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GREAT EXPECTATIONS: HOW ARE COUPLES INFLUENCED BY THREATENING INFORMATION PRIOR TO A PAIN TASK?

by

ANGELIA CORLEY

THESIS

To be Submitted to the Graduate School

of Wayne State University,

Detroit, Michigan

In partial fulfillment of the requirements

for the degree of

MASTER OF ARTS

2014

MAJOR: CLINICAL PSYCHOLOGY

Approved By:

Advisor Date

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ACKNOWLEDGMENTS

I would like to thank my committee: Dr. Annmarie Cano, Dr. Mark Lumley, and Dr. Rich Slatcher, for their incredible support and indispensable feedback throughout the course of this thesis. In particular, I cannot express enough thanks to Dr. Cano for her encouragement and guidance.

I would also like to thank Dr. Liesbet Goubert, who along with Dr. Cano, developed the study from which this thesis derives its data from. I offer my sincere appreciation to the students who collected this study’s data: Ashley, Danielle, Hasti, Kailee, Laura, Mateen, Matt, Merdijana, and Sarah.

To my parents, thank you for your love and support. You were the first to encourage me to pursue higher education and you continue to inspire me. Finally, I would like to express my gratitude to my husband; without his unwavering love and support, I could not have completed this project.

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Chapter 1

Introduction

According to the Institute of Medicine (2011), at least 116 million American adults struggle with chronic pain and countless more are affected by acute pain. The national economic cost of chronic pain alone is estimated to be $560-635 billion (Institute of Medicine [IOM], 2011). This is a largely conservative estimate as it excludes the cost of pain affecting institutionalized individuals (such as those in nursing homes or prisons), personal caregivers, children under 18, and military personnel. Pizzo and Clark (2012) estimate that the direct (e.g., medical costs) and indirect (e.g., lost wages) costs associated with pain are higher than the costs for cancer, heart disease, and diabetes combined. Pain is also the primary reason for seeking primary care in the United States and an estimated $16.4 billion is spent yearly on medication for pain management (Hing, Cherry & Woodwell, 2006; Turk & Theodore, 2011). The Institute of Medicine's Committee on Advancing Pain Research, Care, and Education (2011) recently concluded that treatment for pain is a significantly overlooked problem in the United States. To alleviate the impact of pain, researchers have been developing and testing models that explain pain and identify appropriate targets for intervention.

As described by Gatchel, Peng, Peters, Fuchs, and Turk (2007), the earliest models of pain perception sought to explain pain through a biomedical lens, and considered pain to be solely linked to tissue injury. Conversely, other early models of pain argued for a purely sensory theoretical approach and envisioned pain entirely as an emotional or subjective experience. In 1965, the landmark gate control theory of pain was proposed which integrated biological, emotional and cognitive conceptualizations of pain (Melzack & Wall). Since then, a number of different models have been proposed to explain both acute and chronic pain; however, the field has largely shifted to a biopsychosocial perspective (Gatchel et al., 2007; Lumley et al., 2011). From a biopsychosocial perspective, a large number of highly interactive factors are involved in the perception of pain including biological, cognitive, somatic, affective, and a number of social variables such as environmental stressors, interpersonal relationships, and social expectations (Gatchel, 2004).

One biopsychosocial model that incorporates many of these variables is the Fear-Avoidance Model (Vlaeyen & Linton, 2000). Briefly, the Fear-Avoidance Model illustrates that expectations of pain can affect the experience of pain, particularly when individuals perceive pain as threatening. The purpose of the current study was to test the extent to which expectations of pain-related threat can be experimentally manipulated and whether these expectations relate to pain intensity and pain tolerance. The present study also broadened the Fear-Avoidance Model of Pain to incorporate the social context to a greater degree by hypothesizing that romantic partners' expectations can also be manipulated and can affect the experience of pain. This study used the cold pressor paradigm to test these hypotheses in a sample of undergraduate student couples. For the purposes of this study, pain-related threat is a broad term incorporating pain-related fear, anxiety, or negative expectations about an upcoming painful task. Although some research models distinguish fear from anxiety (e.g. the Expectancy Model by Reiss, 1991, Rhudy and Meagher, 2000), the Fear-Avoidance Model does not make these distinctions. Thus, "fear", "anxiety", and "negative expectations" are used interchangeably with “threat” throughout the remainder of this manuscript, although this issue will be revisited in the Discussion.

The Fear-Avoidance Model

The Fear-Avoidance Model is based on learning theories and explains the development of chronic pain by incorporating the role of threat in the pain experience (Vlaeyen & Linton, 2000). The Fear-Avoidance Model posits that an acute injury naturally leads to muscle tension, fear, and sympathetic nervous system activation. Over time, a neutral activity, for example lifting a heavy object, may elicit the same response of muscle tension, fear, and sympathetic activation in the absence of injury. This fear response may develop through one’s own experience, watching another person experience pain from the activity or from being informed that a behavior could cause pain or injury. After an individual has learned to fear a certain behavior, he or she copes with this fear by avoiding the behavior. Avoidant pain behaviors are then negatively reinforced, such that avoiding a certain activity reduces fear. Further, if avoidant pain behaviors always precede potential pain, the individual does not have the opportunity to discover that a certain activity does not actually elicit pain. Even when an individual is unable to avoid performing the behavior, avoidant pain behaviors may still be reinforced because his or her fear and sympathetic arousal will still provide a negative consequence of the activity. Over time, avoidance of daily activities that an individual expects to produce pain will develop into functional disability, and/or other detrimental outcomes – such as depression and ‘disuse syndrome’ both of which are associated with decreased pain tolerance. Thus, through mechanisms of fear and avoidance, an acute pain experience can lead to chronic pain. Numerous studies have supported the Fear-Avoidance Model (Leeuw et al., 2007; Turk & Wilson, 2010; Vlaeyen & Linton, 2000). Similarly, related research on anxiety sensitivity (i.e., anxiety about experiencing anxiety-related symptoms) in patients with chronic pain has shown that anxiety sensitivity predicts greater pain, disability, distress and healthcare use (McCracken & Keogh, 2009). Thus, the Fear-Avoidance Model suggests that expectations about what activities might cause pain play an important role in the development of chronic pain and that treatments for chronic pain should target threat and fear beliefs about pain.

Newer formulations of the Fear-Avoidance Model have emphasized the importance of threat, which varies across contexts and individuals (Vlaeyen & Linton, 2012). Threat has been experimentally manipulated through written information, verbal explanation of a pain task, classical conditioning, and observation of others (Boston & Sharpe, 2005; Helsen, Goubert, & Vlaeyen, 2013; Helsen, Goubert, Peters, & Vlaeyen, 2011; Koyama, McHaffie, Laurienti, & Coghill, 2005; Leventhal, Brown, Shacham, & Engquist, 1979; Vlaeyen et al., 2009). For example, Leventhal et al. (1979) gave subjects different types of preparatory information prior to a cold pressor task, such as information describing the sensory properties of the task: the potential painfulness of the task. Participants who were given threatening information reported more distress during a cold pressor task (Leventhal, 1979). The present study tested whether threat can be experimentally manipulated in a manner similar to these studies (i.e., by showing videos of people who have previously undergone the task to participants). Further, this paradigm was extended to examine whether it is possible to manipulate romantic partners' perceptions of threat. It is important to study how significant others can be affected by threatening information because they often play a significant role in pain coping as will be described below.

The Fear-Avoidance Model in a Social Context

The Fear-Avoidance Model includes a social component by positing that fear of pain can be developed through observation of others undergoing a similar task. However, that is the only explicit reference to social context in this model. Indeed, most research studying the Fear-Avoidance Model examines determinants occurring solely within the individual (e.g., individual's pain catastrophizing, fear of re-injury) and does not examine the impact of the negative expectations of others who might not be experiencing the painful task. Thus, the Fear-Avoidance Model does not fully account for the importance of the social context in threat expectations. For example, both partners can fear pain, whether or not it is pain they will directly experience, and both of their experiences can contribute to pain. Take, for example, a male patient who is preparing to undergo a painful medical procedure. On the way to the hospital, his wife might say, "It makes me nervous that the doctor said that you could have breathing difficulties after the surgery." Although the patient was not feeling anxious about the procedure before, he might begin to think about negative consequences of the procedure. If the husband and wife continue to talk about some of the threatening aspects of the surgery, this might influence the husband's expectations of the surgery and subsequent interpretations of pain following the surgery. When this patient is in the recovery room and feels tightness in his throat, he may worry that this is an indication that he might not be able to breathe. If a significant other is feeling anxious prior to an acute painful procedure, she or he might directly express this anxiety, as in the example above, or act in ways that otherwise elevate the anxiety of the patient (e.g., pace around the room nervously). On the other hand, significant others might be a source of support and comfort for a patient about to undergo a painful procedure, through verbal expression, physical contact, or other reassuring behaviors, which might mitigate the fear and anxiety that the patient experiences.

Research has shown that significant others' cognitions and behaviors prior to painful procedures indeed relate to distress and pain, although this research appears to be limited samples of parents and their children. Parents' behavior and communication with their child before and during an acute painful medical procedure, such as suggesting coping strategies, using humor, or reassuring the child, have been found to be important factors related to the child's distress and pain regarding the procedure (Frank, Blount, Smith, & Manimala, 1995; Jacobsen et al., 1990; Schechter et al., 2007). Parental anxiety prior to the child's medical procedure has been found to be associated with the child's distress during the painful task (Jay, Ozolins, Elliott & Caldwell, 1973). More recently, parental anxiety sensitivity has been found to be associated with girls' pain intensity during a cold pressor task (Tsao et al., 2007).

Unfortunately, this type of research has not often been conducted with adults. Research has shown that a partner's pain catastrophizing, which can be thought of as a cognitive style related to pain threat, is associated with the other partner's greater pain severity in the context of chronic pain (Leonard & Cano, 2006). Nevertheless research has yet to demonstrate that adults, like children, are likely to be influenced by their significant others' perceptions of threat and corresponding behaviors prior to a painful procedure. This is a significant gap in the literature because it is not clear how expectations of fear and threat in loved ones might affect the ability of adults to cope with acute pain, including pain from painful procedures.

One way in which significant others' perceived threat might affect a person who is expecting pain is through social support. Yet, researchers have not yet examined whether a significant other's threat is an important determinant in whether or not significant others will provide support for their partner. Research on observers' anticipatory reaction to an acquaintance's pain suggests that threat and expectations of pain alter one's emotional response to an acquaintance's pain (Caes et al., 2012). Observers in that study had increased levels of self-reported fear, fear-potentiated startle, and corrugator EMG activity when anticipating that another person would be exposed to a painful stimulus. Additionally, observers who reported high levels of catastrophizing about another's pain demonstrated augmented increases in self-reported fear and corrugator EMG activity. These results suggest that individuals who have negative expectations about pain react with more negative emotional responses to an acquaintance being exposed to a painful stimulus (Caes et al., 2012). These findings have also been replicated in parent-child relationships (Caes, Vervoort, Trost, & Goubert, 2012). Given the preliminary evidence, I hypothesized that not only is the perceived threat of the cold pressor participant important in predicting pain but the perceived threat of the romantic partner is also a key determinant in pain, perhaps because partner threat affects the partner's ability to support the participant.

The Present Study

As described above, there is a need for research on the extent to which significant others' perceptions of pain-related threat relates to their partners' ability to tolerate activities that involve acute pain. To this end, the current study used an expanded Fear-Avoidance Model to explain how threat experienced by a significant other might affect acute pain. In my Contextual Fear-Avoidance Model shown in Figure 1, both partners may be exposed to threatening information that can heighten each partner's perceptions of threat. This model was designed as a conceptualization aid in understanding how threat experienced by a significant other might affect acute pain. To illustrate all that the model encompasses, suppose that a woman is in need of a lumbar puncture. Imagine if the physician tells the patient that there are many risks including brief but severe pain during the procedure (high threat). When the doctor leaves the room to retrieve the necessary equipment, the husband may decide to hold his wife's hand and suggest to her, "If you distract yourself, I bet it won't hurt at all." With this small gesture of comfort, the wife may feel more supported and less anxious about the upcoming procedure. Consequently, she may be better able to focus on coping strategies rather than her own fear about the lumbar puncture. Alternately, the husband might begin to pace the room and asking her, "Have you ever seen the needle they use for a lumbar puncture? It's huge!" This type of response may escalate the wife's anxiety so that during the procedure, she perceives every sensation as more painful. On the other hand, we can imagine a different sequence events if the doctor were to convey a low threat message: "You will only feel a slight amount of pressure and tingling." In this case, the husband may not even consider reassuring his wife prior to the lumbar puncture. The wife too, may not be anxious after receiving this information. During the actual procedure, the wife may actually interpret a painful experience as normally occurring feelings of pressure and tingling and experience less pain during the procedure overall.

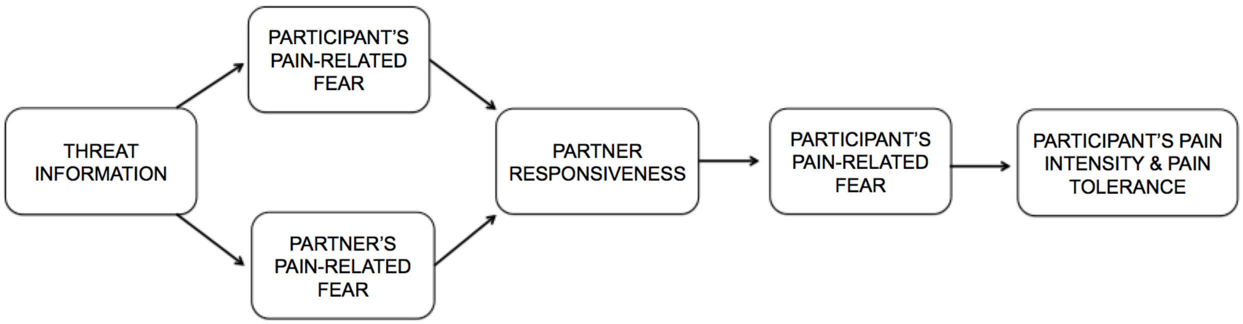

Figure 1. The Contextual Fear-Avoidance Model of pain, adapted from Vlaeyen & Linton, 2000. The Fear-Avoidance Model shown here revises the model in two ways: (1) the model is no longer cyclical and (2) the model incorporates the social context, specifically showing a partner's effect on the pain experience (the individual in pain is designated as 'participant')

As these examples demonstrate, the effect of threatening information is likely to be immediate, affect both partners, and persist over time. Other individual difference variables might also affect the level of responsiveness a partner provides to another prior to an acute pain task (e.g., trait pain catastrophizing). The Contextual Fear-Avoidance Model (C-FAM) model demonstrates that a responsive partner may reduce the participant's pain-related fear, which is expected to affect the participant's pain. Another difference in the C-FAM, is that unlike the Fear-Avoidance Model, the cyclical aspect of the model is not included. A recent review argues that while pain-related fear is clearly predictive of pain, there is little evidence supporting the cyclical relationships in the Fear-Avoidance Model and that future research is better served by abandoning the cyclical form of the Fear-Avoidance Model in favor of a more comprehensive, multidimensional framework yet to be developed (Wideman et al., in press).

The present study aimed to test hypotheses derived from the Contextual Fear-Avoidance Model. However, the hypotheses do not include a test of the C-FAM as a complete model because research incorporating the social context into the Fear-Avoidance Model is in its infancy. While Structural Equation Modeling may be one avenue to test this model, it is not recommended because little prior research evidence exists for each path in the model and there is less interest in the overall fit of the model than the validity of its parts. Again, C-FAM best serves as a conceptual model to guide and structure hypotheses. To put these hypotheses in context, a brief description of the procedure follows. Participants were romantic couples in which one partner from each couple was randomly assigned to undergo a painful task (i.e., the cold pressor task) while his or her partner observed via a video monitor from an adjacent room. Couples were also randomly assigned to one of two conditions: a high threat or a low threat condition that aimed to manipulate the perceived threat of the upcoming task. At multiple points, both participants and their partners self-reported their perceived threat. After receiving the threat manipulation, the couple was asked to discuss any thoughts or feelings about the pain task with each other. Participants' satisfaction with the interaction task, their perceptions of the partners' emotional responsiveness, and extent of perceived threat were assessed following the couple's interaction. Finally, participants were asked to engage in the cold pressor task for as long as they could tolerate and to rate the pain intensity felt during the task while partners observed on a video monitor from an adjoining room. In the current study, I make three sets of hypotheses concerning threat and social context in the experience of acute pain.

The first set of hypotheses attempted to replicate and extend previous findings supporting the Fear Avoidance Model regarding the possibility of manipulating threat in *both* partners and the effect of threatening information on the participant's pain experience. I hypothesized that participants and partners who were in the high threat group would report higher perceived threat and catastrophizing, in comparison to participants and partners in the low group threat after receiving the threat information (H1a). Further, I aimed to study whether heightened perceived threat is sustained over time. Specifically, I hypothesized that participant and partner perceived threat would also be greater in the high threat group at the post-interaction assessment (H1b). I also hypothesized that participants who are in the high threat group would have higher pain intensity ratings and less pain tolerance during the cold pressor task than those in the low threat group (H1c).

The second set of hypotheses (H2) focused on how threatening information might relate to social support as well as the extent to which social support may mitigate participants' anxiety and perceived threat regarding the cold water task. Participants and partners' trait pain catastrophizing and threat information about the task are likely to contribute to participants' perceptions of partner responsiveness during the couple interaction (H2a). I also hypothesized that participants would experience greater reductions in anxiety about the cold water task to the extent that they reported a supportive and satisfying interaction with their partner (H2b). While partner reductions in anxiety may also occur following the couple interaction, only participant anxiety was tested since their anxiety may more directly modify their performance during the pain task. I also explored the possibility that trait pain catastrophizing, prior to manipulation of threat may moderate the effect of group condition on perceived partner responsiveness.

The third set of hypotheses (H3) examined the extent to which threat affects pain intensity and pain tolerance in the context of partner responsiveness. Because of the sequence of tasks, I was less interested in whether initial threat (i.e., threat assessed prior to the interaction) or the threat group related to pain. Instead, I was interested in the extent to which participants' pain ratings and pain tolerance are a function of both their perceived partner responsiveness and satisfaction with the interaction and fear right before the painful task. I hypothesized that a more supportive interaction with one's partner would be related to greater pain tolerance and lower pain ratings (H3a), and that this association would be explained by lower pain-related fear just prior to the task (H3b).

Chapter 2

Method

Participants

Participants were 134 undergraduate students and their romantic partners. All participants were recruited from an online research participation system, SONA, at Wayne State University. Participants were excluded from the study if they had medical conditions that might involve blood circulation problems (e.g., Reynaud's disease) or Diabetes since some people with this disease experience circulation problems as well. Again, participants who were randomly selected to undergo the cold pressor task will be referred to as 'participants' to distinguish them from their partners. The gender of the participants was balanced with 52.2% female (n = 70). The gender of their partner was also balanced with 54.5% male (n = 73). While most couples were heterosexual, seven homosexual couples were included in the study (2 female, 5 male couples). The average age of participants and partners were 22.89 (SD = 6.11) and 22.73 years (SD = 5.72). The sample had some racial and ethnic diversity for both participants (Race: 50.7% Caucasian, 28.4% African American, 18.7% Asian American, Ethnicity: 17.2% Arabic, 7.5% Hispanic) and their partners (Race: 47.8% Caucasian, 28.4% African American, 18.7% Asian American, Ethnicity: 14.2% Arabic, 7.5% Hispanic). On average, couples were in a relationship for 26.94 months (SD = 25.78). Most participants were currently attending college or had some college education (79.8%), although some only had a high school diploma (15.7%), and a small portion had some graduate-level education (2.2%). Similarly, most partners were currently attending college or had some college education (80.6%); the highest level of education for others was a high school diploma (14.9%) or some graduate school (3.6%).

Procedure

Prior to beginning the study, IRB approval was obtained. Potential participants responded to an advertisement posted on SONA, an online research participation system at Wayne State University. The advertisement posted on SONA read:

> "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 undergraduates signed up for scheduled times posted in SONA. Once a couple signed up for a scheduled time, couples were randomized with a coin flip: Heads = High Threat, Tails = Low Threat. When a couple arrived at the laboratory, a research assistant greeted them, reviewed the general purpose of the study, obtained informed consent and asked them to wash their hands. The following study activities will also be displayed in a flowchart below, Figure 2. Both participants and their partners then completed several self-report measures individually in separate rooms, including questions about demographic information, trait pain catastrophizing, and perceived partner responsiveness. Participants were asked to not discuss their answers with each other until the completion of the study. While participants completed the surveys, the research assistant flipped a coin to determine who would undergo the cold pressor task; Heads = Female partner, Tails = Male partner. After completing the self-report measures, the couple was brought into the observation room and informed which partner would be putting their hand in the cold water later. Participants were then asked to complete additional surveys that included questions about expected pain, anxiety, and willingness to do or observe the cold pressor task, collectively described as a perceived threat measure. Although the couple was not separated into different rooms, they were again asked to not to discuss their answers with each other until after the end of the study.

After participants completed the surveys, the research assistant returned and introduced a video about the cold pressor task that the participant would engage in later. Unknown to participants, there were two different versions of the video. Both videos contained silent footage of participants in a previous study who consented to using their video in other research studies. In the High Threat condition, the video had footage of people expressing a high number of pain behaviors while completing the cold pressor task (e.g., grimacing, eyes tightening). In the Low Threat condition, the video had footage of people expressing no or minimal pain behaviors. Both videos showed a sequence of 8 individuals (4 females, 4 males, alternating between each gender), with each individual being shown for 35 seconds. Before each individual is shown, a 15-second clip displays close-up footage of a hand being placed into the cold water container. Thus, the sequence of clips shown alternates between: a hand being inserted into the container of cold water, an individual engaging in the task, a hand being inserted into the container of cold water, a different individual engaging in the task, etc.

Individuals are not shown withdrawing their hand from the cold pressor task at any point in the video. In total, each video's duration was 6 minutes and 40 seconds.

Following the video, participants were asked to respond to additional surveys, which assessed current perceived threat, pain catastrophizing, and perceived partner responsiveness. Couples were then asked to engage in a discussion about what they expected in the cold pressor task, and any thoughts, feelings, concerns or fears about performing the task. The research assistant then left the room and the couple engaged in a two-minute discussion. Unfortunately, due to poor audio and video quality, it was not possible to code the videos for this study. Following the couple interaction, each individual completed self-report measures addressing perceived threat, pain catastrophizing, and perceived partner responsiveness, including questions assessing their satisfaction with the interaction, and their partner's and their own expectations about the task. During this time, the couple remained together in the same room.

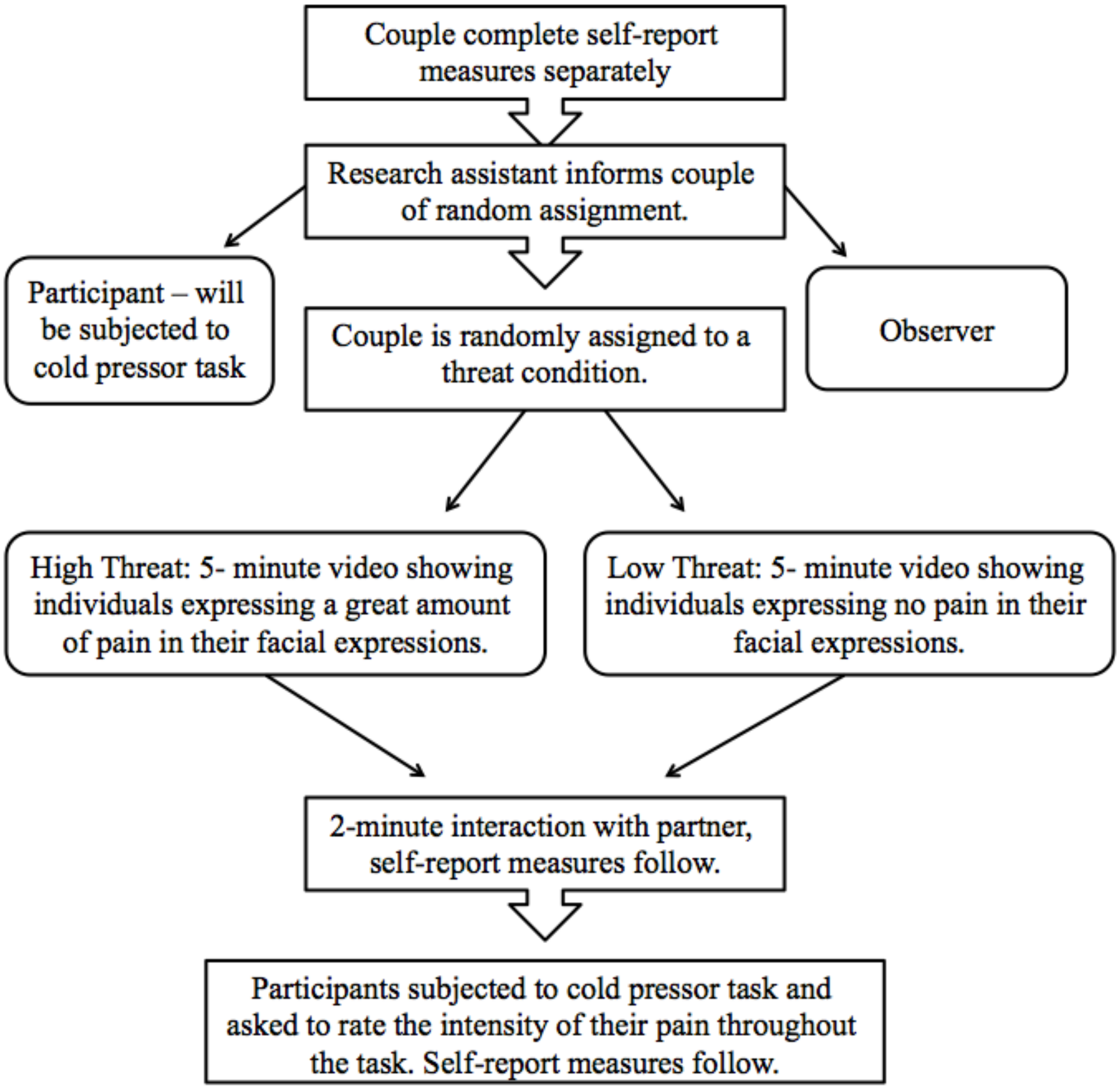

Figure 2: Study procedure.

Following the completion of the surveys, the partner was asked to step out of the room, and the participant designated to complete the cold pressor task was informed about the cold pressor task, given clear instructions on how to hold their hand in the water container, and instructed to dip his/her hand into the water after the first tone. Participants were also instructed to rate their pain after each of the following tones.

Participants were seated in a chair adjacent to the water container and dipped their non-dominant hand in the water. Prior to the task, the research assistant asked that chewing gum or food be removed from the room before proceeding, and that jewelry not be worn during the cold pressor task. Participants first dipped their non-dominant hand in a bucket of room temperature water for 1 minute to ensure all participants begin the task at a standard hand temperature. Participants were additionally asked to keep their head up and look at cross-hairs on a piece of paper affixed to the wall. Prior to beginning, the research assistant asked participants if there were any questions about the cold pressor task procedure and also asked the participant to describe the procedure back before proceeding.

Although participants were not informed of this, the maximum duration of immersion was set at 2 minutes, and the research assistant kept track of the duration using a digital stopwatch. Tones alerting the participant to record their current pain rating were spaced every 10 seconds for the first 40 seconds and then every 20 seconds thereafter. After two minutes, the research assistant asked the participant to withdraw their hand if they had not voluntarily withdrawn their hand prior to that point. Following the cold pressor task, both the participant and the partner were asked to separately fill out another set of surveys regarding pain catastrophizing and perceived partner responsiveness. After completion of the surveys, the couple was brought back together in the same room and debriefed about the purpose of the study, given the opportunity to ask questions, and administered extra credit.

Measures

This section is organized in the order in which measures were administered. See Figure 3 as a guide to the order of the presentation of self-report measures. Baseline measures that were administered prior to randomization are presented first. Inter-item reliabilities for all multi-item measures are also reported.

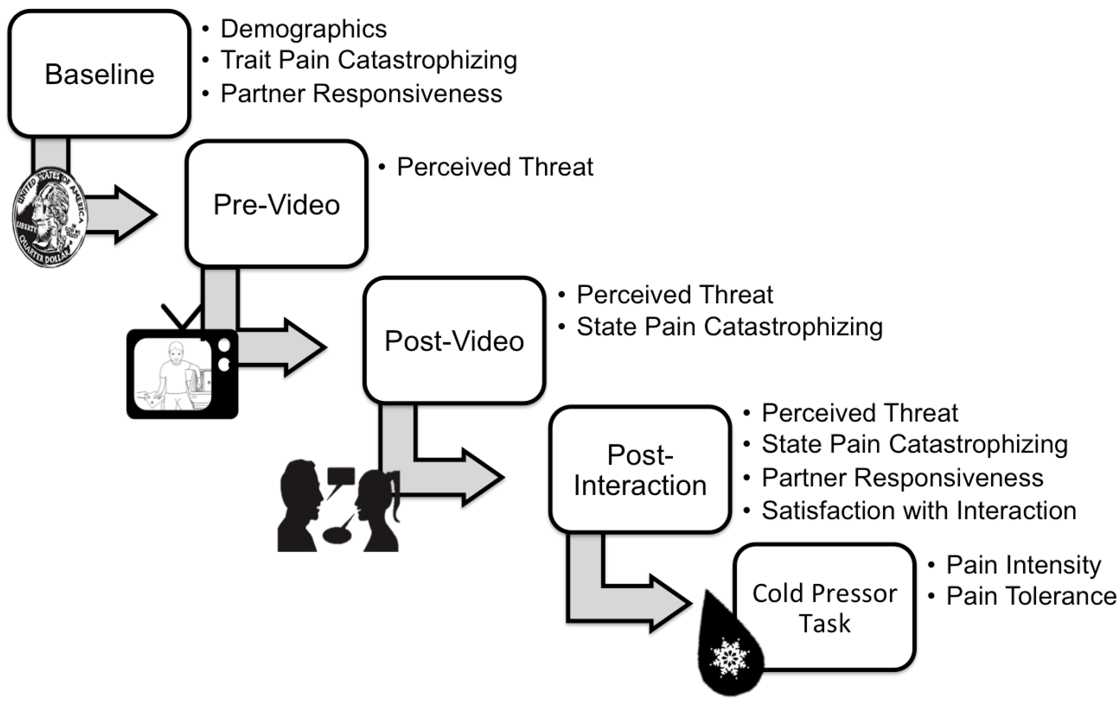

Figure 3: Assessment phases of the study. This figure illustrates the temporal order of assessment phases in the present study and the self-report measures administered at each assessment phase. Graphics indicate the various tasks participants and their partners engaged in during the study, such as a coin icon to represent the coin-flip randomization procedure described above.

Baseline Measures. The following measures were administered prior to randomization of threat group and participant to complete the cold pressor task.

Pain Catastrophizing. Baseline measures of pain catastrophizing were administered to control for trait sensitivity to pain threat prior to experimental manipulation. The extent to which participants and their partners had a trait tendency to feel threatened, fearful, anxious, or to catastrophize about pain was measured by the Pain Catastrophizing Scale, which consists of 13 items (PCS; Sullivan, Bishop, & Pivik, 1995). Scores may range from 0 to 52 with greater scores indicating greater pain catastrophizing. In this sample, scores ranged from 0 to 49; the mean score for participants was 17.16 (SD = 10.94) and the mean score for partners was 17.94 (10.46). Internal consistency of PCS for this sample was excellent (alpha = .93 and alpha = .92 for participants and partners, respectively).

Perceived Partner Responsiveness. A baseline measure of perceived partner responsiveness was administered to control for trait-like perceived partner responsiveness prior to experimental manipulation. An 18-item scale for perceived partner responsiveness was administered to participants and partners to assess the extent to which they typically perceived emotional responsiveness from their partner (Khan et al., 2009). This scale yields a summed score with possible scores ranging from 18 to 162. Higher scores indicated greater perceived partner responsiveness. For participants, scores ranged from 50 to 161, with a mean score of 131.09 (SD = 23.78). For partners, scores ranged from 44 to 162, with a mean score of 127.15 (SD = 25.75). The internal consistency of this scale was excellent (alpha = .94 for participants; alpha = .95 for partners).

Couple Satisfaction. Participants and partners also completed a baseline measure of their satisfaction with their relationship with their partner. The Couples' Satisfaction Index, which includes 32 items, was used to assess couple satisfaction (Funk & Rogge, 2007). This scale yields a summed score with possible scores ranging from 0 to 161, which higher scores indicating greater relationship satisfaction. In this sample, scores ranged from 51 to 161, with participants yielding a mean score of 125.17 (SD = 26.57) and partners yielding a mean score of 124.83 (SD = 25.96). This scale also demonstrated excellent internal consistency (alpha = .97 for both participants and partners).

Pre-Video Measures. The following measures were administered immediately prior to threat manipulation videos.

Perceived Threat. Participants responded to four questions that were specific to the pain task and designed to capture the extent to which participants and partners felt threatened and anxious about the task (e.g., “How anxious or tense are you about the cold water task?”). For partners, the question was phrased, “How much pain do YOU think your partner will have during the cold water task?” The word “you” was emphasized to distinguish from questions asking about the participant’s fear discussed below. Partners responded to the same questions as participants, although rephrased. The response scale was a 11-point Likert-type scale (0 = “Not at all”, 10 = “Very much”). The four items were summed to create a composite score of the participant’s perceived threat of pain, which had excellent internal consistency (alpha = .88). Thus, the remaining four questions were summed to create a composite score of the participant’s perceived threat of pain; in this sample, scores ranged from 0 to 37. Prior to the threat manipulation video, participants had a mean score of 13.15 (SD = 9.78).

Partners were also asked to respond to questions about their own fear and threat about the upcoming pain task (perceived threat) and also four items regarding their perception of their partner’s anxiety about the upcoming pain task (perceived partner threat). The four perceived threat items had good internal consistency (alpha = .83). The items were summed to create a composite score with a range from 0 to 40. Partners obtained a mean score of 13.57 (SD = 9.32) prior to the threat manipulation video.

Participants additionally responded to the question, "How much pain do you think you will have during the cold water task?" and partners responded to the similar question, "How much pain do YOU think your partner will experience during the task?" on a 10-point Likert-type scale. Since theoretically, expected pain may be high even when perceived threat is low, this item was analyzed separately as a unique indicator of the participants' and partners' expectations about the cold pressor task. For participants, the mean score on this item prior to the threat manipulation video was 4.36 (SD = 2.84). For partners, the mean score was 4.42 (SD = 2.77) prior to the threat manipulation video.

Post-Video Measures*.* The following measures were administered after the presentation of threat manipulation.

Threat and Catastrophizing. As described above, participants and partners completed a 4-item measure of threat and a one-item expected pain measure. At this assessment, the participants' threat scale showed good internal consistency (alpha = .89). For participants, the mean perceived threat score was 13.29 (SD = 9.90) and the expected pain score was 4.29 (SD = 2.72). For partners', the measure of their perceived threat showed good internal consistency (alpha = .87), as did the measure of their perception of their partner's threat (alpha = .90). The partners' mean was 12.18 (SD = 9.71) on the measure of perceived threat, 16.78 (SD = 11.39) on the measure of their perception of their partner's threat, and 4.51 (SD = 2.65) on the measure of expected pain.

Additionally, state pain catastrophizing was assessed by revising 9 of the 13 PCS items to be specific to the pain task rather than general pain and providing an 11-point Likert-type scale (0 = “Not at all”, 10 “Very much”). Prior research has demonstrated that the pain catastrophizing scale can be adapted into a state measure (Goubert, Vervoort, Cano, & Crombez, 2009). The 9 PCS items were summed; creating a composite score that can range from 0 to 90. This composite score demonstrated good internal consistency for participants and partners (alpha = .92 and .89, respectively). In this sample, scores ranged from 0 to 88. Following the threat manipulation video, participants had a mean score of 27.02 (SD = 18.61), and their partners had a mean score of 30.32 (SD = 18.90).

Post-Interaction Measures*.* The following measures were administered after the couple discussed the video.

Threat and Catastrophizing. Participants again completed a measure of threat (M = 11.18, SD = 9.34) and catastrophizing, as described above, (M = 23.46, SD = 18.49) following the interaction with their partner. Internal consistency for these measures remained high (alpha = .90, alpha = .94, respectively). Partners also completed a measure of perceived threat (M = 11.77, SD = 9.14), perceived partner threat (M = 13.31, SD = 10.60), and catastrophizing (M = 26.61, SD = 18.34). The partners’ measures of threat, partner threat, and catastrophizing also maintained good internal consistency (alpha = .83, alpha = .89, alpha = .89). Additionally, both participants and their partners completed a one-item measure of expected pain. Participants’ had a mean score of 3.57 (SD = 2.70) and partners’ had a mean score of 4.24 (SD = 2.68).

Perceived Partner Responsiveness. At this assessment phase, participants (but not their partners) responded to a shortened version of the perceived partner responsiveness scale consisting of 4 items (Khan et al., 2009). Responses on these items were summed, and scores ranged from 4 to 36. Participants' mean score on this scale was 28.09 (SD = 7.11) and internal consistency on this brief scale was high (alpha = .89).

Satisfaction with Interaction. Both participants and their partners were asked, "To what extent are you satisfied with the interaction you just had with your partner?" and were given a Likert-type scale from 0 to 10, where a score of 10 indicated the most satisfaction. In this sample, scores ranged from 1 to 10. For participants, the mean score was 8.08 (SD = 1.92) and for their partners, the mean score was 7.73 (SD = 2.26).

Cold Pressor Task Measures. The following measures were administered during the cold pressor task and, thus, were completed by the participant only.

Pain Duration. The experimenter used a digital stopwatch to record the time in seconds that the participant held their hand in the cold water basin. Participants' pain duration ranged from 11 to 120 seconds. On average, participants held their hand in the cold water basin for 93.39 seconds (SD = 38.64).

Pain Intensity. Participants were given an 11-point pain rating scale to report their pain intensity. Participants rated their pain when tones alerted them to record their current pain level, which were spaced every 10 seconds for the first 40 seconds and then were sounded every 20 seconds thereafter. Pain ratings ranged from 0 to 10 across all time points. Means and standard deviations of pain ratings across time points are shown in Table 1. Internal consistency of pain ratings across time points was excellent (alpha = .95).

Table 1

Means and Standard Deviations of Pain Intensity Scores

Time (secs)	N	Mean	S.D.
10	134	5.08	2.90
20	125	5.59	2.74
30	118	6.41	2.57
40	114	6.99	2.52
60	102	7.39	2.39
80	91	7.41	2.23
100	87	7.08	2.37
120	85	6.78	2.78

Chapter 3

Results

Data Screening

The data were screened for univariate outliers, normality, internal reliability, and excessive missing data. Screening revealed only one univariate outlier across all variables. The univariate outlier showed an extreme value on participant's post-interaction perceived partner responsiveness so the participant's score was removed from the dataset.

Skewness was also investigated. Participants' baseline and post-interaction perceived partner responsiveness, and pain intensity ratings at 40, 60, 80, 100, and 120 seconds were significantly negatively skewed. Participants' pre-video, post-video, and post-interaction unpleasantness ratings, participants' post-interaction perceived threat, partners' post-video perceived threat, and partners' post-interaction state pain catastrophizing and perceived threat were significantly positively skewed. In this dataset, all significantly skewed variables underwent a square root transformation. Following this transformation, the distribution of these variables was considered normal. Analyses were conducted on both the untransformed and transformed data; if the results did not differ, results were reported in terms of the original, untransformed data for ease of understanding purposes. In the case that the untransformed and transformed results were different, both results were presented.

Data on the length of time participants held their hand in the cold water basin (pain tolerance) demonstrated significant negative skew, which is also evident upon visual inspection (see Figure 4). As underscored in the figure, 63.9% of participants completed the pain task. Given this extreme skew, which suggests a meaningful difference between individuals who completed the task versus individuals who did not complete the task, it was deemed appropriate to dichotomize pain tolerance (i.e., completed the task vs. did not complete the task).

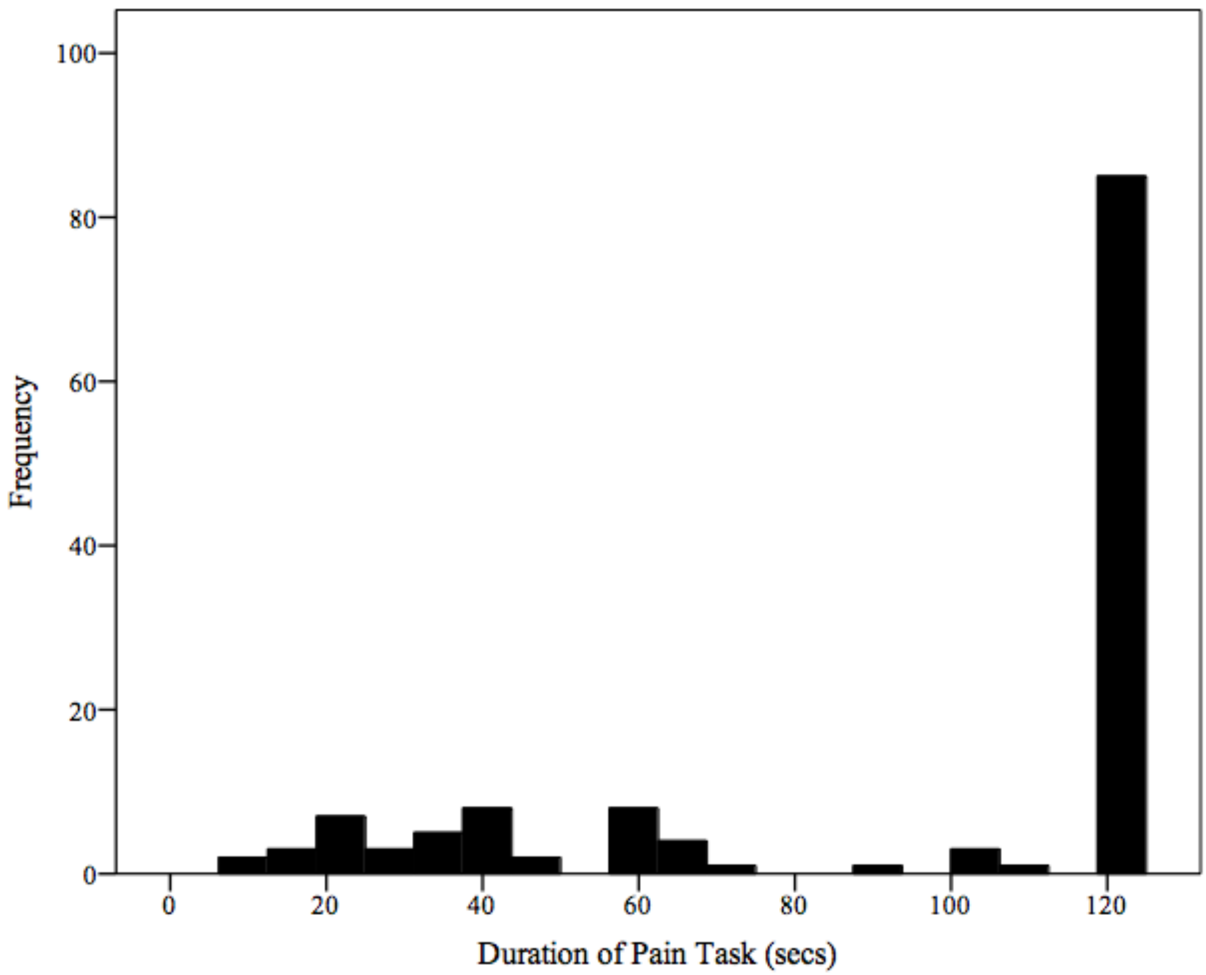

Figure 4. Histogram of pain tolerance in seconds.

Twenty-seven variables had at least some missing data; each variable indicated a unique combination of time point, reporter (participant or partner), and measure. For example, participant's perceived threat at post-interaction would be considered one variable, and partner's perceived threat at post-interaction a separate variable. Of these

27 variables, 24 variables had just two or less instances that were missing 10% or more data, equating to a loss of <1 to 1% of the data collected on each measure from each individual at each time point. Exceptions to this were: partner's pre-video unpleasantness rating, in which 3% of the partners did not respond to the item, participant's baseline perceived partner responsiveness, in which 7.46% of the participants had excessive missing data (≥10%) and participant's post-interaction perceived partner responsiveness, in which 13.4% of the participants had excessive missing data. If any respondent was missing more than 10% of any one scale, his or her data were not used for that scale. If a participant did not respond to some of the items in a scale but these items make up less than 10% of the scale, the missing values were replaced with the series mean. This procedure for dealing with missing data is considered acceptable (Tabachnick & Fidell, 2012).

For descriptive purposes, a number of correlations were conducted. An alpha level of .05 was used for all of the following analyses. For all correlations, the pattern of results based on transformed variables was similar to the pattern of findings based on untransformed variables. Thus, raw variable results are presented for ease of interpretation.

Correlations among participant variables can be found in Table 2. The data in Table 2 was collected from the individual who engaged in the cold pressor task. Table 2 includes a number of variables assessing pain catastrophizing, expected pain and unpleasantness during the task, and perceived threat of the task for a number of time points. Additionally, Table 2 includes participant average pain rating, satisfaction with the interaction, and baseline and post-interaction perceived partner responsiveness.

Notably, baseline pain catastrophizing is significantly related to average pain during the task, *r*(133) = .24, *p* = .005. Average pain during the task was also correlated with other variables assessed prior to the threat video - perceived threat, *r*(134) = .37, *p* < .001, and expected pain, *r*(134) = .29, *p* =.001, although not expected unpleasantness. Following the video, pain catastrophizing, *r*(133) = .39, *p* < .001, perceived threat, *r*(133) = .35, *p* < .001, expected pain, *r*(133) = .32, *p* <.001, and expected unpleasantness, *r*(133) = .18, *p* = .04, were all related to average pain ratings during the pain task. These same variables, when assessed following the couple interaction, remained significantly correlated with average pain, perceived threat: *r*(133) = .37, *p* < .001, expected pain: *r*(133) = .32, *p* < .001, expected unpleasantness *r*(133) = .18, *p* = .04, and pain catastrophizing: *r*(133) = .36, *p* < .001).

Table 2

Correlations among Participant Variables

Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Baseline PCS	--															
2. Baseline PPR	-.14	--														
3. Pre-Video Perceived Threat	.25**	.17	--													
4. Pre-Video Expected Pain	.26**	.20*	.64**	--												
5. Pre-Video Unpleasantness	.00	-.04	.07	.05	--											
6. Post-Video Perceived Threat	.16	.12	.80**	.46**	.07	--										
7. Post-Video Expected Pain	.12	.07	.50**	.61**	.06	.70**	--									
8. Post-Video Unpleasantness	. 04	-.04	.08	.08	.66**	.12	.15	--								
9. Post-Video PCS	.29**	.00	.58**	.41**	.03	.77**	.71**	.12	--							
10. PI Perceived Threat	.19*	.09	.74**	.42**	.06	.84**	.57**	.13	.71**	--						
11. PI Expected Pain	.11	.07	.55**	.50**	.00	.66**	.73**	.06	.73**	.75**	--					
12. PI Unpleasantness	.03	.01	.21*	.23**	.67**	.19*	.26**	.69**	.20*	.28**	.27**	--				
13. PI PCS	.21*	.02	.56**	.36**	.04	.64**	.58**	.04	.84**	.74**	.77**	.25**	--			
14. Satisfaction with Interaction	-.10	.28**	-.06	.06	-.07	-.10	-.08	-.11	-.17	-.14	-.05	-.18	-.14	--		
15. PI PPR	-.17	.35**	-.11	.00	-.02	-.08	.00	-.06	-.11	-.11	.00	-.12	-.05	.60**	--	
16. Average Pain	.24**	-.04	.37**	.29**	.15	.35**	.32**	.18*	.39**	.37**	.32**	.18*	.36**	-.09	-.06	--

Note: PCS = Pain Catastrophizing Scale, PPR = Perceived Partner Responsiveness, PI = Post-Interaction, $^*p < .05$. $^{**}p < .01$.

Because pain tolerance was dichotomized, t-tests were conducted to examine whether there were differences between participants who completed and those who did not complete the task. On average, those who did not complete the cold pressor task reported at the post-video (M = 5.42 for non-completers, M = 6.70 for completers), $t(131) = -3.14$, $p = .002$, and post-interaction assessments (M = 5.39, for non-completers, M = 6.32 for completers), $t(131) = -2.45$, $p = .02$, that they expected more unpleasantness during the task. All t-tests are displayed in Table 3. Additionally, t-tests revealed that completers did not differ from non-completers on partner variables, see Table 5.

Table 3

T-tests for Pain Duration Group Differences in Participant Variables

Variable	t	df	p
Baseline PCS	-0.13	131	.90
Baseline PPR	-0.42	122	.67
Pre-Video Threat	1.30	132	.20
Pre-Video Exp. Pain	0.09	132	.93
Pre-Video Unple.	-1.25	132	.21
Post-Video Threat	1.35	131	.18
Post-Video Exp. Pain	0.44	131	.66
Post-Video Unple.	-3.14	131	.002**
Post-Video PCS	0.99	131	.33
Post-Interaction Threat	0.54	131	.59
Post-Interaction Exp. Pain	-0.13	131	.90
Post-Interaction Unple.	-2.45	131	.02*
Post-Interaction PCS	0.82	131	.41
Satisfaction with Interaction	-0.32	130	.75
Post-Interaction PPR	-1.14	114	.26
Average Pain	1.64	132	.10

Table 4

Correlations among Partner Variables

Measure	1	2	3	4	5	6	7	8	9	10	11	12
1. Baseline PCS	--											
2. Pre-Video Perceived Threat	.13	--										
3. Pre-Video Expected Pain	-.07	.33**	--									
4. Pre-Video Unpleasantness	.05	.13	.10	--								
5. Post-Video Perceived Threat	.18*	.67**	.20*	-.05	--							
6. Post-Video Expected Pain	.13	.38**	.43**	.03	.57**	--						
7. Post-Video Unpleasantness	.08	.18*	-.03	.57**	.15	.09	--					
8. Post-Video PCS	.30**	.53**	.16	-.08	.71**	.56**	.08	--				
9. PI Perceived Threat	.20*	.58**	.13	-.09	.70**	.45**	.08	.70**	--			
10. PI Expected Pain	.28**	.33**	.23**	.08	.42**	.59**	.17	.52**	.61**	--		
11. PI Unpleasantness	.21*	.14	-.11	.22*	.23**	.16	.51**	.21**	.14	.20*	--	
12. PI PCS	.37**	.35**	.07	-.02	.45**	.30**	.05	.73**	.74**	.58**	.18*	--

Note: PCS = Pain Catastrophizing Scale, PI = Post-Interaction

$^*p < .05$. $^{**}p < .01$.

Table 5

T-tests for Pain Duration Group Differences in Partner Variables

Variable	t	df	p
Baseline PCS	-0.10	131	.92
Pre-Video Threat	-1.35	128	.18
Pre-Video Exp. Pain	-0.69	131	.49
Pre-Video Unple.	-0.91	128	.37
Post-Video Threat	-0.35	131	.73
Post-Video Exp. Pain	-0.20	130	.85
Post-Video Unple.	-1.56	131	.12
Post-Video PCS	-0.75	131	.46
Post-Interaction Threat	-1.38	130	.17
Post-Interaction Exp. Pain	-1.68	130	.10
Post-Interaction Unple.	-1.11	130	.27
Post-Interaction PCS	-0.77	130	.44
Satisfaction with Interaction	0.31	129	.76

Although all of the participant variables were already assessed for group differences between completers and non-completers of the cold pressor task, differences between cold pressor task completers and non-completers were examined in regards to partner variables.

As with participants, partners' responses on relevant variables were also examined for correlations (Table 4). Partner baseline pain catastrophizing was correlated with variables assessed following the couple interaction: perceived threat, expected pain, and expected unpleasantness and perceived threat assessed following the threat manipulation. Partner baseline pain catastrophizing was not correlated with any of these variables when they were assessed prior to the threat manipulation. As may be expected, many of these variables also tended to be highly correlated across time points.

Finally, Table 6 displays the correlations between participants and partners on the same variables. Following the threat manipulation, there was a positive correlation between participant's and partner's pain catastrophizing, *r*(132) = .20, *p* = .02, and expectations of how much pain the cold pressor task would produce, *r*(131) = .29, *p* = .001. More positive correlations between participants' and partners' responses occurred following the couple interaction, which were their responses for perceived threat, *r*(132) = .21, *p* = .01, expected pain, *r*(132) = .33, *p* < .001, and pain catastrophizing, *r*(132) = .21, *p* = .02.

Table 6

Correlations among Participant and Partner Measures

	Measure	Partner
Participant	1. Baseline PCS	.04
	2. Pre-Video Threat	-.05
	3. Pre-Video Expected Pain	-.05
	4. Pre-Video Unpleasantness	.09
	5. Post-Video Threat	.13
	7. Post-Video Expected Pain	.29**
	8. Post-Video Unpleasantness	.08
	9. Post-Video PCS	.20*
	10. Post-Interaction Threat	.21*
	12. Post-Interaction Expected Pain	.33**
	13. Post-Interaction Unpleasantness	.16
	14. Post-Interaction PCS	.21*

Note: PCS = Pain Catastrophizing Scale
* *p < .05.* ** *p < .01.*

The following analyses were conducted with both the original (untransformed) and transformed variables. A majority of the analyses with transformed variables yielded similar results to analyses conducted with the original variables. Thus, analyses are reported in terms of original, untransformed variables for ease of interpretation. When the patterns are different, results are reported in terms of transformed variables as indicated. As stated above, all of the following analyses applied a significance level of $p < .05$.

First Set of Hypotheses (H1a and H1b): Perceived threat in both partners can be manipulated

First, analyses were conducted to test whether receiving threatening information about the pain task would predict perceived threat about the task (H1a). There were no significant group (low or high threat) differences on perceived threat assessed prior to the threat manipulation, participant: $t(132) = 0.63$, $p = .53$, partner: $t(128) = -0.70$, $p = .49$. An ANCOVA was used to examine whether participants and partners in the high threat group reported more post-video perceived threat while accounting for participants' baseline (i.e., pre-video) perceptions of threat. Indeed, participants in the high threat group had higher levels of post-video perceived threat than participants in the low threat group, when accounting for pre-video perceived threat, $F(1, 130) = 5.94$, $p = .02$. Similarly, partners in the high threat group report greater post-video perceived threat than the low threat group, while controlling for pre-video perceived threat, $F(1, 127) = 12.73$, $p = .001$. These results provide support for the first hypothesis concerning the ability to manipulate perceived threat through a video manipulation.

To test whether the perceived threat manipulation effects persisted over time (H1b), two additional ANCOVAs were conducted in which post-interaction perceived threat was the dependent variable. Recall that perceived threat was assessed three times: prior to the video manipulation, just after the manipulation, and after the dyad discussed the pain task. Therefore the covariate in one set of these analyses was baseline perceived threat and the covariate in the other set of analyses was post-video perceived threat. Partners in the high threat group continued to report significantly more perceived threat at post-interaction, accounting for pre-video (baseline) perceived threat, compared to partners in the low threat group, $F(1, 126) = 5.98$, $p = .02$. However, no group differences emerged for participants, again controlling for baseline perceived threat, $F(1, 130) = 2.45$, $p = .12$. When post-video perceived threat was controlled for, group differences in perceived threat did not persist into the post-interaction period in participants, $F(1, 129) = 0.10$, $p = 0.75$, or partners, $F(1, 129) = 0.12$, $p = 0.73$.

The above analyses do not directly test whether the change over time was significantly different in the two groups. Thus, a repeated measures ANOVA was also conducted. Group (high threat and low threat) was the between-subjects variable and assessment (pre-video, post-video, post-interaction) was the within-subjects variable. In this analysis, the only variable that had significant skew to warrant creation of a transformed variable was post-interaction threat. Given that this is a repeated measures analysis, this transformed variable was not used to maintain similar scaling of variables across repeated assessments, and all variables included were not transformed.

First, this analysis was conducted with participants' perceived threat. Mauchly's Test of Sphericity indicated that the assumption of sphericity was violated, $X^2(2) = 9.038$, $p = .01$. Given that the assumption of sphericity was violated, a Huynh-Feldt correction was used ($\varepsilon = .957$). Results showed that participants experienced different changes in perceived threat depending on group membership, $F(1.914, 248.855) = 3.519$, $p = .03$. Paired samples t-tests were conducted by threat group as post hoc tests, allowing for comparison across assessments within each group. In the low threat group, paired-samples t-tests revealed that participants reported significant decreases in perceived threat from the post-video to the post-interaction assessment, $t(67) = 2.89$, $p = .005$, and from the pre-video to the post-interaction assessment, $t(67) = 3.25$, $p = .002$. In contrast, there were no changes from pre-video perceived threat following the video threat manipulation, $t(68) = 1.39$, $p = .17$. For the high threat group, there were significant increases in perceived threat from pre-video to post-video assessments, $t(63) = -2.27$, $p = .03$. Then, significant decreases in perceived threat occurred from the post-video to the post-interaction assessment, $t(63) = 4.00$, $p < .001$. However, there was no significant difference in pre-video levels of perceived threat to post-interaction levels of perceived threat, $t(64) = 1.32$, $p = .19$. Figure 5 displays participants' perceived threat, for each threat group, across assessments.

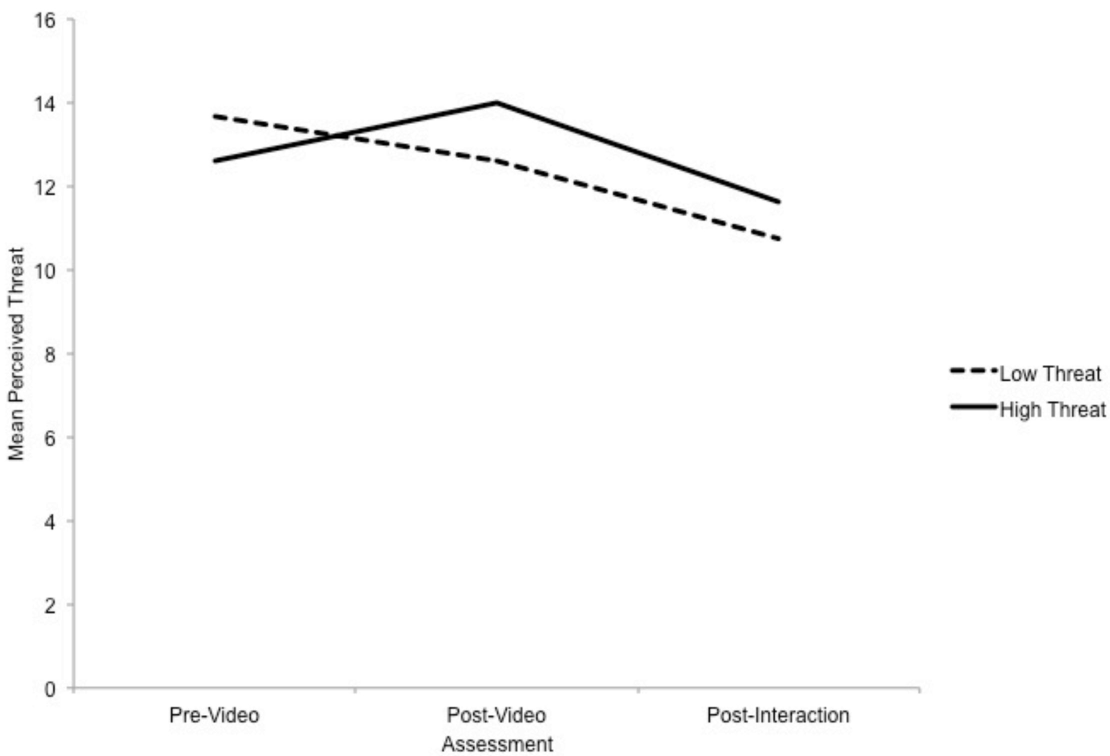

Figure 5. Participants' mean perceived threat for each threat group across three assessments: pre-video, post-video, and post-interaction.

Secondly, this same question was addressed for partners' perceived threat across assessments. According to Mauchly's Test of Sphericity, the assumption of sphericity was met, $X^2(2) = 3.050$, $p = .22$. The repeated measures ANOVA indicated that partners' perceived threat across assessments also differed by threat group, $F(2, 254) = 4.261$, $p = .02$. As for participants, paired samples t-tests were used to examine differences across assessments within each threat group. For the low threat group, there was a significant decrease in perceived threat from the pre-video to the post-video assessment, $t(66) = 3.62$, $p = .001$, as well as from pre-video to post-interaction, $t(65) = 2.59$, $p = .01$. However, perceived threat did not significantly change between post-video and post-interaction assessments, $t(66) = -0.20$, $p = .84$. In contrast, the high threat group did not demonstrate any significant changes in perceived threat across time points, pre-video vs. post-video: *t*(62) = -0.78, *p* = .44, post-video vs. post-interaction: *t*(64) = 1.37, *p* = .18, post-interaction vs. pre-video: *t*(62) = 0.33, *p* = .75. Figure 6 shows each threat group's perceived threat separately and across assessments.

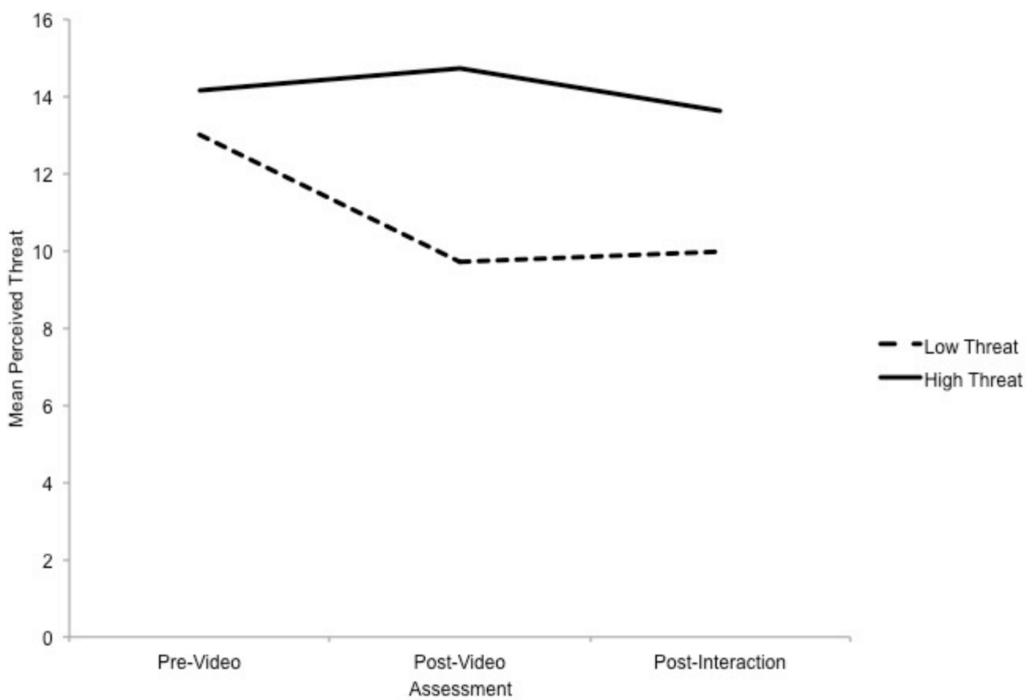

Figure 6. Partners' mean perceived threat for each threat group across three assessments: pre-video, post-video, and post-interaction.

In sum, the results from the first set of hypotheses (H1a and H1b) indicate that both participants' and partners' perceived threat levels were manipulated via information provided through the videos. In the present study, group differences in partners' but not participants' perceived threat persisted following the couple interaction. In addition, participants' in the high threat group experienced a brief increase in threat after watching the video whereas low threat participants experienced some relief about the task after talking with their partner. Yet, partners in the high threat group sustained a high level of perceived threat over time, whereas their low threat counterparts experienced a decrease in perceived threat after watching the video that was sustained into post-interaction.

First Set of Hypotheses (H1c): Threat group predicts pain task behavior

The hypothesis that the high threat group participants would have less pain tolerance in comparison to the low threat group was inspected with another set of analyses (H1c: pain tolerance). Because pain tolerance was dichotomized, a chi-square test of independence was used to test group differences in pain task completion. Unexpectedly, results showed that participants in the high threat group were *more* likely to persist in the cold pressor task, $X^2(1, N = 134) = 5.90$, $p = .02$. Specifically, 73.8% of the high threat group completed the task, compared to 53.6% of the low threat group.

An attempt was made to understand why high threat participants were more likely to persist in the task. One idea was that low threat participants may have been underprepared for the cold pressor task, and thus, withdrew from the task sooner. However, low and high threat groups did not statistically differ in pain catastrophizing following the cold pressor task, $t(129) = 1.67$, $p = .10$; perceived threat was not assessed following the cold pressor task. On the other hand, participants in the low threat group had a significant increase in pain catastrophizing after completing the cold pressor task compared to just prior to the cold pressor task, $t(66) = -9.38$, $p < .001$. Still, greater pain catastrophizing after completing the cold pressor task is not unique to the low threat group, as the high threat group also experienced an increase, $t(62) = -6.44$, $p < .001$.

It is possible that post-interaction threat appraisals demonstrate a U-shaped relationship with pain tolerance, with individuals experiencing high and low levels of threat least able to tolerate pain during the task. Conceptually, individuals who expect little to no pain may be more likely to withdraw from the task because they are not psychologically prepared to tolerate the pain. On the other end of the spectrum, participants who are highly threatened by the task may have more negative interpretations of pain perceptions and may also be more likely to withdraw from the task. An exploratory curve fit estimation regression did not support this exploratory hypothesis, $F(2, 129) = 0.83$, $p = .44$.

Next, multilevel modeling was used to study group differences in pain intensity over time. It was hypothesized that participants in the high threat group would experience greater pain over time compared to the low threat group (H1c: pain intensity). This analysis included a main effect for time as well as a quadratic effect for time because prior research has shown that pain ratings during the cold pressor task have a typically curvilinear pattern, with pain increasing in the beginning and then plateauing or decreasing slightly (Wolf & Hardy, 1941). In addition, interactions for threat group by time and threat group by quadratic time, the latter of which tests hypothesis 1c, were included. Neither of the group by time interactions was significant (group x time: $b = -0.003$, $SE = 0.007$, $t = -0.49$, $p = 0.63$; group x quadratic time: $b = 0.00007$, $SE = 0.00006$, $t = -1.10$, $p = .28$). Only the effect of quadratic time was significant ($b = -0.0006$, $SE = 0.00003$, $t = -19.40$, $p < .001$). These findings indicate that participant's pain ratings followed a curvilinear pattern over time but that the temporal pattern of pain did not differ by group. For all multilevel modeling analyses, a series of single-df likelihood ratio tests were conducted to examine statistical significance (Baayen, Davidson, & Bates, 2008; Bates, Maechler, Bolker, & Walker, 2014). To derive the p-value for any given predictor, two models are created: one containing all of the predictors and one in which the predictor of interest is omitted. Then, these models are compared using a X^2 distribution and the p-value represents the extent to which the addition of the predictor explains additional significant variance.

Second Set of Hypotheses: Threat will be related to perceived partner responsiveness

To investigate whether threat contributed to participants' perceptions of partner supportiveness during the interaction, several analyses were conducted (H2a). First, t-tests assessed whether threat groups differed in the amount of perceived partner responsiveness, as measured by participants' perceived partner responsiveness scale and both participants' and partners' satisfaction with the interaction. There were no significant group differences in any of these variables, participant perceived partner responsiveness: $t(114) = -0.18$, $p = 0.86$, participants' satisfaction with the interaction: $t(130) = 0.46$, $p = 0.65$, partners' satisfaction with the interaction: $t(129) = 1.36$, $p = 0.18$.

Secondly, the hypothesis that perceived threat and catastrophizing were associated with perceived partner responsiveness regardless of group membership was tested. None of the indicators of partners' threat or anxiety about pain were significantly associated with participants' perceived partner responsiveness or satisfaction with the interaction (see Table 7).

Table 7

Correlations Between Partners' Threat and Participants' Support

Measure	1	2	3	4	5
1. Participants' Post-Interaction PPR	--				
2. Partners' Baseline PCS about Significant Other	.15	--			
3. Partners' Pre-Video Perceived Threat	-.03	.14	--		
4. Partners' Post-Video Perceived Threat	.10	.14	.67**	--	
5. Partners' Post-Video PCS	.08	.23**	.53**	.71**	--

Note: PPR = Perceived Partner Responsiveness, PCS = Pain Catastrophizing Scale
**p < .05. **p < .01*

Table 8

Correlations Between Participants' Threat and Support

Measure	1	2	3	4	5
1. Participants' Post-Interaction PPR	--				
2. Participants' Baseline PCS	-.17	--			
3. Participants' Pre-Video Perceived Threat	-.11	.25**	--		
4. Participants' Post-Video Perceived Threat	-.08	.16	.80**	--	
5. Participants' Post-Video PCS	-.11	.29**	.58**	.77**	--

Note: PPR = Perceived Partner Responsiveness, PCS = Pain Catastrophizing Scale

**p < .05. **p < .01*

Another set of correlations were conducted testing the extent to which *participants'* anxiety about the cold pressor task was correlated with their perceptions that the couple interaction was more supportive and satisfying (H2b). These correlations can be found in Table 8. Participants' satisfaction with the interaction was associated with the transformed post-interaction perceived threat variable, but not with the original post-interaction threat variable, original: $r(132) = -.14$, $p = .10$, transformed: $r(132) = -.19$, $p = .03$. As noted above, post-interaction threat was transformed using a square root transformation to correct for significant positive skew. Participants' post-interaction pain catastrophizing was not significantly related to participants' satisfaction with the couple interaction, $r(132) = -.14$, $p = .11$. Neither post-interaction threat, nor post-interaction catastrophizing were significantly correlated with post-interaction perceived partner responsiveness, $r(116) = -.11$, $p = .25$, $r(116) = -.05$, $p = .59$.

The previous set of correlations demonstrated that threat and anxiety about the pain task in either partner was typically not associated with how responsive the partner was perceived or with participants' satisfaction with the interaction about the task. Next, analyses were conducted to explore the potential interaction effects between the partner's baseline trait pain catastrophizing (of other) and threat condition on the participant's perceived partner responsiveness and satisfaction with the interaction. Baseline trait pain catastrophizing was used here to indicate trait susceptibility to have higher perceived threat. Thus, this hypothesis addresses whether the effect of threat group depends on susceptibility to threat. There were no significant interaction effects between pain catastrophizing and threat condition in predicting perceived partner responsiveness, $F(3, 111) = 1.62$, $p = .19$, or satisfaction with the interaction, $F(3, 111) = 1.72$, $p = .17$.

These analyses were repeated with post-interaction perceived threat in place of trait catastrophizing. However, the interaction between group and either partner's perceived threat did not predict participant's perceived partner responsiveness, participants: $F(3, 112) = 1.322$, $p = .27$, partners: $F(3,111) = 0.822$, $p = .48$, or satisfaction with interaction, participants: $F(3,128) = 1.020$, $p =.39$, partners: $F(3, 127) = 0.687$, $p = .56$.

Based on these results, there is little evidence that the participants' and partners' perceived threat affects participants' perceptions of support following the couple interaction. However, when participants' post-interaction perceived threat is appropriately transformed, it is associated with participants' satisfaction with the interaction.

Third Set of Hypotheses: Perceived partner responsiveness and satisfaction with the interaction will be related to greater pain tolerance and lower pain intensity

Perceived partner responsiveness and satisfaction with the interaction have some conceptual overlap. Indeed, these two variables were significantly correlated at baseline, participants: $r\,(121) = .65$, $p < .001$, partners: $r(117) = .77$, $p < .001$. However, they appear to be two separate constructs and were investigated as such below.

A logistic regression was used to determine if post-interaction perceived partner responsiveness, regardless of group, predicted whether participants completed the cold pressor task (H3a). Contrary to the hypothesis, perceived partner responsiveness did not significantly predict pain tolerance, $X^2(1) = 1.285$, $p = .26$. Similar results were found for participant's satisfaction with the interaction, $X^2(1) = 0.102$, $p = .75$.

Although perceived partner responsiveness and pain tolerance were not significantly related, a test of mediation was still conducted (H3b: pain tolerance), which tested the main effects of participant perceived threat prior to the task as a second step in the regression as a test of mediation (James & Brett, 1984). In this analysis, pain tolerance was not dichotomized as in other analyses so that pain tolerance could remain a continuous variable. Again, pain tolerance is measured by the number of seconds participants persisted in the task. Then, a Sobel test was conducted to assess the extent to which the indirect effects of perceived threat account for variation in pain tolerance. The Sobel test produced a Sobel z of 0.10, which indicates that the results of the Sobel test were not statistically significant, and that mediation did not occur.

Perceived threat was also tested as a mediator in the relationship between participant's satisfaction with the interaction and pain tolerance. Using the procedure above, the Sobel test produced a Sobel z of 0.62, which indicates that the results of the Sobel test were not statistically significant. In other words, the Sobel test indicated that mediation did not occur.

Recall that participants rated their pain several times over the course of the cold pressor task. Therefore, multilevel modeling was used to test whether changes in pain severity are associated with perceived partner responsiveness and satisfaction assessed after the interaction task (H3a: pain intensity). The models below controlled for participants' baseline levels of relationship appraisals to ensure that the findings are assessing the effect of state partner responsiveness or satisfaction on pain ratings.

Thus, the model included effects for time, quadratic effect for time, baseline perceived partner responsiveness (or satisfaction with the relationship), perceived partner responsiveness (or satisfaction with the interaction), and all higher order interactions between perceived partner responsiveness (or satisfaction with the interaction) with each time variable (time and the quadratic effect for time) predicting pain intensity. For reasons explained above, the same model will be conducted with both participants' perceived partner responsiveness and satisfaction with the interaction.

The interaction between quadratic time and perceived partner responsiveness did not significantly predict pain intensity (*b* = 0.000008, *SE* = 0.000005, *t* = 1.72, *p* = .09). Further, this effect was not attenuated by accounting for baseline perceived partner responsiveness, as demonstrated when baseline perceived partner responsiveness was added to the model (*b* = 0.000008, *SE* = 0.000005, *t* = 1.72, *p* = .09). These two models are not statistically different and indicate that the addition of baseline perceived partner responsiveness did not affect the model, $X^2(11) = 0.04$, *p* = .85. No other lower-level interactions were significant aside from the time and quadratic time variables.

However, the interaction between quadratic time and participant's post-interaction satisfaction significantly predicted pain intensity (*b* = 0.00005, *SE* = 0.00001, *t* = 3.51, *p* < .001). Including baseline satisfaction with one's relationship to the model produced similar results (*b* = 0.00005, *SE* = .00001, *t* = 3.51, *p* < .001). Further, when these models are compared, they are statistically indistinguishable, $X^2(11) = 0.66$, *p* = .42. A visual representation of the interaction between participant's satisfaction and quadratic time predicting pain intensity is shown in Figure 7. Briefly, it appears that having a satisfying interaction right before the cold pressor tasks is associated with less pain across the task as well as a slower acceleration in pain scores earlier on.

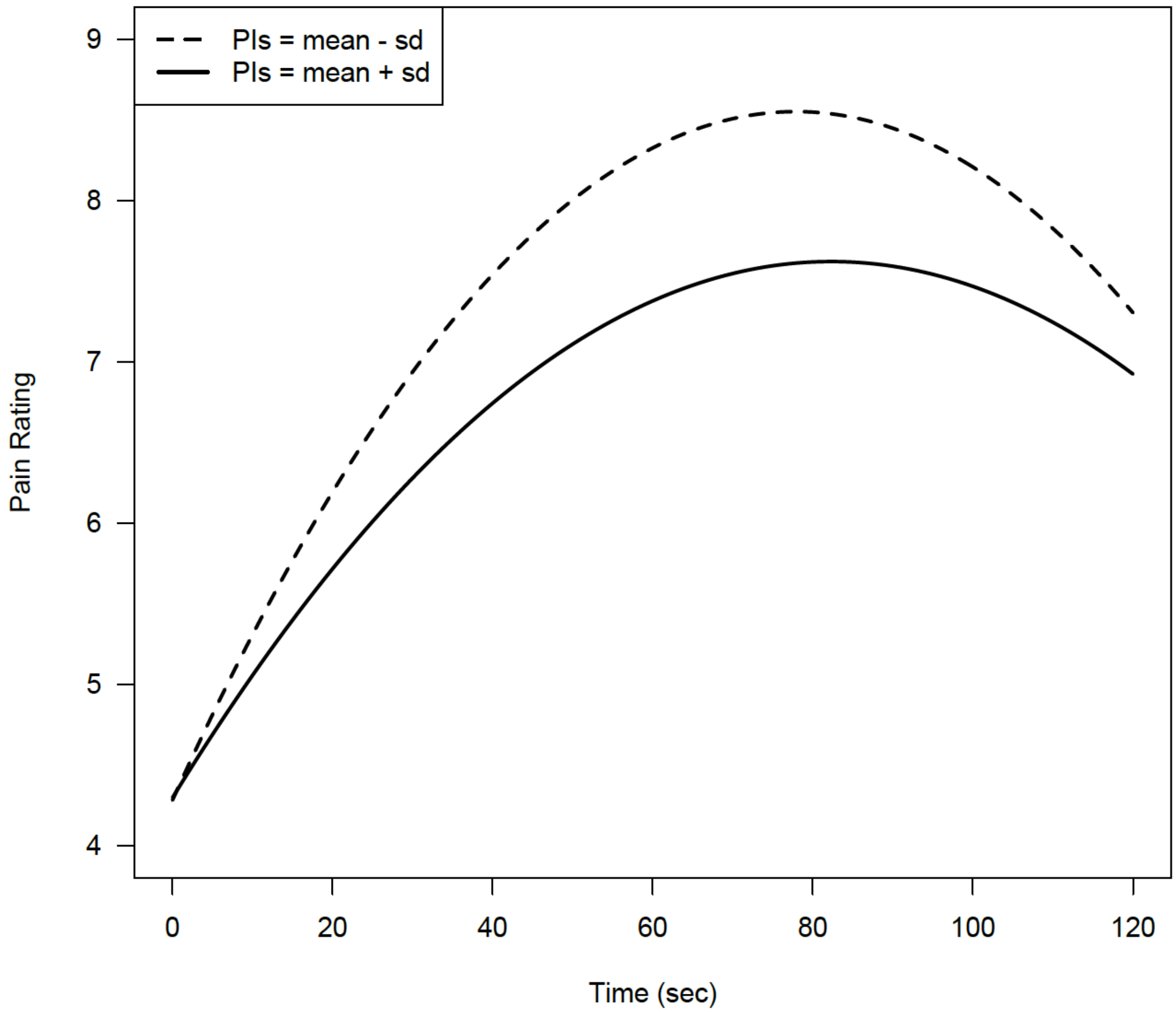

Figure 7. The interaction between participant's satisfaction and quadratic time predicting pain intensity.

To assess whether post-interaction perceived threat accounts for this association (H3b: pain intensity); a main effect of this variable was added to determine whether the addition of post-interaction threat reduces or eliminates the effect of perceived partner responsiveness (or satisfaction with interaction). Results showed that the addition of post-interaction perceived threat in the model produces a slightly improved model, model including perceived partner responsiveness: $X^2(8) = 14.41$, $p < .001$, including satisfaction with the interaction: $X^2(8) = 14.16$, $p < .001$. However, it did not reduce the effect of the variable of interest in each respective model, neither post-interaction perceived partner responsiveness nor satisfaction with the interaction, effect of post-interaction perceived partner responsiveness: $b = -0.02$, $SE = 0.03$, $t = -0.79$, $p = .42$, interaction effect of satisfaction with the interaction and quadratic time: $b = -0.09$, $SE = 0.09$, $t = -0.92$, $p = .35$.

Exploratory Analyses: Gender

Lastly, a great body of literature has demonstrated that women report greater pain intensity and have lower pain tolerance (Greenspan et al., 2007; Racine, et al., 2012, Riley, Robinson, Wise, Myers, & Fillingim, 1998; Unruh, 1996). Thus, this study also explored whether gender predicted pain intensity or pain tolerance. Multilevel modeling analyses found a significant interaction between time and gender in predicting pain intensity, such that women have higher pain intensity initially but have a gradual slope in comparison to men ($b = -0.02$, $SE = 0.007$, $t = 2.21$, $p < .001$). Gender did not significantly interact with quadratic time to predict pain intensity ($b = 0.0001$, $SE = 0.00006$, $t = 1.76$, $p = .08$). Additionally, neither men nor women were more likely to withdraw from the cold pressor task, $X^2(1) = 1.49$, $p = .22$. To determine whether more gender-related analyses were relevant to the present study, the study examined whether the effect of threat group on perceived threat varied by gender. If such an interaction occurred, more analyses would be appropriate to examine how gender interplays with the rest of the Contextual Fear Avoidance Model. The interaction between gender and threat group did not predict perceived threat at any time point (pre-video: $\beta = .222$, $p = .27$, post-video: $\beta = .219$, $p = .12$, post-interaction: $\beta = .253$, $p = .07$). Notably, women have significantly greater levels of perceived threat at each time point, pre-video: $t(132) = -3.98$, $p < .001$, post-video: $t(131) = -4.57$, $p < .001$, post-interaction: $t(131) = -5.10$, $p < .001$. Nonetheless, considering that gender does not interact with threat group, further analyses with gender are beyond the scope of the present study.

Chapter 4

Discussion

The purpose of the present study was to examine whether the perceived threat of a painful task could be experimentally manipulated, and to test the Contextual-Fear Avoidance Model (C-FAM) of pain. The Fear Avoidance Model posits that an individual's perceived threat regarding an anticipated painful task affects later pain experience (Vlaeyen & Linton, 2000). The C-FAM further develops this pain model by adding that one's social environment influences perceived threat and subsequent pain experience. In the present study, one's social environment was operationalized as the significant other whose responsiveness towards his or her partner influences the partner's pain experience. Overall, this study's results replicated previous findings and extended the existing literature by showing that threat can be manipulated for both an individual anticipating a painful task *and* his or her romantic partner. Threat manipulation is important because, as the present study found, it predicts aspects of the pain experience. If perceived threat is malleable, it could be a target of future treatments as will be discussed below. Further, results revealed that one's satisfaction related to a conversation with a partner just prior to a painful task also predicts aspects of later pain experience. Thus, this study presents preliminary support for a novel theory that integrates social variables into the Fear Avoidance Model.

The study's major findings can be divided into two major components: the effects of the threat manipulation and the effects of the couple interaction just prior to the painful task. Findings and implications related to both components will be discussed. Then, limitations, future directions, and clinical applications will be considered.

Effects of Threat Manipulation

In line with the Fear Avoidance Model, previous research has found that perceived threat about a painful task can be experimentally manipulated (Boston & Sharpe, 2005; Helsen, Goubert, & Vlaeyen, 2013; Helsen et al., 2011; Koyama et al., 2005; Leventhal et al., 1979; Vlaeyen et al., 2009). Yet, no other studies have included partners or assessed their perceptions of threat. In the present study, participants, and their romantic partners watched a video showing people undergoing the cold pressor task. Couples in the high threat group saw people with facial expressions exhibiting pain, whereas the low threat group saw people display stoic facial expressions. In support of the first set of hypotheses, this video effectively manipulated perceived threat. After watching the video, both participants *and* partners in the high threat group experience more fear and anxiety about the participant's upcoming cold pressor task compared to those in the low threat group, and accounting for baseline fear and anxiety. Thus, the findings replicate previous work with participants and extend this research to show that intimate partners become anxious when given highly threatening information about a painful task. Future work may be needed to determine if similar results are found with preparatory information for painful medical procedures and if so, how partners' elevations in perceived threat affect the individual about to undergo the procedure. It is possible that partner elevations in perceived threat may have a positive effect, such as increasing the partner's likelihood of providing emotional support, or a negative effect, such as promoting fearful discussion with one's romantic partner and further elevating both partners' anxiety.

In the low threat group, participants maintained baseline levels of perceived threat after the threat manipulation, and partners in the low threat group experienced decreases from baseline perceived threat after watching the video. These results indicate that the same threat manipulation does not always impact participants and partners in the same way. Perhaps the threatening aspects of the cold pressor task are different for participants and partners. For example, partners may be threatened by seeing their partner in pain or the inability to help their partner during the pain, whereas participants may be threatened by the experience of pain itself. Further, given that the low threat manipulation did not maintain partner's baseline levels of perceived threat, neither the high nor the low threat group should be conceptualized as a control group. A control for threat manipulation might include watching a completely unrelated video of the same time length or a video showing how the cold pressor task is set up and individuals putting their hand in the cold water basin without showing reactions to the task.

The present study also revealed that threat manipulation effects persist over time for partners. In both threat groups, there are no significant differences between partners' levels of perceived threat prior to the couple interaction and following the couple interaction. For partners in the high threat group, baseline levels of perceived threat are sustained across assessment periods. On the other hand, partners in the low threat group experience a decrease in perceived threat after the threat manipulation, and this decrease is sustained after discussing the painful task with their partner. One explanation of this pattern of findings is that for partners, the threatening aspect of the cold pressor task is the possibility that they may see their loved one in pain. Thus, partners in the low threat group may experience a sense of relief that they will not see their partners in pain, while partners in the high threat group maintain a level of threat in accordance with the belief that they will see their partner in pain. Another explanation may be that partners assumed the role of supporting their significant other and participants assumed the role of “being supported.” Thus, social support and subsequent reductions in perceived threat were unidirectional within the couple, from partner to participant only. On the other hand, threat group differences in participant perceived threat do not appear to last over time. In the effects of the couple interaction section below, it will be argued that these differences were not sustained because of the couple interaction task.

Support was also found for the hypothesis that highly threatening information affects later pain experience, although the manner in which these variables were related was unexpected. Specifically, pain tolerance differed by threat group, such that individuals in the high threat group were more likely to persist in the cold pressor task than individuals in the low threat group. A recent meta-analysis revealed elevated threat appraisals were associated with reduced pain tolerance (Jackson, Wang, & Fan, 2014). Thus, it is surprising that participants in the high threat group demonstrated greater pain tolerance relative to those in the low threat group. Two alternative hypotheses were tested to further elucidate this finding. One possibility was that individual levels of fear about the task would be more predictive of task completion than threat group status. However, completers and non-completers reported similar levels of perceived threat across assessments, including just prior to the task, and threat groups did not differ in participant’s post-task levels of pain catastrophizing. Another possibility was that there was a quadratic relationship between perceived threat and pain tolerance, in which high and low levels of threat interfere with one's ability to tolerate pain. Again, analyses did not support this hypothesis.

Instead, it is likely that another unmeasured variable or unmeasured aspect of perceived threat affects pain tolerance. For instance, one unmeasured variable was the extent to which participants believed that other people were able to endure the pain of the task. Alternately, expectations of adverse effects or pain duration may be critical unmeasured aspects of perceived threat. In the present study, a relatively novel measure of perceived threat was used, which focused on how anxious, tense, hesitant, and reluctant participants and partners felt regarding the cold pressor task. Some of these perceived threat items have been used in previous work done by Helsen, Goubert, and Vlaeyen (2013). Future research could ask participants to estimate the average length of duration in the cold pressor task to examine whether higher estimates are associated with longer pain tolerance. Participants could also be asked to estimate the extent to which they think that the cold pressor task is associated with tissue damage or other adverse effects. It is possible that expectations specific to pain duration or risk of tissue damage affect pain tolerance more than perceived threat as measured in this study.

Another possible explanation for the absent relationship between perceived threat and pain tolerance is the type of threat manipulation. The present study's threat manipulation appears to be different from studies in the previously described meta-analysis by Jackson et al. (2014). Most previous studies manipulated threat via explicit communication that indicates the loss of physical integrity, such as tissue damage. In contrast, the current study used a threat manipulation that uniquely utilizes social learning by showing participants other individuals undergoing the cold pressor task rather than overtly giving a threatening message to participants. Given that this threat manipulation might also work as a social comparison manipulation, it may be that its relationship to pain tolerance is different. When individuals watched the video, they may have drawn conclusions regarding how most people respond to the task, and compared their own reactions during the cold pressor task to their perceptions of others' reactions. In line with this idea, one study found that the manipulation of social comparison affected pain tolerance, such that upward social comparison (participants were told that others had persisted in the task for 3 minutes compared to 45 seconds) in a low threat condition produced higher pain tolerance (Jackson & Phillips, 2011). In that study, the low threat condition involved reading a passage that described the cold pressor task as safe and not able to cause tissue damage. When compared to the current study's threat manipulation, participants in the high threat group may have interpreted the video as individuals persisting in the task despite clearly experiencing pain, thus, experiencing a type of upward social comparison. Whereas, participants in the low threat group may have expected that individuals do not typically experience pain during the task, and thus, were more likely to withdraw their hand when they, themselves, did experience pain.

Although threat group was related to pain tolerance, it did not predict pain intensity. This finding is inconsistent with the present study's hypothesis. Nonetheless, regardless of threat group, greater perceived threat was associated with greater pain intensity, indicating that one's individual perception of threat is more predictive of pain intensity than one’s overall threat context. This finding is consistent with the meta-analysis cited earlier, which found that threat appraisals are associated with greater pain intensity (Jackson et al., 2014). Other studies have also found that experimental manipulation designed to alter pain perception affects pain tolerance but not pain intensity (Jackson et al., 2005; Jackson et al., 2009; Jackson & Phillips, 2011). It is possible that in this study the presence of partner affected the association between threat group and pain intensity. Perhaps, when a person receives threatening information while alone or only in the presence of a stranger, they are more susceptible to a high threat manipulation, or to an elevated threat context affecting their experience of pain intensity. In other words, although participants in the high threat group experienced increases in perceived threat, perhaps these increases were not to the extent that other studies have found, an extent that elicits changes in pain intensity. Although previous research (e.g., Sullivan, Adams, & Sullivan, 2004) has compared the behavior of participants alone or in the presence of an observer during a cold pressor task, no studies have explicitly examined the effects of the presence of an observer during a threat manipulation. A study that addressed a similar question used a 2 x 2 factorial design to test the effect of the presence of an observer during a cold pressor task in high and low threat contexts (Vlaeyen et al., 2009). Results showed an interaction between threat group and social context, with the presence of observer reducing pain intensity in a threatening pain context. Future research could examine whether an interaction effect also occurs for social presence during the threat manipulation by comparing experimental groups in which an individual receives threatening information with or without their romantic partner present. This also highlights the importance of developing a reliable and valid measure of perceived threat that can be used to compare different types of threat manipulations across studies.

Lastly, it was hypothesized that a partner's perceived threat would predict partner support. Contrary to the proposed Contextual-Fear Avoidance Model, a romantic partner's perceived threat regarding the cold pressor task or one's threat condition does not appear to affect their partner's pain experience, perceived threat, the extent to which they provide a satisfying discussion to their partner, or respond to their partner. Participant perception of support was also not predicted by an interaction between the partner's susceptibility to catastrophize about the pain of a significant other and threat condition. Instead, participant's satisfaction with the interaction was related to their concurrently measured perception of threat. Interestingly, this relationship was not present with catastrophizing or perceived partner responsiveness, again demonstrating that while these variables are similar conceptually, they represent distinct ideas. Participants who are highly threatened may be less able to focus on the couple discussion in the first place or a satisfying couple discussion may alleviate pain-related fear.

The present study suggests that threat does not play a role in determining whether partners choose to provide support, and is not disruptive to a partner's ability to provide support. Either partners use factors unrelated to threat or other factors related to threat but unmeasured in the present study to determine the amount of support they should provide. For example, using their partner's typical level of coping or potential damage to their partner's physical integrity, respectively, to gauge level of support necessary. Thus, partner perceived threat might not be a variable of interest for researchers solely interested in altering the participant's pain experience. Even though participants' and partners' perceived threat is related in the present study, it cannot be determined whether partners' perceived threat exerts any influence on participant's perceived threat or whether this effect is the result of each member of the couple experiencing the same threat manipulation. Future studies could investigate this question by assigning each individual within the couple to different threat conditions to study how partners with different expectations regarding a painful task interact and whether they resolve these differences or maintain separate perceptions of threat. Yet, participants who are satisfied with a couple discussion are less likely to perceive the upcoming task as threatening.

Effects of a Couple Interaction

The present findings support the inclusion of significant others in the Fear Avoidance Model. When couples were given the opportunity to discuss the cold pressor task with each other, results suggest that conversation with one's partner alleviated participant's fears regarding the cold pressor task. Regardless of group, participants experienced decreases in perceived threat after they were given the opportunity to discuss the impending cold pressor task with their romantic partner. In fact, differences in perceived threat between threat groups were no longer present after participants interacted with their partner, indicating a return to baseline perceived threat for participants in the high threat group, and a significant decrease in perceived threat relative to their baseline for those in the low threat group.

Because the present study did not include a control group of participants who did not have a 2-minute interaction, a causal relationship between the 2-minute interaction and reduced pain or threat cannot be established. Although this finding may be attributable to simply the passage of time, it is likely that the couple interaction also contributed to changes in perceived threat given that partners do not experience changes in perceived threat following the couple discussion. Nonetheless, participants may be distinct from their partners. It is possible that participants' levels of perceived threat decompose over time without repeated manipulation of threat. In sum, these findings provide some preliminary support that a short 2-minute discussion with a partner prior to a painful task might reduce a partner's perceived threat. Recall, that partners were not present with participants during the cold pressor task and could not provide any interaction with their significant other during the pain task, yet effects of participant's perceived support affected later pain intensity. Although more definitive support is needed, such an effect would be impressive given the short duration of the interaction with their partner *prior to* the cold pressor task. Notably, the benefit of an interaction with one's partner appears to be independent of the partner's perceived threat or the couple's threat group.

The finding that partners might contribute to alleviations in perceived threat is in line with previous research showing benefits of social support during painful tasks, particularly for women, including studies showing that the mere presence of another person during a painful task reduces perceived pain (Brown, Sheffield, Leary, Robinson, 2003; Jackson, Iezzi, Chen, Ebnet, and Eglitis, 2005; Jackson, 2007). It may be that a discussion with a partner prior to a cold pressor task is sufficient to activate feelings of support. Other research has found that viewing a photograph of a significant other or holding a partner's hand during a painful task reduced pain intensity (Master et al., 2009). This research suggests that active support from a partner may not be necessary to reduce pain during a painful task. Rather, the activation of a mental representation of social support may be sufficient to produce reductions in pain. Future research could also include a comparison group of individuals who have their partners in the room, to test whether the couple discussion provided benefits equivalent to or greater than the benefit of having a partner in the room.

Given that behavior and perceptions were not coded during the couple interaction, participant's perceived partner responsiveness and satisfaction with the interaction were used as indicators of what occurred during the couple's discussion. Unexpectedly, having a supportive discussion with one's partner did not help participants persist in the painful task and this relationship was not mediated by perceived threat. In regards to pain intensity, all participants' ratings showed a curvilinear pattern over time, which replicates previous work and also demonstrates that the manipulation of threat does not alter this curvilinear pattern of pain ratings (Wolf & Hardy, 1941). Results showed that participants who experienced a more satisfying conversation with their partner just prior to the task, reported less pain intensity during the task. This finding holds even when accounting for satisfaction with the relationship assessed at baseline. Thus, satisfaction with the conversation is related to reduced pain intensity over and above general relationship satisfaction. It is unlikely that these findings could be explained by general feelings about one's relationship. This finding is consistent with previous research showing that perceptions of support are more predictive of well-being and adjustment to stressful life events than levels of support actually received (Reinhardt, Boerner, & Horowitz, 2006; Wethington & Kessler, 1986).

Specific to perceived partner responsiveness, research indicates that perceived partner responsiveness may be a better indicator of support compared to categorizing support into visible and invisible support (Maisel & Gable, 2009). Perceived partner responsiveness was also thought to be an indicator of what occurred during the couple's discussion. Although the relationship between perceived partner responsiveness and pain intensity was not statistically significant, the relationship was trending in the same direction as the relationship between satisfaction with the interaction and pain tolerance. Further research might investigate why satisfaction with the discussion is more predictive of pain intensity in comparison to perceived partner responsiveness.

The mediation hypothesis that partners' support reduces a participant's perceived threat and subsequently, reduces pain intensity was largely unsupported. Thus, it is not clear how a satisfying interaction could relate to pain. Thus, this study is unable to provide further explanation for how satisfaction with one's interaction fits within the rest of the Fear Avoidance Model. Even though the results of this study suggest that partners' have some influence in reducing their partners' perceptions of pain, via participant's satisfaction with the interaction, causality cannot be concluded from these findings. It is possible that individuals who are more likely to feel satisfied with an interaction with their partner are also more likely to be able to handle pain because of a third, confounding variable explaining both satisfaction and pain sensitivity, for instance, locus of control. A participant who has a strong internal locus of control may be more likely to feel satisfied with their partner and better able to tolerate pain because they feel that they are able to exert some control in both a discussion with their partner and a painful task. In sum, the results of this study indicate that future research involving the social context may be fruitful in developing a better understanding of pain. In particular, more research should be conducted to determine how the social context affects pain perception and how the social context can be manipulated to reduce pain.

In order to explore another dimension of social context effects, analyses were conducted to test gender differences. On average and over time, women reported greater pain intensity. However, there were no gender differences in pain tolerance. This finding is partially consistent with the literature that has found that women experience greater pain intensity and lower pain tolerance (Greenspan et al., 2007; Racine et al., 2012, Riley et al., 1998; Unruh, 1996). Some researchers have hypothesized that gender differences in catastrophizing underlie gender differences in pain intensity (Edwards, Haythornthwaite, Sullivan, & Fillingim, 2004; Sullivan, Tripp, & Santor, 2000). In line with such research, women reported greater perceived threat prior to the video, following the video, and following the couple interaction. Although it was tempting to explore further gender differences, this study aimed to remain focused on the interaction between threat and social context. Gender and threat group did not interact to predict perceived threat, pain tolerance, or pain intensity. Thus, further investigation into gender differences was deemed beyond the scope of the study.

Limitations and Future Directions

The present study, although notable for its novelty, included a number of limitations. Many of the present study's limitations and future directions have been noted in the discussion of the study's findings but will be highlighted here. First, this study was limited in the variables measured. Due to poor video quality, couples' behavior and speech could not be coded during the couple interaction. Thus, the current study cannot address what occurred when couples were directed to discuss with each other the upcoming painful task. Even though the relationship between satisfaction with the interaction and pain intensity was still discovered, the results of this study cannot provide more information as to what occurred during the course of the couple interaction that increased the partner's satisfaction with the interaction. Although it may be that the participant's perception of satisfaction is more predictive than the partner's objective behavior, a study that includes behavioral coding data would allow for such direct comparison to examine which variable is a better predictor. Further, if research is able to pinpoint specific behaviors or verbalizations that are related to greater partner satisfaction, interventions can be developed to further elicit such behavior.

In addition to the lack of behavioral coding, the study did not assess other variables that may have shed light on why satisfaction with the interaction and pain intensity were related, such as the partner's perception of social support, why the couple interaction was satisfying, or physiological responses. Perceptions of responsiveness were collected from the participant only. Partners may have had differing perceptions regarding the amount of support that he/she provided during the couple interaction. Participants were also not asked to elaborate on why they found the couple interaction to be satisfying. A number of different reasons could have contributed to why participants felt that their interaction with their partner was satisfying. Another possibility that might explain how partners may have alleviated participant's later pain could be through physiological changes. For instance, the presence of a friend has been found to attenuate heart rate reactivity to psychological challenge and men who are instructed to think about a close friend experience reductions in heart rate and cardiac output during a stressful task (Kamarck, Manuck, & Jennings, 1990; Well & Kolk, 2008).

Additionally, it is unclear why the low threat group experienced less pain tolerance, and measurement of post-task perceived threat may have helped to explain whether low threat participants were actually underprepared to experience pain during the cold pressor task. It is possible that the present study's measure of perceived threat could have added predictive validity by assessing the extent to which participants think they will be able to persist in the task or the extent to which participants believe the task will cause physical injury.

This study also was limited in its ability to draw causal conclusions due to the lack of inclusion of control groups for the threat manipulation and couple interaction. Even though the high threat manipulation is arguably more threatening than the low threat manipulation, these threat groups demonstrate differences in threat relative to each other but not relative to baseline levels of the threat of a cold pressor task. Lastly, this research was conducted using undergraduate participants, which limits generalizability to patients with chronic pain or those undergoing painful medical procedures, which are the groups of most clinical interest in the field of pain research.

Clinical Implications

Although the present study is an analogue study, conducted on healthy undergraduates, it may have some tentative implications for clinical work involving individuals with a chronic pain condition or individuals who will undergo a painful medical procedure. For instance, this study suggests that people who are about to undergo a painful procedure are likely affected by the information that is provided to them *as well as* the appraisals of intimate others. Research has indicated that threat may be an important predictor of pain during a medical procedure. In a study with a clinical population of women undergoing breast biopsy or cyst aspiration, anticipated pain was found to be a strong predictor of pain during the procedure (Soo et al., 2014). Doctors should be aware that material provided to patients about a medical procedure and the patient's experiences of other people undergoing the medical procedure are likely to influence the extent to which the medical procedure is going to threatening to them. It is also possible that watching another individual undergo the same procedure despite pain may increase pain tolerance. Yet, the effects of such social learning appear to vary widely depending on the amount of pain the model shows and likely is affected by a number of presently unknown variables. In other words, the use of social learning prior to a painful procedure is a complex issue requiring further study.

Given that this study found that a 2-minute discussion with one's partner prior to a painful task is associated with decreases in perceived threat, individuals who are directed to talk with a significant other prior to a painful medical procedure may also experience reduced anxiety about the procedure. Potentially, this short intervention could result in lasting impact given research revealing that greater fear prior to surgery is associated with worse recovery (Kiecolt-Glaser, Page, Marucha, MacCallum, & Glaser, 1998). The present study does not involve a variable analogous to post-operative recovery to demonstrate evidence of a similar relationship but the reduction of perceived threat is promising. Additionally, increasing patient satisfaction with a partner discussion may also result in less pain during a medical procedure. Of course, more research is needed before either intervention is used in relation to medical procedures. In particular, it is important to learn what type of partner behavior most reduces perceived threat of a medical procedure and increases satisfaction for the patient so that ways to increase such behavior can be developed and used.

Conclusions

The present study demonstrated novelty in its unique inclusion of the social context and development of a measure for perceived threat. The presence of a partner prior to a painful task and the measurement of partner and social support variables allowed for study of the effects of such variables and the interrelationships between psychological and social variables. Additionally, the threat manipulation itself incorporated the social context, as couples watch other individuals undergo the cold pressor task via video. In other words, observational social learning occurred when couples drew conclusions about the potential painfulness, unpleasantness, and threat of a task from facial expressions of others. Further, this study uniquely developed a measure to assess perceived threat, which allowed for examination of the effectiveness of the threat manipulation.

In sum, this study developed and tested the Contextual-Fear Avoidance Model, which is the first attempt at conceptualizing the relationships that might occur between variables when the social context is included in the Fear Avoidance Model. In consideration of the results as a whole, both threat and conversation with one’s romantic partner are related to later pain intensity and pain tolerance. A simple threat manipulation was found to alter both participants’ and partners’ perceived threat and determined later level of pain tolerance for participants. Impressively, greater satisfaction with a mere 2-minute conversation with one’s partner predicted lower pain intensity ratings over time and all participants experienced decreases in perceived threat following the discussion with their partner. These findings exemplify the importance of including the social context in theoretical models involving threat and pain. Although the present model was unable to establish a causal link between threat and social context, such associations are promising. In consideration of the novelty of this study, it is not surprising that many of the results reported here do not fit some of the more nuanced predictions of the proposed model. Instead, the results support the general utility of including the social context in the Fear Avoidance Model, in particular, the potential benefit of a discussion with a partner in alleviating perceived threat and pain intensity.

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ABSTRACT

GREAT EXPECTATIONS: HOW ARE COUPLES INFLUENCED BY THREATENING INFORMATION PRIOR TO A PAIN TASK?

by

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August 2014

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Major: Psychology

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The present study examines the effects of a threat manipulation on romantic partners, in which one partner is about to undergo a painful task. Couples were randomly assigned to high and low threat manipulation groups, designed to alter one's pain-related fear about the task. The study examined a novel theoretical model, the Contextual Fear Avoidance Model (C-FAM). The proposed model incorporates the social context into the Fear Avoidance Model (Vlaeyen & Linton, 2000). Results demonstrated that the threat manipulation was effective for both participants and their romantic partners. The present study also yielded preliminary evidence for the inclusion of social variables into the Fear Avoidance Model. Notably, an individual's satisfaction with a conversation with his or her intimate partner was found to predict later pain perception. Clinical and theoretical implications of these findings are discussed.

AUTOBIOGRAPHICAL STATEMENT

Angelia Corley obtained her Bachelors of Science in Psychology at the University of Arizona. She enjoys conducting research in health psychology, which involves studying the interplay between biological, psychological, and social factors. In particular, Angelia is interested in research on chronic pain and romantic couples. 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.