Evaluating the effects of sensory focus and distraction on ethnic differences in reports of laboratory induced pain

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EVALUATING THE EFFECTS OF SENSORY FOCUS AND DISTRACTION ON ETHNIC DIFFERENCES IN REPORTS OF LABORATORY INDUCED PAIN

by

Regina L. McConley

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A DISSERTATION

Submitted to the graduate faculty of The University of Alabama at Birmingham in partial fulfillment of the requirements for the degree of Doctor of Philosophy

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2009
There is consistent evidence of ethnic group differences in pain response in clinical and laboratory settings. However, few studies have examined potential contributors to the group differences, or assessed the efficacy of interventions to reduce pain across ethnic groups. The aims of the study were to: 1. Compare African Americans and non-Hispanic Whites’ (NH Whites) scores on the Pain Catastrophizing Scale, 2. Compare the pain responses (e.g., pain threshold, tolerance, intensity and unpleasantness) of African Americans and NH Whites in response to the Cold Pressor Procedure (CPT), and 3. Evaluate the effects of sensory focus and distraction interventions on pain tolerance. Sensory focus required individuals to focus on words assessing the sensory aspect of pain, while individuals in the distraction intervention concentrated on words unrelated to pain. It was hypothesized that the pain tolerance of NH Whites would not differ by intervention, while the tolerance of African Americans would vary across interventions. Participants included 91 healthy students (48 African American, 43 NH White) who were randomly assigned to the sensory focus or distraction intervention. Each participant completed a baseline CPT(1) and then a second CPT(2) following training in sensory focus or distraction. Pain tolerance (in seconds) was recorded for each CPT, as well as ratings of intensity and unpleasantness. Results showed that NH Whites produced higher catastrophizing scores for the rumination scale than African Americans. African Americans displayed lower
tolerances than NH Whites during CPT1 and CPT2. There were no differences between the groups’ unpleasantness ratings. NH Whites evidenced higher intensity ratings than African Americans during CPT1. African Americans in the distraction group showed an increase of 21 seconds in their tolerance from CPT1 to CPT2, although there were no changes for African Americans in the sensory focus group. Neither the sensory focus or distraction interventions resulted in changes in tolerance from CPT1 to CPT2 for NH Whites. Results suggest that the efficacy of specific interventions may vary according to ethnic group. Interventions aimed at reducing the impact of pain may be more successful if ethnicity is considered as an important determinant of the pain experience.
DEDICATION

This work is dedicated to my loving parents Eddie Dean & Willie Love McConley, my grandmother, Linnie Mae Linsay, and all my wonderful siblings.

“Trust in the Lord with all your heart, and lean not on your own understanding; in all your ways acknowledge Him, and He shall direct your paths.”

Proverbs 3: 5-6
ACKNOWLEDGEMENTS

I would like to acknowledge everyone who contributed to this process of growth and development. First and foremost, I would like to thank my Lord and Savior Jesus Christ for all of His love and support. I would also like to thank my dissertation committee chairs, Dr. Beverly Thorn and Dr. Cheryl Holt, for their encouragement and guidance. Many thanks to my committee members, who generously contributed their time and their talents to this project: Dr. Martha Crowther, Dr. Sharina Person, & Dr. David Schwebel. A special thanks goes to Drs. Rex Wright and Timothy Ness, who were instrumental in the completion of this study. Last but not least, I would certainly like to thank all of my friends for helping me see the light at the end of the tunnel.
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INTRODUCTION

Pain is an expensive and pervasive problem that affects an estimated 65 million Americans, and costs the U.S. economy more than 100 billion dollars each year (National Institute of Health, 1998; Stewart, Ricci, Chee, Morganstein, & Lipton, 2003). However, the consequences of painful medical conditions, (e.g., glaucoma, AIDS, end-stage chronic illness, and arthritis), are especially severe for African American individuals who generally report higher levels of pain and disability, and more symptoms of anxiety and depression than Non-Hispanic Whites (NH Whites) (Breitbart et al., 1996; Green et al., 2003a; Green, Baker, Sato, Washington, & Smith, 2003b; Jordan, 1999; Rabow & Dibble, 2005; Sherwood et al., 1997). The reported racial/ethnic differences in pain severity persist even after adjusting for indicators of disease status (e.g., severity, duration of illness) and demographic variables (e.g., socioeconomic status, age) (McCracken, Matthews, Tang, & Cuba, 2001). Moreover, laboratory-based studies of patients with chronic pain, as well as healthy individuals, consistently reveal ethnic differences in pain responses similar to those described above (Campbell, Edwards, & Fillingim, 2005; Edwards & Fillingim, 1999; Edwards, Fillingim, & Keefe, 2001a).

In response to these findings, some investigations have attempted to identify factors that influence ethnic group differences in pain response (e.g., pain tolerance, ratings of the aversiveness of pain, frequency of pain behaviors). Recent evidence suggests that catastrophizing, which consists of feelings of helplessness, difficulty
distracting oneself from thoughts about pain, and the anticipation of highly negative consequences from the experience of pain, may contribute to the heightened pain sensitivity in African Americans (Hastie et al., 2004).

The present study contributes to the literature by assessing catastrophizing as a potential mediator for ethnic group differences in the pain experience, and evaluating the effect of two brief cognitive interventions (sensory focusing and distraction) on ethnic group differences in pain reports. In order to illustrate the proposed framework for the interventions, the next section will focus on the nature of pain. Since the factors contributing to the experience of pain are multi-faceted, the following section examines: a) the neuromatrix model of pain perception, b) a review of the early and current literature on ethnic group differences in pain sensitivity, and c) potential mechanisms for the differences, especially with regard to catastrophizing. Finally, the present discussion reviewed the literature concerning the efficacy of the sensory focus and distraction interventions in reducing affective pain responses, and in increasing pain tolerance.

The Neuromatrix Model

Pain is defined as an “unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage” (International Association for the Study of Pain, 1979). This definition emphasizes the multidimensional nature of pain by acknowledging that there are sensory (e.g., tingling, aching) and affective (or emotional) components of the pain experience. In addition, cognitive processes (e.g., expectations or beliefs about the severity, extent, and duration of pain) also contribute to pain perception by enabling individuals to attribute meaning to the pain experience. It is important to note that the formation of pain-related cognitive
and affective processes are influenced by several factors, such as pain intensity, previous experience with pain, individuals’ physiological responses, and cultural and environmental factors (Bradley, 2004). Therefore, the experience of pain is characterized by the interaction of subjective cognitive and affective influences, as well as sensory stimulation (Melzack & Wall, 1965).

A recent revision of the Gate Control Theory, the neuromatrix model (Melzack, 1999), provides a framework for understanding the interaction of the factors that contribute to pain perception. Conceptually, the neuromatrix model retains the sensory-discriminative, affective-motivational, and cognitive-evaluative components of pain expressed in the Gate Control Theory, in addition to defining areas of the brain where this processing occurs. It posits that the neural pathways linking the thalamus, cortex, and limbic system compose a neuromatrix that generates patterns of neural activity. This entity is a genetically wired matrix of neurons which produces distinct neural impulses and somatosensory experiences in the whole body. The neuromatrix is subsequently influenced by various internal and external inputs, including: cultural influences, expectations, cognitive and emotional states, stress regulation, immune system modulation, and sensory information (e.g., visual, auditory, cutaneous) (Melzack, 1999). Each factor has the potential to increase the sensory flow of pain signals, which are hypothesized to change central thresholds of excitability with repeated stimulation over time (Watkins, Milligan, & Maier, 2001). Thus, pain sensitivity and pain behavior can be influenced by changes in any factor. This new model, therefore, states that genetically specified processing is modified by experience. Moreover, it offers support for the concept that psychosocial factors, including ethnic group membership and pain-related
expectations, influence pain sensitivity and pain behavior through the neuromatrix (Melzack, 1999).

Ethnic Group Differences in Pain Sensitivity

The neuromatrix model described above suggests that one important psychosocial influence on pain perception and behavior is ethnic group membership (Edwards, Doleys, Fillingim, & Lowery, 2001b; Edwards et al., 2001a; Riley, Wade, Myers, Sheffield, Papas, & Price, 2002). Therefore, understanding the distinct patterns of pain responses and behaviors among ethnic groups is important. This is due to the fact that differences in the occurrence of these phenomena could account for ethnic group differences in perceived pain (Hastie, Riley, & Fillingim, 2005).

Early observation of the behaviors of individuals with painful medical conditions revealed that there were ethnic group differences in their pain reports. Zborowski (1969) examined the pain behaviors of male neurosurgical patients from four ethnic groups: Jewish, Irish, Italian, and “Old Americans” (defined as Anglo-Saxon individuals born in the U.S.). Qualitative observation revealed that Jewish and Italian patients generally engaged in more pain behavior than Irish or Old American patients. From these data, Zborowski (1969) concluded that the cultural influences of each group uniquely shaped attitudes and behavioral responses to pain.

Ethnic group differences in pain reports are also found in current studies of individuals with chronic pain. Two of the most frequently observed ethnic groups are African Americans and NH Whites (Zatzick & Dimsdale, 1990; Green et al., 2003a). Studies conducted on these two groups have shown that African Americans report more severe pain experiences in clinical settings compared to their NH White counterparts.
(Faucett, Gordan, & Levine, 1994; Sheffield, Kirby, Biles & Sheps, 1999; White, Asher, Lai, & Burton, 1999). Additionally, African Americans, compared to NH Whites, report higher levels of pain associated with several medical conditions, including glaucoma (Sherwood et al., 1998), myofascial disorders (Nelson, Novy, Averill, & Berry, 1996), acquired immune deficiency syndrome (AIDS) (Breitbart et al., 1996), arthritis (Creamer, Lethbridge-Cejku, & Hochberg, 1999), and low back pain (Selim et al., 2001). African American patients also produce higher scores on measures of pain-related interference, emotional distress, and disability relative to NH White patients (Green et al., 2003a; Green et al., 2003b; Riley et al., 2002; Tan, Jensen, Thomby, & Anderson, 2005). Collectively, the previous studies provide strong support for the observation of enhanced pain sensitivity in African Americans.

While clinical reports of ethnic differences in pain are informative, these studies are limited in that they only assessed the self-report of individuals. During the early 1970s, investigators employed laboratory-based procedures to study ethnic group differences in the pain responses of healthy individuals and individuals with painful medical conditions. These procedures enabled investigators to quantify behavioral measures of pain, such as the amount of time that elapsed between the initial detection of pain produced by noxious stimulation (e.g., pain threshold), and the request for cessation of the stimulation (e.g., pain tolerance), across groups. In addition, the use of quantitative measures of pain allowed investigators to differentiate between the sensory and affective dimensions of pain. This enabled investigators to determine the effects of variations in the intensity of noxious stimulation on individuals’ sensory and affective pain reports (via verbal and visual analogue scale (VAS) ratings of intensity and unpleasantness). Thus,
the assessment of pain included multiple estimations of the affective dimension of pain (e.g., pain unpleasantness, pain tolerance) as well as its sensory dimension (e.g., pain intensity, pain threshold) (Harris & Rollman, 1983).

Laboratory studies of patients with painful medical conditions have shown that African Americans exhibit greater levels of affective pain compared to NH Whites. For instance, in a sample of chronic pain patients, it was found that African Americans exhibited lower tolerance of noxious ischemic stimulation and greater perceptions of unpleasantness relative to NH Whites (Edwards et al., 2001b). Laboratory-based studies of healthy African American and NH White individuals’ responses to noxious stimuli have yielded similar results (Chapman & Jones, 1944; Sheffield, Biles, Orom, Maixner, & Sheps, 2000; Walsh, Shoenfeld, Ramamuthy, & Hoffman, 1989; Woodrow, Friedman, Siegelaub, & Collen, 1972; Zatzick & Dimsdale, 1990). During exposure to noxious stimulation (e.g., heat, cold, or mechanical pressure applied to the skin), African Americans exhibit lower pain tolerance levels and generally describe these stimuli as significantly more aversive or unpleasant than NH Whites (Campbell, Edwards, & Fillingim, 2005; Edwards & Fillingim, 1999; Edwards, Fillingim, & Keefe, 2001a). The previous findings show that affective measures of pain consistently differentiate the responses of African Americans and NH Whites to noxious stimulation. Moreover, these results are consistent for healthy individuals, as well as patients with painful medical conditions, thus the ethnic group differences in pain sensitivity found in the laboratory are not specific to patient samples.

The previous literature demonstrates that African Americans produce heightened affective responses to pain relative to NH Whites in both laboratory and clinical settings.
However, the mechanisms that may underlie these differences are not well characterized. The complex roles of physiological and psychosocial factors that contribute to ethnic group differences in pain sensitivity warrant further investigation.

Mechanisms

Within the last decade, investigators have focused on illuminating systematic differences in pain perception that underlie the experience of African American and NH White individuals. However, the majority of the existing research on ethnic group differences merely documents discrepancies between the pain responses of African Americans and Whites (Edwards et al., 2001a; Jones 2001). Therefore, studies that explore possible mechanisms for these differences are needed in order to facilitate the development and evaluation of interventions to improve pain-related outcomes for ethnically diverse populations.

According to the neuromatrix model, the complex interaction of physiological and psychosocial factors play a key role in sculpting the pain experience. A number of these factors, therefore, have been proposed as contributing to the ethnic group differences in pain (Kim et al., 2004). For example, psychosocial factors influenced by ethnicity, like exposure to higher levels of daily stress/discrimination, and psychological risk factors (e.g., maladaptive cognitive and affective responses), could contribute to enhanced pain sensitivity by diminishing the physiological function of endogenous pain inhibition systems (Mechlin, Maixner, Light, Fisher, & Girdler, 2005). Thus, examining the interaction of physiological and psychosocial factors is important for identifying the mechanisms that contribute to the observed ethnic group differences in pain reports.
Physiological Factors.

Several studies have documented an association between cardiovascular function and pain sensitivity (Edwards, Ness, & Fillingim, 2004; France, 1999). Specifically, hypertension and high blood pressure are frequently associated with decreased pain sensitivity, or hypoalgesia (France & Ditto, 1996). Moreover, the relatives of hypertensive individuals also tend to exhibit behaviors indicative of hypoalgesia. For example, during exposure to noxious stimulation, relatives of hypertensive individuals produce lower ratings of pain intensity and unpleasantness compared to persons without family histories of hypertension (Campbell, Hughes, Girdler, Maixner, & Sherwood, 2004; Stewart & France, 1996). However, most of this research was conducted using samples comprised entirely of NH White individuals. African Americans, who are at greater risk for hypertension compared to NH Whites (Kramer et al., 2004; Hajjar & Kotchen, 2003), consistently display enhanced pain sensitivity in both laboratory and clinical settings. Because of this discrepancy, it has been suggested that African Americans exhibit increased pain responses (hyperalgesia) due to physiological differences in the pathogenesis of hypertension. Some empirical studies have examined this assertion.

McNeilly & Zeichner (1989) compared the cardiovascular and endorphin responses to intravenous catheterization of African American and NH White individuals who were either hypertensive or normotensive. The investigators used the intravenous catheterization procedure as an in vivo stressor prior to the measurement of cardiovascular reactivity and endogenous endorphin levels. African American hypertensives exhibited lower beta endorphin levels than normotensive African American
individuals. In contrast, White hypertensives exhibited higher beta endorphin levels than their normotensive counterparts. It was also found that White hypertensives displayed lower heart rates and systolic/diastolic blood pressures compared to African American hypertensives in response to the stressor. Ratings of pain in response to the stressor were not reported (McNeilly & Zeichner, 1989). Based on these results, the investigators concluded that the physiological correlates of hypertension differ among African American and NH White individuals.

In response to these findings, recent investigations have examined the effects of ethnicity on blood pressure, pain sensitivity, and endogenous opioids. Several studies have shown that the inverse relationship between blood pressure and pain sensitivity among NH White hypertensives is influenced by endogenous opioid levels and stimulation of baroreceptors (al’Absi, France, Harju, France, & Wittmers, 2006; Campbell & Ditto, 2002; France, 1999; McCubbin, Helfer, Switzer, Galloway, & Griffith, 2006). Overall, these studies have shown that NH Whites with elevated blood pressures who received opioid antagonists (e.g., naltrexone) exhibit enhanced sensitivity to noxious stimuli in the laboratory. However, recent comparisons of African Americans and NH Whites with hypertension revealed results similar to those reported by McNeilly and Zeichner (1989) (Campbell, Hughes, Girdler, Maixner, & Sherwood, 2004; Sheffield, Kirby, Biles, & Sheps, 1999). Based on these findings, there is evidence that endogenous opioids may mediate the relationship between high blood pressure and pain sensitivity in NH Whites, but may have less of an influence among African Americans. Therefore, the literature suggests that differences in levels of endogenous opioids might contribute to ethnic group differences in pain sensitivity (Sigurdsson & Maixner, 1994).
In addition, Edwards and colleagues (2001) posited that differences in the vascular and adrenergic responses of African Americans to stress may account for enhanced pain sensitivity in clinical and experimental settings. Recent evidence indicates that healthy African American individuals, compared to NH Whites, produce lower levels of hormones that inhibit pain such as cortisol and norepinephrine (NE) during exposure to laboratory stressors (Mechlin et al., 2005). Although plasma levels of cortisol and NE are negatively associated with pain reports among NH Whites, there is no association between plasma levels of these hormones and pain reports in African Americans. Thus, it has been hypothesized that psychosocial factors such as exposure to relatively higher levels of stress among African Americans, may diminish the function of endogenous pain inhibition systems involving NE, cortisol, and blood pressure (Mechlin et al., 2005; Sheffield, Biles, Orom, Maixner, & Sheps, 2000). This finding suggests that physiological responses do not fully account for differences in the pain reports of African American and NH White individuals.

Collectively, evidence from physiological studies of ethnic group differences support the concept that psychosocial factors (e.g., exposure to stressors) also contribute to the enhanced pain response of African Americans (Mechlin et al., 2005; Sheffield et al., 2000). Moreover, it is speculated that the experience of more severe pain among African Americans could contribute to the formation of maladaptive cognitive and affective responses to pain. This finding is important, in that these risk factors are considered modifiable.
Psychosocial Factors.

Catastrophizing. Catastrophizing is a frequently encountered cognitive and affective response to pain (Chaves & Brown, 1987; Novy, Nelson, Hetzel, Squitiri, & Kennington, 1998). Catastrophizing is defined as the tendency to focus on or exaggerate the aversiveness of pain, and as a perceived inability to cope with pain (Thorn, Boothby, & Sullivan, 2002; Heyneman, Fremouw, Gano, Kirkland, & Heiden, 1990). This negative mental orientation involves feelings of helplessness, difficulty distracting oneself from thoughts about pain (rumination), and the anticipation of highly negative consequences from the experience of pain (magnification) (Sullivan et al., 2001). Several studies have explored the relationship between ethnicity and catastrophizing.

In general, healthy African Americans produce higher catastrophizing scores on standardized questionnaires (e.g., Pain Catastrophizing Scale, (PCS); Coping Strategies Questionnaire, (CSQ) than NH Whites (Edwards & Fillingim, 1999; Hastie, Riley & Fillingim, 2005; Rhuelman, Karoly, & Newton, 2005). Hastie and colleagues (2004) found that the higher catastrophizing scores reported by African Americans on the CSQ were associated with more frequent reports of pain episodes on a questionnaire that assessed general health. Similarly, Ruehlman et al. (2005) found that African American chronic pain patients produced higher catastrophizing scores relative to NH White patients and also experienced greater pain-related interference with activities. This research suggests that African American and NH White individuals differ with regard to catastrophizing. Of the presumed factors influencing the relationship between pain sensitivity and ethnicity, catastrophizing is remarkable because it is associated with heightened pain sensitivity, greater levels of psychological distress, and frequent pain
behaviors in samples of healthy persons as well as patients with chronic pain (France et al., 2004; Keefe, Rumble, Scipio, Giordana, & Perri, 2004; Sullivan et al., 1998; Sullivan et al., 2001; Sullivan & Neish, 1999; Turner, Mancl, & Aaron, 2004).

Studies conducted in the laboratory have shown that healthy individuals with frequent catastrophic thoughts display lower pain tolerances during exposure to noxious stimulation (Sullivan et al., 1998). In addition, higher levels of catastrophizing are consistently associated with greater pain severity and perceived unpleasantness ratings. This relationship is evident across both think aloud assessments (e.g., participants verbalize all thoughts generated during noxious stimulation), and questionnaire assessments of catastrophizing. For instance, college students who reported frequent catastrophic thoughts exhibited lower pain thresholds and tolerances during the cold pressor procedure than those students who rarely reported catastrophic thoughts (Spanos, Radtke-Bodorik, Ferguson, & Jones, 1979; Sullivan et al., 1997). Higher levels of catastrophizing are related to lower pain tolerances in healthy participants during thermal (Edwards, Fillingim, Maixner, Sigurdsson, & Haythornthwaite, 2004) and electrocutaneous (France, France, al’Absi, Ring, & McIntyre, 2002) stimulations as well. Furthermore, high levels of catastrophizing enhance the amount of pain experienced during medical procedures (e.g., procedural pain) in otherwise healthy individuals (Sullivan et al., 2001). For example, dental patients who reported catastrophic thoughts also reported greater levels of pain and emotional distress (e.g., greater levels of anxiety) than patients who did not report experiencing catastrophic thoughts (Chaves & Brown, 1987; Sullivan & Neish, 1999; Sullivan, Tripp, & Santor, 2000).
Catastrophizing is also associated with adverse effects for individuals with chronic low back pain (Picavet, Vlaeyen, & Schouten, 2002), soft tissue injuries (Sullivan, Stanish, Waite, & Tripp, 1998), and mixed chronic pain (Sullivan & D’Eon, 1990). Individuals with chronic pain who catastrophize tend to have higher rates of disability and health care usage (Gil, Abrams, Phillips, & Williams, 1992), greater postoperative pain (Jacobsen & Butler, 1996), and longer hospital stays compared to chronic pain patients with low levels of catastrophizing. Turner and colleagues (2002) reported that higher levels of catastrophizing were associated with increased scores on measures of anxiety, depression, and pain-related disability in individuals with spinal cord injuries. Greater levels of catastrophizing are also associated with chronic pain patients’ ratings of pain affect during exposure to noxious stimulation. For instance, DeBerry and colleagues (2002) found that osteoarthritis patients, compared to healthy controls, produced higher PCS scores and McGill Pain Questionnaire ratings of pain affect in response to mechanical pressure stimulation of the knees. In addition, it was found that the PCS scores mediated the group difference in pain affect ratings. A similar investigation showed that higher scores on a measure of catastrophizing were associated with lower pain thresholds and tolerances in a sample of osteoarthritis patients (France et al., 2004). The results also indicated that catastrophizing was positively associated with higher overall ratings of laboratory based and clinical pain. Collectively, this evidence suggests that catastrophizing is associated with enhanced pain sensitivity and emotional distress in both clinical and laboratory settings.

More research is needed to investigate catastrophizing as a potential mediator for the ethnic group differences in pain perception. Catastrophizing is a particularly
important factor, due to the fact that it: 1) is related to poor pain-related outcomes in healthy and pain populations, 2) has been shown to partially mediate group differences in pain perception (Deberry et al., 2002; Sullivan, Santor, & Tripp, 2000), and 3) is a modifiable risk factor. This is important, given that there are interventions that may successfully reduce the frequency of negative pain-related thoughts, and result in improved health outcomes (Burns, Bruehl, Harden, & Lofland, 2003; Gil, Abrams, Phillips, & Keefe, 1996; Heyneman, Fremouw, Gano, Kirkland, & Heiden, 1990; Sullivan & Neish, 1999). Evidence indicating that African Americans engage in catastrophic thinking to a greater extent than NH White individuals suggests that differences in this factor could contribute to the enhanced pain sensitivity of African Americans. Thus, minimizing catastrophizing may help reduce heightened pain sensitivity among African Americans.

Theoretical Framework for Intervention

Research has shown that catastrophizing is positively associated with pain sensitivity. Moreover, the identification of catastrophizing as an antecedent for predicting pain severity and disability shows that it may have a causal role in the development of negative pain-related outcomes (Keefe, Brown, Wallston, & Caldwell, 1989; Turner, Mancl, & Aaron, 2004). In order to understand its role in the perception of pain, a review of the current theoretical framework for pain affect is necessary. The following discussion evaluates the theoretical basis for which catastrophizing exerts its effects, and illustrates how cognitive techniques that offset catastrophic thinking could mitigate the pain experience.
Several theoretical models of catastrophizing exist. Within the context of Beck’s cognitive theory (1967), catastrophizing is conceptualized as a negative emotional schema created from experience with pain as a distressing phenomenon. Due to the fact that schemata help to structurally organize information (Sacco & Beck, 1995), pain is consistently interpreted from the perspective that it is a stressful experience resulting in adverse outcomes (e.g., injury, debilitation). Similarly, appraisal models of pain state that catastrophic thoughts emerge when noxious stimuli are perceived as threatening to the individual (Sullivan et al., 2001). Since schema and appraisal theories of catastrophizing have garnered empirical support, it has been hypothesized that catastrophizing has features of multiple theories. In this regard, hierarchical models of catastrophizing may offer the most explanatory power in terms of its relationship to pain (Sullivan et al., 2001). Both schema and appraisal models of catastrophizing suggest that individuals who intensify the threat of painful stimuli/sensations are likely to allocate attention to these stimuli preferentially (Sullivan et al., 2001). Given the complexity of these theories, a discussion of attentional focus is warranted to clarify the effects of catastrophizing on pain perception and evaluation of cognitive strategies for the relief of pain.

According to the neuromatrix model (Melzack & Wall, 1996), attention is one factor that can influence neural representations of pain. Thus, cognitive strategies affecting attentional focus may impact pain sensitivity and pain behavior. For instance, Price (2002) postulated that the sensory and affective components of pain exist in both serial and parallel circuits of the brain. Furthermore, he hypothesized that cognitive activity in the anterior cingulate could modulate the degree to which attention is directed
to affective or sensory characteristics of noxious stimulation. For instance, it is already known that training in biofeedback strategies can regulate activity in the rostral anterior cingulate cortex (rACC) during real-time functional MRI scans (deCharms et al., 2005). Cognitive mediation, then, could be used to emphasize the sensory or affective elements of pain (Price, 2002; Wade & Hart, 2002). Thus, attending to the affective component of pain, rather than the sensory component, would be expected to result in greater pain unpleasantness and a heightened pain experience (Ahles, Blanchard, & Leventhal, 1983; Leventhal, Brown, Shacham, & Engquist, 1979). In order to test this hypothesis, Rainville, Carrier, Hofbauer, Bushnell & Duncan (1999) assessed whether hypnotic suggestions influenced individuals’ sensory and affective pain ratings after cold water immersion. It was found that suggestions designed to increase pain affect resulted in higher pain unpleasantness ratings. Conversely, suggestions designed to decrease pain affect resulted in lower pain unpleasantness ratings. There were little or no changes in ratings of intensity. A similar relationship was observed between suggestion and pain sensation. Instructions aimed at increasing pain sensation were accompanied by changes in pain intensity ratings and secondary changes in pain unpleasantness ratings. This study offers support for cognitive mediation of the pain experience. The ability to use cognitive techniques to emphasize either the sensory or the affective aspects of the pain experience demonstrates that the aversiveness of pain can be modulated.

There is evidence that catastrophizing focuses attention on the affective and negative cognitive evaluation components of pain (Crombez, Eccleston, Baeyens, & Eelen, 1998; Eccleston, Crombez, Aldrich, & Stannard, 1997). Several investigations have shown that individuals with higher levels of catastrophizing have more difficulty
suppressing thoughts about pain, and report more pain-related thought intrusions than individuals with low levels of catastrophizing (Sullivan et al., 1995; Sullivan et al., 1997). In addition, they typically exhibit lower pain tolerances and rate pain as a more aversive experience than low catastrophizers. Various cognitive interventions have been evaluated in mitigating the distress caused by pain, and the enhanced distress associated with catastrophizing. Two commonly evaluated interventions are distraction and sensory focus.

**Efficacy of Sensory Focus and Distraction**

Given the invasive nature of catastrophic thoughts, it is not surprising that studies assessing the effectiveness of distraction on pain (e.g., attempts to divert attention away from the entire pain experience) have shown little or no effects on the pain reports of individuals who catastrophize (Heyneman et al., 1990; Spanos, Stam, & Brazil, 1981). For example, Goubert, Crombez, Eccleston, & Devulder (2004) evaluated the effect of distraction (i.e., reaction times to musical tones) on the self-reports of chronic low back pain patients during and after a pain evoking lifting task. Results showed that distraction did not have an effect on self-reported pain (per the Multidimensional Pain Inventory) during the lifting task. Instead, distraction evoked greater reports of pain immediately following the task. The analyses also indicated that higher catastrophizing levels were positively correlated with greater interference on the distraction task, and participant’s ratings of the amount of attention directed to pain during the lifting task (e.g., 0: not at all, 10: very much). Further, the amount of attention directed to pain mediated the relationship between catastrophic thoughts and reaction times on the distraction task,
such that the relationship between these two variables weakened when attention to pain was removed from the analysis. In sum, catastrophic thinking was associated with less engagement in the distraction task. Overall, this research indicates that the intrusive nature of catastrophic thinking makes it resistant to distraction.

An alternate approach to distraction is to attend to the sensory characteristics of noxious stimulation. Sensory focus involves giving individuals information about a noxious stimulus, and the types of tactile, thermal, or visual changes that are likely to occur during the event (Leventhal et al., 1979; Leventhal, Leventhal, Shacham, & Easterling, 1989). Occasionally, it is offered in the form of sensory suggestions to reinterpret physical sensations (e.g., numbness or dullness) in the affected region (e.g. arm) (Spanos, Stam, & Brazil, 1981). Sensory focus has had therapeutic effects on the pain ratings and tolerances of healthy individuals during childbirth (Leventhal et al., 1989), surgical procedures (Suls & Wan, 1989), and noxious experimental stimuli, such as ischemic and cold pressor procedures (Dar & Leventhal, 1993; Johnson, 1973). In addition, the available evidence seems to indicate that sensory focus is effective for individuals who catastrophize (Forys & Dahlquist, 2007; Hadjistavropoulos, Hadjistavropoulos, & Quine, 2000; Spanos et al., 1981). By attending to the sensory characteristics of a stimulus, the affective focus activated by catastrophizing may diminish (Leventhal et al., 1979). This may result in increases in pain tolerance and decreases in perceived unpleasantness of the stimulation.

In order to test this hypothesis, Michael (1998) investigated the effects of sensory focus, affective focus, and distraction on chronic pain patients assessed as high or low catastrophizers. Results showed that high catastrophizers, compared to the low
catastrophizing group, exhibited lower pain tolerances during an affective focus condition. Within the sensory focus condition, the low catastrophizing group exhibited greater pain tolerances and thresholds. No significant differences were reported for pain tolerance or threshold among high catastrophizers in the sensory focus condition. Although it seems that sensory focus was ineffective for the high catastrophizers, a trend was reported in which this group appeared to benefit more from the intervention than high catastrophizers assigned to the affective focus and distraction groups. This finding is important, due to the fact that the high catastrophizers in the sample produced unusually high mean PCS scores. Although healthy African Americans, compared to NH Whites, produce higher scores on measures of catastrophizing, their catastrophizing levels are generally not as high as chronic pain patients. Sensory focus, therefore, may be more beneficial to healthy African Americans, due to the fact that their levels of catastrophizing are not as extreme.

Specific Aims

The previous research shows that there is consistent evidence that ethnicity is an important determinant of the pain experience (Campbell et al., 2005; Edwards & Fillingim, 1999; Edwards et al., 2001, Green et al. 2001a). Compared to NH Whites, African Americans generally display lower pain tolerances and report more intense and unpleasant pain experiences. African Americans also tend to produce higher scores on measures assessing negative pain-related thoughts than NH Whites, such as the PCS (Campbell et al., 2005; Edwards & Fillingim, 1999; Thorn et al., 2007). Given the association between catastrophizing and increased pain perception (Keefe et al., 2004,
Sullivan et al., 1997; Sullivan et al., 2001), it has been suggested that higher levels of catastrophizing among African Americans may contribute to the ethnic group differences in pain behavior and response (Hastie et al., 2004). This is important, given that there are cognitive interventions that reduce catastrophizing and may reduce pain response.

The present study examined the effects of two brief cognitive interventions on individuals’ responses to a standard laboratory-based method for producing cold pressor pain among both African American and NH White individuals. The primary intervention was “sensory focus,” a technique that requires individuals to focus their attention on the physical sensations, rather than the unpleasant emotional responses, produced by pain. The second intervention was “distraction,” a technique that requires individuals to attempt to focus their attention on perceptions other than pain (e.g., listening to music). Evidence suggests that sensory focus produces results that are superior to distraction among NH White individuals with higher levels of catastrophizing (Hadjistavropoulos, Hadjistavropoulos, & Quine, 2000). Sensory focusing, therefore, may be more beneficial to African Americans than distraction, due to the fact that focusing on the physical sensations of pain tends to de-emphasize catastrophizing. To date, however, there are no investigations examining the extent to which sensory focus and distraction influence the pain reports of both African American and NH White individuals.

The aims of the present study were to assess: 1) baseline differences between healthy African American and NH White individuals’ scores on a measure of negative pain-related thoughts, the PCS, 2) each group’s pain response (e.g., tolerance, ratings of pain intensity and unpleasantness) to a standard laboratory method for evoking acute pain (cold pressor procedure), as well as evaluating the extent to which catastrophizing may
mediate the anticipated ethnic group differences in pain responses, and 3) the effects of
the sensory focus and distraction interventions on measures of cold pressor pain response.
Specifically, it was hypothesized that:

1. At baseline, African Americans would produce higher scores than NH Whites on
the PCS.

2. At baseline, African Americans would exhibit lower cold pressor pain tolerance
levels and produce higher pain intensity and unpleasantness ratings. It was also
predicted that catastrophizing would partially mediate the relationship between
ethnic group (African American, NH White) and pain tolerance, as well as the
relationship between ethnic group and pain ratings during the cold pressor
procedure.

3. a). There would be an interaction between ethnic group and intervention group,
such that, while the tolerance times of NH were not expected to differ by
intervention group, levels of pain tolerance among African Americans were
expected to vary across interventions (with sensory focus resulting in improved
pain tolerance). Further, a main effect among African Americans was expected,
such that participants in the sensory focus group would display greater mean pain
tolerances than participants in the distraction group. Additional analyses
compared the ethnic and intervention groups on measures of the sensory
component of pain (i.e., threshold, intensity), but it was anticipated that there
would be no differences between groups on these measures. b). It was also
predicted that the unpleasantness ratings of NH Whites would not differ by
intervention condition, and that the ratings of African Americans would decrease
according to intervention group. African Americans in the sensory focus group were expected to have lower unpleasantness ratings compared to African Americans in the distraction group. Few differences were anticipated between the pain unpleasantness and intensity ratings of NH White individuals in the sensory focus group compared to NH White individuals in the distraction group.

This research is salient because it will help further the development and evaluation of interventions designed to mitigate psychosocial factors contributing to heightened pain sensitivity among ethnically diverse populations.
METHOD

Participants

A power analysis determined that a sample size (n) of 62 was required to achieve a power of .80 for the mediation analysis, based on the following specifications for the mediation analyses: alpha=.05, predictors (n)=6, and a moderate effect size ($f^2=.25$). The power analysis was conducted for the tests of mediation because there were no previous estimates of effect size for the sensory focus and distraction interventions with a diverse sample.

Undergraduate Psychology students (ages 19-30) enrolled in an introductory Psychology course (PY101) were recruited through the use of sign up sheets. Students received course credit for participating in the study. Participants were also recruited from the University of Alabama subject pool via web based sign up sheets. The gender and ethnic composition of the sample included: African Americans (22 males, 26 females) and NH Whites (20 males, 23 females) for a total of 91 participants. The study was approved by the Institutional Review Boards at the University of Alabama at Birmingham, and the University of Alabama.

Prior to the investigation, students completed a telephone screening that lasted approximately 15 minutes. Participants were eligible for inclusion if they unequivocally identify themselves as African American, Black, Caucasian or NH White. The exclusion criteria for participation in the study were as follows:
1. Acknowledgement of a serious or painful health condition (e.g., fibromyalgia, peripheral vascular disease, Raynaud’s syndrome, recurrent migraines, hypertension, current symptoms of IBS, cardiac illness, diabetes),

2. Pregnancy,

3. Previous history of frost-bite in the hands and arms,

4. Inability or unwillingness to discontinue analgesic medicine for a forty eight hour period prior to the laboratory session,

5. Inability or unwillingness to refrain from the use of caffeine or tobacco products (e.g., dependence) for a four hour period prior to the laboratory session,

6. Unusually prominent symptoms of anxiety or depression (current episodes of Major Depression and/or General Anxiety Disorder, Bipolar Disorder, or Panic Disorder) according to portions of the Mini-International Neuropsychiatric Interview (M.I.N.I.), a diagnostic psychiatric interview for DSM-IV criteria (Sheehan et al., 1998). The reason for the exclusion of certain classes of anxious and depressive disorders is because these illnesses may interfere with an individual’s ability to attend to the noxious stimulus, which could result in inaccurate estimations of intensity and unpleasantness (Klatzkin, Mechlin, Bunevicius, & Girdler, 2007).

Eligible participants were then given a description of the study. Due to the fact that the phase of the menstrual cycle may affect pain perception (Riley, Robinson, Wise, & Price, 1999), females were tested during the follicular phase of their menstrual cycle (within 4-10 days after the onset of menses). Female participants were asked to estimate the onset of their next menstrual cycle in order to determine a tentative date for their laboratory
session. Appropriate timing for the session was confirmed by obtaining self-report about the onset of their menstrual cycle. In the event that the time of menstruation differed from the estimated start date, the session was rescheduled as appropriate (n= 2). Finally, individuals who reported experiencing an acute pain episode on the day of testing (e.g., migraine headache, general aches, cramps etc.), were rescheduled after the episode subsided (n= 1).

Of the eligible participants screened into the study, two did not show for the laboratory session (e.g., passive refusal). There were no students who declined from participating after entry into the study.

Materials

*Measures and Demographic information*

*Pain Catastrophizing Scale (PCS).* This instrument consists of 13 items that measure three dimensions of pain-related catastrophizing (e.g., rumination, magnification, and helplessness). Each dimension encompasses a distinct aspect of catastrophizing. Rumination is characterized by worry and persistent pain-related thoughts. Magnification entails focusing on pain unpleasantness and expectancies for negative pain-related outcomes. Helplessness may be defined as perceived inability to control or decrease pain. The PCS is characterized by acceptable test-retest reliability (r=.75) and internal consistency for the instrument (coefficient α for scale=.87) (Sullivan, Bishop, & Pivik, 1995). The internal consistency for the present sample was adequate for the rumination (overall α=.84; African Americans, α=.84; NH Whites α=.82), and helplessness scales (overall α = .85; African Americans, α=.84; NH Whites
α=.86) for both African Americans and NH Whites. Consistent with previous research, the magnification scale produced borderline results overall α = .57 (Sullivan et al., 1995). However, the scale was substantially more consistent for African Americans (α=.67) than NH Whites (α=.29). For this reason, the magnification subscale was not interpreted independently from the other PCS scales.

*General Health Questionnaire-12 (GHQ-12).* This instrument contains twelve items designed to assess psychological distress (Goldberg, 1978). The questions address domains related to concentration, negative affect, sleep disturbance, and daily activities. It is a popular and widely used screening instrument for common symptoms of anxiety and depression (Goldberg, Gater, & Sartorius et al., 1997). The GHQ-12 has an excellent internal consistency coefficient (α=.89), and the total GHQ 12 scale demonstrated strong construct validity in previous research (Shevlin & Adamson, 2005). The internal consistency for the present sample was good (α=.84).

*Demographic Questionnaire.* This questionnaire assesses information about the age, ethnic group, and education level of each participant.

*Intervention Materials*

*Sensory Focus List.* This list consisted of 15 words from the sensory subscale of the McGill Pain Questionnaire (MPQ) (Melzack, 1975), as well as a prompt to rate the intensity and unpleasantness of the noxious stimulation. The list of 15 sensory words was identical to the list used by Michael & Burns (2004). Following the baseline cold pressor procedure, participants assigned to the sensory focus group heard a description of different sensations associated with pain, such as tingling or numbness. The participants then provided three of their own sensory words to add to the list. The final sensory focus
list contained eighteen sensory words as well as the prompts for rating the intensity and unpleasantness of the stimulation. The sensory focus list was designed to help participants concentrate on the sensations experienced during the second cold pressor procedure.

**Distraction List.** This list contained fifteen words devoid of sensory or affective content (e.g., desk, chair) used in Michael & Burns’ protocol (2004), as well as prompts for rating pain intensity and unpleasantness. The words comprising the distraction list were common words unrelated to pain. The participants were also asked three questions requesting them to state their favorite dessert, favorite vacation spot, and favorite color. The three answers provided by the participants were then added to the distraction list. Following the list formation, participants were given the distraction list and instructed to read the list aloud during the next procedure. Thus, the final distraction list contained a total of eighteen common words as well as the prompts for rating the intensity and unpleasantness of the stimulation.

**Manipulation Check Items.** These items assessed the degree to which participants focused on the sensations in their hand and arm and the degree to which they distracted themselves during the second cold pressor procedure. The items were from the protocol of Michael (1998). Participants rated their responses on a scale of 0-10, with zero representing not at all, and 10 meaning that they very much engaged in the cognitive manipulation. Scores on the ten point scales for the sensory focus and distraction groups were used as a manipulation check to assess the degree to which they attended to their task instructions.
Pain Tasks

Cold Pressor Task. The cold pressor procedure was similar to the procedure described by Turk, Meichenbaum, & Genest (1983). The cold pressor apparatus consisted of a steel basin and a submerged water pump which allowed for the hand and part of the arm to be submersed in water. The submerged pump circulated water throughout the basin and also cooled the water to the correct temperature. The temperature of the water was regulated by a computer control NESLAB RTE 10.0 refrigerated bath circulator. The water temperature was maintained between 0-2 degrees Celsius. All participants were instructed to keep their hand in the water for 3 minutes, but to inform the researcher if they were no longer able to tolerate the procedure. Each participant submersed their non-dominant hand in the water. Blood pressure was monitored throughout the procedure to ensure that participants did not experience any unusually high elevations. The procedure was terminated after participants verbally indicated that the pain became intolerable, or after an uninformed time limit of 5 minutes. Pain threshold and tolerance times were recorded with a stopwatch during the procedure. Individuals were asked to provide their final pain intensity and unpleasantness ratings at the end of the procedure.

Pain threshold. This measure was operationally defined as the time at which an individual first noticed pain as a result of noxious cold stimulation. The participants were informed that they may feel a variety of sensations (e.g., pressure), but that they were to indicate when they first felt faint pain by saying the word “Now”. After the participant verbally indicated that this point had occurred, the time in minutes and seconds was recorded using a stopwatch.
Pain tolerance. This measure was defined as the time at which an individual requested cessation of the noxious stimulus. The participants indicated when they were no longer able to tolerate pain by saying the word “Stop”. This prompted the researcher to end the procedure, and the time in minutes and seconds was recorded via stopwatch.

Intensity and Unpleasantness. The participants rated the intensity and unpleasantness of pain at the end of each cold pressor procedure. In order to illustrate the difference between intensity and unpleasantness, participants were given the following analogy (Price, 1983):

“The distinction between these two aspects of pain might be made clearer if you think of listening to music on the radio. As the volume of the music increases, I can ask you how loud it sounds or how unpleasant it is to you. The intensity of the stimulation is like loudness. The pleasantness or unpleasantness of the music depends on how much you like or dislike the music. The unpleasantness of pain depends on how much you dislike the stimulation.”

The participants then viewed a 0-100 point box scale with several descriptors anchored to the numbers on the scale. For example, the words “weak”, “mild”, “strong”, and “very intense”, appeared next to the numbers on the pain intensity scale to help participants select a rating. Similarly, the pain unpleasantness scale consisted of descriptors such as “neutral”, “annoying”, “distressing”, and “intolerable” to assist participants with selecting a rating. Verbal descriptor scales have successfully differentiated between the sensory (intensity) and affective (unpleasantness) components of pain (Duncan, Bushnell, & Lavigne, 1989). Participants were instructed to verbally indicate their numerical ratings for intensity and unpleasantness at the end of each procedure.
Timeline of procedures

I. Screening (15 min)
II. Obtain/Review Informed Consent (10 min)
III. Blood pressure measurement (5 min)
IV. Instructions for Cold Pressor Task I (CPT1) (5 min).
V. Baseline: CPT1 (5 min)
VI. Wait period (20 min): Verbal administration of the PCS and questionnaire packet, Sensory Focus and Distraction list formation.
VII. Sensory Focus & Distraction instructions (5 min)
VIII. Cold Pressor Task II (CPT2) (5 min)
IX. Post-assessment questionnaires (PCS, Manipulation check, efficacy) (10 min)

Entire time for study: ~1 hour 30 minutes

Procedure

Upon completion of the informed consent form, participants were randomly assigned (e.g., the groups were stratified and randomly assigned prior to the study by drawing slips of paper) to the sensory focus or distraction group. Next, participants’ systolic and diastolic blood pressures were measured with an automatic wrist cuff. Individuals with high blood pressure readings (above 140/90) were monitored for a period of 5 minutes, and then the reading was repeated (n= 8). Those persons who continued to display high blood pressure readings after this period were excluded from the study and advised to visit their physician for consultation (n = 2). Eligible participants then listened to a description of the cold pressor procedure, and received
instructions for how to signal when they first felt pain (threshold), and when they felt they could no longer withstand pain (tolerance). Participants then underwent CPT1.

*Interventions*

*Sensory Focus Group.* Immediately following CPT1, those assigned to the sensory focus group sat for a twenty minute period, during which they completed the PCS, GHQ-12, and demographic questionnaires. Next, the participants listened to a recorded description of different sensations associated with pain, such as tingling or numbness. They were then asked to provide three sensations they experienced during CPT1. In the event that participants provided affective words, they were instructed to choose words that describe the physical sensations experienced, rather than the feelings experienced during the task. The three words generated by the participants were added to the sensory focus list. Participants were then instructed to “Focus on the sensations you will experience in your hand during the cold pressor procedure as you read this list of words aloud. The list will help you concentrate on the sensations.” The participants then read the list aloud as they underwent CPT2. The purpose of this cognitive intervention was to mitigate catastrophizing during the cold pressor procedure by de-emphasizing attention directed to these negative thoughts about pain. Pain threshold and tolerance times were recorded during each CPT. In addition, final intensity and unpleasantness ratings were recorded at the cessation of the trial. Following the CPT2, the PCS was re-administered. Finally, participants in the sensory focus group were asked to rate the extent to which they focused on the sensations produced in their hand and the extent to which they distracted themselves during the cold pressor stimulation.
**Distraction Group.** Following CPT1, participants assigned to the distraction group also sat for a twenty minute period, as they completed the PCS, GHQ-12, and demographic questionnaires. They were then informed that they would be required to read a list aloud while undergoing CPT2. The purpose of the list was to engage participants in a task so that they would not concentrate on pain, and also to control for the distracting effects of reading aloud in the sensory focus group. In order to make the distraction intervention more comparable to the sensory focus intervention, participants provided words for the distraction list. Each participant answered the following questions: 1. My favorite dessert is: ______; My favorite vacation spot is: ______; and My favorite color is: ______. The three words were added to the distraction list. The final distraction list consisted of 18 words that were related to pain. Individuals in the distraction group were then instructed to “Read the following list of words aloud during the cold pressor stimulation. Concentrate on reading the words.” Each participant read the distraction list aloud during CPT2 until they reached their pain tolerance. Then, they provided their final intensity and unpleasantness ratings. Following this, the PCS was re-administered and participants in the distraction group rated the degree that they focused on the sensations in their hand, and the extent that they focused on the reading task.

Finally, participants in both intervention groups were asked two questions assessing the extent to which they believed their assigned intervention was effective in reducing pain intensity and unpleasantness.
Data Analysis

Preliminary analyses assessing for group differences in the demographic variables were performed using univariate Analyses of Variance (ANOVA). Pearson correlation coefficients were also conducted to examine the relationship between pain-related measures. Aim 1 of the proposed study was tested using a MANOVA with Ethnic group (African American, NH white) serving as the between-subjects factor. Scores on the two PCS subscales served as the dependent variables. PCS total scores were analyzed in a separate univariate ANOVA because of multicollinearity concerns.

Aim 2 consisted of a similar one way MANOVA design with pain tolerance and pain unpleasantness serving as the dependent variables. Aim 2 also included a series of regression equations to test if catastrophizing mediated the relationship between Ethnic group and pain tolerance and between Ethnic group and pain unpleasantness. This was evaluated using a series of regression equations according to the criteria of Baron & Kenny (1986). According to the criteria, mediation is achieved if: 1) a. the predictor variable and the proposed mediator are significantly related (e.g., Catastrophizing = Ethnic group + Error$_1$) and b. the predictor variable is significantly associated with the outcome measure (e.g., Tolerance = Ethnic group + Error$_2$), 2) the proposed mediator and outcome measure are significantly related (e.g., Tolerance = Catastrophizing + Error$_3$), and 3) the full model is significant, (adjusted coefficients for the predictor and mediating variables predict the outcome measure (e.g., Tolerance = Ethnic group + Catastrophizing + Error$_4$) and the full model remains significant after statistically controlling for the effects of the proposed mediator. In the event that the magnitude of the association between the predictor variable and the outcome variable is reduced, there is evidence for
partial mediation. If the test becomes non-significant, the variable fully mediates the relationship between ethnic group and pain tolerance. Supplemental analyses examined differences in pain threshold and pain intensity ratings.

Aim 3 featured a 2 x 2 repeated measures ANCOVA, with pain tolerance as the dependent variable, and ethnic group (African American, NH White) and intervention group (Sensory focus, Distraction) as the between subjects factors. Time, represented by CPT1 and CPT2, was the within subjects factor, and sex served as the covariate. To control for Type I inflation that may occur with multiple comparisons, Bonferroni adjustments were performed to define the alpha level: $\alpha = 1 - \alpha_1 (1 - \alpha_2) \ldots (1 - \alpha_n)$ (Tabachnick & Fiddell, 2001).
RESULTS

One-way Analyses of Variance (ANOVA) were used to compare African American and NH White participants on demographic variables. There were no significant differences in age F(1, 88) = .521, p = .47, (M = 20.14, SD = 1.77), or GHQ-12 scores F(1,89) = 3.81, p = .05, (M = 9.11, SD = 4.73). There was also a significant group difference in systolic F(1,89) = 7.57, p = .007 (M = 120.86, SD = 13.05), but not diastolic blood pressure F(1,89) = 1.66, p = .06, (M = 76.00, SD = 8.50). African American participants had lower systolic blood pressures compared to White participants (M = 117.42 vs. M =124.70). In addition, females exhibited lower systolic blood pressures compared to males F(1,89) = 19.19, p = .000 (M = 115.80 vs. M =126.76).

Although systolic blood pressure was not significantly correlated with the catastrophizing or VAS ratings (r’s = .004 to -.13), it was included as a covariate because it was significantly related to pain tolerance (r = .35), such that the higher the systolic blood pressure, the longer the tolerance times. The proportion of males (46.2%) and females (53.8%) did not differ between African Americans and NH Whites (χ² = .004, p = .90).

A multivariate ANOVA (MANOVA) was conducted to compare the PCS scores of participants in the sensory focus and distraction groups. Tests of the MANOVA assumptions revealed that both the PCS subscales and the total score met the criteria for linearity, and there were no univariate or multivariate outliers (an indication of normality).
The homogeneity of variance assumption was evaluated with the Levine test, and this assumption was met for each variable (rumination $p = .34$; helplessness $p = .21$). In addition, the value for Box’s M ($p = .84$) indicated that the assumption of the homogeneity of variance-covariance matrices was met. The results of the analysis showed that there were no significant differences in the PCS scores of individuals in either intervention group $F(2, 87) = .62, p = .54$.

Aim 1 “Assess differences between African Americans and NH Whites on the PCS.”

_Hypothesis 1_

African Americans will produce higher catastrophizing scores on the PCS than NH Whites. The initial aim was tested using a one way MANCOVA, with ethnic group serving as the between subjects factor and the PCS subscales serving as the dependent variables. Systolic blood pressure served as the covariate. Given the high correlations between the PCS total score and each of the subscales, this variable was removed from the MANCOVA analysis to prevent multicollinearity. A total of 91 participants was included in the sample. Using Wilks’ criterion, the omnibus test revealed that ethnic group was significantly related to the combination of catastrophizing variables $F(2, 86) = 5.62, p = .005$. Systolic blood pressure was not significantly related to the catastrophizing variables $F(2, 86) = 1.50, p = .23$. To further characterize the nature of the ethnic group main effect, the univariate tests were examined. Based on the Bonferroni procedure, alpha for each dependent variable was set at .03. Examination of the univariate tests revealed there was a significant difference between African Americans and NH Whites on the rumination scale $F(1, 87) = 7.07, p = .009$. NH Whites displayed higher mean rumination scores than African Americans. There were no
differences between the groups on the helplessness scale $F(1, 87) = .35, p = .56$. A univariate test using the total PCS scores as the dependent variable revealed that there were no differences between the groups on this measure $F(1,87) = 1.31, p = .26$.

Table 1 displays the Pearson correlation coefficients among the PCS total score and measures of pain sensitivity. Table 2 displays the average pain responses of African Americans and NH Whites.

Table 1

\textit{Descriptive Statistics and Correlations among Pain-related Measures}

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<th>M (SD)</th>
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<tbody>
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<td>Cold Pressor 1 (CPT1)</td>
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<tr>
<td>1 Threshold</td>
<td>19.09 (19.38)</td>
<td>1.00</td>
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<tr>
<td>2 Tolerance</td>
<td>99.98 (101.31)</td>
<td>.37+</td>
<td>1.00</td>
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<tr>
<td>3 Intensity</td>
<td>78.34 (16.19)</td>
<td>-.02</td>
<td>.07</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Unpleasantness</td>
<td>74.40 (20.12)</td>
<td>-.06</td>
<td>.03</td>
<td>.46+</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 PCS total</td>
<td>22.67 (9.87)</td>
<td>-.19</td>
<td>-.25+</td>
<td>.22*</td>
<td>.36+</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cold Pressor 2 (CPT2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Threshold</td>
<td>25.23 (26.16)</td>
<td>.80+</td>
<td>.46+</td>
<td>-.01</td>
<td>-.03</td>
<td>-.24*</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Tolerance</td>
<td>108.90 (104.45)</td>
<td>-.38+</td>
<td>.89+</td>
<td>-.02</td>
<td>-.06</td>
<td>-.28*</td>
<td>.54+</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Intensity</td>
<td>78.56 (19.25)</td>
<td>-.01</td>
<td>-.11</td>
<td>.51+</td>
<td>.54+</td>
<td>.29+</td>
<td>-.11</td>
<td>-.16*</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>9 Unpleasantness</td>
<td>77.59 (21.22)</td>
<td>-.04</td>
<td>-.18</td>
<td>.41+</td>
<td>.70+</td>
<td>.24*</td>
<td>-.12</td>
<td>-.24*</td>
<td>-.68+</td>
<td>1.00</td>
</tr>
<tr>
<td>10 PCS total</td>
<td>19.38 (10.75)</td>
<td>-.22*</td>
<td>-.39*</td>
<td>.07</td>
<td>.23*</td>
<td>.67+</td>
<td>-.29+</td>
<td>-.45+</td>
<td>.39+</td>
<td>.30+</td>
</tr>
</tbody>
</table>

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

Table 2

\textit{Comparison of African American and NH White Participants at Baseline}

<table>
<thead>
<tr>
<th></th>
<th>African American</th>
<th></th>
<th>White</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td>M (SD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Threshold</td>
<td>17.66 (22.82)</td>
<td>20.65 (14.84)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tolerance</td>
<td>71.73 (88.07)</td>
<td>127.50 (104.66)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VAS Intensity</td>
<td>74.28 (17.06)</td>
<td>81.20 (10.26)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VAS Unpleasantness</td>
<td>71.08 (21.19)</td>
<td>78.19 (18.33)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain Catastrophizing Scale</td>
<td>21.96 (10.34)</td>
<td>22.34 (9.29)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In order to assess potential sex differences that may have served as confounds, an exploratory MANCOVA was performed using sex and ethnic group as the between subjects factors, and systolic blood pressure as the covariate. Similar to the previous analysis, tests of the MANCOVA assumptions were satisfactory. With the use of Wilks’ criterion, the omnibus test showed there was no significant main effect of sex on the catastrophizing variables $F(2,84) = .57, p = .57$. Thus, there were no significant differences in rumination and helplessness PCS scores among males and females. Although there was no sex by ethnic group interaction $F(2,84) = 1.05, p = .36$, ethnic group remained significantly associated with the catastrophizing variables $F(2,84) = 5.14, p = .008$. Similarly, the univariate tests confirmed that there was an ethnic group difference in rumination scores $F(1,85) = 5.67, p = .02$, but not in the helplessness subscale $F(1, 85) = .08, p = .77$. The univariate test using PCS total score as the dependent variable demonstrated that there were no significant effects for ethnic group $F(1, 85) = .70, p = .41$, sex $F(1, 85) = .87, p = .35$, or the ethnic group x sex interaction $F(1, 85) = 2.50, p = .12$. Table 3 shows the descriptive statistics by ethnic group and sex.

### Table 3

*Descriptive Statistics in Pain Sensitivity by Ethnic Group and Sex*

<table>
<thead>
<tr>
<th></th>
<th>Threshold M (SD)</th>
<th>Tolerance M (SD)</th>
<th>Intensity M (SD)</th>
<th>Unpleasantness M (SD)</th>
<th>PCS M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>African American</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>12.25 (5.71)</td>
<td>54.00 (75.59)</td>
<td>70.20 (19.28)</td>
<td>66.23 (20.54)</td>
<td>21.58 (9.13)</td>
</tr>
<tr>
<td><strong>NH White</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>19.09 (14.55)</td>
<td>108.09 (104.63)</td>
<td>81.70 (9.88)</td>
<td>81.30 (15.46)</td>
<td>26.20 (9.42)</td>
</tr>
<tr>
<td><strong>African American</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>17.00 (8.91)</td>
<td>92.68 (98.52)</td>
<td>78.91 (13.06)</td>
<td>76.82 (20.96)</td>
<td>22.41 (11.82)</td>
</tr>
<tr>
<td><strong>NH White</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>21.39 (14.31)</td>
<td>151.00 (102.49)</td>
<td>80.56 (10.97)</td>
<td>74.42 (21.11)</td>
<td>20.05 (8.18)</td>
</tr>
</tbody>
</table>
Although there were no significant ethnic group x sex interactions for the PCS subscales and the PCS total scores, examination of the means of African American females, NH White females, African American males, and NH White males revealed unique trends in PCS scores. This difference was likely not detected by the omnibus tests because of a lack of statistical power. Supplementary analyses revealed that the observation of higher rumination scores in NH Whites was facilitated by NH White females compared to African American females $F(1,46) = 8.28, p = .006$. In males, African Americans tended to report higher helplessness $F(1,40) = 1.15$ and PCS total scores than NH White males, but these differences were not significant $F’s = 1.15$ to $2.79, p’s > .30$. With regard to sex, NH White females evidenced higher helplessness $F(1,48) = 5.61, p = .02$) than NH White males, but there were no discernable differences between African American males and females $F’s = .002$ to $.36, p’s > .78$. Figures 1 and 2 show the average PCS scale scores according to ethnic group and sex.

Figure 1. PCS Rumination Scale Scores by Ethnic Group and Sex.
Figure 2. PCS Helplessness Scale Scores by Ethnic Group and Sex.

Figure 3 displays total catastrophizing scores by group. In order to adjust for the effects of sex on pain tolerance, it was used as a covariate in subsequent analyses.

Figure 3. PCS Total Scores by Ethnic Group and Sex
Aim 2 “Evaluation of the pain sensitivity of African Americans and NH Whites.”

**Hypothesis 1**

NH Whites will exhibit higher pain tolerances and lower pain unpleasantness ratings compared to African Americans. The second aim was addressed using a MANCOVA for pain tolerance and unpleasantness ratings obtained from the baseline cold pressor procedure. In the analysis, ethnic group and intervention group served as the between subjects factors, and sex and systolic blood pressure served as covariates.

Examination of the MANCOVA assumptions showed that there were no violations of homogeneity of variance-covariance matrices (Box’s M, \( p = .32 \)) or homogeneity of variance for pain unpleasantness \( F(3,86) = .48, \ p = .70 \) and pain tolerance \( F(3,86) = 1.56, \ p = .20 \). Further, the distributions for unpleasantness and pain tolerance ratings met the criteria for multivariate normality according to residuals plots. However, a scatter plot of pain tolerance and unpleasantness indicated that the relationship between the variables was not linear. Further examination with P-P plots revealed that only pain tolerance was not linear. Although MANCOVA is generally considered robust to this violation, an additional multivariate analysis was conducted using unpleasantness and a log transformation of pain tolerance as the dependent variables. Since the results of the analysis did not differ, results from the non-transformed pain tolerance variable are reported.

The omnibus test yielded a significant main effect for ethnic group \( F(2,83) = 3.97, \ p = .02 \). There were no significant effects for sex \( F(2, 83) = .84, \ p = .43 \) and systolic blood pressure \( F(2, 83) = 2.20, \ p = .12 \). The main effect for the intervention group was not statistically significant \( F(2,83) = .49, \ p = .62 \), and there was no significant ethnic
group by intervention group interaction F(2,83) = .84, p = .44. More specifically, the univariate test confirmed the main effect of ethnic group on pain tolerance F(1, 84) = 4.75, p = .03, such that African Americans evidenced lower pain tolerances than NH Whites. There was no significant main effect of ethnic group on unpleasantness ratings F(1, 84) = 3.21, p = .08.

Hypothesis 2

There will be few ethnic group differences in pain threshold and pain intensity ratings. A similar analysis compared African Americans and NH White’s pain threshold and pain intensity ratings. Since the assumption for homogeneity of variance-covariance matrices was violated (Box’s M, p = .000), Pillai’s criterion was used to interpret the results. The omnibus test showed that there was a significant ethnic group difference F(2,82) = 4.12, p = .02. There were no significant effects for intervention group F(2,82) = .44, p = .65, or the ethnic group by intervention group interaction F(2,82) = .84, p = .44. Examination of the univariate tests showed that NH Whites reported higher pain intensities than African Americans F(1,83) = 8.29, p = .005. There were no significant differences between groups for pain threshold F(1,83) = .04, p = .85. In order to compare the effects of the current study to the previous literature, effect sizes were calculated from similar studies. Table 4 is a summary of effect sizes for measures of pain sensitivity across two similar studies. African Americans are used as the reference group in the first two studies. The F-statistic was used to calculate effect sizes from the third study.
Table 4.

*Effect sizes among African American and White participants in response to the cold pressor*

<table>
<thead>
<tr>
<th></th>
<th>McConley (N = 91)</th>
<th>Thorn et al. (N = 356)</th>
<th>Weisse et al.* (N = 290)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tolerance</td>
<td>(-.59)</td>
<td>(-.58)</td>
<td>(.81)</td>
</tr>
<tr>
<td>Intensity</td>
<td>(-.16)</td>
<td>(.04)</td>
<td>(.41)</td>
</tr>
<tr>
<td>Unpleasantness</td>
<td>(-.36)</td>
<td>(.20)</td>
<td>(.41)</td>
</tr>
<tr>
<td>PCS</td>
<td>(-.04)</td>
<td>(.54)</td>
<td>N/A</td>
</tr>
</tbody>
</table>

*Note. Effect size is Cohen’s d. *Calculated from F-statistic

**Hypothesis 3**

Catastrophizing will serve as a mediator for the ethnic group differences in pain tolerance and pain unpleasantness. A series of regression analyses were conducted to determine if the PCS total catastrophizing score mediated the relationship between ethnic group and pain response. Figures 4 and 5 display the proposed mediation model with standardized \( \beta \) coefficients.

![Diagram](image)

Figure 4. Regression Analyses for the Relationship between Ethnic Group, Catastrophizing, and Pain Tolerance.
To test the first criteria for mediation, catastrophizing was regressed on ethnic group to identify if the proposed mediator and the predictor variable were related. The previous univariate analysis showed that there was no statistically significant association between ethnic group and catastrophizing (see Aim 1, Hypothesis 1), and thus the criteria for mediation was not established. However, the remaining analyses were conducted to examine the links among catastrophizing, ethnic group, and pain tolerance. Next, ethnic group was used to predict pain tolerance. The regression revealed that ethnic group was significantly associated with pain tolerance $F(1,89) = 8.56, p = .004$, and accounted for 7.8% of the variance in tolerance. NH White participants evidenced higher pain tolerances than African American participants $t(89) = -2.93, p = .004$. Catastrophizing scores were negatively related to pain tolerance $t(88) = -2.37, p = .02$. In the final equation, both ethnic group and catastrophizing scores were used to predict pain tolerance. The model was statistically significant, $F(2,87) = 8.34, p = .000$, and the variables accounted for 16.1% of the variance in pain tolerance. Being African American was inversely associated with pain tolerance $t(88) = -3.23, p = .002$. Overall, these
results show that total catastrophizing scores did not meet criteria as a mediator of the relationship between ethnic group and pain tolerance. The regression analyses were also conducted using the PCS rumination scale scores as a potential mediator. While rumination was significantly associated with ethnicity $F(1,89) = 5.43, p = .02$, it was not correlated with pain tolerance $F(1,89) = 2.20, p = .14$ and therefore did not meet criteria for mediation.

Similarly, regression analyses were conducted to evaluate if catastrophizing was significantly associated with pain unpleasantness. Since there were no ethnic group differences in pain unpleasantness or in PCS total scores, only the link between catastrophizing and unpleasantness scores was tested. Results demonstrated that catastrophizing was significantly associated with pain unpleasantness $F(1,88) = 12.67, p = .001$ and accounted for 11.7% of the variance in unpleasantness ratings. Higher PCS total scores were associated with higher pain unpleasantness ratings $t(88) = 3.56, p = .001$.

Aim 3 “Effects of ethnic group and intervention group on cold pressor pain response”

Hypothesis 1

There will be an interaction between ethnic group and intervention group. The extent to which each group engaged in their cognitive tasks was assessed by performing one way ANOVA on each of the manipulation check questions. There was no significant difference in the strategies of individuals in the sensory focus and distraction groups on the distraction check item $F(1,89) = 1.11, p = .30$, or on the sensory focus check item $F(1,89) = 2.32, p = .13$. Thus, participants rated that the manipulation was not successful in engaging them in their assigned intervention.
In order to test the hypothesis that the pain tolerance of African American individuals would vary according to intervention group, a 2 x 2 (ethnic group x intervention group) repeated measures ANCOVA was performed. Time, represented by baseline cold pressor (CPT1) and the final cold pressor (CPT2), served as the within subjects factor. Ethnic group (African American, NH White) and intervention group (sensory focus, distraction) served as between subjects factors, and sex and systolic blood pressure were entered as covariates. There were five univariate outliers in the data. None of the univariate outliers were considered extreme (more than 3 SD above or below the mean), and since their removal did not change the results, they were included in the analyses. The other ANOVA assumptions (including the sphericity assumption) were satisfactory. The overall test showed that there were no appreciable differences in tolerance time from CPT1 to CPT2 F(1,84) = .009, p = .92. The analysis also revealed that there were no significant tolerance time by ethnic group F(1,84) = .57, p = .45 or tolerance time by intervention group interactions F(1,84) = .03, p = .86. There was no significant interaction between tolerance time and each of the covariates. Further, the interaction between tolerance time, ethnic group, and intervention group was also non-significant F(1,84) = 1.94, p = .17. The between subjects tests revealed a trend for a main effect of tolerance time for ethnic group F(1,84) = 4.40, p = .04, such that NH White individuals tended to tolerate the CPT for longer time periods than African Americans. There was no main effect for sex F(1,84) = 1.74, p = .19. Figure 6 illustrates the pain tolerances of African Americans and NH Whites from CPT1 to CPT2.
Hypothesis 2

African Americans in the sensory focus group will display higher pain tolerances than African Americans in the distraction group. There will be few differences in the pain tolerances of NH Whites in each intervention group. In order to examine potential within-group differences in pain tolerance from CPT1 to CPT2, paired samples t-tests were conducted for African Americans and NH Whites in each intervention group (e.g., African Americans in the sensory focus group, African Americans in the distraction group, NH Whites in the sensory focus group, and NH Whites in the distraction group). Figure 7 shows the average pain tolerance of African Americans in both intervention groups.
The results showed that the pain tolerance of African Americans in the sensory focus group did not change significantly from CPT1 to CPT2 $t(23) = -.32, p = .75$. However, the pain tolerances of African Americans in the distraction group improved from CPT1 to CPT2 $t(23) = -2.37, p = .03$. African Americans in the distraction group displayed a 21 second increase in pain tolerance at CPT2 compared to their pain tolerance at CPT1.

There was no significant difference between the pain tolerances of African Americans in the sensory focus and distraction groups at CPT2 $t(46) = -.60, p = .55$. A different pattern was observed for NH Whites. Figure 8 illustrates the pain tolerance of NH Whites in each intervention group.
There were small but non-significant increases in the tolerance of Whites in the sensory focus group from CPT1 to CPT2 (increase of 10 seconds, $t(22) = -1.18, p = .25$). There were no significant differences between CPT1 and CPT2 for Whites in the distraction group $t(19) = .28, p = .78$, and no differences in the pain tolerances of NH Whites the sensory focus and distraction groups at CPT2 $t(40) = -.62, p = .54$.

Additional analyses revealed that there were no ethnic group by intervention group differences in catastrophizing following CPT2 $F(3,82) = .70, p = .55$. However, the second catastrophizing assessment was inversely associated with pain tolerance at CPT2 $t(89) = -4.72, p = .00$. There were no ethnic group differences in pain threshold or pain intensity $F(2, 77) = 2.08, p = .13$ after the second CPT.
DISCUSSION

The present study aimed to replicate and extend previous observations of group differences in pain sensitivity (e.g., heightened pain sensitivity in African Americans relative to NH Whites) as well as pain-related catastrophizing (e.g., higher levels of catastrophizing among African Americans compared to NH Whites). An additional objective of the study was to examine the nature of the relationship between catastrophizing, ethnic group membership, and the affective components of pain. The previous aims served as a foundation for the principal aim of the study, which was to evaluate the efficacy of sensory focus and distraction interventions on the pain tolerances of healthy African American and NH White individuals. However, before the effects of the intervention could be assessed, it is first necessary to determine if the pain responses of the present sample were consistent with previous research.

In order to examine if the present sample exhibited the ethnic group differences in pain previously reported in the literature, comparisons were made between the pain responses of African Americans and NH Whites to the CPT. Results showed some of the anticipated ethnic group differences in pain sensitivity. African Americans displayed lower pain tolerances than NH Whites in response to the CPT. The two groups did not differ in their pain thresholds (i.e., onset of pain in response to noxious stimulation) or VAS ratings of pain unpleasantness. However, NH Whites reported significantly higher pain intensities than African Americans.
Although the latter finding is unusual, the observation of lower pain tolerance among African Americans is generally consistent with the literature (Chapman & Jones, 1944; Edwards & Fillingim, 1999; Edwards et al., 2001a, Edwards et al., 2001b, Woodrow et al., 1972). Previous studies have shown that behavioral measures of the affective component of pain (e.g., tolerance) dissociate racial and ethnic groups more consistently than measures of the sensory component of pain (e.g., threshold)(Campbell et al., 2005; Rollman & Harris, 1987; Rhahim-Williams et al., 2007). Although it has also been documented that ratings of unpleasantness (affective) have also differentiated African Americans and Whites to a greater extent than intensity ratings (sensory), these findings are somewhat less consistent in the literature (Campbell et al., 2004). A potential explanation for the higher intensity ratings among NH Whites may be that higher pain tolerance during the CPT was associated with greater pain severity. This finding may emphasize the need to adjust for pain tolerance when examining participant ratings of intensity or unpleasantness. Overall, the current findings contribute to the accumulation of studies suggesting heightened affective pain sensitivity among African Americans.

While there is a considerable amount of research documenting ethnic group differences in pain, few studies have evaluated potential mechanisms for the disparities between African Americans and NH Whites. The extent to which individuals magnify, ruminate, or believe they are helpless in response to pain (i.e., catastrophizing) may contribute to the group differences in pain tolerance. African Americans typically endorse higher levels of catastrophic thoughts than NH Whites (Edwards et al., 2005; Hastie et al., 2004; Ruehlman et al., 2005). This is a salient observation because higher levels of catastrophizing are related to increased pain severity and pain behaviors, and
lower pain tolerance in a number of populations (France et al., 2004; Keefe et al., 2004; Spanos et al., 1979; Sullivan et al., 1997; Sullivan et al., 2001; Turner et al., 2004). Since catastrophizing is associated with heightened pain sensitivity, there is a suggestion in the literature that this factor could mediate the ethnic group differences in pain sensitivity (Hastie et al., 2004). However, this hypothesis has not been thoroughly evaluated among African Americans and NH Whites.

The present study contributes to the literature by evaluating catastrophizing as a potential mediator of ethnic group differences in affective measures of pain (e.g., pain tolerance, pain unpleasantness). The results showed that catastrophizing was related to both pain tolerance and pain unpleasantness ratings. Although catastrophizing was positively associated with pain unpleasantness ratings, the overall analysis failed to meet the criteria for mediation because there were no ethnic group differences in pain unpleasantness. With regard to tolerance, catastrophizing was negatively associated with the amount of time participants held their hand in the water. Similarly, being African American was inversely related to pain tolerance. However, the criteria for mediation were not met because catastrophizing was not significantly associated with ethnic group. Contrary to expectation, there were few ethnic group differences in pain-related catastrophizing at baseline. Although it is well-documented that African Americans generally report higher levels of catastrophizing than NH Whites (Edwards & Fillingim, 1999; Hastie et al., 2004; Ruehlman et al., 1995; Thorn et al., 2007), this was not observed in the current study. African Americans and NH Whites tended to report similar levels of catastrophizing on all but one scale of the PCS. Interestingly, NH Whites reported ruminating about pain to a greater extent than African Americans. This
latter finding prompted additional analyses to investigate the potential influence of participant sex in producing the results.

Several studies have shown that females report higher levels of catastrophizing than males (Edwards, Haythornthwaite, Sullivan, & Fillingim, 2004; Jackson, Iezzi, Chen, Ebnet, & Eglitis, 2005; Thorn et al., 2004). Although there was an even distribution of males and females in each ethnic group, an ethnic group by sex interaction could have contributed to the present findings. The analyses showed that the ethnic group difference in rumination scores was produced primarily by NH White females in comparison to African American females. NH White females also tended to endorse higher helplessness and PCS total scores than African American females, but these differences failed to reach significance. However, there was a tendency for the opposite pattern to occur in males. African American males tended to report higher levels of catastrophizing (i.e., helplessness, PCS total scores) than NH White males, which is consistent with previous research of racial and ethnic group differences. NH White males reported only slightly higher rumination levels than African American males. This pattern of results suggests that there was a trend for levels of catastrophizing to vary across ethnicity and sex. Examinations of the effect of sex within each ethnic group showed that NH White females reported high levels of helplessness and PCS total scores relative to NH White males. In contrast, there were no differences in reports of catastrophizing between African American females and African American males. The relatively small sample size of individuals in each subgroup most likely limited the ability to detect a significant ethnic group by sex interaction. Nevertheless, the factors
which may have contributed to the unanticipated pattern of results deserve further discussion.

The observation that NH Whites displayed higher pain tolerances and rated the CPT as more intense than African Americans may have contributed to their elevated rumination scores. It may be that the longer an individual tolerates a noxious stimulus, the more prone they become to catastrophic thinking. Although catastrophizing has been shown to have stable trait-like characteristics, there may be situations in which a transient state of catastrophizing is induced even in individuals who are likely to report low levels of catastrophic thinking (Spanos et al., 1981; Sullivan et al., 2001). During prolonged exposure, the perceived threat of the noxious stimulus may increase, which in turn could lead to an enhanced magnification of the pain experience, sense of helplessness, and rumination. However, this hypothesis is still tentative, and previous studies show that NH Whites exhibit low catastrophizing scores (and ratings of the aversiveness of pain) compared to African Americans despite enduring noxious stimuli for longer time periods (Edwards et al., 2001a). Further, it may be that the measure used to assess catastrophizing influenced the present results. While the PCS has been demonstrated as a sound instrument for the measurement of catastrophizing, more evidence is needed to determine if it is adept at measuring both state and trait levels of this construct. Perhaps a more comprehensive instrument (e.g., Cognitive Coping Strategies Inventory, CCSI) assessing additional dimensions of catastrophizing could better differentiate the African Americans and NH Whites in the present study.

Another set of factors which may have influenced the current pattern of catastrophizing scores are the ethnicity and sex of the experimenter. The data from the
present study was collected by an African American female. Interestingly, the present study revealed some of the previously reported differences in catastrophizing among groups that were not concordant with the experimenter’s ethnicity (i.e., NH White females catastrophized more than NH White males) and sex (African American males tended to catastrophize more than NH White males). In comparison, African American females reported lower levels of catastrophizing than anticipated based on previous research in laboratory (Campbell et al., 2005, Edwards et al., 1999) and clinical settings (Edwards et al., 2005, Ruehlman et al., 2005). This observation raises the question of whether African American females in the sample approached the task with less apprehension and with a less negative mental orientation because they were in the presence of a concordant experimenter. If so, experimenter characteristics may be protective for concordant individuals. Unfortunately, the present study does not allow for concordance analyses because all participants were tested by a single experimenter. However, review of the existing literature revealed that there are some studies that have investigated this hypothesis.

Although there is some evidence that participant’s reports of pain vary according to the sex and/or ethnicity of the experimenter (Aslaksen, Myrbakk, Hoifodt, & Flaten, 2007; Gijbers & Nicholson, 2005; Weisse, Foster, & Fisher, 2005), only one study has examined the effects of experimenter characteristics on participant’s catastrophizing levels. Shelby et al. (2000), analyzed catastrophizing levels and pain appraisals among African American and NH White males and females during the CPT. Although African Americans evidenced significantly higher catastrophizing scores than NH White, there were no sizeable differences in the PCS total scores of participants tested by ethnic
concordant female experimenters. These data indicated that ethnic concordance had little influence on individuals’ total PCS scores. Similar studies are needed in order to identify what (if any) effects experimenter characteristics may have on participant levels of catastrophic thinking and behavior. Such investigations are warranted, given that catastrophizing is closely related to pain and may vary in different social, environmental, and interpersonal contexts (Boothby, Thorn, Overduin, & Ward, 2004; Buenaver, Edwards, & Haythornthwaite, 2007; Sullivan et al., 2001; Sullivan, Adams, & Sullivan, 2004). This knowledge could guide clinical practice in pain management, and potentially offer support for the physician-patient concordance hypothesis in health care settings, a concept which has not been widely explored (Bender, 2007).

While catastrophizing scores did not differentiate African Americans and NH Whites, preliminary analyses revealed a significant group difference in participants’ blood pressures. African Americans displayed lower systolic blood pressures prior to engaging in the CPT than Whites. There were no differences in the groups’ diastolic blood pressures. This was unanticipated, given that the sample consisted of healthy young college students, and that there is a higher prevalence of hypertension in African Americans overall (Kramer et al., 2004; Hajjar & Kotchen, 2003). Further, the correlation coefficient revealed that systolic blood pressure was positively associated with pain tolerance. It should be noted however, that the measurement of blood pressure in the present study is cursory, and does not adhere to the rigors of psychophysiological research. These studies typically involve having the participant sit quietly for a minimum of eight minutes and employ multiple measurements of blood pressure (Appel & Stason, 1993; Gordon, Sorlie, & Kannel, 1976). The blood pressure measures used during the
present research were for protection of human participants, rather than for physiological research. During the present study, blood pressure was measured after a description of informed consent, which took approximately 5 minutes. Since blood pressure changes as a function of stress, environmental, and social cues, it may be that the differences in systolic blood pressure in the present study reflect individuals’ willingness to interact with the experimenter (R. Wright, personal communication, May 1, 2008). This hypothesis, though interesting, would require more rigorous scrutiny before generalizations could be made. If these findings were replicable, it would lend further support for the assessment of physiological measures in addition to standard measures of pain in the ethnic difference literature. This research is necessary, because the ethnic group differences in pain are most likely the result of a combination of psychosocial and physiological factors.

Although knowledge of the etiology of ethnic group differences is salient in guiding treatment decisions, it is not always necessary to know the source of a problem before intervening. Given the robust ethnic group differences in adverse consequences associated with pain (e.g., increased severity, disability, depressive and anxious symptomology), the development and application of efficacious interventions is warranted. There are several interventions for pain management (e.g., cognitive behavioral therapy, medication, physical therapy) that are both efficacious (i.e., resulting in improved outcomes with homogenous samples in standardized conditions) and effective (i.e., resulting in improved outcomes with heterogenous samples naturalistic settings) (Glasgow, Lichtenstein, & Marcus, 2003). Brief cognitive interventions, such as sensory focus and distraction, are particularly advantageous because they have been
shown to improve pain in both laboratory (Dar & Leventhal, 1993) and clinical settings (Haythornthwaite et al., 2001, Baron, Logan, & Hoppe, 1993; Leventhal et al., 1989; Suls & Wan, 1989), and may have long-term effects on the pain responses of individuals (Tsao, Fanurik, & Zeltzer, 2003). It is hypothesized that sensory focus and distraction influence pain by impacting attentional focus (Melzack & Wall, 1996; Price, 2002). Studies of sensory focus have shown that attending to the neutral, sensory aspects of the pain experience rather than the unpleasant emotional aspects can increase pain tolerance (Leventhal et al., 1989; Suls & Wan, 1989). In contrast, the purpose of distraction is to focus attention away from the pain experience entirely. In both instances, the focus of attention could be used to mitigate pain sensitivity (Price, 2002; Wade & Hart, 2002). However, little is known about whether these interventions may have differential benefits for individuals of diverse backgrounds.

The present study assessed the effects of sensory focus and distraction on the pain tolerance of African Americans and NH White individuals. Similar to the initial pattern of results, African Americans displayed low pain tolerances relative to NH Whites during a second cold pressor procedure (CPT2). While there was a marginal increase in pain tolerance from the baseline CPT to CPT2, this increase was not significant. Further, pain tolerance did not vary by intervention group, suggesting that the interventions did not result in overall improvements in tolerance. Similarly, there were no differences in the unpleasantness ratings of African Americans and NH Whites from CPT1 to CPT2. These findings suggest that there were no meaningful differences in pain responses between African Americans and NH Whites in the sensory focus and distraction groups.
Since it is also important to investigate within-group differences in response to an intervention (Lang, 2004), the pain tolerances of participants assigned to the sensory focus and distraction groups were compared within NH Whites and African Americans. Surprisingly, these analyses revealed that African Americans in the distraction group evidenced significant increases in pain tolerance from baseline. The difference between baseline CPT1 tolerance and CPT2 tolerance was twenty one seconds. However, there were no significant differences in the pain tolerances of African Americans in the sensory focus condition. Conversely, there were no appreciable changes in the pain tolerances of NH Whites in the sensory focus or distraction conditions.

These data, while surprising, most likely reflect the unusual pattern of ethnic and sex group differences in catastrophizing found in the present study. The tendency for African Americans to endorse less catastrophic thoughts than NH Whites at baseline may explain why there were few within-group changes in the sensory focus group. In contrast, NH Whites appeared to improve in the sensory focus group, but this change was not significant. Previous studies of sensory focus and distraction suggest that sensory focus may be more beneficial for individuals who catastrophize than distraction because they attend to and monitor the negative affective components of pain (Hadjistavropolous et al., 2000; Heyneman et al., 1990; Spanos et al., 1981). Distraction was hypothesized to be more difficult for catastrophizers because it requires an individual to divert attention to pleasant or neutral stimuli (Goubert et al., 2004; Forys & Dahlquist, 2007). Thus, the data seem to fit the current pattern of results, because African Americans tended to catastrophize less than NH Whites. Another hypothesis for the improved pain tolerances of African Americans in the distraction group is related to ethnic group differences in
preferred strategies for managing pain. Although the current study focused on catastrophizing, there is evidence indicating that African Americans also report a greater reliance on praying/hoping and distraction for managing pain compared to NH Whites (Edwards et al., 2001a; Jordan, Lumley, & Leisen, 1998). The tendency for African Americans to endorse distraction as a coping strategy could have influenced the results because they may have more experience with this technique. This is salient because individual preferences and/or familiarity with an intervention have been shown to enhance the effects of this intervention relative to another (Piira, Hayes, Goodenough, & von Baeyer, 2006; Kwekkeboom, Kneip, & Pearson, 2003; Tsao et al., 2003). Thus, individuals who frequently employ distraction as a coping strategy may find it more beneficial than a novel intervention during pain or distress and vice versa (Forys & Dahlquist, 2007). African Americans in the distraction group, therefore, may have exhibited greater pain tolerances because of engagement in a preferred strategy. Given these observations, future studies evaluating the effects of cognitive interventions on pain should assess baseline differences in coping strategies. However, in order to evaluate whether the present findings are merely the result of methodological differences, a comparison of the sensory focus and distraction paradigms used in the present study to prior conceptualizations of sensory focus and distraction is necessary.

Sensory focus interventions are usually initiated by instructing participants to focus on sensations that will occur during the pain experience (e.g., throbbing, tingling) (Leventhal et al., 1979). The instructions are commonly read to participants prior to the task, but some studies have also delivered the intervention using prompts and audio-taped instructions throughout the course of the pain experience (Baron et al., 1993;
Haythornthwaite et al., 2001; Johnson, 1973; Quartana et al., 2007). The length of the intervention has varied from two (Baron et al., 1993) to twenty minutes (Haythornthwaite et al., 2001). Unlike the sensory focus intervention, the task instructions for distraction include a wide range of themes, such as listening to music (Haythornthwaite et al., 2001), responding to a tonal stimulus, (Goubert et al., 2004), reading a list, (Michael & Burns, 2004), rhythmic breathing (Leventhal et al., 1979), or remembering an image (Quartana et al., 2007).

One weakness of the previously mentioned studies is that the sensory focus and distraction tasks are difficult to compare because of fundamental differences in task instructions (Forys & Dahlquist, 2007). This is undesirable for assessing the efficacy of interventions because it lowers internal validity. For this reason, the current study employed both audio-taped instructions and a list reading task for the sensory focus and distraction groups. This approach has both strengths and weaknesses. The list format ensured that participants in both groups differed only in the type of instructions given and on the content of each list. An advantage of this approach was heightened internal validity because of similarities in the task and the amount of time the experimenter interacted with each participant. However, a disadvantage of this approach is the natural overlap between the two intervention groups (e.g., reading). This may account for the lack of differences in participant’s endorsement of their engagement in the sensory focus and distraction tasks (i.e., non-significant manipulation checks). Qualitative observations from the study revealed that several participants reported engaging in the task instructions, but also acknowledged employing other strategies. This evidence suggests that participants may have used a combination of coping strategies during the CPT. This
could also have contributed to the current results, because participants most likely reverted to a preferred coping strategy along with the assigned intervention. As a result, the manipulation was not as powerful as intended. It may be that additional training sessions are required in order to fully engage participants in the assigned intervention. While training to a criterion has been performed during clinical research of the effects of sensory focus and distraction on pain response (Haythornthwaite et al., 2001; Leventhal et al., 1979), it is seldom conducted within laboratory settings (Jaaniste, Hayes, & von Baeyer; Michael & Burns, 2004; Tsao, Fanurik, & Zeltzer, 2003). The current study followed the example of the laboratory methods for training individuals in sensory focus and distraction. Although the interventions were not discernable according to participant ratings, significant within-group differences among African Americans in the distraction group (but not the sensory focus group) and the trend among NH Whites in the sensory focus group (but not the distraction group) suggests that there was a distinction between the interventions.

There are several limitations to the current study. The first is that it lacks the ability to make causal inferences about the nature of ethnic group differences in the experience of pain. Further, due to the use of a convenience sample as the participant group, the results of the study are limited in terms of external validity. Thus, findings among healthy college students may not generalize to individuals in clinical settings. However, studies of both healthy individuals and chronic pain patients have shown that laboratory induced pain responses are related to reports of clinical pain (Clauw et al., 1999; Edwards, Sarlani, Wesselman, & Fillingim, 2005; Granot, Lowenstein, Yamitsky, Tamir, & Zimmer, 2003). Additional limitations of the present study are the unique
challenges associated with examining group differences in pain sensitivity. Individual variations in pain tolerance, as well as between and within group differences, also make it difficult to draw inferences about general populations. In particular, the wide range of individual pain tolerances produces large error variances typical of pain studies. Such inflated error terms reduce the power to detect differences in the absence of large effect sizes. Thus, the relatively small sample size in the current study most likely hindered the ability to detect significant effects. Despite these limitations, the current study provides some evidence of the differential effects of brief cognitive strategies for managing pain among diverse individuals.

The present study also has several strengths. The evaluation of sensory focus and distraction in the laboratory is consistent with early phase translational research, in which intervention components are tested with healthy populations in controlled settings (Tashiro & Mortensen, 2006). Further, several steps were taken in order to increase internal validity: participants were carefully screened for painful medical conditions, and were asked to refrain from analgesic use prior to the testing session to reduce the confounding effects of these medications on pain tolerance. Additionally, all female participants were scheduled during the follicular phase of their menstrual cycle in order to control for potential hormonal variations in pain sensitivity (Riley, Robinson, Wise, & Price, 1999). During the testing session, instructions were delivered to participants via audio-tapes and scripts. The use of standardized instructions for each intervention group served to reduce potential experimenter bias and error variance across groups. Thus, the observed ethnic differences between individuals in the sensory focus and distraction groups are more likely to be attributed to the effects of the interventions rather than
random error. Another strength of the present study is the measurement of catastrophizing following a painful experience (state), rather than one that is based on the memory of past pain experiences (trait). The PCS was administered following the CPT to obtain state measures of catastrophizing because research has demonstrated that these are more strongly associated with pain sensitivity than trait measures of catastrophizing (Dixon, Thorn, & Ward, 2004). Finally, the current study adds to the literature by reporting results from a substantial number of participants tested by an African American experimenter. The information of effect sizes gathered from the results can be used to compare across other studies to help determine the magnitude of experimenter characteristics on participant pain perception. Overall, distraction was shown to be efficacious in improving the pain tolerance of African Americans from baseline. This observation will provide some support for the study of additional interventions among diverse individuals.

Conclusion and Future Directions

In sum, the present study both supported and extended research of ethnic group differences in pain. As predicted, African Americans displayed lower pain tolerances compared to NH Whites during the CPT. Although catastrophizing was evaluated as a mediator of the differences in pain tolerance, results revealed that it was not significantly associated with ethnic group. Thus, the contribution of this psychosocial factor as a mechanism for the ethnic group differences in pain remains unclear. Based on supplemental analyses of participant’s PCS scores, it is evident that each subgroup (African American females, NH White females, African American males, NH White
males) was heterogeneous in terms of their reports. Thus, research comparing the pain responses of participants by ethnicity or sex alone may overlook the diversity of the pain experience within groups. Since reports of catastrophizing and pain may also depend on the social context in which pain is communicated, future studies should utilize more complex research designs (experimenter ethnicity and sex x participant ethnicity and sex) with large sample sizes and diverse experimenters to assess the pain responses and cognitions of participants. If catastrophizing levels and pain responses were observed to vary according to experimenter characteristics, it would strengthen the hypothesis that catastrophizing is a maladaptive coping style that serves to elicit social support from others (Giardino, Jensen, Turner, Ehde, & Cardenas, 2003; Thorn, Ward, Sullivan, & Boothby, 2003). This area of research is important because it may suggest that facilitating supportive environments could reduce catastrophizing and result in improvements in pain.

The current study contributes to the literature by demonstrating that the cold pain tolerance of African Americans improved in response to a brief distraction intervention. This finding reinforces the evidence that brief cognitive interventions are efficacious for reducing pain responsivity in laboratory settings (Dar & Leventhal, 1993; Hadjistavropoulos et al., 2000; Leventhal et al., 1989; Michael & Burns, 2004; Spanos et al., 1981). Additional studies are needed in order to evaluate the effectiveness of these interventions with ethnically diverse samples in clinical settings. This information will aid in the selection of interventions that are tailored according to participant characteristics and that will result in optimal pain relief (Forys & Dahlquist, 2007).
The observation that African Americans benefited from distraction also provides support for theories characterizing attention as an important determinant of the pain experience (Melzack & Wall, 1996; Price, 2002; Sullivan et al., 2001). It has been suggested that cognitive activity in the anterior cingulate could modulate the degree to which attention is directed to sensory and affective components of pain in the brain (Price, 2002; deCharms et al., 2005). Thus, research demonstrating that cognitive strategies like distraction or sensory focus can influence pain perception strengthens attentional models of pain. This knowledge will help establish a basis for testing more complex interventions and relating the effects of these interventions to neural pathways for pain perception in the brain. For instance, it is known that training in biofeedback strategies can regulate activity in the rostral anterior cingulate cortex (rACC) during real-time functional MRI scans (deCharms et al., 2005). Future studies could investigate the effects of cognitive strategies and physiological responses on ACC activity, and assess for potential interactions with participant ethnicity.
LIST OF REFERENCES


Melzack, R. (1999). From the gate to the neuromatrix. *Pain, 6*(Suppl. 6), 121-126.


APPENDIX A

INSTITUTIONAL REVIEW BOARD APPROVAL
Form 4: IRB Approval Form
Identification and Certification of Research
Projects Involving Human Subjects

UAB's Institutional Review Boards for Human Use (IRBs) have an approved Federalwide Assurance with the Office for Human Research Protections (OHRP). The UAB IRBs are also in compliance with 21 CFR Parts 50 and 56 and ICH GCP Guidelines. The Assurance became effective on November 24, 2003 and expires on February 14, 2009. The Assurance number is FWA00005960.

Principal Investigator: MCCONLEY, REGINA L
Co-Investigator(s): 
Protocol Number: F050719001
Protocol Title: Evaluating the Role of Catastrophizing as a Mediator in Racial/Ethnic Differences in Laboratory Induced Pain Sensitivity

The IRB reviewed and approved the above named project on 8/1/2007. The review was conducted in accordance with UAB's Assurance of Compliance approved by the Department of Health and Human Services. This Project will be subject to Annual continuing review as provided in that Assurance.

This project received FULL COMMITTEE review.
IRB Approval Date: 8/1/2007
Date IRB Approval Issued: 08.02.07
Identification Number: IRB00000726
HIPAA Waiver Approved?: N/A

Investigators please note:

The IRB approved consent form used in the study must contain the IRB approval date and expiration date.

IRB approval is given for one year unless otherwise noted. For projects subject to annual review research activities may not continue past the one year anniversary of the IRB approval date.

Any modifications in the study methodology, protocol and/or consent form must be submitted for review and approval to the IRB prior to implementation.

Adverse Events and/or unanticipated risks to subjects or others at UAB or other participating institutions must be reported promptly to the IRB.
April 18, 2008

Regina McConley
Psychology
College of Arts and Sciences

Re: IRB # 07-OR-106-R1 “Evaluating the Role of Cognitive Factors as a Mediator in Laboratory Induced Pain Sensitivity”

Dear Ms. McConely:

The University of Alabama Institutional Review Board has granted your renewal application approval.

Your renewal application has been given expedited approval according to 45 CFR part 46. You have also been granted the requested waiver of informed consent. Approval has been given under expedited review category 7 as outlined below:

(7) Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

Should you need to submit any further correspondence regarding this proposal, please include the assigned IRB application number. Please provide participants with a copy of the attached participant information sheet.

Good luck with your research.

Sincerely,

[Signature]

Carpentato T. Myles, MSM, CIM
Director of Research Compliance & Research Compliance Officer
Office of Research Compliance
The University of Alabama
APPENDIX B

INFORMED CONSENT FORM
TITLE OF RESEARCH: Evaluating the role of catastrophizing as a mediator in racial/ethnic differences in laboratory induced pain sensitivity.

INVESTIGATOR: Regina McConley, M.A.
PRE-DOCTORAL FELLOW, DEPARTMENT OF MEDICAL PSYCHOLOGY

Explanation of Procedures

You are being asked to participate in a research study that is designed to provide information regarding the influence of psychological factors on laboratory pain sensitivity.

If you decide to participate in the study, you will be asked to spend approximately 1 hour and 30 minutes in the UAB Campbell Hall. You will be asked to refrain from using analgesic medication (i.e., aspirin) 48 hours before your appointment. You will also be asked to refrain from using caffeine and nicotine 4 hours prior to your appointment.

Next, your resting blood pressure will be measured by a blood pressure cuff on your arm. You will then be asked to participate in two brief (approximately 1-5 minutes each) procedures that will measure your responses to a stimulus that produces pain. The Cold Pressor Task involves immersing your arm and hand in cold water. During this procedure, the type of discomfort you will experience will be cold pain produced by contact with water at temperatures 0-2°C.

This procedure will cause you to experience aching pain in your hand and arm, and you will be asked to rate the intensity and unpleasantness of this pain at different points during this procedure. We also wish to determine when the procedure first causes you to feel faint pain and when you feel you can no longer tolerate the pain. You will be asked to indicate when you feel high levels of pain,
and at this point the procedure will immediately end. Your hand and arm will be removed from the water when you tell us you can no longer tolerate the pain or after a pre-set time limit, depending on which occurs first. You may discontinue any of these procedures at any point simply by telling the investigator that you wish to stop.

Following completion of the cold pressor task, you will be asked to provide information regarding your age, education, ethnicity, income, and physical health. You will also be asked to complete some short questionnaires regarding your current levels of anxiety and depression, thoughts you experienced during the procedure, and potential strategies you used to cope with the procedure.

Next, you will randomly be assigned to focus on and read aloud one of two word-lists during the next task. You may be asked to give feedback on how the first cold pressor procedure felt. After this, you will receive instructions for reading the list of words aloud during the next task. You will then sit quietly until the next cold pressor procedure.

You will then undergo the cold pressor procedure a second time. This time, you will be asked to read aloud the list of words. Again, we wish to know when the procedure first causes you to feel faint pain and when you feel you can no longer tolerate the pain. Your non-dominant hand and arm will be removed when you tell us you can no longer tolerate the pain or after a pre-set time limit, depending on which occurs first. You may discontinue any of these procedures at any point simply by telling the investigator that you wish to stop. Finally, you will be asked to complete a questionnaire, and some short questions about the study procedures.
**Risks and Discomforts**

**Questionnaires:** None

**Pain Assessments:** There is a slight chance that you may feel faint, or have a sudden change in blood pressure after fully immersing your hand in the water. This may occur if you have not had anything to eat prior to the testing session. In order to minimize this risk, the researcher will ask if you’ve had anything to eat prior to the cold pressor procedure, and offer you an opportunity to visit the vending machine (on the first floor) before the session. If the vending machine is not a viable option for you, the study session will be rescheduled after you have had a chance to eat. If you report feeling faint at any time during the procedure or exhibit an unusual blood pressure response (systolic greater than 180 and/or diastolic greater than 100), the researcher will stop the study procedures immediately. The PI will then escort you to Student Health which is less than 10 minutes away.

**Benefits**

There may be no direct benefit to you, such as a treatment for pain relief, from the study. However, by participating in the study, you will have the satisfaction of knowing that you are providing valuable research information that may increase our understanding of the influence of psychological and cultural factors on pain perception in healthy persons and may lead to more effective ways of treating painful disorders.

**Alternatives**

You may choose not to participate in the study. Students enrolled in the Psychology 101 subject pool have additional options for obtaining course credit, and do not have to participate in the research.
Confidentiality

The information gathered during this study will be kept confidential to the extent permitted by law. All research material concerning your responses to the pain assessments and questionnaires will be coded by number and secured in a locked cabinet in the Division of Clinical Immunology and Rheumatology. All psychological tests and pain assessments will be administered by the Principal Investigator or by research assistants trained by the Principal Investigator. Confidential records of study results will be maintained and your identity will be protected. Only the research investigators and the UAB Institutional Review Board will have access to study information that may identify you. In all publications generated from this work, only group data will be presented.

Withdrawal Without Prejudice

You are free to withdraw your consent and to discontinue participation in this project at any time without prejudice against further care that you may receive at this institution.

What if you are a UAB Student?

You may choose not to be in the study or you may withdraw from (stop) the study at any time before it is over. This will not affect your class standing or grades at UAB. You will not be offered or receive any special consideration if you participate in this research.

Significant New Findings

Any significant new findings that develop during the course of the study that may affect your willingness to continue in the research will be provided to you by the investigator, Ms. McConley, M.A., or Dr. Cheryl Holt, PhD.
**Cost of Participation**

There will be no cost to you for participation in the research.

**Payment for Participation in Research**

There is no compensation for participating in the study. Students will receive 4 course credits for PY101.

**Payment for Research Related Injuries**

UAB has made no provision for monetary compensation in the event of injury resulting from the research and in the event of such injury, treatment is provided, but is not provided free of charge.

**Questions**

If you have any questions about the research or a research related injury, Regina McConley 205 266-2948 or Dr. Cheryl Holt 205 934-2816, will be glad to answer them. If you have questions about your rights as a research participant, you may contact Ms. Sheila Moore, Director of the Office of the Institutional Review Board for Human Use (IRB). Ms. Moore may be reached at (205) 934-3789 or 1-800-822-8816, press the option for an operator/attendant and ask for extension 4-3789 between the hours of 8:00 a.m. and 5:00 p.m. CT, Monday through Friday.

**Legal Rights**

You are not waiving any of your legal rights by signing this consent form.

**Signatures**

Your signature below indicates that you agree to participate in this study. You will receive a copy of this signed informed consent.
Signature of Participant

Signature of Investigator

Signature of Witness
**What is the purpose of this form?** You are being asked to sign this form so that UAB may use and release your health information for research. Participation in research is voluntary. If you choose to participate in the research, you must sign this form so that your health information may be used for the research.

Participant name: __________________ UAB IRB Protocol Number: F050719001

Research Protocol: Evaluating the Role of Catastrophizing as a Mediator in Racial/Ethnic Differences in Laboratory Induced Pain Sensitivity

Principal Investigator: Regina McConley, M.A. Faculty advisor: Cheryl Holt, PhD

**What health information do the researchers want to use?** Your telephone number was requested in order to contact you about the study, and to schedule the study session. Under the HIPAA guidelines, your telephone number qualifies as protected health information.

**Why do the researchers want my health information?** The researchers want to use your health information as part of the research protocol listed above and described to you in the Informed Consent document.

**Who will disclose, use and/or receive my health information?** The physicians, nurses and staff working on the research protocol (whether at UAB or elsewhere); other operating units of UAB, HSF, The Children’s Hospital of Alabama, Callahan Eye Foundation Hospital and the Jefferson County Department of Public Health, as necessary for their operations; the IRB and its staff; the sponsor of the research and its employees; and outside regulatory agencies, such as the Food and Drug Administration.

**How will my health information be protected once it is given to others?** Your health information that is given to the study sponsor will remain private to the extent possible, even though the study sponsor is not required to follow the federal privacy laws. However, once your information is given to other organizations that are not required to follow federal privacy laws, we cannot assure that the information will remain protected.

**How long will this Authorization last?** Your authorization for the uses and disclosures described in this Authorization does not have an expiration date.

**Can I cancel the Authorization?** You may cancel this Authorization at any time by notifying the Director of the IRB, in writing, referencing the Research Protocol and IRB Protocol Number. If you cancel this Authorization, the study doctor and staff will not use any new health information for research. However, researchers may continue to use the health information that was provided before you cancelled your authorization.

**Can I see my health information?** You have a right to request to see your health information. However, to ensure the scientific integrity of the research, you will not be able to review the research information until after the research protocol has been completed.

**Signature of participant:**
**Date:**
UNIVERSITY OF ALABAMA  
Informed Consent for the Research Study

You are being asked to take part in a research study. This study is called Evaluating the role of catastrophizing as a mediator in ethnic differences in laboratory induced pain sensitivity. The study is being done by Regina McConley, who is a doctoral student at the University of Alabama at Birmingham. Ms. McConley is being supervised by Dr. Beverly Thorn, who is a professor and licensed clinical psychologist at the University of Alabama.

What is this study about?

This study is being done to find out the effects of two interventions on the pain reports of African American and White students during a standard, laboratory based pain procedure. The study is also designed to provide information regarding the influence of psychological factors on laboratory pain sensitivity.

Why is this study important—What good will the results do?

This knowledge is important/useful because it will help in finding out which interventions are effective for reducing pain among both African American and White individuals. The results will help researchers develop and study more interventions that will reduce pain for diverse populations.

Why have I been asked to take part in this study?

You have been asked to be in this study because you are a healthy student attending the university. Your responses/experiences are also likely to match other healthy adults in the same age range.

How many people besides me will be in this study?

About 62 other people will be in this study.

What will I be asked to do in this study?

If you decide to be in this study, you will be asked to do these things:

First, you will be screened to be sure that you meet the study requirements. You will complete a short screening questionnaire that will assess any health or conditions you may have or have had in the past. If you do not meet the criteria, you cannot participate in the study.
If you qualify and decide to participate, you will be asked to refrain from using analgesic medication (i.e., aspirin) 48 hours before your appointment. You will also be asked to refrain from using caffeine and nicotine 4 hours prior to your appointment.

You will then have your resting blood pressure measured by an automated blood pressure cuff on your arm. You will then be asked to participate in two brief (1-5 minutes each) procedures that will measure your responses to a stimulus that produces pain. The Cold Pressor Task involves immersing your arm and hand in cold water. During this procedure, the type of pain you will experience will be cold pain produced by contact with water at temperatures 0-2°C.

This procedure will cause you to experience aching pain in your hand and arm, and you will be asked to rate the intensity and unpleasantness of this pain at different points during this procedure. We also wish to determine when the procedure first causes you to feel faint pain and when you feel you can no longer tolerate the pain. You will be asked to indicate when you feel high levels of pain, and at this point the procedure will immediately end. Your hand and arm will be removed from the water when you tell us you can no longer tolerate the pain or after a pre-set time limit, depending on which occurs first. You may discontinue any of these procedures at any point simply by telling the investigator that you wish to stop.

Following completion of the cold pressor task, you will be asked to provide information regarding your age, education, ethnicity, income, and physical health. You will also be asked to complete some short questionnaires regarding your current levels of anxiety and depression, thoughts you experienced during the procedure, and potential strategies you used to cope with the procedure.

Next, you will randomly be assigned to read one of two word-lists during the next task. You may be asked to give feedback on how the procedure felt. After this, you will receive instructions for reading the list of words aloud during the next task. You will then rest quietly for twenty minutes.

You will then undergo the cold pressor procedure a second time. This time, you will be asked to read aloud a list of words. Again, we wish to know when the procedure first causes you to feel faint pain and when you feel you can no longer tolerate the pain. The blood pressure cuff will be removed when you tell us you can no longer tolerate the pain or after a pre-set time limit, depending on which occurs first. You may discontinue any of these procedures at any point simply by telling the investigator that you wish to stop.

**How much time will I spend being in this study?**

Being in this study will take about 1 hour and 30 minutes. This time includes 15 minutes for the screening questionnaire, and approximately an hour and 15 minutes for the study procedures.
Will I be paid for being in this study?

You will not be paid for being in the study. Instead, you will receive course credit for completing the entire study.

Will being in this study cost me anything?

There will be no cost to you except for your time in completing the questionnaires.

Can the researcher take me out of this study?

The researcher may take you out of this study if she feels that your skin is very sensitive to the blood pressure cuff (for example, if you bruise easily).

What are the benefits (good things) that may happen to me if I am in this study?

Although benefits cannot be promised in research, it is possible/likely that you will learn more about your responses to pain. In addition, you may or may not regard having your responses to the pain assessment, and any questions they may have about the procedure reviewed with the researcher as a benefit.

What are the benefits to scientists or society?

This study will help treatment providers (including physicians, psychologists, nurses, etc), provide better services to people with pain. This knowledge is valuable, in that it would help to guide treatment approaches for pain disorders in racial/ethnic groups.

Society will benefit using the most effective medical treatments for people with pain. This may help reduce the cost of health care for people experiencing pain.

What are the risks (dangers or harm) to me if I am in this study?

During this study, you will experience discomfort. However, there is a wide range in the discomfort people experience as a result of the cold pressor procedure.

There is a slight chance that a participant may feel faint after fully immersing their hand in the water. This may occur if a participant has not had anything to eat. If the participants report feeling faint, the study procedures will stop immediately. In order to minimize this risk, the researcher will offer students an opportunity to visit the vending machine before the session. If this is not a viable option for the participant, the study session will be rescheduled after they have had a chance to eat.

The Principal Investigator and/or research participants will carefully monitor each procedure to ensure that the risk of feeling faint is minimized. In addition, the Cold Pressor Task (CPT) will not exceed a specified time limit, to ensure that long-term effects of exposure to cold does not occur.
How will my confidentiality (privacy) be protected? What will happen to the information the study keeps on me?

The information gathered during this study will be kept confidential to the extent permitted by law. All research material concerning your responses to the pain assessments and questionnaires will be coded by number and secured in a locked cabinet in the lab setting. All psychological tests and pain assessments will be administered by the Principal Investigator or by research assistants trained by the Principal Investigator. Confidential records of study results will be maintained and your identity will be protected. Only the research investigators and the UAB Institutional Review Board will have access to study information that may identify you. In all publications generated from this work, only group data will be presented.

What are the alternatives to being in this study? Do I have other choices?

You may choose not to participate in the study. Students enrolled in the Psychology subject pool have additional options for obtaining course credit, and do not have to participate in the research.

What are my rights as a participant?

Taking part in this study is voluntary—it is your free choice. You may choose not to take part at all. If you start the study, you can stop at any time. Leaving the study will not result in any penalty or loss of any benefits you would otherwise receive.

The University of Alabama Institutional Review Board (IRB) is the committee that protects the rights of people in research studies. The IRB may review study records from time to time to be sure that people in research studies are being treated fairly and that the study is being carried out as planned.

Who do I call if I have questions or problems?

If you have questions about the study right now, please ask them. If you have questions about the study later on, please call the investigator Regina McConley at (266-2948). If you have questions about your rights as a person taking part in a research study, you may call the Research Compliance Officer at UA at (205)-348-5152.

I have read this information form. The study has been explained to me. I understand what I will be asked to do. I freely agree to take part in it. I will receive a copy of this information form to keep.
APPENDIX C

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

We are interested in the types of thoughts and feelings that you experienced in your hand during the CPT. Listed below are thirteen statements describing different thoughts and feelings that may be associated with pain. Using the following scale, please indicate the degree to which you have these thoughts and feelings while your hand was in the water.

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>not at all</td>
<td>to a slight degree</td>
<td>to a moderate degree</td>
<td>to a great degree</td>
<td>all the time</td>
</tr>
</tbody>
</table>

When I’m in pain ...

_____ 1. I worry all the time about whether the pain will end.

_____ 2. I feel I can’t go on.

_____ 3. It’s terrible and I think it’s never going to get any better.

_____ 4. It’s awful and I feel that it overwhelms me.

_____ 5. I feel I can't stand it anymore.

_____ 6. I become afraid that the pain will get worse.

_____ 7. I keep thinking of other painful events.

_____ 8. I anxiously want the pain to go away.

_____ 9. I can’t seem to keep it out of my mind.

_____ 10. I keep thinking about how much it hurts.

_____ 11. I keep thinking about how badly I want the pain to stop.

_____ 12. There’s nothing I can do to reduce the intensity of the pain.

_____ 13. I wonder whether something serious may happen.
APPENDIX D

GENERAL HEALTH QUESTIONNAIRE-12
GENERAL HEALTH QUESTIONNAIRE-12

We want to know how your health has been in general over the last few weeks. Please read the questions below and each of the four possible answers. Circle the response that best applies to you. Thank you for answering all the questions.

Have you recently:

1. been able to concentrate on what you’re doing?
   better than usual  same as usual  less than usual  much less than usual
   (0)               (1)          (2)          (3)

2. lost much sleep over worry?
   Not at all  no more than usual  rather more than usual  much more than usual

3. felt that you are playing a useful part in things?
   more so than usual  same as usual  less so than usual  much less than usual

4. felt capable of making decisions about things?
   more so than usual  same as usual  less than usual  much less than usual

5. felt constantly under strain?
   Not at all  no more than usual  rather more than usual  much more than usual

6. felt you couldn’t overcome your difficulties?
   Not at all  no more than usual  rather more than usual  much more than usual

7. been able to enjoy your normal day to day activities?
   more so than usual  same as usual  less so than usual  much less than usual

8. been able to face up to your problems?
   more so than usual  same as usual  less than usual  much less than usual

9. been feeling unhappy or depressed?
   not at all  no more than usual  rather more than usual  much more than usual
10. been losing confidence in yourself?
not at all  no more than usual  rather more than usual  much more than usual

11. been thinking of yourself as a worthless person?
not at all  no more than usual  rather more than usual  much more than usual

12. been feeling reasonably happy, all things considered?
more so than usual  same as usual  less so than usual  much less than usual
APPENDIX E

DEMOGRAPHIC QUESTIONNAIRE
DATE OF VISIT:

DEMOGRAPHIC INFORMATION

NAME:
LAST              FIRST              M.I.

PHONE:  HOME(__)       WORK(__)

SEX:  M, F  DATE OF BIRTH:

AGE:  ___  RACE:  ____  ETHNIC IDENTIFICATION:  
(W,B,O,NA)

YEARS OF EDUCATION:  _____

MARITAL:  ____  NO. IN FAMILY OR HOUSEHOLD:  
(M,S,D,Sep)

CURRENT OCCUPATION:  __________________________  YEARS:

Place a mark like this | at the point on the line that best indicates the severity of 
stressfulness related to your job/daily activities:

Job stress:

|______________________________|

Not stressful                Extremely stressful
APPENDIX F

PROTOCOL
Protocol

Procedures

I. Screening

II. Obtain/Review Informed Consent

III. Blood pressure measurement

IV. Instructions for Cold Pressor Task I

V. Baseline: Cold Pressor Task I

VI. Wait period: Verbal administration of the PCS and questionnaire packet, Sensory Focus and Distraction list formation.

VII. Sensory Focus & Distraction instructions

VIII. Cold Pressor Task II

IX. Administration of PCS and manipulation check items

IX. Post-assessment questionnaires (PCS, Manipulation check, efficacy)
I. Screening

Prior to the investigation, students will undergo a telephone screening that will take approximately 15 minutes. The interviewer will complete the Healthy Control Screening form, and the Major Depression, Bipolar Disorder, and Generalized Anxiety Disorder portions of the M.I.N.I diagnostic psychiatric interview for DSM-IV criteria (Sheehan et al., 1998). Depressed/anxious individuals will be counseled by an advanced clinical psychology student supervised by a licensed clinical psychologist.

Participants are eligible for inclusion into the study if they unequivocally identify themselves as African American, Black, Caucasian or non-Hispanic White. The exclusion criteria for participation in the study are as follows:

Exclusion criteria:

A. Serious medical conditions: A serious medical condition is considered as a condition that requires regular treatment (e.g., medications, monitoring blood counts or blood sugar levels) from a doctor or established medical professions. These may include, but are not limited to: fibromyalgia, peripheral vascular disease, Raynaud’s syndrome, temperomandibular disorder, recurrent migraines, current symptoms of IBS cardiac illness, tobacco dependence, and diabetes.

B. Individuals who report experiencing an acute pain episode the scheduled day of testing (e.g., migraine headache, aches and cramps of moderate to severe intensity), will be rescheduled at a later time or date after the acute pain episode has subsided.

C. Individuals with unusually prominent symptoms of anxiety and/or depression and/or current episodes of Major Depression, Generalized Anxiety Disorder, Bipolar Disorder, or Panic Disorder will also be excluded. In addition individuals who persistently take certain classes of medications: anxiolytic, antidepressant, sleep medications, or other mood-altering medications will also be excluded from the study.

D. Individuals who smoke will be asked to refrain from engaging in this activity for a period of 4 hours prior to the laboratory session. In addition, participants are asked to refrain from consuming caffeine for a period of 4 hours prior to the session.

E. Finally, individuals who are unable or unwilling to discontinue analgesic medicine for a forty eight hour period prior to the laboratory session will also be excluded.
II. Informed Consent

A copy of the informed consent form will be sent via e-mail to participants if they qualified for screening. Individuals who wish to participate will review and sign the informed consent form prior to enrollment in the study.

III. Blood pressure measurement

We will obtain blood pressure readings after the informed consent form has been obtained. Individuals with unusually high blood pressure readings will be monitored for a period of 5 minutes, during which the reading will be repeated. Those persons who continue to display unusually high blood pressure readings (140/90 or above) after this period will be excluded from the study.

IV. Instructions for Cold Pressor Task I

Read the instructions for intensity and unpleasantness (see Revised instructions for Price’s analogy below):

PAIN INTENSITY VS. PAIN UNPLEASANTNESS

“There are two primary aspects of pain that we are interested in measuring: the intensity, which is the strength of the stimulation, and the unpleasantness, which is how unpleasant or disturbing the stimulation is to you.

“The distinction between these two aspects of pain might be made clearer if you think of listening to music on the radio. As the volume of the music increases, I can ask you how loud it sounds or how unpleasant it is to you. The intensity of the stimulation is like loudness. The pleasantness or unpleasantness of the music depends on how much you like or dislike the music. The unpleasantness of pain depends on how much you dislike the stimulation.”

I want to make sure that I explained everything clearly to you, so please tell me your understanding of what will occur during the next procedure.

- Present the participant with intensity/unpleasantness instructions and NUMERIC SCALE DESCRIPTORS (have these in front of the participants)

Read the instructions for the CPT (see below).
COLD PRESSOR PROCEDURE: VERBAL INSTRUCTIONS

We are about to begin the cold pressor procedure.

The first thing that we will ask you to do – when we are ready to begin – is to place your right hand and arm in the water. You will probably feel a variety of things in your right hand, including tingling, numbness, etc… However, we are most interested in feelings of pain that you may feel during the procedure.

We would like for you to tell us two things related to the pain you experience during the cold pressor procedure. First, we want to know when you first feel pain as a result of the procedure. When the feelings in your lower arm and hand first become painful, say the word “Now”. Then, we want to know when the pain from the cold becomes intolerable. Keep going for 3 minutes, but if you feel that you are no longer feel able to tolerate the pain in your hand say the word “Stop”.

At this point, you will remove your hand from the water, and we will ask you to rate your hand pain using the scales. We may also ask you to rate the pain in your hand at other points during the procedure using these scales.

Remember, we want you to tell us two things…
1) say painful when you first feel pain, and
2) say stop when you no longer feel able to tolerate the pain.

I want to make sure that I explained everything clearly to you, so please tell me your understanding of what will occur during the cold pressor procedure.

V. Baseline: Cold Pressor Task I

- Next, have the person place their hand in the water
- Start the stop watch
- When the person first feels pain, record the time (Pain Threshold).
- If the patient says “stop”, terminate the procedure by having them remove their hand from the water.
  Record the time (Pain tolerance).
- Ask for final intensity and unpleasantness ratings.

VI. Wait period (20 min): Administration of questionnaires.

- Following the baseline CPT, participants in both intervention groups will sit for a twenty minute period, during which they will provide answers to the PCS, GHQ-12, and demographic questionnaires.
Sensory Focus and Distraction List Formation

- After questionnaire administration:

Those assigned to the sensory focus condition will hear a recorded description of different sensations associated with pain such as tingling or numbness. They will then be asked to provide three sensations they experienced while undergoing the baseline cold pressor pain procedure.

Recording: Sensory Focus Condition

DESCRIPTION/DEFINITION OF PAIN SENSATIONS

During the cold pressor procedure, you may have felt a variety of sensations in your right hand, including tingling or numbness. Sensations are described as your body’s awareness of stimulation, or as bodily feelings of discomfort (e.g. when the discomfort becomes very strong, the sensations are considered painful). At this time, pick three words that you experienced in your hand during the CPT.

In the event that participants provide non-sensory words, the recording will be stopped, and they will be instructed to choose words that describe the physical sensations experienced. In addition, they will be provided prompts and examples to help them select sensory words.

CORRECTIONS FOR NON-SENSORY WORD SELECTION

In the event that participants provide non-sensory and/or affective words, they will be instructed to choose words that describe the physical sensations experienced, rather than the emotions experienced during the task.

That’s true, you may have experienced ________ (insert word). However, the word you picked, ________, would not be considered a sensory word. A sensory word describes what the feelings in your hand were like, for example, pricking, squeezing or shooting*.

If participants happen to select a word that is already on the list, they will be directed to pick another sensory word.

That’s true, you may have experienced ________ (insert word). Are there any other sensations you experienced during the procedure?*

*If the participant is unable to think of sensory words after prompting, they will be provided with a list of more sensory words from the McGill Pain Questionnaire, and asked to select a word that most resembles what they experienced during the procedure.
• The three words generated by the participants will be added to the sensory focus list.

• Finally, the participants will sit for a twenty minute period, during which they will provide answers to the GHQ-12, and demographic questionnaires.

Recording: Distraction Condition

Individuals assigned to the distraction condition will also be asked to provide three words to help personalize the distraction lists. In order to obtain the words, participants will be asked to verbally complete the sentences:

My favorite color is: __________
My favorite vacation spot is:__________
My favorite dessert is: ______________

In the event the participants are unable to choose an answer to a question, the recording will be stopped. They will then be encouraged and prompted by the question, “What’s a __________ (insert word, color, vacation spot, dessert) that you like?”

• The three words generated by the participants will be added to the distraction list.

VII. Sensory Focus and Distraction instructions for Cold Pressor Task II

Prior to the second CPT, individuals will receive brief instructions reminding them about the cold pressor procedure (see bold text of cold pressor Procedure Verbal Instructions)

In addition, individuals in the Sensory Focus condition will be instructed via a recording:

**SENSORY FOCUS PROCEDURE: RECORDED INSTRUCTIONS**

Pain and discomfort have several important qualities—some can be controlled well by medication, while others may need other approaches. Thoughts and feelings can also have a powerful effect on how strong that pain becomes.

Your mind is the most powerful tool you have for controlling your pain. Normally your mind is bombarded by many different thoughts and sensations at once. For example, right now you see many different things in the room. If you thought about it, you could identify at least six different sounds you are listening to—and you are feeling many different sensations in your body as well.
“Focus on the sensations you will experience in your hand during the cold stimulation as you read this list of words aloud. The list will help you concentrate on the sensations.”

Individuals in the Distraction condition will also be instructed via a recording:

DISTRACTION PROCEDURE: RECORDED INSTRUCTIONS

Pain and discomfort have several important qualities—some can be controlled well by medication, while others may need other approaches. Thoughts and feelings can also have a powerful effect on how strong that pain becomes.

Your mind is the most powerful tool you have for controlling your pain. Normally your mind is bombarded by many different thoughts and sensations at once. For example, right now you see many different things in the room. If you thought about it, you could identify at least six different sounds you are listening to—and you are feeling many different sensations in your body as well. Think about the following list of words as you read it aloud.

“Read the following list of words aloud as during the cold stimulation. Concentrate on reading the words.”

Participants will again be asked to provide descriptions of what will be expected of them during the task, and will undergo the second CPT.

Answers to questions during the CPT:

I. Standard responses (both groups):

Do your best
Continue reading the list aloud until you are no longer able to tolerate the procedure.

Sensory Focus Prompt: Remember to concentrate on the sensations as you read the list aloud.

Distraction Prompt: Remember to concentrate on reading the list aloud.

VIII. Cold Pressor Task II
Participants will complete the cold pressor procedure a second time as they read their list of words aloud. Participants will pause only to indicate when they have reached pain threshold (“Now”), and pain tolerance (“Stop”).

IX. Post-assessment questionnaires

Participants in each condition will be asked to rate on a ten point scale the extent to which they focused on the sensations produced in their hand and/or distracted themselves during the cold pressor stimulation.

Participants will then verbally complete a brief measure of catastrophizing (PCS).

Finally, each participant will respond to two questions (see below) assessing their beliefs in the efficacy of their assigned intervention to reduce pain intensity and unpleasantness.

Please answer the following two questions concerning your pain experience:

Was the training effective in reducing pain intensity?  YES  NO
Was the training effective in reducing pain unpleasantness?  YES  NO
1. During the second CPT procedure, I focused on the sensations in my hand when it was in the water.

Not at | Somewhat | Very
---|---|---
All | Much

2. During the second CPT procedure, I distracted myself by reading the list when my hand was in the water.

Not at | Somewhat | Very
---|---|---
All | Much