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I Feel Your Pain: The Influence Of Pain Catastrophizing And Perceived Threat On Pain Severity Congruence In Couples

Shannon Clark
Wayne State University,

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**I FEEL YOUR PAIN: THE INFLUENCE OF PAIN CATASTROPHIZING AND
PERCEIVED THREAT ON PAIN SEVERITY CONGRUENCE IN COUPLES**

by

SHANNON CLARK

THESIS

Submitted to the Graduate School

of Wayne State University,

Detroit, Michigan

in partial fulfillment of the requirements

for the degree of

MASTER OF ARTS

2016

MAJOR: CLINICAL PSYCHOLOGY

Approved By:

Advisor

Date

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Chapter 1

Introduction

The Importance of Understanding Pain

Fearful expectations of pain can exacerbate pain. For example, pre-operative anxiety predicts post-surgical pain severity in children and adults (Kain, Mayes, Caldwell-Andrews, Karas, & McClain, 2006; Kain, Sevarino, Alexander, Pincus, & Mayes, 2000; Sjöling, Nordahl, Olofsson, & Asplund, 2003). Additional research has shown that the social environment, such as spouses and family members, may buffer or amplify fearful expectations of pain (McClelland & McCubbin, 2008; Montoya, Larbig, Braun, Preissl, & Birbaumer, 2004; Platow et al., 2007). However, little is known about the extent to which fearful expectations and pain anxiety might contribute not only to the perceptions of the person experiencing pain but also to those of their significant others. Also unknown is the extent to which pain anxiety might contribute to pain congruence; that is, the degree of similarity in pain ratings when each partner rates one partner's pain. The purpose of the current study was to examine congruence of pain severity reports within couples in which one partner experienced a painful task and to identify pain-related anxiety as a predictor of that congruence.

Observer-Patient Pain Congruence

Observer-patient pain congruence is the extent to which a participant's pain ratings and the observer's ratings of the participant's pain are similar. This is determined by calculating the discrepancy, or difference, between these two ratings. The terms "congruence" and "incongruence" will be used to explain the similarity or discrepancy, respectively, to be consistent with existing chronic pain research terminology (Kankkunen

& Välimäki, 2014; Lyons, et al., 2014; Mohammadi, Dehghani, Khatibi, Sanderman, & Hagedoorn, 2015; Winters-Stone, Lyons, Bennett, & Beer, 2013). Other terms such as "correspondence" and "concordance" have also been used in the literature (Martire, Keefe, Schulz, Ready, Beach, Rudy, & Starz, 2006; Porter, Keefe, McBride, Pollak, Fish, & Garst, 2002); however, these terms are assessed with a correlation coefficient and provide a measure of association rather than a measure of discrepancy.

Romantic partner-patient congruence has been studied extensively in clinical chronic pain populations (Cremeans-Smith et al., 2003; Winters-Stone, Lyons, Bennett, & Beer, 2013). Spouses not only underestimate pain severity in their partners but also their partners' pain disability ratings (i.e., ratings of how pain interferes with physical activity and social interaction; Cano, Johansen, & Geisser, 2004; Cano, Johansen, & Franz, 2005). Incongruence between acute pain ratings has also been found in health care settings where physicians frequently underestimate patient pain severity (Solomon, 2001). In other studies, observers have viewed external behavior, such as their partners' daily functioning, more negatively. Spouses viewed patients as having more difficulty with daily living tasks than patients viewed themselves (Clipp & George, 1992; Riemsma, Taal, & Rasker, 2000). Research supports that incongruence is common, and outside observers can both overestimate and underestimate different aspects of a patient's pain experience. When considering, however, a patient's internal experience (e.g., pain severity), outside observers frequently underestimate a patient's report.

Within and outside of romantic relationships, pain-rating incongruence is related to negative psychological effects. Again, studies observing negative psychological effects have focused on clinical populations. Cremeans-Smith et al. (2003) found that pain

congruence between older women with chronic pain and their spouses was associated with greater patient well-being. This study compared couples reporting higher congruence to couples in which spouses under-or-overestimated their partner's pain. In addition, lower patient-reported well-being for incongruent couples was most problematic when spouses underestimated pain.

Congruence between patients with cancer and their family members has also been studied. When incongruent in pain intensity ratings, both patients and family members reported greater patient negative mood and poorer patient quality of life compared to patients and family members who had congruent pain ratings (Miaskowski, Zimmer, Barrett, Dibble, & Wallhagen, 1997).

In summary, incongruence in pain ratings is evident and exhibits a pattern where observers frequently underestimate the pain of others. Incongruence is also associated with poor quality of life in both observers and people with chronic pain. A question not answered, however, is how psychological variables influence congruence. Some child-parent studies suggest that anxiety might play a key role as parents' anxiety about their child's pain has been shown to be associated with greater incongruence (Goubert, Vervoort, Cano, & Crombez, 2008).

The first aim of this study was to replicate pain rating congruence research between romantic partners by measuring less commonly studied acute pain. Unlike studies conducted with a clinical population, the current study assessed pain as it occurred rather than as a one-time, retrospective report. This study also aimed to advance the field by tracking congruence over the course of a painful task to demonstrate the extent to which congruence may change over time. Finally, a gap in the literature is

that many studies do not apply research methods that examine the directional relationship between psychological correlates and pain-rating congruence. Currently, research is needed to examine both the extent to which congruence occurs and which psychological variables are related to congruence. Novel research methods applied to acute pain congruence can address directionality of this relationship. Experimental designs provide “in moment” measures of pain to isolate the predictive power of psychological variables. The current study included these design elements.

When speaking about or performing painful tasks, individuals are likely to elicit pain behaviors (e.g., grimacing, touching the injured area, or painful gestures; Cinciripini & Floreen, 1983). By requiring the participant to hold their hand in freezing water, the cold pressor task elicits pain that intensifies over time. As participants' pain increases over the course of the task, it can be assumed that the opportunity for pain behavior will increase as well and that observers will use this information to correspondingly increase their pain ratings over time. Thus, it is expected that congruence will increase over time as observers gather more information about the task by viewing their partners.

Pain-Related Anxiety

Pain catastrophizing and perceived threat appear to be promising predictors of congruence given the theoretical and empirical literature. Pain catastrophizing can be conceptualized as a stable, trait-like pain anxiety variable. Perceived threat can be understood as a state-like variable triggered by pain that is about to occur. Perceived threat could be triggered by a fearful prime such as threatening information about a painful task. Both trait and state pain anxiety may be important predictors of congruence within couples.

Pain Catastrophizing

Pain catastrophizing is magnified or atypical worry associated with pain. This can be conceptualized as worry about one's own pain or worry about another in pain. Catastrophizing is consistently related to more intense pain across experimental and clinical studies (Goubert, Vervoort, Sullivan, Verhoeven, & Crombez, 2008; Sullivan et al., 2001; Vlaeyen & Linton, 2000). People who engage in high pain catastrophizing engage in more pain behaviors, including verbal and motor responses. Catastrophizing accounts for anywhere between 7-31% of the variation in pain ratings across diverse pain samples (e.g., rheumatoid arthritis, back pain, burn dressing pain, dental pain, etc.), age, and gender (Sullivan et al., 2001).

According to the communal coping model of pain catastrophizing (Sullivan et al., 2001), pain catastrophizing has a social attention function versus a function to decrease actual pain. Individuals engage in pain catastrophizing to elicit empathy, assistance, and social support from others. Receiving support may result in decreased pain or simply validate that pain is difficult to cope with. Catastrophizing in individuals experiencing pain may contribute to greater congruence, because verbal or physical expressions may communicate their pain more clearly to their partners. Also, observers may become aware of the general fear their partners are in.

In support of this communicative hypothesis, Sullivan, Adams, and Sullivan (2004) found that the social environment modified the relationship between pain catastrophizing and the duration of emitted pain behaviors. People who underwent a painful task and reported a great deal of catastrophizing emitted facial and vocal expressions of pain for a longer duration when an observer was present during the task. Individuals rating

themselves as low pain catastrophizers did not differ in duration of pain expression whether there was an observer present or whether they were alone.

Sullivan, Martel, Tripp, Savard, and Crombez (2006) also found that pain catastrophizing alters an observer's perception of pain severity. Forty participants were videotaped completing the cold pressor task described above. Patients who reported high pain catastrophizing and then underwent the cold pressor task had scores that correlated with more intense pain when being viewed by unknown observers versus when they were alone. Those who reported engaging in high pain catastrophizing were viewed as experiencing more intense pain from novel individuals watching them complete the cold pressor task. Additionally, the relationship between pain catastrophizing and inferred pain was mediated by the videotaped participant's pain behavior exhibited. This provides evidence for the communal coping model and a social reinforcement component to exhibiting pain behaviors, even to strangers.

Given this literature supporting the role of pain catastrophizing in the communication of pain, a hypothesis tested in the current study is that pain catastrophizing in individuals with pain will be related to greater congruence between partners.

Pain Catastrophizing in the Observing Partner

Whereas pain catastrophizing in individuals with pain may enhance congruence in pain ratings, pain catastrophizing in an observer may contribute to incongruence. Batson, Fultz, and Schoenrade (1987) offer a conceptualization in which responses to distress in others can be divided into two categories: personal distress or empathy. When viewing an individual in pain, a partner could respond with empathy and understanding. Viewing

another in pain could also evoke a fearful and worried response. High pain catastrophizing in an observer may lead to distress and avoidance that interferes with a partner's ability to perceive pain in a similar manner as their loved one. If a partner becomes distressed at viewing a loved one in pain, the partner without pain may avoid and distance themselves physically and emotionally from their loved one to decrease distress in themselves. Observers or romantic partners who engage in high pain catastrophizing may underestimate partner pain severity. Underestimating pain may allow high catastrophizing observers to distance themselves from their partner's pain and decrease their own distress in comparison to observers who report low pain catastrophizing. Thus, pain catastrophizing in observers is hypothesized to be related to less pain rating congruence (i.e., more incongruence).

Perceived Threat

Although one's typical approach to pain (i.e., pain catastrophizing) may affect congruence, other pain anxiety-related constructs may also contribute to congruence. Perceived threat, fear regarding pain that is about to occur to oneself or another, is a state measure of pain anxiety. A framework with which to conceptualize the effect of perceived threat on an individual's pain is the Fear Avoidance Model (Fritz, George, & Delitto, 2001; Leeuw et al., 2007; Vlaeyen & Linton, 2000); perceived threat may increase the likelihood that an individual will have an avoidant response to pain. Both high threat and negative affect may contribute to the development of avoidant pain behavior, and these behaviors may include distancing oneself physically or emotionally during threats of pain. Avoidant pain responses can lead to hypervigilance and maladaptive behavioral repertoires (e.g.,

unhealthy coping such as becoming angry at partner) in addition to other negative physical responses to pain (Vlaeyen & Linton, 2000).

A study by Kirwilliam and Derbyshire (2008) found higher reported heat detection in chronic pain patients who were primed with fearful stimuli. This effect has also been observed with a cold pressor task; fearful slide shows primed participants to report lower levels of pain tolerance during the task (Meagher, Arnau, & Rhudy, 2001).

McGowan, Sharpe, Refshauge, and Nicholas (2009) utilized both a fear priming narrative and fear attention training with a dot probe task in an experimental study of threat expectancy. Increasing attention to pain, particularly when the threat for pain has already been primed, can increase pain severity and lower pain thresholds before completing a painful task.

Perceived threat may produce effects on congruence similar to the hypothesized effects of pain catastrophizing. If perceived threat increases one's anxiety about pain, threat should have similar effects for the observer and partner in pain as pain catastrophizing does for both partners. Increased state anxiety in the partner who is in pain may contribute to the expression of pain behaviors. Conversely, state anxiety in the observer may trigger avoidance. The influence of perceived threat may increase or decrease congruence depending on which partner experiences high anxiety, similar to the affects of pain catastrophizing.

Pain Catastrophizing and Perceived Threat Interaction

Perceived threat may also interact with pain catastrophizing in predicting the perception of pain (Caes, Vervoort, Trost, & Goubert, 2012; Goubert, Vervoort, Ruddere, & Crombez, 2012; Goubert, Vervoort, Sullivan, Verhoeven, & Crombez, 2008; Vervoort

et al., 2011; Trost, France, Vervoort, Lange, & Goubert, 2012). Individuals who reported high pain catastrophizing reported greater expected pain when primed with fearful, painful looking visual stimuli. (Trost, France, Vervoort, Lange, & Goubert, 2012).

There is evidence supporting a state-trait anxiety interaction in predicting pain, but many studies have primarily focused only on parent-child relationships. In one particular parent-child study, parents received a threatening primer stimulus before watching their children undergo a painful task. The parents reporting high pain catastrophizing were more likely than parents who did not report high pain catastrophizing to engage in pain attending talk with their child after the task was completed. Parents who reported higher pain catastrophizing were more likely to give attention to a child's pain and limit activities that may risk more pain to their child (Caes, Vervoort, Trost, & Goubert, 2012). Finally, Vervoort et al. (2011) found that when parents viewed painful facial expressions from their children, more intense, painful fear priming resulted in delayed responding to a dot probe task. This effect was exaggerated in the parents who reported high levels of pain catastrophizing.

Parent-child congruence studies have also provided evidence for psychological effects on the observer. Parental pain catastrophizing about a child's pain was associated with parental distress in addition to predicting particular response behaviors toward that child. (Goubert, Vervoort, Sullivan, Verhoeven, & Crombez, 2008). There is evidence supporting an interaction between state and trait anxiety affecting responses in loved ones observing pain. Research, however, should observe this interaction in close relationships other than parent-child dyads. The interaction between trait and state pain anxiety on congruence for romantic partners was explored in the current study.

The Present Study

The purpose of this study was to test the extent to which congruence occurs in an experimental acute pain context and to examine pain-related anxiety variables as predictors of congruence. Additionally, the current study aimed to observe changes in congruence over a brief time. Pain ratings were reported by both the participant completing a painful task (i.e., the cold pressor task) and the observing romantic partner. Pain was assessed multiple times over the course of the task. Pain catastrophizing was self-reported by each partner at baseline, and perceived threat regarding task was measured immediately prior to the task.

The following research questions and hypotheses were examined in this study:

Research Question #1: To what extent do couples display congruence on pain ratings during the cold pressor task?

Hypothesis #1: It was expected that couples would not display congruent pain ratings over the course of the task. It was hypothesized that observers would consistently underreport pain ratings provided by the participants completing the cold pressor task.

Research Question #2: How does congruence change over time?

Hypothesis #2: Pain severity was assessed at multiple time points during the cold pressor task. Thus, analyses were conducted to determine how congruence might change over the two-minute interval in which the partners held their hands in the cold-water basin. It was hypothesized that pain-rating congruence would increase over the course of the task as observers would have more time to view their partners' pain behaviors. Previous studies conducted in our laboratory have found a curvilinear trajectory when assessing individual pain ratings. Thus, it was additionally hypothesized

that congruence over time would follow a similar trajectory. Congruence was operationalized as the raw difference between participant's and observer's pain rating scores (i.e., average pain difference). Increased average pain difference was indicative of greater pain rating incongruence with a couple (i.e., ratings between participant and observer become further apart). Lower average pain difference was indicative of greater congruence (i.e., ratings between partners become more similar).

Research Question #3: Does pain catastrophizing and perceived threat in participants affect congruence?

Hypothesis #3a: It was hypothesized that both pain catastrophizing (trait anxiety) and perceived threat (state anxiety) in *participants* would increase congruence. Congruence was, again, operationalized as lower average pain difference.

Hypothesis #3b: It was also tentatively hypothesized that the effects of participant pain anxiety would become stronger over time. Specifically, if higher participant pain anxiety was present, congruence would increase gradually over the course of the task.

Research Question #4: Does pain catastrophizing and perceived threat in observers affect congruence?

Hypothesis 4a: It was hypothesized that both pain catastrophizing (trait anxiety) and perceived threat (state anxiety) in *observers* would decrease congruence. Again, congruence was operationalized as lower average pain difference.

Hypothesis 4b: Again, considering time, it was tentatively hypothesized that the findings above would become stronger as task duration increased. If the observer reported higher pain anxiety, congruence between pain rating scores would decrease gradually over time.

Exploratory Questions: To what extent will perceived threat and pain catastrophizing interact in relating to pain congruence?

Pain catastrophizing and perceived threat may interact when predicting congruence. These interactions may exist within each partner and between the participant and observer.

Exploratory Hypothesis #1 - Observer Trait and State Anxiety: Based on the hypotheses above, observers who reported both higher state and trait pain anxiety may be in couples with less congruent pain ratings (i.e., amplified avoidance in observers).

Exploratory Hypothesis #2 - Participant Trait and State Anxiety: Additionally, couples may be more congruent when the participant (i.e., partner completing the pain task) reported both higher state and trait anxiety. This is based on the assumption that the effects hypothesized above would be amplified in situations where participants reported both higher pain catastrophizing and perceived threat (i.e., amplified pain expression in participants).

Exploratory Hypothesis #3 - Participant and Observer Trait Anxiety: Considering the interaction of pain anxiety between partners, it is possible that couples in which both participant and observer reported higher pain catastrophizing would be the least congruent in their pain ratings. It was hypothesized that increased pain behaviors in the participant would trigger more avoidance of other's pain in the observer.

Exploratory Hypothesis #4 - Participant and Observer State Anxiety: Couples in which both participant and observer report higher perceived threat may also be less congruent in their pain ratings. It was assumed that increased pain behaviors in the

participant would trigger more avoidance of other's pain in the observer and thus cancel the communicative coping effects of the participant's anxiety.

Additional Research Questions: Observer empathy, relationship satisfaction, and gender

It is possible that other variables may contribute to pain rating congruence. This study also explored whether observer empathy, both partners' relationship satisfaction, and both partners' gender were associated with congruence.

Considering Batson, Fultz, and Schoenrade's model, an additional hypothesis was developed: Observers with high reported empathy would be more likely to respond to pain behaviors. These models suggest that empathy, particularly in the observer, may enhance congruence. However, since research is limited regarding the relationship between observer empathy and congruence, this was an exploratory question. For completeness, participant empathy was also measured, but not expected to significantly influence congruence.

Relationship satisfaction may also influence congruence; satisfaction could be related to romantic communication and behavior towards one's partner. It was tentatively hypothesized that relationship satisfaction in either or both partners would enhance congruence. Again, since research is limited regarding relationship satisfaction and congruence, this was also an exploratory question.

Finally, gender differences may also influence congruence. Incongruence of pain disability ratings were found when the patient experiencing pain in the couple was female (Cano, Johansen, & Geisser, 2004). This could be that females engage in higher pain catastrophizing than males, or males may be less accurate at perceiving disability. This

will also be an exploratory question. Research has looked at gender differences related to chronic pain, but limited studies have observed gender influence on pain rating congruence specifically.

If empathy, relationship satisfaction, or gender are found to be related to congruence, they will be entered as potential covariates in the main analyses.

Chapter 2

Method

Participants

Participants were 212 individuals (106 romantic dyads) who were enrolled at Wayne State University or were significant others to an undergraduate student. Participants were recruited for a larger, previously conducted study (Corley, Cano, Goubert, Vlaeyen, & Wurm, in press) via an online registration, SONA. Students from the larger study were eligible to receive extra credit in their psychology courses for participation. Partners not enrolled in courses did not receive compensation. Due to the effects of intense cold, participants were not eligible to undergo the cold pressor task if it was possible they could experience enhanced sensitivity to pain due to a blood circulation problem (e.g., diabetes or another medical condition).

To differentiate between roles assigned to partners, the term “participant” will refer to individuals who completed the cold pressor task, and “observer” will refer to the individuals who observed from a neighboring room.

The participant sample was 50.9% female ($n=54$). The observer sample was 52.8% male ($n = 56$). Most couples that completed the experiment reported being in a mixed-sex relationship, however, seven couples identified as same-sex couples. The average length of time that the couples reported being together was 26.94 months ($SD = 25.78$). Age of participants and observers was on average 22.89 ($SD = 6.11$) and 22.73 ($SD = 5.72$), respectively. Although half the participant sample (50.7%) identified as Caucasian, other races were represented (28.4% identified as African American and 18.7% as Asian American), as were ethnicities (17.2% identified as Middle-Eastern and

7.5% as Hispanic). As for the observers, 47.8% reported being Caucasian, 28.4% African American, 18.7% Asian American, 14.2% Arabic, and 7.5% Hispanic. The majority of participants reported currently attending college or had some college education (79.8%). A smaller percentage of participants reported having a high school diploma and no college experience (15.7%), and an even smaller percentage reported some graduate-level education (2.2%). Most observers were also currently attending college or had some college education (80.6%), with 14.9% reporting a high school diploma and no college experience and, again, a small percentage reporting some graduate school education (3.6%).

Procedure

Ethical approval was obtained by the Wayne State University Institutional Review Board (IRB). The following statement was posted on SONA to recruit participants:

“The purpose of this study is to understand how people and their romantic partners cope with acute stress. Participants are eligible for this study if they and/or their romantic partner is a WSU psychology student and both are willing to attend a 1.5-hour lab session at the same time. Both participants will answer questions about pain, mood, and their relationship at various times during the lab session. In addition, one partner will be asked to put one of his or her hands in a bin of very cold water and to rate his or her pain during the task. Upon completion of the study, WSU student participants will receive 2 credits of extra credit towards a psychology class. Since there is only one time slot per couple, please let us know if both of you need extra credit so we can arrange it. A partner who is not enrolled in psychology classes at WSU can participate if the other person is receiving extra credit but the non-psychology student will not receive compensation. Participants are ineligible if they are at risk for having blood circulation problems due to circulatory disorders (e.g., Raynaud’s Disease) or Diabetes.”

Interested participants signed up for the allotted times to participate listed on SONA. Upon arrival at the laboratory, couples were randomized via coin flip to an experimental group (heads = high threat prime, tails = low threat prime). Couples were

not told of their group assignment or that there were different groups. Another study derived from this dataset (Corley, Cano, Goubert, Vlaeyen, & Wurm, in press) found evidence that the high and low threat groups did not show significant differences in perceived threat immediately prior to task. Perceived threat measured for the purposes of this study were reports that varied naturally. The current study did not examine high and low threat group differences. After reviewing the procedures and obtaining informed consent, both participants and observers were asked to complete a battery of questionnaires separately and to not discuss their measures with each other. Questions included measures of pain catastrophizing and relationship satisfaction, a measure typically included in romantic dyad studies, along with general demographic information. The experimenter, to determine which partner would undergo the cold pressor task, flipped a coin. Once the participant and observer roles were selected, both partners completed questionnaires about fear and anxiety related to the expected pain.

Even though high and low threat groups did not vary on reported threat prior to task, the procedure for threat manipulation will be described. This description provides a complete understanding of the larger study's design from which the data for the current study was derived. Before beginning the task, participants watched a 5-minute, silent video of a novel individual completing the cold pressor task. Videos seen by the couple differed depending on whether the couple was randomly assigned to the high threat or low threat group. The couple either saw an individual, varying on gender across conditions, complete the task with pained expression and behaviors (e.g., wincing, grimacing, etc.; Figure 1) or a neutral expression showing little to no pained behaviors

(Figure 2.). Measures of perceived threat were taken immediately before and immediately after participants and observers viewed the videos.



Figure 1. Example of threat prime viewed in high threat group (photograph is not of a participant in the study)



Figure 2. Example of threat prime viewed in low threat group (photograph is not of a participant in the study)

Prior to separating for the task, the couple had two minutes to discuss the task after watching the video. The interaction between participant and observer was included to address research questions asked in the previous study. Measures of pain threat taken immediately before the participant began the cold pressor task and were the measures used to represent perceived pain in the current study.

Before the cold pressor task began, participants were asked to wash their hands before placing them in the water basin. The experimenter explained the procedure, required the participant to repeat the whole procedure back to them, and answered any questions the participant might have regarding the task. No jewelry was worn on the

hands or wrists during the task, and participants could not be chewing gum or eating food. Participants first dipped their hand for one minute in a bucket of room temperature water to ensure that baseline temperatures were equivalent across participants.

The cold pressor task required the participant to insert his or her hand into a metal basin filled with water set at six degrees Celsius. Participants were also asked to fixate their gaze on a piece of paper on the wall while completing the task. When a repeating tone sounded, participants and observers were asked to rate the level of pain intensity of the participant with their hand in the basin.

Participants were not told that the maximum time that their hand could be submerged was two minutes. Also unknown to the participant, tones to record current pain severity would occur every 10 seconds for the first 40 seconds and then every 20 seconds thereafter. Participants were permitted, however, to remove their hand if they could no longer withstand pain from the cold pressor. During this time, observers were watching their partners undergoing the task on a video screen in a nearby room. Observers were rating pain intensity of their partner undergoing the task at the same time intervals as the participant. A summary of the procedure is provided in Figure 3.

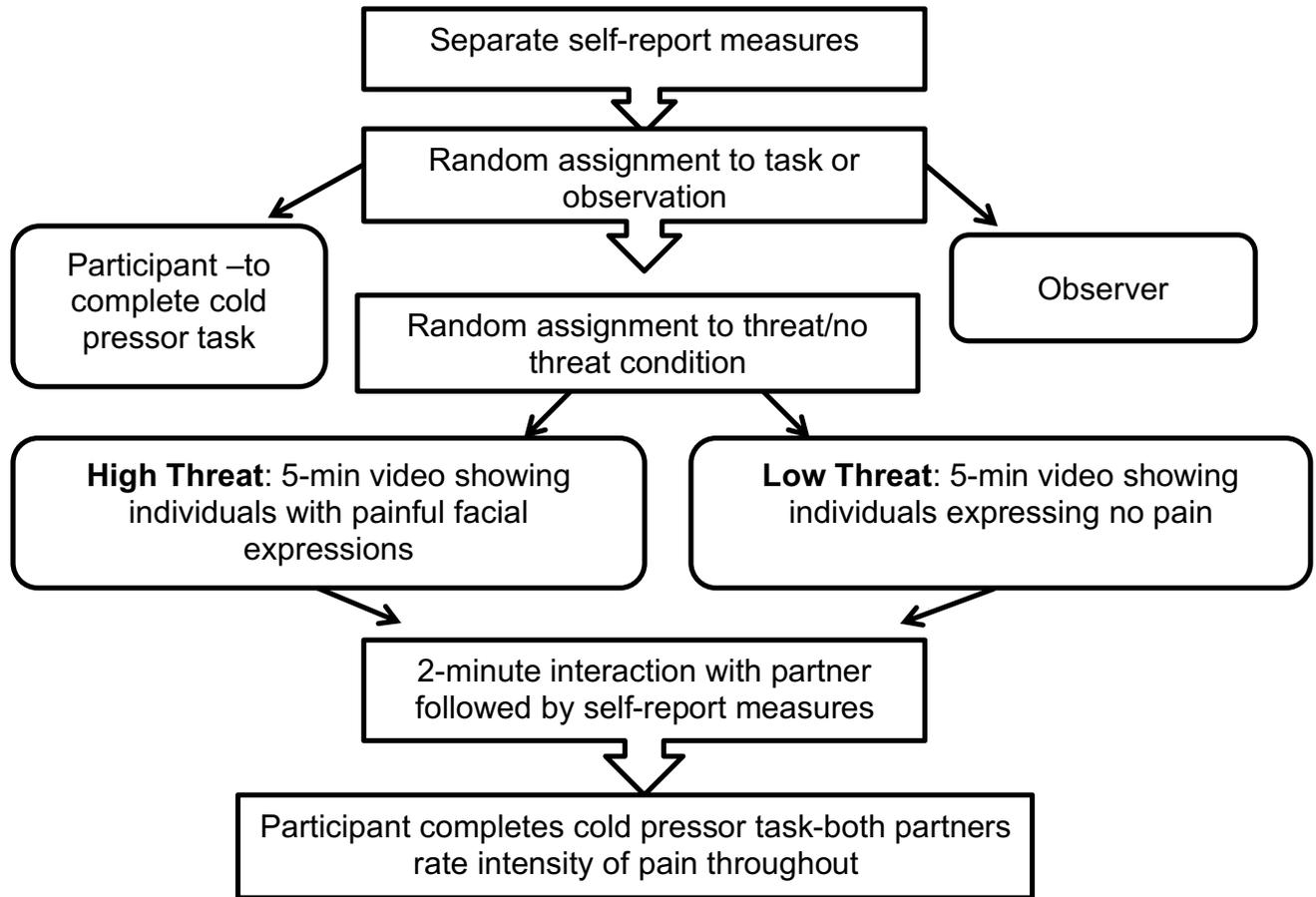


Figure 3. Study procedure

When the cold pressor task was completed, the couple was debriefed on the experiment and allowed to ask further questions.

Measures

Baseline Measures. The following measures were given before participant and observer were randomized to a threat group and before completing the cold pressor task.

Demographic Information. Both participant and observer reported gender, race, ethnicity, age, relationship status, relationship length, highest education level obtained, and employment status for descriptive purposes.

Relationship Satisfaction. Participants and observers both completed the Couples Satisfaction Index (CSI) to measure baseline relationship satisfaction. The CSI is a 32-

item measure comprised of the most empirically supported items of the Dyadic Adjustment Scale (DAS) and Marital Adjustment Test (MAT). The CSI shows strong convergent and construct validity in comparison to other relationship satisfaction measures. Items are worded from both a positive and negative perspective (e.g., “I still feel a strong connection with my partner.” or “I sometimes wonder if there is someone else out there for me.”). Scores on individual items range from zero (“not at all true”) to five (“completely true”; Funk & Rogge, 2007).

Empathy. Participant and observer empathy was also measured with the Interpersonal Reactivity Index (IRI), a 28-item measure that assesses perspective taking, fantasy, empathic concern, and personal distress on a 5-point likert scale (Davis, 1980). The empathic concern subscale of the IRI was utilized in the current study.

Pain Catastrophizing. The Pain Catastrophizing Scale (PSC), a 13-item measure, was given to both partners to provide a baseline pain catastrophizing score. This scale measured trait sensitivity to pain threat prior to experimental manipulation. The PSC measures the extent to which an individual, in general, has a tendency to feel threatened, fearful, anxious, or likely to catastrophize about pain. Scores on this measure range from 0 to 52, and items include statements like, “I worry all the time about whether the pain will end.” and “I become afraid that the pain may get worse.” (Sullivan, Bishop, & Pivik, 1995).

Pre/Post-Video Measures. The following measures were given prior to and after the participant and observer viewed the threat manipulation videos. That is, a manipulation check was conducted to determine if the video primes affected state anxiety differently between the high threat and low threat groups.

Perceived Threat. Participants and observers completed four questions aimed to assess the extent to which both partners felt threatened and anxious about the task (e.g., “How anxious or tense are you about the cold water task?”). Observers received questions that emphasized that they would be reporting on their own expected threat regarding their partner who was about to complete the task (e.g., “How much pain do YOU think your partner will have during the cold water task?”). The measure utilized a 11-point Likert scale (0 = “Not at all”, 10 = “Very much”). The four items yielded a total score representing participant or observer perceived threat of pain.

Cold Pressor Task Measures. The following measures were administered during the cold pressor task while the participant had their hands submerged and the observer watched from the adjacent room.

Pain Duration. The experimenter used a digital stopwatch to record time in seconds that the participant held their hand in the cold water basin.

Pain Intensity. Participants and observers rated level of pain intensity on a 11-point scale, with higher scores indicating more severe pain. When a tone alerted them to do so, they were asked to record, in writing, pain intensity at that current moment. Tones were sounded every 10 seconds for the first 40 seconds and every 20 seconds thereafter.

Chapter 3

Results

Data Screening

The data were screened for outliers and significant skewness and kurtosis. Assumptions of normality were also examined, as was missing data. Only one univariate outlier was detected on the variable of participant relationship satisfaction (CSI for participant). Removal of this case did not significantly alter results, thus the outlier remained in the dataset.

Missing data were detected for couples' relationship satisfaction (CSI). Thirty-one cases (participants or observers) were missing scores on the CSI and two couples were missing data points for both the observer and the participant. Missing CSI data was predominantly due to participants and observers not responding to the first question of the CSI ("Indicate the degree of happiness all things considered in your relationship."). The cause is unknown regarding this pattern of missing data and is likely do to improper placement of an item on the page. When less than 10% of CSI items were missing for a participant or observer, the missing data were replaced with the sample mean (participant CSI $M = 129.11$ and observer CSI $M = 127.17$). This is a conservative method of item replacement. Four cases, however, were deleted due to missing more than 10% of CSI items. Twelve cases were missing data on the Interpersonal Reactivity Index (IRI) due to skipped items. Missing data analysis revealed that missing IRI scores were dispersed among several different items and likely skipped at random. One case was deleted for missing more than 10% of responses on the IRI. The other eight cases missing less than 10% of the total IRI were replaced with the subscale mean. The IRI yields four subscales,

and means were generated for each subscale for both participant and observers. Only the Empathic Concern (EC) subscale was used for this study (participant EC $M = 20.41$ and observer EC $M = 20.25$). Additionally, only eight cases had missing pain ratings expected to be recorded during the cold pressor task. Four of these cases were also missing data on other scales (e.g., CSI or IRI). In total, thirteen couples were deleted from the original data set.

Significant negative skewness was detected on both participant and observer relationship satisfaction (CSI; participant skew = -1.2 , $SE = .24$; observer skew = $-.95$, $SE = .24$). Most participants reported higher satisfaction, but a few individuals reported lower relationship satisfaction (participant CSI $M = 125.26$ and $Mdn = 129.11$; observer CSI $M = 127.53$ and $Mdn = 128.10$). Both participant and observer CSI total scores were transformed via reflection and square root to achieve normality (participant skew = $.24$, $SE = .24$; observer skew = $-.11$, $SE = .24$).

Preliminary Analyses

Bivariate correlations were conducted that included relationship satisfaction and empathic concern. These correlations were conducted to assess for covariates that may contribute to pain rating differences outside of pain catastrophizing and perceived threat (see Table 1). Participant and observer relationship satisfaction and participant and observer empathy were not significantly associated with average pain difference (i.e., incongruence or the raw difference between participant and observer rating ratings).

Table 1

Correlations among participant and observer variables and average pain

	PARTICIPANT VARIABLES				
	1	2	3	4	5
1. Perceived Threat	.26**	-.45	-.12	-.03	-.01
2. Pain Catastrophizing	-.02	.10	-.12	.08	-.04
3. Empathy	-.10	.16	.08	.04	-.02
4. Relationship Satisfaction	.01	.08	.02	.40**	.06
5. Average Pain Difference	-.06	.07	.08	-.01	-----

OBSERVER VARIABLES

Note. Variable listed in the row (horizontal) represent participant variables (e.g., participant perceived threat) and those listed in the column (vertical) refer to observer variables (e.g., observer perceived threat). The bolded diagonal represents correlations between observer and participants on the same variable.

** $p < .001$.

Though no significant correlations with average pain difference were found, one significant relationship was detected between participant and observer variables, participant and observer threat ($r[106] = .259, p < .001$). This relationship was not surprising since both partners were exposed to the same threatening information.

Within individuals, a significant correlation was found between participant relationship satisfaction and participant baseline pain catastrophizing (see Table 2); $r(106) = .28, p < .01$. No significant correlation was found between observer relationship satisfaction and observer pain catastrophizing (see Table 3). Greater observer pain catastrophizing was also significantly related to greater observer empathy; $r(106) = .251, p < .01$. No such relationship was found between participant pain catastrophizing and

empathy. Finally, a small, but significant relationship was detected between observer pain catastrophizing and observer threat; $r[106] = .19, p = .05$. Because no significant correlations were detected with average pain difference, covariates were not included in the final analyses.

Table 2

Correlations among participant variables and average pain difference

	PARTICIPANT VARIABLES ONLY				
	1	2	3	4	5
1. Perceived Threat	-----	.17	-.01	.03	.06
2. Pain Catastrophizing		-----	-.01	.28**	.07
3. Empathy			-----	-.14	.08
4. Relationship Satisfaction				-----	-.01
5. Average Pain Difference					-----

** $p < .001$.

Table 3

Correlations among observer variables and average pain difference

	OBSERVER VARIABLES ONLY				
	1	2	3	4	5
1. Perceived Threat	-----	.19*	-.06	-.03	-.01
2. Pain Catastrophizing		-----	.25**	.12	-.04
3. Empathy			-----	-.07	-.02
4. Relationship Satisfaction				-----	.06
5. Average Pain Difference					-----

* $p < .05$. ** $p < .001$.

Research Question #1

It was hypothesized that observers would consistently underreport pain ratings provided by the participants completing the cold pressor task. Multilevel modeling was conducted given that each individual provided multiple ratings of pain over time (i.e., pain ratings were nested within couples, which was the unit of analysis in this study). An effect of time was not included to test this hypothesis. A significant mean difference between observer and participant pain ratings was found. Participants, on average, rated their pain 2.42 points higher on a 11-point scale than their observing partners; $b = 2.42$, $SE = 0.26$, $t(111.4) = 9.42$, $p < .001$.

Research Question #2

It was also hypothesized that pain rating congruence would increase over the course of the task because the observers would have more time to view their partners' pain behaviors. A previous study conducted in our laboratory found a curvilinear trajectory when assessing an individual's pain rating (Leong, Cano, Wurm, Lumley, & Corley, 2015); thus, a non-linear relationship was considered in the model. Multilevel modeling was utilized to assess for this relationship between congruence and time.

A significant relationship was found between pain rating differences and curvilinear time that supports the hypothesis that congruence significantly changes over the course of the cold pressor task; $b = -.0002$, $SE = 0.0004$, $t(549.4) = -4.64$, $p < .001$. The curvilinear trajectory exhibited by this interaction is depicted in Figure 4.

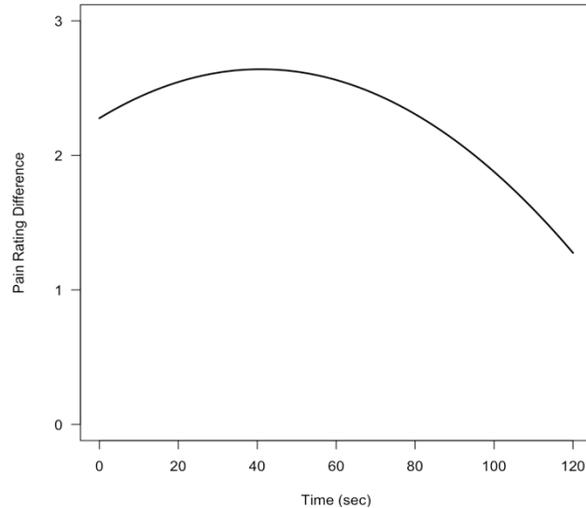


Figure 4. Pain rating congruence over course of task.

Congruence between pain ratings initially decreased (i.e., pain rating difference became larger) before increasing over the course of the task. Further inspection of each partners' data separately shows that the curvilinear trajectory in congruence is due, in part, to different pain rating trajectories for participants and observers. Multilevel modeling analysis was again utilized and accounted for within-couple identification (i.e., participant vs. observer). Results from the analysis indicated that participant and observer trajectories were significantly different from each other (participant pain rating: $b = -.0006$, $SE = .00003$, $t(538.2) = -19.48$, $p < .001$; observer pain rating: $b = -.0004$, $SE = .00004$, $t(490.2) = -19.48$, $p < .001$). Patient and observer pain rating trajectories were graphed separately (see Figure 5). While participants reported higher scores overall, observers' reports became more similar to participants' reports starting at the 80-second mark of the task.

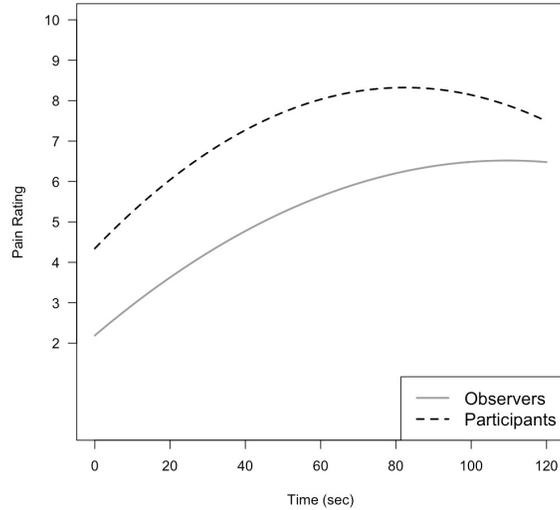


Figure 5. Participant and observer pain ratings over time.

One might question whether the correlation between participant and observer ratings changed over time, which is a slightly different research question than that of congruence examined in the current study. Within-couple correlations were run at each time period (see Table 4). At the initial 10-second interval, the correlation between participant and observer pain ratings was moderate, but this correlation appeared to decrease during the task. These correlations indicate that participant-observer *correspondence* may decrease over time. The other analyses reported earlier indicate that the “distance” between participant-observer ratings also decreases over time (i.e., congruence increases). As pain ratings became less related (decreased correspondence) they become more similar (increased congruence).

Table 4

Relationship between participant and observer pain ratings across time points

Time (seconds)	<i>r</i>
10	.40*
20	.33*
40	.36*
60	.36*
80	.24*
100	.24*
120	.11

* $p < .05$.

Research Question #3a

Multilevel modeling analyses were implemented to test if participant pain catastrophizing or perceived threat were related to pain congruence. Neither a significant relationship between participant pain catastrophizing nor participant perceived threat and congruence within dyads was found (see Table 5).

Table 5

Participant baseline pain catastrophizing and perceived threat related to average pain difference

Independent Variable	Unstandardized Coefficient (<i>b</i>)	<i>SE</i>	<i>df</i>	<i>t</i>
(Intercept)	1.97	.56	105.42	3.55**
Baseline Pain Catastrophizing	.02	.03	106.18	.75
(Intercept)	2.54	.42	102.86	5.99**
Perceived Threat	-.02	.03	102.64	-.60

** $p < .001$.

Research Question #3b

It was additionally hypothesized that the effects of pain catastrophizing and participant perceived threat on congruence would become stronger over time. A significant three-way interaction between participant perceived threat and time squared (time x time) was found in predicting congruence; $b = .00002$, $SE = 0.000004$, $t(546.2) = 3.58$, $p < .001$. Simply put, perceived threat of the participant interacted with time to predict congruence. Figure 6 shows that pain difference trajectories are different for participants reporting lower and higher state anxiety scores. At lower levels of threat, congruence followed a similar curvilinear trajectory as reported earlier (i.e., slight decrease in congruence followed by greater congruence). However, greater perceived threat was related to a steady and steep increase in congruence.

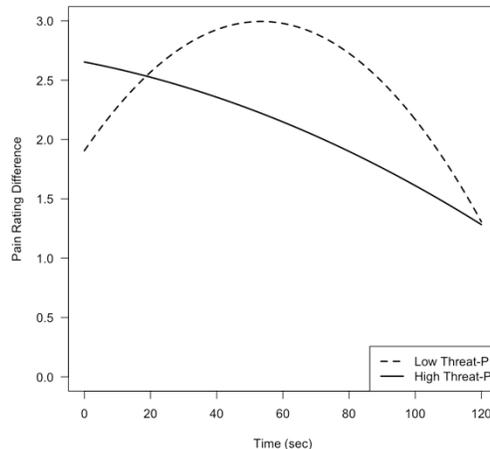


Figure 6. Pain rating congruence over time related to perceived threat in the participant.

A significant relationship was not found between participant pain catastrophizing and time in predicting congruence (pain catastrophizing x time: $b = .0001$, $SE = 0.0004$, $t(91.5) = .31$, $p = .76$; pain catastrophizing x time²: $b = .00005$, $SE = .00$, $t(558.8) = .94$, $p = .35$).

Research Question #4

It was hypothesized that both pain catastrophizing and perceived threat about the painful task in observers would be related to greater congruence (i.e., similarity between partners' pain rating scores). Multilevel modeling was again utilized to test if observer pain catastrophizing or perceived threat were related to greater congruence. Neither observer pain catastrophizing nor observer perceived threat were significantly related to congruence within dyads (see Table 6). Additionally, observer pain anxiety did not interact with time in predicting congruence (pain catastrophizing x time: $b = -.0002$, $SE = 0.0004$, $t(89.7) = -.54$, $p = .59$; pain catastrophizing x time²: $b = .00005$, $SE = 0.000005$, $t(552.7) = -1.07$, $p = .29$; perceived threat x time: $b = .0003$, $SE = 0.0005$, $t(85.3) = 0.56$, $p = .58$; perceived threat x time²: $b = .000008$, $SE = 0.000005$, $t(542.5) = 1.49$, $p = .14$).

Table 6

Observer baseline pain catastrophizing and perceived threat related to average pain difference

Independent Variable	Unstandardized Coefficient (<i>b</i>)	<i>SE</i>	<i>df</i>	<i>t</i>
(Intercept)	2.90	0.54	111.92	5.37**
Baseline Pain Catastrophizing	-.03	0.03	112.68	-1.01
(intercept)	2.45	0.42	111.23	5.81**
Perceived Threat	-.002	0.03	108.65	0.94

** $p < .001$.

Exploratory Questions

Hypotheses 1 and 2 - Multilevel modeling analyses were used to test for interactions between pain catastrophizing and perceived threat within participants or observers. It was hypothesized that, on average, observers reporting higher state and

trait anxiety would be the least congruent couples in their pain ratings and participants reporting higher state and trait anxiety the most. No significant interactions were found between observer pain catastrophizing and perceived threat ($b = -.001$, $SE = 0.003$, $t(108.81) = -0.40$, $p = .69$) nor participant pain catastrophizing and perceived threat in predicting congruence ($b = -.005$, $SE = 0.003$, $t(114.82) = -1.95$, $p = .054$).

Hypotheses 3 and 4 - Additional Multilevel modeling analyses were conducted to test possible interactions across participant and observer pain anxiety as opposed to interactions within individuals. A significant interaction was detected between participant and observer pain catastrophizing in predicting congruence (see Figure 7); $b = -.007$, $SE = 0.002$, $t(118.1) = -2.86$, $p = .005$.

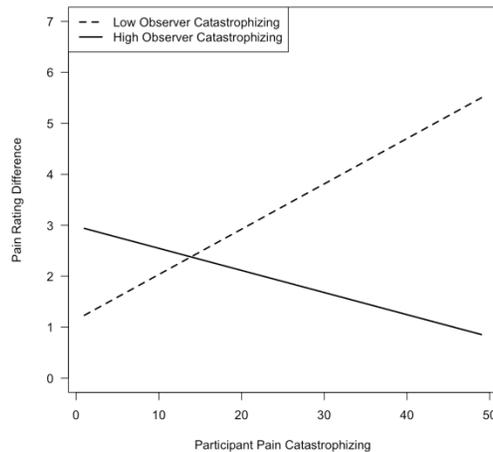


Figure 7. Interaction between baseline observer and participant pain catastrophizing on pain rating congruence.

Congruent pain ratings were least likely when participants reported higher pain catastrophizing and observers lower pain catastrophizing. Congruence was also less likely when observers reported higher pain catastrophizing but their partners lower. Couples were more likely to be congruent on pain ratings when both partners reported

higher or both lower baseline pain catastrophizing. No significant interactions were found between observer and participant perceived threat ($b = .005$, $SE = 0.003$, $t(105.02) = 0.51$, $p = .61$).

Additional Research Questions

It is possible that other variables may contribute to pain rating congruence. This study also explored whether observer empathy, both partners' relationship satisfaction, and both partners' gender were associated with pain rating similarity.

Gender

Independent samples t-tests were conducted to explore gender differences between perceived threat and baseline pain catastrophizing. A significant difference on pain-anxiety was found between male and female participants (i.e., those undergoing the cold pressor task). Female participants reported higher threat prior to task; $t(104) = -4.98$, $p < .001$. Additionally, baseline pain catastrophizing was higher among female participants (see Table 7); $t(104) = -3.28$, $p < .001$. No gender differences were found for average pain difference. Multilevel modeling was again used, and no effects of gender on congruence were found without the variable of time included.

Table 7

Participant and Observer gender differences on baseline pain catastrophizing, perceived threat, and average pain difference

	Male		Female		<i>t</i>
	M	SD	M	SD	
Participant Pain Catastrophizing	15.29	8.34	21.43	1.16	-3.28**
Observer Pain Catastrophizing	17.34	9.27	21.19	10.83	-1.97
Participant Perceived Threat	7.54	6.52	15.76	10.03	-4.98**
Observer Perceived Threat	12.48	8.38	11.33	9.30	0.74
Participant Average Pain Difference	2.33	2.91	2.32	2.56	-0.07
Observer Average Pain Difference	2.33	2.62	2.32	2.86	0.04

** $p < .001$.

When considering time, there was a significant interaction between time and participant's gender on congruence; $b = .0003$, $SE = 0.00009$, $t(546.9) = -3.26$, $p = .001$. Figure 8 displays the different trajectories of congruence over the course of the task for both male and female participants. A significant interaction was also detected between observer gender and time; $b = -.0003$, $SE = 0.00009$, $t(548.4) = -2.78$, $p = .005$. However, due to the small number of same-sex couples enrolled in the study, the graphs of these results mirror each other and so only the participant gender and time interaction is presented.

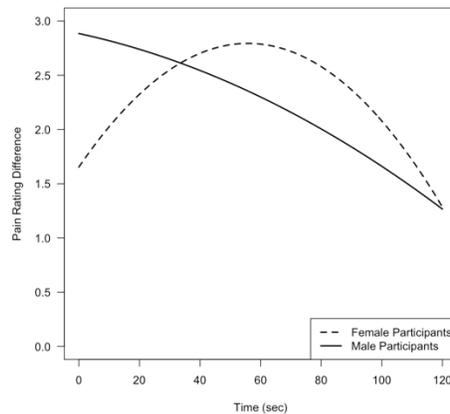


Figure 8. Pain rating congruence by participant gender over time.

When the participant in the couple was female, congruence decreased significantly during the beginning of the task. Similarity between ratings began to increase at a similar rate during the later half, returning to a difference in pain ratings similar to the beginning of the task. When the participant was male, congruence followed a steeper curve. Much larger discrepancies in pain ratings were detected at the beginning of the task but congruence increased rapidly over the course of the task.

Empathy and Relationship Satisfaction

Analyses to test the relationship between empathy and relationship satisfaction with congruence utilized multilevel modeling as well. Two sets of analyses, one with each of the independent variables, were conducted with and without the variable of time included. Without considering time, no significant effects of relationship satisfaction or empathy on congruence were found (participant relationship satisfaction: $b = .01$, $SE = 0.009$, $t(110.1) = 1.25$, $p = .22$; observer relationship satisfaction: $b = .11$, $SE = 0.17$, $t(105.2) = 0.63$, $p = .53$; participant empathy: $b = .05$, $SE = 0.06$, $t(110.6) = 0.77$, $p = .44$; observer empathy: $b = -.03$, $SE = 0.06$, $t(109.5) = -0.59$, $p = .55$).

Participant empathy significantly interacted with time to predict congruence but observer empathy did not (see Table 8); $b = -.0003$, $SE = 0.00001$, $t(561.1) = -3.36$, $p < .001$. This was inconsistent with the original hypothesis that assumed observer empathy would predict congruence.

Table 8

Participant empathy over time predicting congruence

Independent Variables	Unstandardized Coefficient (<i>b</i>)	<i>SE</i>	<i>df</i>	<i>t</i>
(Intercept)	.18	0.17	140	1.05
Participant Empathy	.02	0.08	139.9	0.30
Time	-.05	0.04	495.2	-1.38
Time ²	.0006	0.0002	562.8	2.42*
Participant Empathy X Time	.003	0.002	494.3	1.9
Participant Empathy X Time ²	-.0003	0.00001	561.1	-3.36**

* $p < .05$. ** $p < .001$.

Figure 9 displays the significant interaction between participant empathy and time squared. When participants reported lower empathic concern at baseline, the congruence trajectory followed a slight, almost linear curve. Congruence decreased a small amount across the task and increased a bit more towards the end of the task. When participants reported higher empathic concern, there was an initial decrease in congruence at the onset of the task but a rapid increase in congruence throughout the remainder of the task. No interaction between relationship satisfaction and time was found (participant

relationship satisfaction x time²: $b = -.000002$, $SE = 0.000002$, $t(542.7) = -1.10$, $p = .27$;
 observer relationship satisfaction x time²: $b = -.0000009$, $SE = 0.000002$, $t(524.9) = -0.55$,
 $p = .58$).

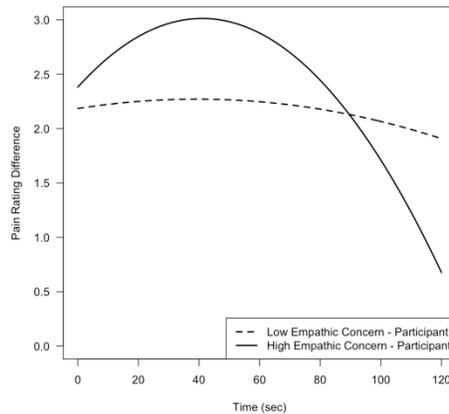


Figure 9. Pain rating congruence over time related to high and low participant empathy.

Gender and Empathy Interaction

Recall that participant perceived threat interacted with time squared. Because gender and empathy were related to congruence, additional multilevel modeling analyses were conducted to test for interactions between participant perceived threat, time, and the exploratory variables (gender and participant empathy). No significant interactions were found between the exploratory variables, participant threat, and time squared (gender x participant threat x time²: $b = .000005$, $SE = 0.00002$, $t(541.0) = 0.46$, $p = .65$; participant empathy x participant threat x time²: $b = .000002$, $SE = 0.000001$, $t(556.9) = 1.28$, $p = .20$).

Chapter 4

Discussion

The aims of this study were to test the extent to which congruence occurs in an experimental acute pain context and to examine pain-related anxiety variables as predictors of congruence. The current study addressed two gaps in the literature. First, the current pain literature has sampled from predominantly clinical populations. Often pain studies sample patients' pain retrospectively and do not capture the dynamics of these ratings as they occur in moment. The application of experimental research methods standardized the induction of pain in the current study; this allowed for the observation of the temporal relationship between pain anxiety and congruence. Another gap in the literature addressed by the current study was the assessment of multiple pain ratings over time instead of pain sampled at a single time point. The measurement of pain ratings over the course of the cold pressor task provided information about how ratings become more or less similar.

In clinical samples, patient pain ratings are frequently underestimated by spouses, family members, and health care providers (Cano, Johansen, & Geisser, 2004; Cano, Johansen, & Franz, 2005; Solomon, 2001; Cremeans-Smith et al., 2003). Thus, it was hypothesized that participants would, on average, assign a higher rating to their acute pain than would their observing partners. This hypothesis was supported by evidence showing that, when collapsing pain ratings over the course of two minutes, participants engaging in a painful task rated their pain 2.42 points higher on a 11-point scale. This finding was consistent with the current pain literature, which states that observers frequently underestimate an individual's reported pain (Cano, Johansen, & Geisser, 2004;

Cano, Johansen, & Franz, 2005; Cremeans-Smith et al., 2003; Solomon, 2001; Winters-Stone, Lyons, Bennett, & Beer, 2013).

It was expected that pain congruence would become more similar over time; this hypothesis was also supported. Partners appeared to become dissimilar in their pain ratings during the task until the end, when ratings became more congruent with one another. In addition, participants and observers had significantly different trajectories in pain ratings over time with participants maintaining higher pain ratings throughout the cold pressor task. Greater congruence over time appeared to be due to observing partners “meeting” the participants in pain ratings. These findings add to the current literature by providing evidence that observers become closer in rating another’s pain even while individuals in pain remain higher in their ratings. Because congruence was measured at multiple time points instead of a single moment, it was possible to capture this effect.

To be consistent with the current pain literature, the term congruence in the present study was a measure of similarity between two pain-rating scores at a given time (Kankkunen & Välimäki, 2014; Lyons, et al., 2014; Mohammadi, Dehghani, Khatibi, Sanderman, & Hagedoorn, 2015; Winters-Stone, Lyons, Bennett, & Beer, 2013). Correspondence, the relationship between pain ratings at each time point, was also examined. Initially, participant and observer pain ratings were moderately related; however, this relationship appeared to decrease during the task. While the relationship between pain ratings lessened over time, so did the “distance” between participant-observer ratings. Pain ratings becoming more similar, however, indicated that congruence increased during the task. As pain ratings became less related (decreased correspondence) they became more similar (increased congruence). This is possible

because correspondence is a measure of accuracy (Do two pain ratings become higher and lower together?) and congruence is a measure of similarity (Do two pain ratings become closer or further apart from each other over time?). The current study provides evidence that correspondence and congruence change independently over time and are two separate constructs.

Pain Related Anxiety Influences Congruence

Trait and state anxiety were examined as correlates of congruence. Pain catastrophizing, conceptualized as trait pain anxiety, is related to more intense pain in both experimental and clinical studies (Goubert, Vervoort, Sullivan, Verhoeven, & Crombez, 2008; Sullivan et al., 2001; Vlaeyen & Linton, 2000). State anxiety, perceived threat, is associated with hypervigilance, negative physical responses to pain, and lower pain tolerance (Kirwilliam & Derbyshire, 2008; Meagher, Arnau, & Rhudy, 2001; Vlaeyen & Linton, 2000). It was hypothesized that pain catastrophizing and perceived threat would influence congruence between two partners' pain ratings. Perceived threat and pain catastrophizing in both the participant and the observer had varying influences on pain rating congruence. In some cases, these variables interacted with and without the effect of the time considered.

It was hypothesized that both pain catastrophizing and perceived threat in the participant about to undergo the cold pressor task would increase congruence. Only participant perceived threat interacted with time in predicting congruence, supporting this hypothesis. While this effect was not found looking at pain congruence on average, couples in which the participants reported higher threat became more congruent over the two-minute interval. Couples in which participants reported lower threat were more likely

to be similar at the onset but became more dissimilar in the middle of the task. Expressed pain behavior may explain the rapid increase in congruence when participants report higher threat (Sullivan et al., 2001). Notably, other dyadic studies looking at the effects of threat have also found that pain appraisals influence the experience of pain (Jackson, Huang, Chen, & Phillips, 2009). Perhaps individuals who report higher perceived threat are more likely to communicate their pain, contributing to increased similarity between their and their partners' ratings.

However, hypotheses regarding participant pain catastrophizing and observer anxiety were not supported. Participant pain catastrophizing, observer threat, and observer pain catastrophizing were not related to congruence with or without the effect of time considered. Only perceived threat reported by the participant influenced pain rating similarity in a manner consistent with the communal coping model. Interactions between the remaining participant and observer anxiety variables, however, revealed interesting results.

Disregarding time, congruence was also influenced by an interaction between participant and observer pain catastrophizing. Among participants who reported greater pain catastrophizing, greater reported catastrophizing in their partners was associated with increased congruence. In contrast, among participants reporting lower pain catastrophizing, lower catastrophizing in observers was also associated with increased congruence. This finding runs counter to the hypothesis that anxiety in both partners would increase avoidance and decrease congruence. It may be that observers reporting similar trait anxiety are better at detecting pain behaviors elicited by their partners. Consistent with the current study, research conducted with parent-child dyads found that

pain catastrophizing in an observer predicted increased pain rating congruence (Goubert, Vervoort, Cano, & Crombez, 2009).

It may also be likely that similar anxiety experiences between two partners contributes to congruence. Leonard and Cano (2006) found that when spouses reported a personal experience with chronic pain, they also reported greater distress and understanding of their partner's chronic pain. Research suggests that it is easier to interpret someone else's pain when considering one's own experience versus trying to imagine another's pain ("self" vs. "other" perspective; Jackson, Brunet, Meltzoff, and Decety, 2006), despite the fact that taking a "self" perspective is more distressing (Batson, Early, & Salvarani, 1997). Also, high anxiety in observers is related to the ability to decode and respond to pain messages in others (Rash, Prkachin, Campbell, 2015; Davis, Bergeron, Sadikaj, Corsini-Munt, & Steben, 2015). Observers' who have similar trait pain anxiety to their partners may experience more understanding and less avoidance of their loved one in pain; thus this may result in increased congruence.

Gender and Empathy Influence Congruence

Other variables were tested as correlates of pain rating congruence, including both partners' relationship satisfaction and self-reported empathy. Gender of the participant completing the cold pressor task was also examined as a variable predicting pain rating congruence. Relationship satisfaction did not significantly influence pain related anxiety and congruence, but the gender and empathy of the participant in the task served an important role.

First, gender interacted with time in predicting congruence. When females underwent the cold pressor task, differences between the partners' pain ratings had

almost a “boomerang” effect; becoming less similar during the first minute of the task and returning to initial pain rating similarity near the end. When the participant in pain was male, pain ratings initially began more incongruent, but a steady increase in similarity was observed as the two minutes passed. In a clinical sample, spousal pain ratings were also more likely to be incongruent when the patients experiencing pain were female (Cano, Johansen, & Geisser, 2004). Among the participants who completed the cold pressor task, females were more likely to report higher perceived threat and pain catastrophizing. However, neither the ability to report similar pain ratings observed in the partner nor average pain differences between partners differed between males and females. It is the trajectory of congruence over time that differs when accounting for the gender of the partner in pain. Other possible explanations for why different pain ratings trajectories were observed between genders were considered. It may be that pain catastrophizing and threat serve as mediators between gender and pain intensity (Keefe et al., 2000). Differences in congruence trajectories could also occur if males are less accurate than females at perceiving distress and pain (Ickes, Gesn, & Graham, 2000). These hypotheses, however, were not directly tested in the current study.

Finally, it was hypothesized that observers who were empathic towards their partners would be more similar in pain ratings to their loved one. Counter to this hypothesis, empathy of the participant, not the observer, interacted with time course of the task to predict congruence. Empathy, the ability to take the perspective of another (with or without direct experience), is a different construct than experiencing similar anxiety (Goubert et al. 2005). Among participants who reported lower empathy, congruence remained relatively stable throughout the course of the task. However, when

participants reported higher empathy, pain ratings became increasingly dissimilar over the first 40 seconds of the task before becoming rapidly congruent in the last minute. Couples with more empathic participants displayed a far more dramatic trajectory than those couples in which participants reported lower empathy. This may suggest that more empathic individuals are quicker at accessing their own pain. Perhaps these individuals are more attuned to their own experience of pain. Fitting with the communal coping model, these individuals may be more effective at expressing pain behaviors and, in turn, effective at increasing congruence.

Limitations

While the results of the present study extend our understanding of the interpersonal influences of pain, a number of limitations must be considered when discussing the outcomes. First, the data utilized in this study is a subset of measures taken from a larger study. Therefore, the study design could not be altered to better test the current study's hypotheses. Design elements that were included to test hypotheses in the larger study (e.g., the 2-minute couple interaction) may have decreased participant and observer perceived threat and rendered the threat manipulation ineffective. Also, any data collection errors that occurred in the original study became errors in the current study.

In the current study, the observer was not present in the room with the participant undergoing the cold pressor task. Some experimental designs in the romantic dyad literature include both partners present in the same room while one partner undergoes a painful task (Coan, Shaefer, & Davidson, 2006). The separation of partners during the task may be considered a limitation but was purposefully included in the current study's

design. The physical absence of the partner controls for potential interference of the observer with the participants' performance. Additionally, since the outcome variable measured similarity in pain ratings, this design kept partners from verbalizing pain ratings to each other.

Regarding the sample, data in this study were collected from an undergraduate, non-clinical population. The results may not be a valid representation of the clinical population, though, this research was conducted in hopes to further understand the influence of interpersonal relationships among individuals with chronic pain. Future studies should seek to replicate the present study's findings among individuals with chronic pain. Additionally, this research should observe congruence over time, not with just measures of acute but chronic pain as well.

The current study provides insights on pain anxiety, gender, and empathy's influence on pain rating congruence among only romantic dyads. Future research should address pain anxiety and congruence among other dyads, such as same-sex dyads (e.g., male-male and female-female dyads). Further research is needed to determine if the above findings are specific to romantic couples or occur within any mixed-gender, non-romantic relationship. Additionally, observing congruence over time with dyads of friends, family, or health care providers may provide further support for the influence of interpersonal relationships on the treatment of chronic pain.

Conclusion and Future Directions

In conclusion, the evidence presented here suggests that congruence in acute pain ratings changes over time; observers rate participants' pain as less intense, on average, than participants' own ratings. The current study also adds to the literature by showing

that state and trait pain anxiety may independently and jointly influence the degree to which two romantic partners similarly rate one partner's pain. A logical next step in this line of research is to examine how pain rating congruence impacts the lives of individuals with chronic pain and others in their environment. One hypothesis is that congruence may increase the likelihood that individuals in pain will engage in activities with their partners (e.g., go on a date to the movies). It is possible that pain rating congruence between romantic partners fosters attachment and intimacy, which could lead to couples spending more time together and expressing more affection to each other. In other words, congruence and intimacy may reinforce each other. Researchers may also test if congruence increases the likelihood that individuals in pain participate in everyday physical activities (e.g., light exercise, cleaning the home, or going to the grocery store). Again, if congruence enhances intimacy, perhaps feelings of closeness could also motivate individuals to contribute to their families by helping with chores and shopping for their loved ones. Congruence may also be related to increased perceptions of empathy. Individuals may experience improved mood when their loved ones appear to understand their pain. If a positive affect results from congruence, an elevated mood may increase the likelihood that individuals will engage in more activities. These examples highlight the fact that the direction of the relationship between empathy and congruence is unclear. It was found in the current study that greater participant empathy was associated with greater congruence. Pain empathy researchers have found that characteristics of the individual in pain, and the individual observing another in pain, both contribute to empathy (Goubert et al., 2005). Future research should not only determine the extent to which

congruence predicts empathy towards an individual in pain but also the extent to which empathy, in either partner, predicts congruence.

The current study examined how affect, specifically pain anxiety, predicted congruence. Researchers should also identify cognitions that might influence congruence. For instance, maladaptive beliefs about pain (e.g., pain is disabling, others should be concerned about the pain, negative emotions exacerbate pain) are related to interpersonal difficulties (Jensen, Turner, Romano, & Lawler, 1994). It is likely that maladaptive beliefs influence congruence; however, further research needs to examine if negative thoughts increase congruence in a similar manner in which anxiety increased congruence in the current study. Both pain anxiety and negative cognitions may increase the likelihood that individuals will express pain behavior. Alternatively, it is possible that negative cognitions might interfere with expressing pain behavior and decrease congruence. Furthermore, an observer's awareness of pain in themselves or in others (e.g., "I frequently think about the pain my partner is in" or "I am very aware of my own pain when I am injured") may predict congruence. Future studies should examine pain awareness (i.e., frequency of thoughts about pain) not associated with emotional distress or anxiety and how it influences congruence. It is possible pain awareness in both partners serves as an empathic tool that increases understanding and similarity between two individuals' pain ratings.

In addition to exploring cognitive and emotional intrapersonal correlates of congruence, behavioral correlates may also be worthy of study. Perhaps expressions of pain must be received by an observer in order to increase congruence. In this case, the person with pain would need to express pain behavior *and* the observer must be able to

interpret these behaviors as pain. Inversely, observer behaviors may predict congruence. For instance, solicitousness or punishing responses from observers may influence pain rating similarity. When observers respond to another's pain behavior with a punishing response (e.g., "Please stop talking about your pain!"), then it decreases the likelihood that their partner will express future pain behaviors. To be consistent with the communal coping model, punishing responses from observers may block the observer from receiving information about their loved one's pain and decrease congruence. Supportive or understanding responses from observers may have different effects on congruence. Solicitousness responses, attending to a partner's pain instead, may increase the pain behaviors expressed by a partner, increase the observer's opportunity to receive information about their partner's pain, and increase congruence.

The mechanisms through which cognitive, emotional, and behavioral variables may be related to congruence have yet to be determined. It is unclear if congruence is enhanced when observers attend to their partner's pain behaviors or if observers simply assume their partner's pain is increasing over time. Continued research is necessary to understand the extent to which the pain experience is influenced by a variety of interpersonal relationships. Future studies should examine how predictors of congruence interact across different settings including the home, health care settings, and the workplace.

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ABSTRACT**I FEEL YOUR PAIN: THE INFLUENCE OF PAIN CATASTROPHIZING AND PERCEIVED THREAT ON PAIN SEVERITY CONGRUENCE IN COUPLES**

by

SHANNON CLARK**August 2016****Advisor:** Dr. Annmarie Cano**Major:** Psychology**Degree:** Master of Arts

The present study examines the extent to which partners were congruent on multiple ratings of participants' pain severity during a cold pressor task and how pain catastrophizing and perceived threat may moderate participant-partner congruence over time. Undergraduate couples in a romantic relationship ($N = 106$ dyads) participated in the study. Both partners rated the participant's pain in writing several times over the course of the task; thus, multilevel modeling was used to analyze the data. Current evidence suggests that congruence in acute pain ratings changes over time but that observers rate participants' pain as less intense, on average, than participants' own ratings. The current study also adds to the literature by showing that state and trait pain anxiety may independently and jointly influence the degree to which two romantic partners similarly rate one partner's pain.

AUTOBIOGRAPHICAL STATEMENT

Shannon Clark obtained her Bachelors of Science in Psychology at Truman State University and a Master of Science in Clinical-Behavioral Psychology at Eastern Michigan University. She enjoys conducting research in health psychology, which involves studying behavioral, social, and biological contributors to chronic pain. In particular, Shannon is interested in researching the effects of interpersonal relationships on maintaining and treating chronic pain. Currently, she is working towards her Ph.D. in Clinical Psychology and this master's thesis marks a significant milestone in her progress towards that goal.