposes of this study, this type of administration will continue to be referred to as "dispositional."

Due to these concerns, some experimental pain research has modified the standard instructions for measuring catastrophizing. This state or "situational" administration instructs participants to refer to a specific pain when responding to the items (usually following an experimental pain task; see Appendix for situational instructions). In studies in which participants were evaluated with the situational administration of the PCS after being exposed to an experimental pain task, the PCS was shown to correlate with pain ratings (r =.46) and account for 21% of the variance (Sullivan et al., 1995). Situational administrations of the PCS also showed correlations with pain tolerance times (r = -.43; Dixon, et al., 2004). Another study supported this relation with the situational administration of the PCS correlating with pain ratings, r = .51, and accounting for 26% of the variance (Osman et al., 2000). While both dispositional and situational administrations of the PCS are significantly correlated with pain responsivity variables (i.e. intensity, unpleasantness, and tolerance), situational administrations do show stronger correlations with pain responsivity than dispositional administrations (Sullivan et al., 1995; Dixon, Thorn, & Ward, 2004). These results indicate that exposure to an

experimental pain task prior to administration of the PCS with instructions to think specifically about the pain just experienced provides stronger correlations with pain responsivity.

Composite Catastrophizing Measure (CCM)

The Composite Catastrophizing Measure (CCM) is a 92-item measure comprised of items from a number of self-report measures of pain catastrophizing and other related negative pain-related cognitions (Clements, 2006). It was administered to unique samples with varying methodology in two independent studies (Clements, 2006; Smitherman & Thorn, 2011).

The CCM (see Appendix) was originally developed and used by Clements (2006) to further examine the construct of catastrophizing by creating a measure that included items from many pain catastrophizing measures as well as items from measures assessing related negative thoughts. The goal was to create a broad catastrophizing measure to identify factors of the construct that may not be assessed with the PCS and other catastrophizing measures as well as to gain a more complete understanding of what has been assessed by all of these measures in combination. Items included on the CCM were drawn from various existing questionnaires, including: the PCS (Sullivan et al., 1995), the threat appraisal subscale of the Pain Appraisal Inventory (PAI; Unruh & Ritchie, 1998), the catastrophizing subscale of the Cognitive Coping Strategies Inventory (CCSI; Butler et al., 1989), the catastrophizing subscale of the Coping Strategies Questionnaire (CSQ; Rosenstiel & Keefe, 1983), the catastrophizing subscale of the Cognitive Errors Questionnaire (CEQ; Lefebvre, 1980), the fear and cognitive anxiety subscales of the Pain Anxiety Symptom Scale (PASS; McCracken et al., 1992), and items taken from the Inventory of Negative Thoughts in Response to Pain (INTRP; Gil et al., 1990). Thirteen additional items were created and added by Clements.

In Clements (2006), items from the various scales were intermixed in three different orders and were all administered with instructions to reflect on a time when the respondent has experienced physical pain (see Appendix). The CCM was administered to a presumably healthy college student sample (n = 220) in Clements' unpublished dissertation (2006). This sample was administered the measure with dispositional instructions asking participants to "write the number that best describes how much each item listed is similar to a thought or feeling you have when you experience physical pain." Response choices were given on a five-point rating scale.

Later, Smitherman and Thorn (2011) administered the CCM to another presumably healthy college student sample (n = 186) with situational instructions after a cold pressor task. These instructions were the same as the dispositional instructions with the following statement added, "Before beginning, please reflect on your recent experience where your hand was immersed in ice water." In this study as well, response choices were given on a five-point rating scale.

The Current Study

The goal of the current project was to develop and validate the Composite Catastrophizing Measure – Short Form (CCM-SF). It was anticipated that the measure would provide new insight into the construct of catastrophizing by eliminating the presence of contaminating constructs (i.e. items representing depressive ideation), would be psychometrically sound (i.e. addressing psychometric flaws of the PCS), and would adequately predict pain outcomes. Archival data from both Clements (2006) and Smitherman and Thorn (2011) were used in the current study to develop the CCM-SF. Specifically, exploratory factor analysis (EFA) was conducted on individual item responses from the Clements (2006) sample

given the dispositional administration. Based on this EFA, individual items were selected from for inclusion in the CCM-SF. Archival data from Smitherman and Thorn (2011) were used in a confirmatory factor analysis (CFA) to test the reliability of the factor structure established from the Clements (2006) archival data. Thereafter, the CCM-SF was administered along with already validated measures of pain catastrophizing and other related measures of negative pain cognitions to a new sample of presumably healthy college students both prior to and after an experimental pain task to establish reliability and validity of the new measure.

DEVELOPMENT STUDY

The CCM-SF, was developed using archival data from Clements (2006) and Smitherman and Thorn (2011). Seventy-three of the CCM's original 92 items were selected for analysis and consideration for inclusion on the CCM-SF. Because they lack an established literature of support, items from the CEQ and items developed by Clements (2006) were not considered for inclusion.

Exploratory Factor Analysis

Archival data of the 73 items extracted from Clements (2006) were subjected to Exploratory Factor Analysis (EFA) with oblimin rotation (n = 220) using MPlus (version 6.12; Muthén & Muthén, 2012), using the weighted least squares mean and variance adjusted (WLSMV) estimator. The WLSMV estimator is the recommended estimator for ordered categorical data and oblimin procedures accomplish the oblique (non-orthogonal) factor solutions by allowing factors to correlate.

A flexible approach was taken to develop the new measure in which multiple solutions were extracted using several widely used approaches. First, a common approach to factor extraction is to consider all eigenvalues greater than one. When an eigenvalue surpasses one it indicates that the component explains more variance than a single variable. This approach has been criticized as having a tendency to over-extract factors leading to the inclusion of factors that

are less than meaningful. For these data, the first 10 eigenvalues were as follows: 27.28, 4.32, 4.01, 2.48, 2.38, 1.89, 1.81, 1.77, 1.49, and 1.40. These values suggest that three-, five-, and eight- factor models would be statistically appropriate. Upon review, the five-factor model did not fit conceptually. There seem to be three broad, well-correlated factors but also an eight-factor model that could provide a more fine-grained explanation. Additional analyses were conducted in order to further clarify the factors.

Another common approach to determining the appropriate number of factors is to evaluate scree tests. A scree is a plot with factor numbers on the x-axis and eigenvalues on the y-axis. The plot is then evaluated for sharp decreases in eigenvalues. The point at which the plot levels off is the point at which no more factors are to be extracted. The scree serves as a visual representation of where conceptual factors become less meaningful. However, this approach, too, is criticized. Some say the scree test is too subjective because there are not clearly and numerically defined cut-offs as to where the scree (leveling off) begins. Inspection of the scree plot (see Figure 1) suggests that a three factor model is most appropriate. While less clear, arguments could also be made for a five or eight factor model. Based on the findings of the scree analyses, parallel analysis for principal components using Monte Carlo simulations was also evaluated to provide a more statistically based evaluation of appropriate factor extraction (Hayton, Allen, & Scarpello, 2004; Watkins, 2006).

Parallel analysis for principal components was performed on the sample (n = 220) for 73 items with 100 replications. The parallel analysis uses random data with the same sample size and number of variables (items) as the actual data and simulates the EFA. The obtained eigenvalues are recorded and averaged across the 100 simulations. From these means and standard deviations, eigenvalues which fall in the 95th percentile are obtained that represent the

level at which eigenvalues are unlikely to have occurred by chance. These values are compared with the eigenvalues of the actual data. The point at which the eigenvalues for the actual data no longer exceed the 95th percentile eigenvalues from the simulated data is the point at which no further factors will be extracted. For these data, the parallel analysis suggested that the eight-factor model was the best fit. However, this method calculates eigenvalues assuming the variables are continuous. Because the actual data being used in this analysis are categorical, these results should be interpreted with caution and used only as a guide rather than a strict rule.

These methods of factor extraction, while not in entire agreement, all suggest a three-, five-, or eight-factor model as statistically appropriate. A qualitative evaluation of each of these models indicated that the five-factor model did not fit conceptually. There seemed to be three broad, well-correlated factors but also an eight-factor model that could provide a more fine-grained explanation.

The three- and eight-factor solutions provide a logical explanation of covariance structure. The former model suggests the three broad factors (labeled Pain Severity, Hypochondriacal Pessimism, and Depressive Ideation) can be divided into eight narrower factors (labeled Pain Preoccupation, Mental Distraction, Hypochondriacal Worry, Morbid Hypochondria, Despondency, Helplessness, and Self-Blame) by the eight-factor analysis. Pain preoccupation and Mental Distraction seemed to align with a higher order factor that relates to pain severity. Hypochondriacal Worry and Morbid Hypochondria seemed to align with a higher order factor relating to hypochondriacal pessimism. Despondency, Helplessness, and Self-Blame seemed to represent a higher order factor relating to depressive ideation in general. The eighth factor, Fearful Pessimism, seemed to represent both pain severity and hypochondriacal pessimism.

For the purposes of this study, the eight-factor model was explored further. The first factor that emerges seems to represent a preoccupation with the severity of pain and includes items describing the strong emotional and cognitive effect of pain (Pain Preoccupation). The two highest loading items from this factor are "I keep thinking how badly it hurts" and "I find it virtually impossible to keep my mind off of my pain and how bad it hurts." These items produce loadings of .90 and .88 respectively.

The second factor seems to represent interference in thought attributed to pain and could be labeled "Mental Distraction." This factor is best represented by the items "I can think pretty clearly even when experiencing severe pain" (reverse scored) and "I can't think straight when in pain" with loadings of .69 and .67 respectively.

The third factor seems to represent the concern that pain serves as a signal of physical damage and/or illness and could be labeled "Hypochondriacal Worry." It can be typified by the items "I begin to worry that something might be seriously wrong with me" and "I'm concerned that the pain might mean something is wrong with me" with loadings of .95 and .83 respectively.

The fourth factor seems to represent cognitions more closely related to death or severe impairment and could be labeled "Morbid Hypochondria." It is typified by the items "I find myself worrying about possibly dying" and "When pain comes on strong, I think that I might become paralyzed or more disabled" with loadings of .66 and .63 respectively.

The fifth factor seemed to represent a loss of hope and could be called "Despondency." It is typified by the items "No one cares about me anymore" and "I feel my life isn't worth living" with loadings of .76 and .68 respectively.

The sixth factor seems to represent a feeling of being unable to care for one's self and could be called "Helplessness." It is best represented by the items "Other people have to do everything for me" and "My family has taken over all of my responsibilities" with loadings of .65 and .64 respectively.

A seventh and much smaller factor seems to represent cognitions related to blaming one's self for one's own suffering and could be called "Self-Blame." It is best represented by the items "It is my own fault I hurt like this" and "I must have done something to bring on this pain" with loadings of .73 and .53 respectively.

An eighth and final factor seems to represent an amalgamation of other factors related to fear of pain increase and can be called "Fearful Pessimism." It is typified by the items "I think that if my pain gets too severe, it will never decrease" and "I am concerned that the pain might become more than I can manage" with loadings of .65 and .54 respectively.

Confirmatory Factor Analysis

The eight-factor structure was then evaluated using archival data from Smitherman & Thorn, 2011 (n=186). These data were submitted to a confirmatory factor analysis (CFA) using WLSMV adjusted estimator on Mplus (version 6.12; Muthén & Muthén, 2012) to evaluate their fit in the reduced factor model in the original sample. Fit was evaluated with chi-square test of model fit, the comparative fit index (CFI), the Root Mean Square Error of Approximation (RMSEA), and the Tucker-Lewis index (TLI).

This CFA indicated that the factor structure remained consistent across situations (dispositional/situational administrations). It indicated that all factor loadings and factor correlations were significantly greater than zero, and the results suggested adequate model fit

without evidence from modification indices of appreciable instances of misspecification. Model fit was shown to be significantly at variance with the data, χ^2 (874, N = 186), = 1141.31, $p <$ .0001. However, the RMSEA of .041 (90% confidence interval: .034-.047) and CFI of .97 indicate acceptable model fit. Factor correlations in this sample tended to be higher than in the original sample. In fact, two sets of factors did not differ significantly from unity (Hypochondriacal Worry/Morbid Hypochondria and Despondency/Helplessness).

Factor Reduction and Consolidation

The primary interest for the present research were the factors that captured aspects related to reactions to pain that conceptually relate to what is commonly referred to as the construct of "catastrophizing." Therefore, decisions regarding factor reduction and consolidation were based both in psychometric value and conceptual utility. While the literature indicates that depressive ideation and catastrophizing are closely correlated (Arnow et al., 2011, Edwards, Calahan, Mensing, Smith, & Haythornthwaite, 2011), they have been clearly identified as distinct and unique constructs (Edwards et al., 2011). Therefore, the factors representing depressive ideation were deemed conceptually inappropriate for inclusion in the final measure and items loading onto these factors were not considered for inclusion on the new measure. These factors were Despondency, Helplessness, and Self-blame.

The factors of pain preoccupation and mental distraction were strongly correlated (r = .82) and therefore their unique psychometric value is questionable. Additionally, the factor mental distraction seemed conceptually to be more closely related to anxiety. While anxiety and catastrophizing are closely related, they have been shown to be unique constructs (Riskind & Williams, 1999; Vasey & Borkovec, 1992). Therefore, rather than consolidating the two

strongly correlated factors, items loading onto the factor called mental distraction were eliminated from consideration for inclusion on the new measure and only preoccupation was considered.

The CFA indicated that the factors Hypochondriacal Worry and Morbid Hypochondria did not differ significantly from unity. Therefore, they were not found to be psychometrically unique and were consolidated into one factor, which was called Worry.

The factor Fearful Pessimism was found through the CFA to cross load onto the two remaining broad factors from the three-factor solution (Pain Severity and Hypochondriacal Pessimism, after the elimination of Depressive Ideation). This factor, both psychometrically and conceptually, did not seem to represent a clearly defined and unique set of items. Therefore, items loading highest in the Fearful Pessimism factor on the eight-factor model were not considered for inclusion in the final measure.

In summary, through the elimination of psychometrically and conceptually inappropriate factors (e.g. those related to depressive ideation like Despondency, Helplessness, and Self-blame, those conceptually related to general anxiety like Mental Distraction, and Fearful Pessimism) and the consolidation of highly correlated factors (e.g. Hypochondriacal Worry/Morbid Hypochondria), two factors from the eight-factor solution remained for item selection which were called Preoccupation and Worry. These two factors represent the two subscales of the CCM-SF.

Item Extraction

Original EFA results were used to select items as the best indicators of each remaining factor (Preoccupation and Worry). Items with ambiguous language and compound statements

were not selected, regardless of their factor loading. Items with the highest loadings on each factor and without significant cross-loadings on other factors were selected for inclusion on the CCM-SF. Items with cross-loadings > .4 were not considered for inclusion. Further evaluation was conducted to determine if more sensitive cross-loading criteria should be considered (e.g. cross-loadings >.3). A total of 14 items were selected to include in the CCM-SF. Each scale (preoccupation and worry) contained seven items. The final items were drawn from the PASS (3 items), PCS (4 items), PAI (1 item), and CCSI (6 items). See Table 1 for information on scale item composition. The presentation order of selected items on the CCM-SF was randomized to address potential for item clustering which could influence response patterns.

VALIDATION STUDY

For the validation portion of this study the CCM-SF was administered in both situational and dispositional forms prior to and after an experimental pain task with a sample of healthy college students. Other previously existing measures of pain catastrophizing were also administered to provide concurrent validity. Measures of pain responsivity variables (intensity, unpleasantness, and tolerance) were used to establish predictive validity of the CCM-SF as well as to compare its predictive validity to that of other established measures. Additionally, factor structure was reassessed in data collected from this sample.

METHODOLOGY

Participants and Setting

Participants for the validation study of the newly constructed CCM-SF were 218 undergraduate students enrolled at the University of Alabama in an Introductory Psychology course. They consisted of 97 men and 126 women. Self-reported racial/ethnic breakdown was 168 white/not Hispanic, 33 black/not Hispanic, 5 Hispanic, 7 Asian, 3 Native American, and 7 other. The average age of participants was 19.53.

Participants were recruited via the online subject pool website and received one credit toward their research participation requirement in Psychology 101. Participants signed up for individual experimental sessions in which they completed a number of self-report measures, completed an initial, time-limited, CPT to establish participants' ratings of pain intensity and unpleasantness, a second round of self-report measures, and a final CPT to establish participants' pain tolerance. Exclusion criteria included: previous participation in a CPT, pregnancy, cardiovascular disease, hypertension, fainting spells, high blood pressure, diabetes, Reynaud's disease, Sickle Cell disease, seizure disorder, chronic pain, current use of pain medication, currently under psychiatric care, skin allergy, and having not eaten yet that day. Previous participation in a CPT could influence cognitions related to pain as well as pain ratings and there is a small chance that participation in a CPT could exacerbate some health and psychiatric conditions. For this reason, the listed conditions with pain and stress components served as exclusion criteria. Also, current use of pain medication could influence perceived pain intensity

that would influence cognitions related to pain. These conditions rarely present themselves in an undergraduate population and results are generalizable to the majority of the student population.

Apparatus

This CPT used Thermo Scientific's Neslab RTE Series refrigerated bath. It consists of a basin that contains chilled water which is constantly circulated allowing it to maintain its temperature at 2º C without freezing and a ledge that allows a participant to submerge his/her hand and forearm into the chilled water while resting the remaining part of his/her arm on the outside of the apparatus.

Measures

Composite Catastrophizing Measure – Short Form (CCM-SF). The new measure was used with two instructional sets to facilitate evaluation of the measure from both the dispositional and situational perspective. The dispositional administration of the CCM-SF (CCM-SF 1; see Appendix) was administered prior to the initial cold pressor task (CPT1) and instructed participants to use the rating scale to indicate "the degree to which you have these thoughts and feelings listed below when you are experiencing pain in general." The situational administration of the CCM-SF (CCM-SF 2; see Appendix) was administered following the initial CPT (CPT1) and instructed participants to indicate "the degree to which you had these thoughts and feelings when you had your hand in the cold water." Both administrations used a 5-point rating scale (0=Not at all, 4=All the time). In the current study, the Cronbach alpha coefficient for the CCM-SF 1 was .92 and .91 for the CCM-SF 2.

Pain Catastrophizing Scale. The Pain Catastrophizing Scale (PCS) was included before and after the initial CPT (CPT1). The PCS serves as the current "gold standard" to which the

predictive ability of the new CCM-SF was compared to establish criterion validity. A general description of the PCS will not be discussed here, as it is included in detail in the introduction.

Like the CCM-SF, the PCS was given twice in an effort to assess both dispositional and situational catastrophizing. The initial PCS (PCS 1; see Appendix) instructed participants to "indicate the degree to which you have these thoughts and feelings when you experience pain" and was administered prior to the initial CPT (CPT1). This is considered to be the standard administration of the PCS and is intended to assess one's dispositional proclivity for catastrophic thinking in the presence of pain. The second PCS (PCS 2; see Appendix) was administered following the final CPT (CPT2) and instructed participants to "answer these questions as they relate to the pain you just experienced when your arm was submerged in the ice water." The PCS 2 allows for a situational evaluation of cognitions associated with a specific pain experience, which has been shown to be more predictive of experimental pain responsivity than the traditional (dispositional) method of administration (Dixon et al., 2004). The PCS has been shown to have good internal consistency (Cronbach's α = .91) among chronic pain patients in the Netherlands as well as good test-retest reliability (r = .78) across a six-week period in a student population (Sullivan et al., 1995; Van Damme, Crombez, Bijttebier, Goubert, & Van Houdenhove, 2002). In the current study, the Cronbach alpha coefficient for the PCS 1 was .91 and .93 for the PCS 2. Four items from the PCS were included in the construction of the CCM-SF (See Table 1). While it was expected that duplicate items would lead to some inflation of correlations between the PCS and the CCM-SF, it was determined that correction for item overlap was unnecessary as these duplicate items were administered separately and required unique responses from their multiple administrations.

Pain Appraisal Inventory. The Pain Appraisal Inventory (PAI; Unruh & Ritchie, 1998; see Appendix) is a 16-item measure used to identify primary appraisals of pain as either threat/harm or challenge. Each of the 16 items is rated on a 6-point Likert scale ranging from *strongly disagree* (1) to *strongly agree* (6) (Unruh & Ritchie, 1998). Examples of threat/harm and challenge statement on the PAI are, "I am concerned that the pain might become more than I can manage," and "I think the pain makes me a stronger person." Threat appraisals and harm/loss appraisals are frequently measured together (Jackson et al., 2005; Sanford et al., 2002; Unruh & Ritchie, 1998). The PAI has been shown to have adequate reliability for both the threat/harm (α = .80) and challenge (α = .86) subscales as well as having concurrent criterion validity with other pain measures (Pence et al., 2011). In the current study, the Cronbach alpha coefficient for the threat/harm subscale was .82 and .93 for the challenge subscale. Like the PCS, the PAI was also administered to serve as a comparison for predictive ability of the CCM-SF and to establish criterion validity. Additionally, one item from the PAI was used in the construction of the CCM-SF (see Table 1) but it was determined that correction for item overlap was unnecessary due to the individual administration of the duplicate item and on each, a unique response was required.

Assessment of Pain Thoughts (see Appendix). Participants were asked to provide the sources of pain they were referring to while responding to the CCM-SF 1. This information was not used in the analyses for this study but will serve in future analyses to assess the unique context in which participants respond to dispositional measures of pain catastrophizing.

Assessment of Current Pain (see Appendix). Participants were asked to indicate whether they were currently experiencing pain. If their response indicated current pain, they were asked to describe their current pain. Like the "Assessment of Pain Thoughts" questionnaire, this

information was not used in the analyses for this study but will serve in future analyses to assess the unique context in which participants respond to dispositional measures of pain catastrophizing.

Assessment of Chronic and Recurrent Pain (see Appendix). Participants were asked to indicate whether they experience chronic pain (defined as "pain that occurs more days than not over at least the past three months that interferes with your functioning") and if "yes," to describe their chronic pain and indicate how many days they experienced that pain over the past three months. Participants were also asked to indicate if they experience recurrent pain (defined as "pain that periodically interferes with your functioning but does not occur more days than not over the past few months") and if "yes," to describe their recurrent pain and indicate how many days they experienced that pain over the past three months. Likewise, this information was not used in the analyses for this study but will serve in future analyses to assess the unique context in which participants respond to dispositional measures of pain catastrophizing

Visual Analog Scale. The Visual Analog Scale (VAS; see Appendix) consists of two 10 centimeter lines on which participants rate their pain intensity and pain unpleasantness ratings between two anchors: "no pain" and "Pain as bad as it can be" for intensity and "not at all unpleasant" and "extremely unpleasant" for unpleasantness (Price, McGrath, Rafii, & Buckingham, 1983). The VAS has been shown to be a valid and reliable measure of pain intensity and unpleasantness in both experimental and clinical pain studies (Price, et al., 1983). A VAS was used to assess pain intensity and unpleasantness of pain thoughts while responding to the CCM-SF 1 (VAS 1), current pain (VAS 2), the initial CPT (CPT1; VAS 3), and the final CPT (CPT2; VAS 4). VAS scores are provided in millimeters with a range of 1-100.

Pain Tolerance. Pain tolerance levels were measured as the amount of time (in seconds) between the submersion of the participant's hand in the cold pressor basin and the participant's removal of his or her hand from the water. Tolerance was established using the final CPT.

Procedure

Potential participants arrived at the study location and were given a brief explanation of the purpose of the study and were asked to read and sign a consent form. They were then asked to complete an eligibility questionnaire to ensure minimized health risk associated with participation in the experimental pain task. Potential participants who endorsed any of the exclusion criteria were dismissed from the study. If no exclusion criteria were endorsed, participants then completed a demographics questionnaire including data regarding age, sex, and race.

Participants were first asked to complete the CCM-SF 1, the Assessment of Pain Thoughts, VAS 1, Assessment of Current Pain, VAS 2. They were then asked to complete the PCS 1 and PAI, which were administered in random order administration to control for order effects. Next, participants completed the Assessment of Chronic and Recurrent Pain. Following completion of the initial set of questionnaires, participants were asked to participate in the initial CPT in which they submerged their non-dominant hands into the water chilled to two degrees Celsius for 30 seconds. After 30 seconds had passed, participants were instructed to remove their hands from the water. This time-limited CPT served as a consistent pain stimulus between participants to which they provided their unique pain intensity and unpleasantness ratings on the VAS 3. Five minutes were allowed to pass between the first and second CPT to allow for the hand to return to room temperature before participating in the final CPT (CPT2). After five

minutes, each participant was instructed to immerse his or her hand in the cold water again and keep it submerged for as long as possible, removing it only when the participant could no longer tolerate the pain. This final CPT was used to establish unique pain tolerance times between participants. The amount of time the participant kept his or her hand submerged in the chilled water was recorded (in seconds) as his or her pain tolerance time. If the participant reached the unannounced five-minute maximum tolerance time, he or she was told to remove his or her hand. After five minutes, the hand becomes numb and the CPT no longer serves as a nociceptive stimulus (Mills & Farrow, 1981). After removal of his or her hand, each participant was asked to complete the VAS 4, the CCM-SF 2 and the PCS 2 based on their thoughts while their hand was in the cold water, thus providing for a situational administration of these measures. Administration order of CCM-SF 2 and the PCS 2 was randomized to control for order effects.

Statistical Analyses

The final sample was 223. However, participants who did not achieve an initial tolerance of 30 seconds in the first cold pressor task (6 participants out of 223) were not included in the analyses involving pain responsivity variables. Additionally, missing data in variables of interest for each stage of statistical analyses were excluded as needed. Therefore, sample sizes for each analysis vary and are reported accordingly. Analyses used unpleasantness and intensity ratings from the initial CPT (CPT1) in which all participants were exposed to the same stimulus. The final CPT (CPT2) was used to establish tolerance times.

Cronbach's alpha was calculated for both the pre and post CPT CCM-SF administrations as well as both subscales for the two administrations of the CCM-SF. This analysis was used to establish internal consistency for the overall measures and subscales for each administration.

Confirmatory factor analysis (CFA) was used to determine if the items of the CCM-SF continued to load onto the same two factors indicated in the evaluation of the CCM in pilot data.

Zero-order Pearson correlations were used to determine the relationships between the summative scores of the pre and post CPT administrations of the CCM-SF (dispositional and situational) and pain tolerance, intensity, and unpleasantness. These correlations were used to determine if the CCM-SF has predictive validity on pain responsivity. Additionally, a test of dependent correlation (Steiger, 1980) was run to determine the significance level of any difference in correlation of the dispositional and situational CCM-SF administrations for pain responsivity ratings.

Zero-order Pearson correlations were used to determine the relationships between pre and post CPT PCS and CCM-SF summative and subscale scores as well as pain tolerance, intensity, and unpleasantness to determine if one measure has greater predictive validity than the other. Pre and post CPT CCM-SF scores were submitted to zero-order Pearson correlations. This correlation was used to determine if the pre CPT CCM-SF (dispositional administration) was related to the post CPT CCM-SF (situational administration) to evaluate the relationship between dispositional and situational catastrophizing when measured with the CCM-SF.

RESULTS

Internal Consistency of the CCM-SF

Internal consistency data for total and subscale scores for both administrations of the CCM-SF are presented in Table 2. For comparison, Cronbach's alphas for total and subscale scores for both administrations of the PCS are also presented. As these tables indicate, the CCM-SF and its subscales showed adequate reliability and were comparable to those of the PCS for both administrations.

Confirmatory factor analysis (CFA)

Data were submitted to a confirmatory factor analysis (CFA) using WLSMV adjusted estimator on Mplus (version 6.12; Muthén & Muthén, 2012) to determine if the factor structure remained consistent in the new data set. Fit was evaluated with chi-square test of model fit, the comparative fit index (CFI), the Root Mean Square Error of Approximation (RMSEA), and the Tucker-Lewis index (TLI).

Dispositional Administration (Pre-CPT)

A two-factor model based on the selected scales was applied to the first administration of the CCM-SF (dispositional; n=223). This initial analysis indicated that the fit was not acceptable, $\chi^2(76, N = 223), = 263.46, p < .0001$, RMSEA = .105, CFI = .97. MPlus modification indices revealed two prominent misspecifications calling for correlated errors between items 10/11 and items 13/14. When these misspecifications were corrected, model fit was improved [$\chi^2(74, N =$

223), = 186.88, $p < .0001$; RMSEA = .083; CFI = .98], and adequate fit for the two-factor description was established. As seen in Figure 2, the revised model produces a factor correlation of .70 which is substantially less than unity and insures discriminant validity for scales constructed from the factors. Figure 2 shows partial correlations associated with the residual item correlations.

Situational Administration (Post-CPT)

The same two factor model, as tested and modified in the dispositional administration of the new measure, was also applied to the situational administration of the CCM-SF (post-CPT; n=223). This model produced good fit for data from this administration of the CCM-SF, $\chi^2(74, N = 223)$, = 132.11, $p < .0001$, RMSEA = .059, CFI = 1.00. However, as shown in Figure 3, factor loadings were high enough to suggest spuriously high item correlations. Further, responses on the Worry factor were highly skewed in the positive direction. This data indicates that the items on the Worry subscale may not be appropriate to use during an experimental pain task like a CPT.

Sample Characteristics

The mean scores for the total and subscale scores for the dispositional and situational administrations of both the PCS and the CCM-SF are presented in Table 3. As indicated in Table 3, the differences between the preoccupation and worry scales on the dispositional administration were minimal, but significant. The difference in mean scores between the scales in the situational administration of the CCM-SF were much larger and significant.

Scores on the preoccupation subscale on both administrations of the measure as well as the differences in scores on the worry scale between the administrations were both significant.

However, zero-order correlations indicate that dispositional preoccupation subscale scores ($r(212) = .53$, $p = .000$) better predict situational preoccupation subscales scores than dispositional worry predicts situational worry ($r(212) = .33$, $p = .000$). Additionally, as shown in Table 4, regression analyses indicate that the worry subscale does not add any significant explanation of variance beyond that of the preoccupation subscale to the prediction of pain tolerance, intensity, or unpleasantness in both the dispositional and situational administrations of the CCM-SF. Conceptually, this is not surprising because the Worry subscale contains items that refer to fear of serious and negative health-related outcomes. Participants in this study were exposed to an experimental pain task from which they knew they could escape and from which they were aware no serious injury would occur. It is hypothesized that the Worry subscale would provide more valuable information in a clinical (chronic and/or acute) pain sample.

Analysis of variance (ANOVA) indicated that women score significantly higher on CCM-SF 1 and 2 total and subscale scores as well as PCS 1 and PCS 2 total and subscale scores except for the CCM-SF 2 worry scale on which men and women did not significantly differ. The results are presented in Table 5. Means and standard deviations for pain responsivity variables are presented in Table 6.

CCM-SF scores were divided into thirds. Scores in the lower third were considered to be low catastrophizers while scores in the upper third were considered to be high catastrophizers. In addition to aiding in the description of this sample, these cutoffs can provide clinical utility by identifying those patients who are likely to benefit from intervention to address catastrophic thinking. Table 7 presents the cutoff scores for high and low catastrophizing established in this study. Table 8 presents the means and standard deviations of the total and subscale scores of both administrations (dispositional and situational) for high and low catastrophizers. Low

catastrophizers had an average pain tolerance score of 144.76 seconds (*SD* = 98.54) while high catastrophizers had an average pain tolerance score of 47.83 seconds (*SD* = 25.68) indicating a significant difference in pain tolerance between high and low catastrophizers, $F(1, 158) = 22.84$, p=.000. There was also an effect of catastrophizing on pain intensity with low catastrophizers yielding significantly lower pain intensity ratings (*M* = 52.35, *SD* = 21.64) than high catastrophizers (*M* = 80.75, *SD* = 80.75), $F(1, 159) = 39.68$, $p = .000$. ANOVA also indicated an effect of catastrophizing on pain unpleasantness with low catastrophizers (*M* = 66.38, *SD* = 21.56) reporting significantly lower unpleasantness ratings than high catastrophizers (*M* = 91.96, *SD* = 9.27), $F(1, 159) = 32.59$, $p = .000$.

Relations among catastrophizing measures and pain responsivity variables

Correlations among cognitive measures (total scores) and pain responsivity variables are presented in Table 9. Tests of dependent correlations indicated a significant difference between the correlations of the CCM-SF1 (dispositional) and pain responsivity variables and the correlations of the CCM-SF 2 (situational) and pain responsivity variables (tolerance, $t(213) = 3.33$, $p < .000$; intensity, $t(213) = -5.62$, $p < .000$; unpleasantness, $t(213) = -5.46$, $p < .000$), such that situational catastrophizing was significantly more predictive of pain responsivity than dispositional catastrophizing. This is consistent with dispositional/situational predictive ability of the PCS.

No significant difference was found in the correlations between the CCM-SF 1 total score and pain responsivity variables and the correlation between the PCS 1 total score and pain responsivity variables. This was also the case for correlations between CCM-SF 2 and PCS 2 total scores and pain responsivity variables. These analyses indicate that psychometrically the

CCM-SF and the PCS (both dispositional and situational) serve as equivalent measures of pain catastrophizing.

The difference in correlation between the CCM-SF 2 total score and tolerance as well as CCM-SF 2 total score and unpleasantness and Challenge Appraisal and the same pain responsivity variables was significant (tolerance, $t(215) = -6.96$, $p < .000$; unpleasantness, $t(213) = 8.9$, $p < .000$), such that the CCM-SF 2 total score had significantly stronger correlations with each of these responsivity variables than Challenge Appraisal. Correlations of the CCM-SF 2 total score with pain intensity and unpleasantness were significantly stronger than the correlations of Threat Appraisal with pain intensity and unpleasantness (intensity, $t(213) = 5.35$, $p < .000$; unpleasantness, $t(213) = 6.17$, $p < .000$).

Correlations among CCM-SF 1 (dispositional) and CCM-SF 2 (situational) subscales and pain responsivity variables are presented in Tables 10 and 11. The differences in correlation between the two CCM-SF 1 subscales and pain responsivity variables were not significant. Differences in correlations between the two CCM-SF 2 subscales and pain responsivity variables were found to be significant for all (tolerance, $t(213) = -2.66$, $p < .01$; intensity, $t(213) = 4.25$, $p < .000$, unpleasantness, $t(213) = 5.05$, $p < .000$), indicating that in this sample the preoccupation subscale of the CCM-SF 2 had stronger correlations with all pain responsivity variables than did the Worry Subscale.

Correlations among PCS 1 (dispositional) and PCS 2 (situational) subscales and pain responsivity variables are presented in Tables 12 and 13. Differences in correlation between the three PCS subscales and pain responsivity variables for both the dispositional and situation administrations of the PCS were generally found to be non significant except in the following

cases. For the PCS 1, Helplessness was found to have a significantly higher correlation with pain tolerance than Magnification ($t(213) = -7.76$, $p < .000$). For the PCS 2, both Helplessness and Rumination had a significantly higher correlations with pain intensity than Magnification (helplessness/magnification, $t(213) = -2.19$, $p < .03$; rumination/magnification, $t(213) = 2.04$, $p < .04$). Helplessness and Rumination subscales for the PCS 2 were also found to have significantly higher correlations with pain unpleasantness than Magnification (helplessness/magnification, $t(213) = -2.13$, $p < .03$; rumination/magnification, $t(213) = 3.28$, $p < .000$).

DISCUSSION

This study set out to develop a comprehensive measure of pain catastrophizing from the measures that currently exist in order to more accurately predict a variety of pain outcomes with flexibility and useful subscale contributions. Additionally, this study was an attempt to rectify other problems associated with the PCS like ambiguous language, compound statements, and poor reliability of certain subscales. Analyses indicate that the CCM-SF is psychometrically comparable to the current gold standard measurements of pain catastrophizing and other related negative pain-related cognitions. The CCM-SF shows good internal consistency with both dispositional and situation administrations for total and subscale scores. It performs similarly to the PCS in terms of the ability of the dispositional scores to predict situational scores in experimental pain tasks. Additionally, its factor structure seems to remain consistent over time as seen from the original factor analyses performed during its development and the CFA performed during the validation phase.

Traditionally the emphasis in measurement of pain catastrophizing has been on the measurement of dispositional pain catastrophizing, that is, one's tendency to catastrophize in response to pain in general. In fact, the standard instructions of the PCS are dispositional and are frequently used in situation specific pain research (e.g. experimental pain tasks, chronic pain patients, etc.) without altered, state-based instructions. As mentioned previously, this is problematic for multiple reasons. The lack of a standard referent between participants allows responses to be based on strikingly disparate pain experiences. The perceptual experience of

pain associated with a nonspecific memory of a paper cut is completely different from that of a painful life threatening injury associated with a traumatic event like a car accident. In fact, context of the pain experience has been shown to influence catastrophizing scores (Kapoor, et al., 2013). This could explain the lower predictive ability of the dispositional measures of pain catastrophizing than that of situational administrations. The literature suggests that should researchers wish to continue to measure dispositional pain catastrophizing, it is advisable that information regarding the specific referent should always be collected to place results of assessment in context (Kapoor, et al., 2013).

While there is an understanding that pain is a complicated perceptual experience, the idea that thoughts associated with varying types of pain (e.g. experimental, acute, chronic) cannot be all be measured similarly has been relatively ignored in the literature. The most unique contribution of the CCM-SF appears in the utility of its subscales. The PCS is exclusively used for its total score and its subscales are almost never interpreted using he individual subscales. In addition, the PCS subscales do not all produce adequate reliability scores. In particular, the magnification subscale of the PCS consistently produces lower internal consistency scores. While this could be due to the fact that it only has three items, it does not change the fact that the subscale does not have adequate internal consistency and does not provide useful independent information. This highlights another problem with the PCS, the differential contribution of subscales to the total score implying that they carry unique importance to the overall construct of catastrophizing. However, there is no evidence to support differential value of each of these subscales, The CCM-SF offers two unique subscales which are each reliable and contribute equally to a total score (7-items each) should the use of a total score be recommended. It is unlikely that one unaltered measure would serve as equally useful for the assessment of pain-

related cognitions in all contexts. However, given information about subscale utility and recommendations for their use in various pain situations, one measure could actually provide for flexible assessment of these cognitions.

In this particular sample we see that the preoccupation subscale performs significantly better than the worry subscale at predicting pain outcomes in an experimental pain context. In fact, the worry scale seems to add no predictive ability beyond that of the preoccupation subscale. However, this does not mean that the worry subscale is without value. In consideration of the actual item content, it makes sense that the worry subscale would not perform as well as the subscale in an experimental pain task. While preoccupation subscale items seem to represent a focus on the actual sensation of pain, items on the worry subscale relate more to worry for negative outcomes from the pain and potentially harmful origins of pain. In an experimental pain task participants have information regarding the harmless source of their pain and their own ability to end the painful experience at any time. Therefore, it is unlikely they would generate thoughts like those presented in the worry subscale. Beyond this, both CCM-SF subscales showed good reliability and contribute equally to the overall score.

While this study is the first step in the validation of this new measure, it is hypothesized that the two subscales will perform differently according to pain sources and will allow for recommendations regarding altered use in varying contexts. Future research with this measure should explore both summative and subscale performance in clinical samples (both acute and chronic pain patients). This information would allow for further recommendations for its use in a variety of pain contexts and populations. It is likely that validation in clinical samples would provide different recommendations for use in those populations. Further, it is likely that acute and chronic pain samples would perform differently on the CCM-SF. For example, acute pain

patients often know the source of their pain is due to injury but the specific organic causes of their pain may be unclear and the consequences of their injury may still be unknown. Therefore, these patients would likely score higher on both the preoccupation and worry subscales than those in the current study. Chronic pain samples may score higher on the worry scale than experimental pain samples, as there are often unknown factors associated with chronic pain, similar in this regard to acute pain patients. However, there may be greater variability within chronic pain samples based on duration, frequency, and intensity of pain and level of acceptance. For example, participants who continue to search for an organic cause of and cure for their pain would likely score high on both the preoccupation and worry subscales. However, those chronic pain patients who have accepted the pain as part of their lives may not score as high on the worry subscale. All of these questions are left for future studies to elucidate.

Beyond this, the CCM-SF evaluates unique pain-related cognitions and removes depressive ideation from the assessment of catastrophizing in response to pain. The literature has established that catastrophizing and depression are related but unique constructs (Arnow et al., 2011; Noel, et al., 2012). Therefore, the measurement of depressive response to pain within a measure of pain catastrophizing provides for a lack of clarity in the specific effect of catastrophizing on the pain experience. While the relation between depression and pain has been established in the literature, depressive ideation in response to pain has been untouched and should be explored in future research as a unique component of the cognitive contributions to the pain experience.

While the CCM-SF has salient strengths, this study is not without limitations. This validation study provides information specifically on the utility and performance of the measure in an experimental pain task. This is a unique type of pain experience in which participants have

control over their pain, know its source, and know that it is harmless. Additionally, these participants know they are being observed which can also influence motivation to withstand pain. It gives solid information on pain-related thoughts in presumably healthy college students. However, it represents a limited sample and does not provide information about the larger population in which assessment of negative pain-related thoughts would be most useful, clinical patients with either chronic or acute pain complaints.

Overall, this study established the CCM-SF as psychometrically sound and a good predictor of pain responsivity variables in a healthy college student sample exposed to a cold pressor task. Additionally, it addresses the problems associated with the current gold standard measure of pain catastrophizing, the PCS. Specifically, it provides independently reliable and useful subscales that can be used jointly or separately and it eliminates ambiguous language and compound statements. Beyond this, the subscales of the CCM-SF contribute equally to the total score and items from the two subscales were randomly distributed throughout the measure to reduce the influence of item clustering on response patterns. Future research to explore the performance of this new measure in clinical samples is already being planned.

REFERENCES

Arnow, B., Balsey, C., Constantino, M., Robinson., Hunkeler, E., Lee, J.,…Hayward, C. (2011). Catastrophizing, depression and pain-related disability. *General Hospital Psychiatry*, *33*, 150-156.

Beck, A. T. (1967). *Depression: Clinical, experimental, and theoretical aspects*. New York: Harper & Row.

Beck, A. T. (1979). *Cognitive Therapy of Depression*. New York: The Guilford Press.

Beecher, H. (1966). Ethics and clinical research. *The New England Journal of Medicine, 274,* 1354-1360.

Bradlow, E., & Fitzsimons, F. (2001). Subscale distance and item clustering effects in self-administered surveys: A new metric. *Journal of Marketing Research*, *38*, 254-261.

Butler, R., Damarin, F., Beaulieu, C., Schwebel, A., & Thorn, B. (1989). Assessing cognitive coping strategies for acute postsurgical pain. *Psychological Assessment*, *1*(1), 41-45.

Campbell, C., Kronfli, T., Buenaver, L., Smith, M., Berna, C., Haythornthwaite, J., & Edwards, R. (2010). Situational versus dispositional measurement of catastrophizing: Associations with pain responses in multiple samples. *The Journal of Pain*, *11*(5), 443-453.

Clark, W. C., & Hunt, H. F. (1971). Pain. In J. A. Downey & R. C. Darling (Eds.),

Physiological basis of rehabilitation medicine. Philadelphia: W. B. Saunders.

Clements, K.L. (2006). *Revising the pain catastrophizing scale*. (Unpublished doctoral dissertation). University of Alabama, Tuscaloosa, AL.

Cohen, F., & Lazarus, R. (1973). Active coping processes, coping dispositions, and recovery from surgery. *Psychosomatic Medicine*, 35, 375-389.

Crombez, G., Eccleston, C., Van den Broek, A., Van Doudenhove, B., & Goubert, L. (2002) The effects of catastrophic thinking about pain on attentional interference by pain: No mediation of negative affectivity in healthy volunteers and in patients with low back pain. *Pain Research and Management, 7*, 31-33.

Davey, G. C. L., & Levy, S. (1999). Internal statements associated with catastrophic worrying. *Personality and Individual Differences, 26,* 21-32.

Dixon, K., Thorn, B. E., & Ward, L. C. (2004). An evaluation of sex differences in psychological and physiological responses to experimentally-induced pain: A path analytic description. *Pain*, *112*, 188-196.

Edwards, R., Calahan, C., Mensing, G., Smith, M., Haythornthwaite, J. (2011). Pain, catastrophizing, and depression in the rheumatic diseases. *Nature Reviews Rheumatology*, *7*, 216-224.

Fisher, E. B., Thorpe, C. T., McEvoy DeVellis, B., & DeVellis, R.F. (2007). Healthy coping, negative emotions, and diabetes management: A systematic review of appraisal. *The Diabetes Educator, 33,* 1080-1103.

France, C. R., Keefe, F. J., Emery, C. F., Afflec, G., France, J. L., Waters, S., . . . Edwards, C. (2004). Laboratory pain perception and clinical pain in post-menopausal women and age-matched men with osteoarthritis: Relationship to pain coping and hormonal status. *Pain, 112*(3), 274-281.

Gendreau, M., Hufford, M., & Stone, A. (2003). Measuring clinical pain in chronic widespread pain: Selected methodological issues. *Best Practice & Research*, *17*(4), 575-592.

Gil, K. M., Williams, D. A., Keefe, F. J., & Beckham, J. C. (1990). The relationship of negative thoughts to pain and psychological distress. *Behavior Therapy, 21,* 349-362.

Hayton, J., Allen, D., & Scarpello, V. (2004). Factor retention decisions in exploratory factor analysis: A tutorial on parallel analysis. *Organizational Research Methods,7*, 191.

Jackson, T., Pope, L., Nagasaka, T., Fritch, A., Lezzi, T., & Chen, H. (2005). The impact of threatening information about pain on coping and pain tolerance. *British Journal of Health Psychology, 10*(3), 441-451.

Kaloupek, D., White, H., & Wong, M. (1984). Multiple assessment of coping strategies used by volunteer blood donors: Implications for preparatory training. *Journal of Behavioral Medicine*, *7*(1), 35-60.

Kapoor, S., Thorn, B., Bandy, O., & Clements, K. (2013). Pain referents used to respond to the Pain Catastrophizing Scale. *European Journal of Pain*. Manuscript invited for revisions and resubmission**.**

Keefe, F. J., Rumble, M. E., Scipio, C. D., Giordano, L. A., & Perri, L. M. (2004). Psychological aspects of persistent pain: Current state of the science. *Journal of Pain, 5*, 195-211.

Lazarus, R. S., & Folkman, S. (1984). *Stress, Appraisal, and Coping.* New York: Springer.

MacCallum, R., Browne, M., & Sugawara, H. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods*, *1*(2), 130-149.

MacCallum, R. C., Widaman, K. F., Zhang, S., & Hong, S. (1999). Sample size in factor analysis. *Psychological Methods*, 4, 84-99.

McCracken, L., Zayfert, C., & Gross, R. (1992). The pain anxiety symptoms scale: Development and validation of a scale to measure fear of pain. *Pain*, *50*, 67-73.

Merens, W., Van der Does, A., & Spinhoven, P. (2007). The effects of serotonin manipulations on emotional information processing and mood. *Journal of Affective Disorders*, *103*, 43-62.

Meyer, T. J., Miller, M. L., Metzger, R. L., & Borkovec, T. D. (1990). Development and validation of the Penn State Worry Questionnaire. *Behavior Research & Therapy, 28,* 487-495.

Mills, M., & Farrow, J. (1981). The transcendental meditation technique and acute experimental pain. *Psychosomatic Medicine*, *43*(*2*), 157-164.

Muthén, L. K. & Muthén, B. O. (2012). MPlus (Version 6.12) [Computer software]. Los Angeles, CA: Muthén & Muthén. Available from http://www.statmodel.com/

Noel, V., Francis, S., Williams-Outerbridge, K., & Fung, S. (2012). Catastrophizing as a predictor of depressive and anxious symptoms in children. *Cognitive Therapy Research*, *36*, 311-320.

Osman, A., Barrios, F. X., Gutierrez, P. M., Kopper, B. A., Merrifield, T. & Grittman, L. (2000). The Pain Catastrophizing Scale: Further psychometric evaluation with adult samples. *Journal of Behavioral Medicine, 23,* 351-365.

Pence, L., Thorn, B., Day, M., & Shelby, G. (2011). Appraisals, catastrophizing, and pain. *Journal of Pain, 12*(5), 563-572.

Perlis, M. L. & Lichstein, K. L. (2003). *Treating Sleep Disorders*. Hoboken, New Jersey: Wiley.

Peterson, C., Seligman, M. E. P., Yurko, K. H., Martin, L. R., & Friedman, H. S. (1998). Catastrophizing and untimely death. *Psychological Science, 9,* 127-130.

Price, D. D., McGrath, P. A., Rafii, A., & Buckingham, B. (1983). The validation of visual analogue scales as ratio scale measures for chronic and experimental pain. *Pain, 17*, 43-56.

Rainville, P., Feine, J. S., Bushnell, M. C., & Duncan, G. (1992). A psychophysical comparison of sensory and affective responses to four modalities of experimental pain. *Somatosensory & Motor Research, 9(4),* 265-277.

Riskind, J. H. & Williams, N. L. (1999). Specific cognitive content of anxiety and catastrophizing: Looming vulnerability and the looming maladaptive style. *Journal of Cognitive Psychotherapy: An International Quarterly, 13,* 41-54.

Rosenstiel, A. K., & Keefe, F. J. (1983). The use of coping strategies in chronic low back pain patients: Relationship to patient characteristics and current adjustment. *Pain 17,* 33-40.

Sanford, S. D., Kersh, B. C., Thorn, B. E., Rich, M. A., & Ward, L. C. (2002). Psychosocial mediators of sex differences in pain responsivity. *Journal of Pain, 3*, 58-64.

Smith, G. M., Egbert, L., Markowitz, R., Mosteller, F., & Beecher, H. K. (1966). An experimental pain method sensitive to morphine in man: The submaximum effort tourniquet technique. *Journal of Pharmacology and Experimental Therapeutics, 145,* 324-332.

Smith, M. T., Perlis, M. L., Carmody, T. P., Smith, M. S., & Giles, D. E. (2001). Presleep cognitions in patients with insomnia secondary to chronic pain. *Journal of Behavioral Medicine*, *24*, 93-114.

Smitherman, A. & Thorn, B. (2011). [Evaluating the construct of pain catastrophizing with an experimental pain task]. Unpublished raw data.

Spanos, N. P., Brown, J. M., Jones, B., & Horner, D. (1981). Cognitive activity and suggestions for analgesia in the reduction of reported pain. *Journal of Abnormal Psychology*, *90*, 554-561.

Spanos, N. P., Radtke-Bodorik, H. L., Ferguson, J. D., & Jones, B. (1979). The effects of hypnotic suggestibility, suggestions for analgesia, and utilization of cognitive strategies on the reduction of pain. *Journal of Abnormal Psychology, 88,* 282-292.

Steiger, J. (1980). Tests for comparing elements of a correlation matrix. *Psychological Bulletin*, *87*(2), 245-251.

Sullivan, M. J. L., Bishop, S. R., & Pivik, J. (1995). The pain catastrophizing scale: Development and validation. *Psychological Assessment, 7,* 524-532.

Sullivan, M. J. L., & D'Eon, J. L. (1990). Relation between catastrophizing and depression in chronic pain patients. *Journal of Abnormal Psychology, 99,* 260-263.

Sullivan, M. J., & Neish, N. (1999). The effects of disclosure on pain during dental hygiene treatment: The moderating role of catastrophizing. *Pain, 79*, 155-163.

Sullivan, M. J., Stanish, W., Waite, H., Sullivan, M., & Tripp, D. A. (1998). Catastrophizing, pain, and disability in patients with soft-tissue injuries. *Pain, 77*, 253-260.

Sullivan, M. J. L., Thorn, B., Haythornthwaite, J. A., Keefe, F., Martin, M., Bradley, L. A., & Lefebvre, J.C. (2001). Theoretical perspectives on the relation between catastrophizing and pain. *The Clinical Journal of Pain, 17,* 52-64.

Sullivan, M. J., Tripp, D. A., Rodgers, W. M., & Stanish, W. (2000). Catastrophizing and pain perception in sports participants. *Journal of Applied Sports Psychology, 12*, 151-167.

Sullivan, M. J. L., Tripp, D. A., & Santor, D. (2000). Gender differences in pain and pain behavior: The role of catastrophizing. *Cognitive Therapy and Research, 24,* 121-134.

Thorn, B. E. (2004). *Cognitive Therapy for Chronic Pain: A Step-by-Step Guide*. New York: Guilford Press.

Turk, D. C., Meichenbaum, D., & Genest, M. (1983). *Pain and Behavioral Medicine: a Cognitive Behavioral Perspective*. New York: Guildford Press.

Turner, J. A., & Aaron, L. A. (2001). Pain-related catastrophizing: What is it? *The Clinical Journal of Pain, 17,* 65-71.

Turner, J., Mancl, L., & Aaron, L. (2004). Pain-related catastrophizing: A daily process study. *Pain*, *110*, 103-111.

Unruh, A. M., & Ritchie, J. A. (1998). Does gender affect appraisals of pain and pain coping strategies? *The Clinical Journal of Pain, 15*, 31-40.

Vasey, M. W., & Borkovec, T. D. (1992). A catastrophizing assessment of worrisome thoughts. *Cognitive Therapy and Research, 16,* 505-520.

Watkins, M. (2006). Determining parallel analysis criteria. *Journal of Modern Applied Statistical Methods,5*(2), 344-346.

Table 1. *Scale/Subscale Composition*

Preoccupation	Measure of Origin
I kept thinking about how badly I wanted the pain to stop.	PCS
I told myself that I didn't think I could bear the pain any longer.	CCSI
I thought that my pain was pretty awful.	CCSI
I thought about the pain constantly.	PASS
I kept thinking of how badly it hurt.	PCS
I found it virtually impossible to keep my mind off of my pain and how bad it hurt.	CCSI
I couldn't seem to keep it out of my mind.	PCS
Worry	
I became afraid that something terrible will happen.	PASS
I became concerned that the pain might mean something is wrong with me.	PAI
I began to worry that something might be seriously wrong with me.	CCSI
I began thinking of all the possible bad things that could go wrong in association with the pain.	CCSI
I found myself worrying about possibly dying.	CCSI
I thought that I might be seriously ill.	PASS
I wondered if something serious may happen.	PCS

Table 2. *Reliability Statistics for Scales and Subscales*

Measure/Scale	# of items	Cronbach's alpha (α)
CCM-SF 1 (Dispositional)		
Total	14	.921
Preoccupation Scale	7	.906
Worry Scale	7	.879
CCM-SF 2 (Situational)		
Total	14	.914
Preoccupation Scale	7	.952
Worry Scale	7	.853
PCS 1 (Dispositional)		
Total	13	.907
Rumination Scale	4	.897
Magnification Scale	3	.593
Helplessness Scale	6	.832
PCS 2 (Situational)		
Total	13	.931
Rumination Scale	4	.940
Magnification Scale	3	.484
Helplessness Scale	6	.883

Table 3. *Means and Standard Deviations of Scale and Subscale Scores*

	Sex					
	Men		Women		All	
Scale/Subscale	Mean	SD	Mean	SD	Mean	SD
CCM-SF 1 (Dispositional)						
Total	20.68	8.42	26.16	10.52	23.72	10.01
Preoccupation	10.58	4.90	13.58	6.12	12.25	5.79
Worry	10.09	4.57	12.54	5.61	11.46	5.31
CCM-SF 2 (Situational)						
Total	13.79	8.98	17.85	10.29	16.03	9.91
Preoccupation	12.52	7.68	15.70	8.21	14.29	8.12
Worry	1.28	3.16	2.08	3.61	1.72	3.164
PCS 1						
Total	17.88	8.36	22.94	9.28	20.70	9.17
Rumination	7.13	3.53	9.36	3.66	8.37	3.76
Magnification	4.14	2.09	4.83	2.39	4.52	2.28
Helplessness	6.61	3.87	8.76	4.56	7.81	4.39
PCS 2						
Total	18.19	11.10	23.22	12.44	21.00	12.10
Rumination	8.00	4.59	10.22	4.75	9.24	4.80
Magnification	1.84	1.84	2.93	2.31	2.45	2.18
Helplessness	8.34	5.79	10.07	6.60	9.30	6.30

Table 4. *Regressions analyses of subscales predicting pain outcomes*

	Predicting (DV)	Predictor (IV)	B	SE B	β	*p*
CCM-SF 1 (Dispositional)						
	Tolerance					
		Preoccupation	-3.74	1.38	-.23	.007
		Worry	-.59	1.51	-.39	.697
	Notes: R^2= .06, F(2, 212) = 7.16, p = .001					
	Intensity					
		Preoccupation	.83	.32	.22	.011
		Worry	.31	.35	.08	.376
	Notes: R^2= .07, F(2, 213) = 8.42, p = .000					
	Unpleasantness					
		Preoccupation	.79	.30	.22	.010
		Worry	.36	.33	.09	.274
	Notes: R^2= .08, F(2, 213) = 9.43, p = .000					
CCM-SF 2 (Situational)						
	Tolerance					
		Preoccupation	-4.64	.80	-.40	.000
		Worry	-2.49	2.05	-.08	.226
	Notes: R^2= .20, F(2, 208) = 25.28, p = .000					
	Intensity					
		Preoccupation	1.49	.17	.55	.000
		Worry	.53	.43	.08	.226
	Notes: R^2= .34, F(2, 209) = 54.06, p = .000					
	Unpleasantness					
		Preoccupation	11.53	.16	.59	.000
		Worry	.18	.41	.03	.65
	Notes: R^2= .36, F(2, 209) = 58.76, p = .000					

Table 5. *ANOVA of Sex and Scale/Subscale Scores on Catastrophizing Measures*

	Sum of Squares	*df*	*Mean Square*	*F*
CCM-SF 1 (Dispositional)				
Total Score				
Between	1602.35	1	1602.35	17.2*
Within	19940.98	214	93.18	
Total	21543.33	215		
Preoccupation				
Between	480.00	1	480.00	15.27*
Within	6728.50	214	31.44	
Total	7208.50	215		
Worry				
Between	319.60	1	319.6	11.93*
Within	5760.24	215	26.79	
Total	6079.83	216		
CCM-SF 2 (Situational)				
Total Score				
Between	866.45	1	866.45	9.16*
Within	19856.32	210	94.55	
Total	20722.77	211		
Preoccupation				
Between	537.61	1	537.60	8.44*
Within	13566.93	213	63.69	
Total	14104.54	214		
Worry				
Between	34.175	1	34.175	3.45
Within	2098.56	212	9.90	
Total	2132.73	213		
PCS 1 (Dispositional)				
Total Score				
Between	1374.44	1	1374.44	17.62*
Within	16767.10	215	77.99	
Total	18141.53	216		
Rumination				
Between	266.29	1	266.29	20.56*
Within	2784.22	215	12.95	
Total	3050.51	216		
Magnification				
Between	25.56	1	25.56	5.00*
Within	1098.60	215	5.11	
Total	1124.16	216		
Helplessness				
Between	246.46	1	24.46	13.53*

	Within	3916.79	215	18.22	
	Total	4163.25	216		
PCS 2 (Situational)					
Total Score					
	Between	1357.40	1	1357.40	9.64*
	Within	30267.60	215	140.78	
	Total	31625.00	216		
Rumination					
	Between	264.56	1	264.56	12.08*
	Within	4708.98	215	21.90	
	Total	4973.54	216		
Magnification					
	Between	63.615	1	63.615	14.22*
	Within	962.13	215	4.48	
	Total	1025.74	216		
Helplessness					
	Between	158.80	1	158.80	4.06*
	Within	8.417.13	215	39.15	
	Total	8575.93	216		

*$p<.05$

Table 6. *Means and standard deviations of pain responsivity variables*

	N	*M*	*SD*
Intensity (mm from 1-100)	217	59.56	22.12
Unpleasantness (mm from 1-100)	217	73.00	21.04
Tolerance Ratings (seconds 0-300)	216	115.82	93.81

Table 7. *Cutoff Scores Indicating Low and High Catastrophizers*

Variable	Low	High
CCM-SF 1		
Total Score	≤19	≥28
Preoccupation	≤9	≥15
Worry	≤9	≥14
CCM-SF 2		
Total Score	≤12	≥21
Preoccupation	≤11	≥19
Worry	≤0	≥1

Table 8. *Means and Standard Deviations on Catastrophizing Measures for Low and High Catastrophizers*

	Low Catastrophizers		High Catastrophizers	
Variable	M	SD	M	SD
CCM-SF 1 (Dispositional)				
Total	13.49 (n=80)	4.92	34.93 (n=74)	5.46
Preoccupation	6.37 (n=79)	2.48	18.79 (n=76)	3.13
Worry	5.77 (n=78)	2.47	17.29 (N=75)	2.78
CCM-SF 2 (Situational)				
Total	5.45 (n=76)	3.85	27.35 (N=74)	5.15
Preoccupation	5.3 (n=79)	3.74	23.14 (n=80)	2.85
Worry	0 (n=129)	0.00	4.2 (n=91)	3.70

Table 9. *Correlations Among Measures and Responsivity Variables*

	CCM-SF 1	CCM-SF 2	PCS 1	PCS 2	PAI-Challenge Scale	PAI-Threat Scale	Pain Tolerance	Pain Intensity	Pain Unpleasantness
CCM-SF 1 (dispositional)	--	.526*	.788*	.511*	-.204*	.570*	-.238*	.265*	.281*
CCM-SF 2 (situational)	.526*	--	.544	.904*	-.257-	.255*	-.439*	.575*	.581*
PCS 1 (dispositional)	.788*	.544*	--	.548*	-.235*	.528*	-.230*	.297*	.264*
PCS 2 (situational)	.511*	.904*	.548*	--	-.268*	.278*	-.461*	.566*	.539*
PAI-Challenge Scale	-.204*	-.257*	-.235*	-.268*	--	.035	.296*	-.114	-.224*
PAI-Threat Scale	.570*	.255*	.528*	.278*	.035	--	-.130	.200*	.151*
Pain Tolerance	-.238*	-.439*	-.230*	-.461*	.296*	-.130	--	-.390*	-.434*
Pain Intensity	.265*	.575*	.297*	.566*	-.114	.200*	-.390*	--	.534*
Pain Unpleasantness	.281*	.581*	.264*	.539*	-.224*	.151*	-.434*	.534*	--

*p<.05

Table 10. *Correlations among CCM-SF 1 (Dispositional) subscales and responsivity*

	Preoccupation	Worry	Pain Tolerance	Pain Intensity	Pain Unpleasantness
Preoccupation	--	.625*	-.250*	.264*	.276*
Worry	.625*	--	-.177*	.209*	.233*
Pain Tolerance	-.250*	-.177*	--	-.390*	-.434*
Pain Intensity	.264*	.209*	-.390*	--	.534*
Pain Unpleasantness	.276	.233*	-.434	.534*	--

*$p<.05$

Table 11. *Correlations among CCM-SF 2 (Situational) subscales and responsivity*

	Preoccupation	Worry	Pain Tolerance	Pain Intensity	Pain Unpleasantness
Preoccupation	--	.436*	-.432*	.573*	.586*
Worry	.436*	--	-.256*	.316*	.283*
Pain Tolerance	-.432*	-.256*	--	-.390*	-.434*
Pain Intensity	.573*	.316*	-.390*	--	.534*
Pain Unpleasantness	.586*	.283*	-.434*	-.534*	--

*$p<.05$

Table 12. *Correlations among PCS 1 (Dispositional) subscales and responsivity*

	Rumination	Magnification	Helplessness	Pain Tolerance	Pain Intensity	Pain Unpleasantness
Rumination	--	.488*	.769*	-.230*	.292*	.256*
Magnification	.488*	--	.581*	-.173*	.187*	.216*
Helplessness	.769*	.581*	--	-.193*	.272*	.221*
Pain Tolerance	-.230*	-.173*	-.193*	--	-.390*	-.434*
Pain Intensity	.292*	.187*	.272*	-.390*	--	.534*
Pain Unpleasantness	.256*	.216*	.221*	-.434*	.534*	--

*$p<.05$

Table 13. *Correlations among PCS 2 (Situational) subscales and responsivity*

	Rumination	Magnification	Helplessness	Pain Tolerance	Pain Intensity	Pain Unpleasantness
Rumination	--	.582*	.801*	-.445*	.535*	.552*
Magnification	.582*	--	.668*	-.361*	.428*	.380*
Helplessness	.801*	.668*	--	-.422*	.531*	.484*
Pain Tolerance	-.445*	-.361*	-.422*	--	-.390*	-.434*
Pain Intensity	.535*	.428*	.531*	-.390*	--	.534*
Pain Unpleasantness	.552*	.380*	.484*	-.434*	.534*	--

*$p<.05$

Figure 1. *Scree plot of EFA*

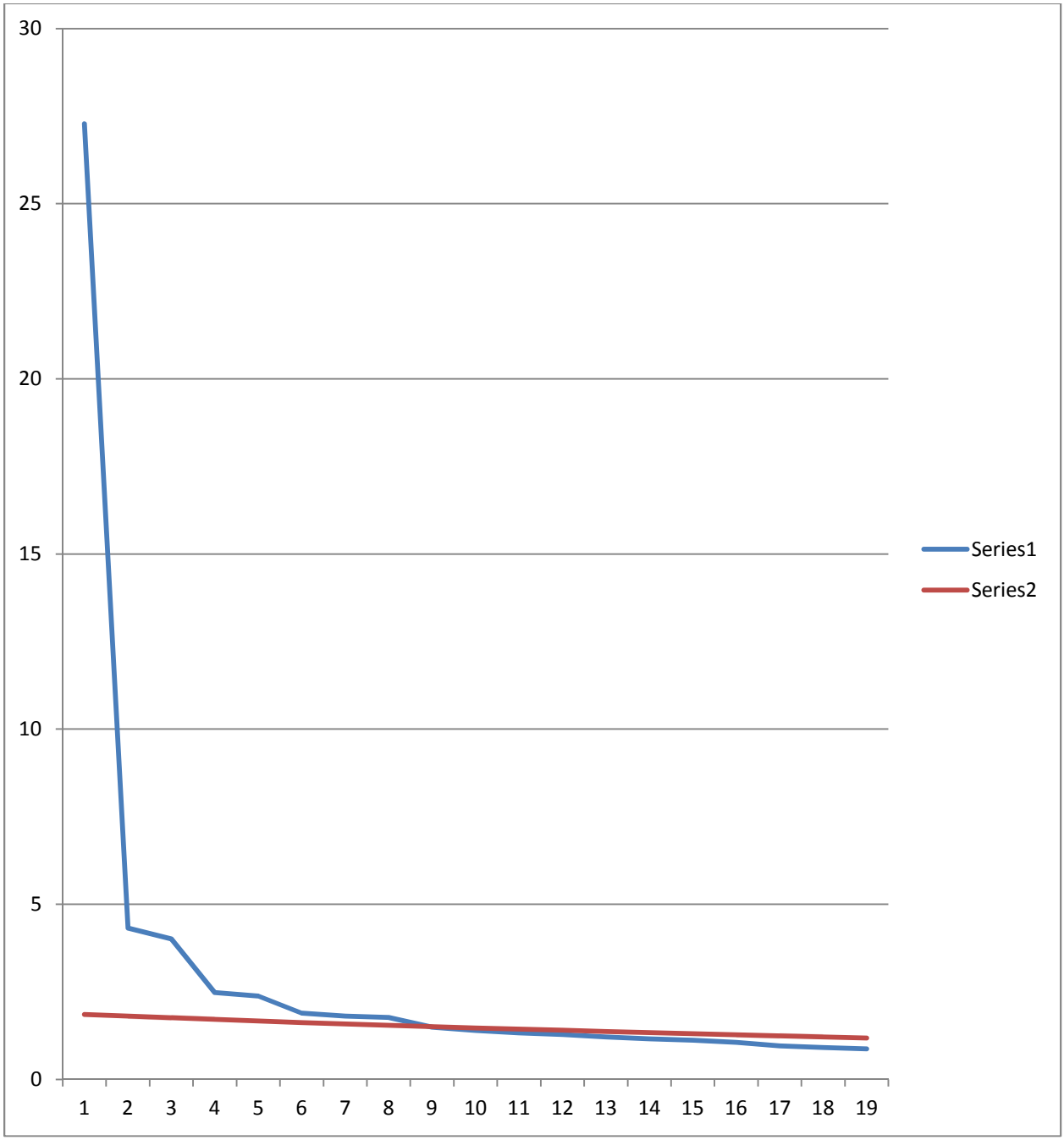


Figure 2. *CFA of Dispositional (Pre-CPT) Administration of CCM-SF*

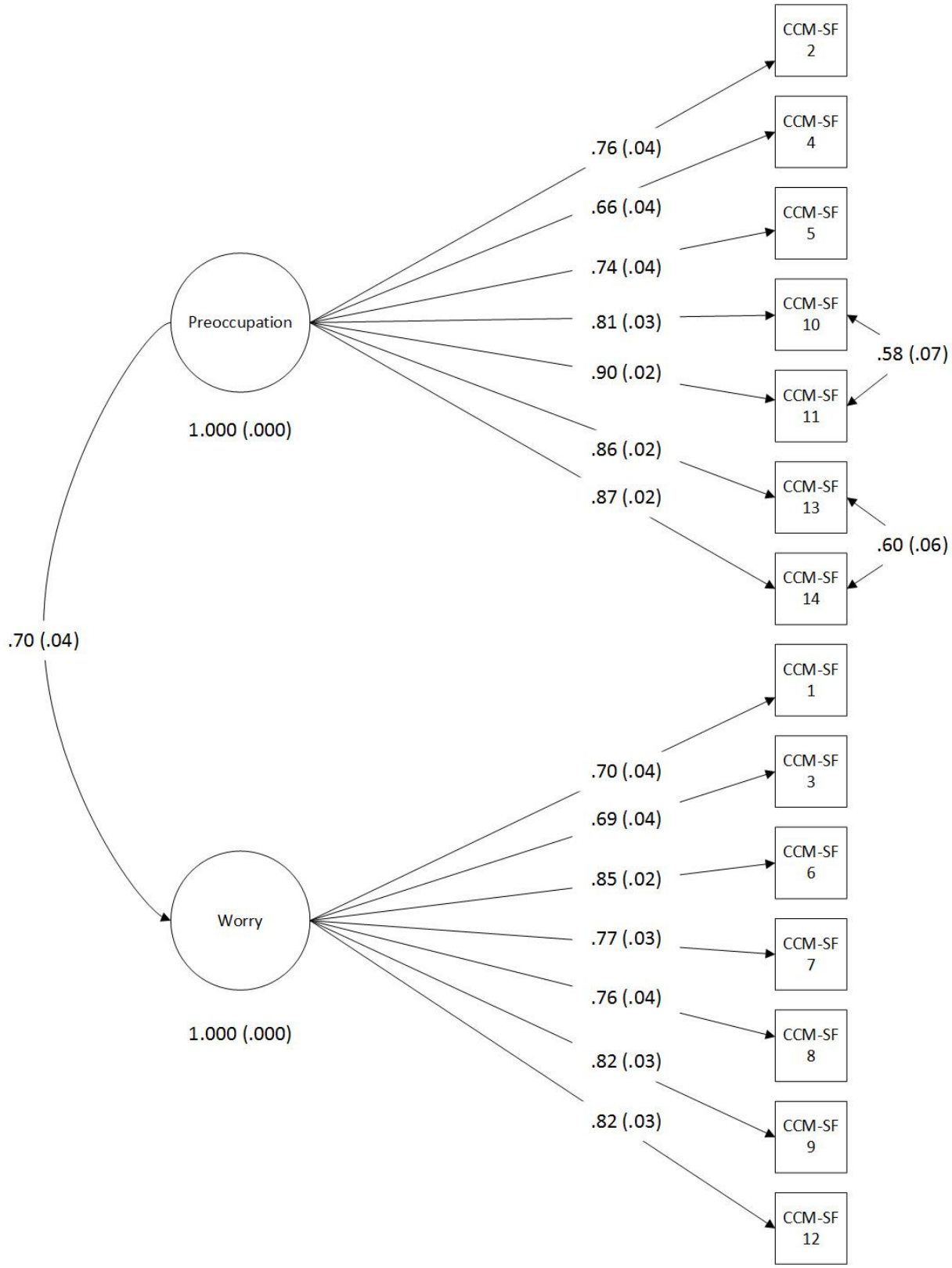
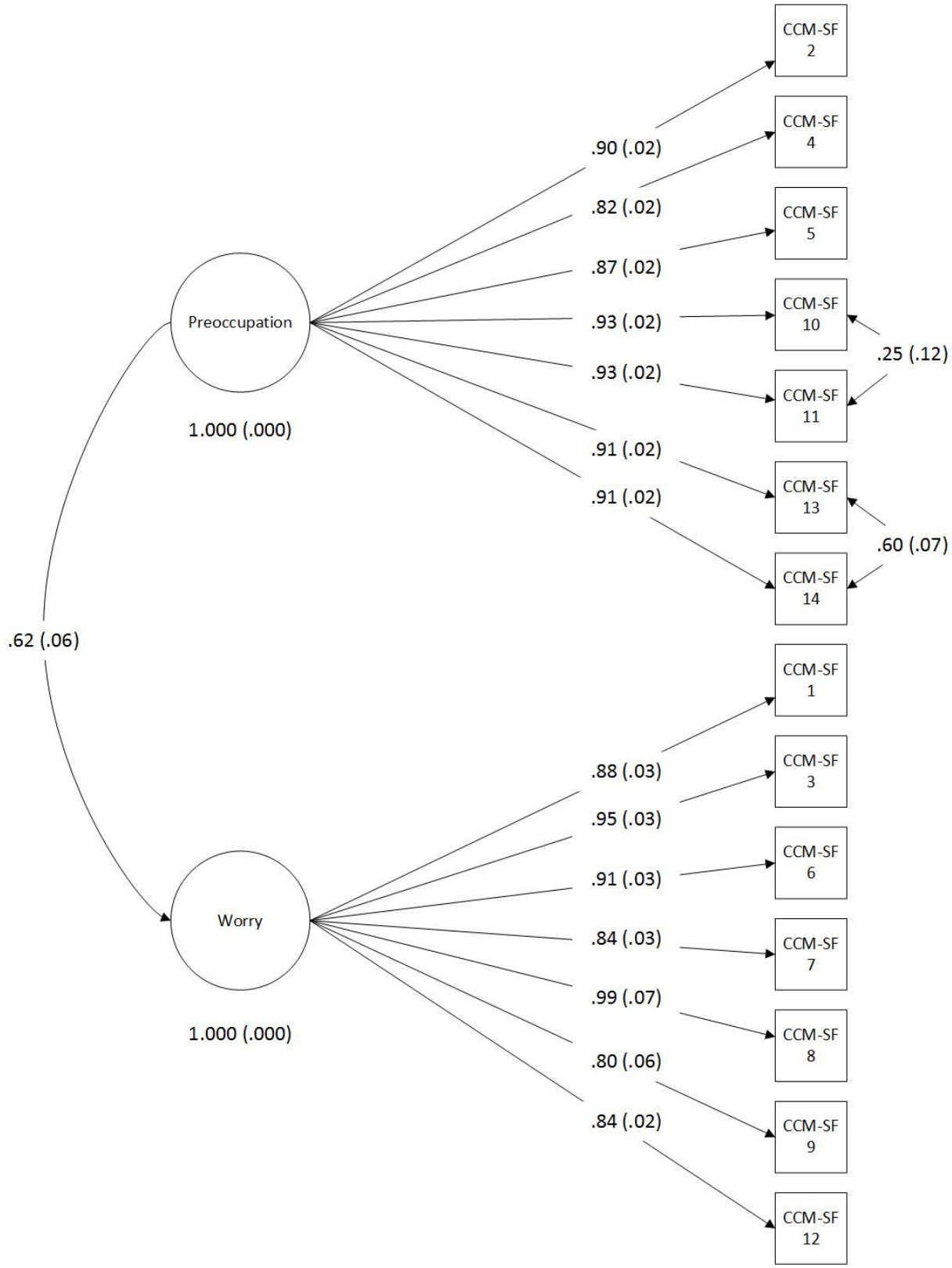


Figure 3. *CFA of Situational (Post-CPT) Administration of CCM-SF*



APPENDIX

CCM

On a scale from 1 (not at all similar) to 5 (extremely similar), please write the number that best describes how much each item listed is similar to a thought or feeling you have when you experience physical pain.

Before beginning, please reflect on your recent experience where your hand was immersed in ice water.

1	2	3	4	5
not at all similar			**extremely similar**	

	1	During painful episodes it is difficult for me to think of anything besides the pain.
	2	I know if I do anything it is going to make my pain worse.
	3	I keep thinking about death.
	4	My sleeping patterns change.
	5	I am so inadequate.
	6	I am concerned that the pain might mean something is wrong with me.
	7	I am worthless.
	8	I feel I can't stand it anymore.
	9	I think that if my pain gets too severe, it will never decrease.
	10	I think of the pain as a threat.
	11	I can't help but concentrate on how bad the pain actually feels.
	12	I can't do anything for others.
	13	I wonder whether something serious may happen.
	14	When I feel pain, I become afraid of dying.
	15	I feel my life isn't worth living.
	16	Even though it hurts, I know that I'm going to be okay.
	17	It is my own fault I hurt like this.
	18	My pain is getting worse.
	19	I feel like crying.
	20	No one cares about me anymore.
	21	I have a change in appetite.
	22	I am helpless.
	23	I've injured myself again.
	24	Bad things seem to always happen to me.
	25	I worry when I am in pain.
	26	I can't stand depending on my family and friends anymore.
	27	Other people have to do everything for me.
	28	It's awful and I feel that it overwhelms me.
	29	I find myself expecting the worst.
	30	Pain sensations are terrifying.
	31	I lose interest in things I normally find pleasurable.
	32	I think that I have a serious medical problem that my physician has failed to

	uncover.
	33 I have trouble making decisions.
	34 I am worried about being depressed or discouraged because of the pain.
	35 I find it hard to concentrate when I hurt.
	36 I can't seem to keep it out of my mind.
	37 Other people do not believe I have pain.
	38 I feel I can't go on.
	39 I must have done something to bring on this pain.
	40 Unless I start going with them (for example: my family, to a baseball game), I won't have anyone to go out with.
	41 I can't think straight when in pain.
	42 No one wants to hear about my problems.
	43 My family has taken over all of my responsibilities.
	44 I begin thinking of all the possible bad things that could go wrong in association with the pain.
	45 When I feel pain, I am afraid that something terrible will happen.
	46 I am concerned about how much pain I can take.
	47 When pain comes on strong, I think that I might become paralyzed or more disabled.
	48 I anxiously want the pain to go away.
	49 I am going to become an invalid.
	50 There's nothing I can do to reduce the intensity of the pain.
	51 No one cares about my pain.
	52 I become afraid that the pain will get worse.
	53 I am worried about getting things done.
	54 My mind is calm when I am in pain.
	55 When I feel pain, I think that I might be seriously ill.
	56 I begin to worry that something might be seriously wrong with me.
	57 I won't be able to have sex.
	58 I feel disoriented and confused when I hurt.
	59 I am concerned that the pain might become more than I can manage.
	60 I cannot control this pain.
	61 I can't play sports.
	62 Even if I do an activity that causes pain, I know it will decrease later.
	63 I dread feeling pain.
	64 I can think pretty clearly even while experiencing severe pain.
	65 I can no longer do anything.
	66 When I hurt, I think about the pain constantly.
	67 I am more wound up than usual.
	68 I feel hopeless.
	69 It is not fair that I have to live this way.
	70 I feel like I don't have energy.
	71 The pain makes me feel sad.
	72 I am bothered by unwanted thoughts when I'm in pain.
	73 I keep thinking about how badly I want the pain to stop.

	74 I keep thinking of other painful events.
	75 I imagine the pain becoming even more intense and hurtful.
	76 I worry all the time about whether the pain will end.
	77 My thoughts are agitated and keyed up as pain approaches.
	78 I tend to think that my pain is pretty awful.
	79 If I don't get some time to relax during the day, I'm going to be bedridden and unable to work.
	80 If my pain keeps up, I'll be crippled and won't be able to work or even walk.
	81 The pain seems threatening.
	82 I am a burden on my family.
	83 It's terrible and I think its never going to get any better.
	84 I am useless.
	85 I feel like I just want to get up and run away.
	86 I find it virtually impossible to keep my mind off of my pain and how bad it hurts.
	87 I am afraid to do anything.
	88 I keep thinking of how badly it hurts.
	89 I find myself worrying about possibly dying.
	90 I tell myself that I don't think I can bear the pain any longer.
	91 I won't be able to exercise at all.
	92 I feel controlled by the pain.

Demographics Questionnaire

Sex (please check one)

☐ Male

☐Female

Race (please check one)

☐White, non Hispanic

☐Black, African American

☐Hispanic

☐Asian

☐Native American

☐Other

Age _____

Height _____

Weight _____

CCM-SF-1 (Dispositional)

We are interested in the types of thoughts and feelings that you have when you are in pain. Listed below are fourteen statements describing different thoughts and feelings that may be associated with pain. Using the following scale, please indicate the degree to which you have these thoughts and feelings listed below when you are experiencing pain in general.

0	1	2	3	4
not at all				**All the time**

1.	When I feel pain, I am afraid that something terrible will happen.	
2.	I keep thinking about how badly I want the pain to stop.	
3.	I am concerned that the pain might mean something is wrong with me.	
4.	I tell myself that I don't think I can bear the pain any longer.	
5.	I tend to think that my pain is pretty awful.	
6.	I begin to worry that something might be seriously wrong with me.	
7.	I begin thinking of all the possible bad things that could go wrong in association with the pain.	
8.	I find myself worrying about possibly dying.	
9.	When I feel pain, I think that I might be seriously ill.	
10.	When I hurt, I think about the pain constantly.	
11.	I keep thinking of how badly it hurts.	
12.	I wonder whether something serious may happen.	
13.	I find it virtually impossible to keep my mind off of my pain and how bad it hurts.	
14.	I can't seem to keep it out of my mind.	

Assessment of Pain Thoughts

What sources of pain, if any, were you considering when you were completing the questionnaire?

_____
_____
_____

VAS-1

Place a mark like this | at the point on the line below that best describes the intensity of pain that you were thinking about **when you responded to the previous items**.

_____

no pain — pain as bad as it can be

Place a mark like this | at the point on the line below that best describes any unpleasantness related to pain that you were thinking about **when you responded to the previous items**.

_____

not at all unpleasant — extremely unpleasant

Assessment of Current Pain

Are you currently experiencing any pain?

☐Yes ☐No

If yes, please describe your current pain below.

_____
_____
_____

VAS-2

Place a mark like this | at the point on the line below that best describes the intensity of pain that you are **currently experiencing**.

no pain — pain as bad as it can be

Place a mark like this | at the point on the line below that best describes any unpleasantness related to pain that you are **currently experiencing**.

not at all unpleasant — extremely unpleasant

PCS-1 (Dispositional)

Everyone experiences pain 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.

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. Using the following scale, please indicate the degree to which you have these thoughts and feelings when you are experiencing pain.

0- not at all **1**- to a slight degree **2**-to a moderate degree **3**-to a great degree **4**-all the time

When I'm in pain…

___1. I worry all the time about whether the pain will end.

___2. I feel I can't go on.

___3. It's terrible and I think it's never going to get any better.

___4. It's awful and I feel it overwhelms me.

___5. I feel I can't stand it anymore.

___6. I become afraid that the pain will get worse.

___7. I keep thinking of other painful events.

___8. I anxiously want the pain to go away.

___9. I can't seem to keep it out of my mind.

___10. I keep thinking about how much it hurts.

___11. I keep thinking about how badly I want the pain to stop.

___12. There's nothing I can do to reduce the intensity of the pain.

___13. I wonder whether something serious may happen.

PAI

We are interested in how you have been thinking about your pain. Please read each of these sentences. Think about whether you agree or disagree with the sentence. Circle the number that fits with your answer.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
1	2	3	4	5	6

1. I am concerned that the pain might mean something is wrong with me….1 2 3 4 5 6

2. I think the pain is a chance to prove myself……1 2 3 4 5 6

3. I am concerned that the pain might become more than I can manage……1 2 3 4 5 6

4. I think the pain is a test of my strength and ability……..1 2 3 4 5 6

5. I think something good might come out of having the pain……..1 2 3 4 5 6

6. I am worried about getting things done……..1 2 3 4 5 6

7. I think the pain makes me a stronger person……...1 2 3 4 5 6

8. I am concerned about how much more pain I can take……...1 2 3 4 5 6

9. I think the pain is a chance to learn more about myself……..1 2 3 4 5 6

10. The pain seems threatening……...1 2 3 4 5 6

11. I think without pain, there is no gain……1 2 3 4 5 6

12. I am worried about being depressed or discouraged because of the pain……1 2 3 4 5 6

13. I think of this pain as a challenge…….1 2 3 4 5 6

14. I feel controlled by the pain……...1 2 3 4 5 6

15. I think the pain tests how well I can manage…….…...1 2 3 4 5 6

16. I think of the pain as a threat……..……...1 2 3 4 5 6

Assessment of Chronic/Recurrent Pain

1. Chronic pain is pain that occurs more days than not over at least the past three months that interferes with your functioning.

   a. Based on this definition, do you have chronic pain?

   ☐Yes ☐No

   b. What kind?

   _____
   _____
   _____

   c. About how many days did you experience this pain over the past 3 months?

   _____

2. Recurrent pain is pain that periodically interferes with your functioning but does not occur more days than not over the past few months.

   a. Based on this definition, do you have recurrent pain?

   ☐Yes ☐No

   b. What kind?

   _____
   _____
   _____

   c. About how many days did you experience this pain over the past 3 months?

   _____

VAS-3

Place a mark like this | at the point on the line below that best describes the intensity of pain that you experienced **when your hand was in the ice water**.

---

no pain — pain as bad as it can be

Place a mark like this | at the point on the line below that best describes the unpleasantness of pain that you experienced **when your hand was in the ice water**.

---

not at all unpleasant — extremely unpleasant

CCM-SF-2 (Situational)

We are interested in the types of thoughts and feelings that you have when you are in pain. Listed below are fourteen statements describing different thoughts and feelings that may be associated with pain. Using the following scale, please indicate the degree to which you had these thoughts and feelings **when you had your hand in the cold water**.

0	1	2	3	4
Not at all				**All the time**

1.	I became afraid that something terrible will happen.	
2.	I kept thinking about how badly I wanted the pain to stop.	
3.	I became concerned that the pain might mean something is wrong with me.	
4.	I told myself that I didn't think I could bear the pain any longer.	
5.	I thought that my pain was pretty awful.	
6.	I began to worry that something might be seriously wrong with me.	
7.	I began thinking of all the possible bad things that could go wrong in association with the pain.	
8.	I found myself worrying about possibly dying.	
9.	I thought that I might be seriously ill.	
10.	I thought about the pain constantly.	
11.	I kept thinking of how badly it hurt.	
12.	I wondered if something serious may happen.	
13.	I found it virtually impossible to keep my mind off of my pain and how bad it hurt.	
14.	I couldn't seem to keep it out of my mind.	

PCS-2 (Situational)

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. Using the following scale, please indicate the degree to which you had these thoughts and feelings **when you had your hand in the cold water**.

0- not at all **1**- to a slight degree **2**-to a moderate degree **3**-to a great degree **4**-all the time

When I'm in pain…

___1. I worry all the time about whether the pain will end.

___2. I feel I can't go on.

___3. It's terrible and I think it's never going to get any better.

___4. It's awful and I feel it overwhelms me.

___5. I feel I can't stand it anymore.

___6. I become afraid that the pain will get worse.

___7. I keep thinking of other painful events.

___8. I anxiously want the pain to go away.

___9. I can't seem to keep it out of my mind.

___10. I keep thinking about how much it hurts.

___11. I keep thinking about how badly I want the pain to stop.

___12. There's nothing I can do to reduce the intensity of the pain.

___13. I wonder whether something serious may happen.

VAS-4

Place a mark like this | at the point on the line below that best describes the intensity of pain that you experienced **when your hand was in the ice water**.

---

no pain — pain as bad as it can be

Place a mark like this | at the point on the line below that best describes the unpleasantness of pain that you experienced **when your hand was in the ice water**.

---

not at all unpleasant — extremely unpleasant

Office for Research

Institutional Review Board for the
Protection of Human Subjects

THE UNIVERSITY OF

R E S E A R C H

October 2, 2012

Anna Smitherman
Department of Psychology
College of Arts & Sciences
The University of Alabama

Re: IRB Protocol # 12-013-ME
"Development and Validation of the Composite Catastrophizing Measure-Short Form"

Ms. Smitherman:

The University of Alabama IRB has received the revisions requested by the full board on 8/15/12. The board has reviewed the revisions and your protocol is now approved for a one-year period. Please be advised that your protocol will expire one year from the date of approval, 8/9/12.

If your research will continue beyond this date, complete the Renewal Application Form. If you need to modify the study, please submit the Modification of An Approved Protocol Form. Changes in this study cannot

apparent immediate hazards to participants. When the study closes, please complete the Request for Study Closure Form.

Should you need to submit any further correspondence regarding this proposal, please include the assigned IRB application number. Please use reproductions of the IRB approved stamped consent/assent forms to obtain consent from your participants.

Good luck with your research.

Sincerely

John C. Higginbotham, Ph.D., MPH
Medical IRB Chair
The University of Alabama

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