DO BELIEFS ABOUT RACE DIFFERENCES IN PAIN CONTRIBUTE TO ACTUAL RACE DIFFERENCES IN EXPERIMENTAL PAIN RESPONSE?

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ABSTRACT

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Chronic pain is a costly health problem that affects more than 100 million people in the United States. Race differences exist in the way that pain is experienced and in how it is treated. Many biopsychosocial factors contribute to race differences in pain tolerance. Beliefs about race differences in pain sensitivity may be one of these factors. Previous research has identified that individuals' explicit beliefs about their gender group influence their own pain tolerance on a cold pressor task. Explicit beliefs about race and pain sensitivity have also been identified but have yet to be linked to actual pain tolerance. Implicit beliefs about race are well documented; however, little is known about the extent to which individuals hold implicit beliefs about race differences in pain sensitivity or whether these beliefs contribute to actual race differences in pain. My thesis examined explicit and implicit beliefs about race and pain and explored whether these beliefs moderated race differences in pain tolerance. I found that White participants had a higher pain tolerance than Black participants on the cold pressor task, U=1165.50, p<.01. Participants held the explicit, $t_{(131)}$=-6.83, p<.01, and implicit, $t_{(131)}$=6.35, p<.01, belief that White people are more pain sensitive than Black people. Both explicit, b=-0.37, p=.71, and implicit, b=-21.87, p=.65, beliefs failed to moderate the relationship between race and pain tolerance. Further exploration indicated that participants' comparisons of their own pain sensitivity to that of their race group moderated the relationship between race and pain tolerance, ω=4.40, p=.04. These

results provide further insight into race differences in pain tolerance. Researchers may consider examining explicit and implicit beliefs about race differences in pain in health care providers to better understand disparities in pain related recommendations.

INTRODUCTION

Pain is a global health problem. About 10 percent of the world population is estimated to suffer from chronic pain (Jackson, Stabile, & McQueen, 2014). In the United States, 100 million people suffer from chronic pain, which is more than heart disease, cancer, and diabetes combined (IOM, 2011). The rates of chronic pain are increasing due to, among other causes, the aging population, increased rates of obesity, higher survival from catastrophic injury, earlier discharge after surgery, and increased awareness of chronic pain syndromes (IOM, 2011). Chronic pain is one of the leading causes of disability (Hootman, 2009). Pain is also one of the main reported reasons for doctor visits (Sauver et al., 2013). Additionally, chronic pain is leading to an increased reliance on home care during aging (Turner, Ersek, & Kemp, 2005). The medical costs and lost productivity caused by chronic pain costs America $635 billion dollars a year (IOM, 2011).

Pain has been defined as an unpleasant sensory and emotional experience that elicits a response to protect the body (Vlaeyen, Morley, & Crombez, 2016). Acute pain is a sensation in the nervous system to draw attention to a possible injury (IOM, 2011). In contrast, chronic pain is defined as "pain that persists beyond the normal tissue healing time," usually ≥3 months often in the absence of an obvious underlying biological cause (Bonica, 1953; Merskey & Bogduk, 1994, p. xi). Pain is more than a biological experience; it has emotional, cognitive, and social components as well (IOM, 2011). Elements of pain such as severity, duration, and disabling consequences vary from person to person (IOM, 2011). In addition to the profound individual differences in the sensory experience of pain (Coghill, 2010), group differences have also been found.

Race differences exist in the experience and treatment of chronic pain. For many chronic pain conditions, Black patients report higher levels of pain than White patients (Selim et al., 2001; White, Asher, Lai, & Burton, 1999). Additionally, in experimental pain tasks, Black participants typically report lower pain tolerance than White participants across quantitative sensory tests (Campbell, Edwards, & Fillingim, 2005; Edwards, Fillingim, & Keefe, 2001; Edwards & Fillingim, 1999; Rahim-Williams et al., 2007; Sheffield, Biles, Orom, Maixner, & Sheps, 2000; Woodrow, Friedman, Siegelaub, & Collen, 1972). Cintron and Morrison (2006) systematically reviewed the literature related to race differences in pain care and found that minority patients were more likely to have their pain underestimated and less likely to have pain scores documented in medical records. Additionally, Black patients are significantly less likely to be prescribed opioids after surgery or for chronic pain conditions (Meghani, Byun, & Gallagher, 2012). Furthermore, White patients are more likely to receive a prescription for opioids or analgesic medication when discharged from the emergency room than are Black patients (Heins et al., 2006). Many factors have been proposed to explain these differences, but relatively few have been empirically examined.

The perception of pain is influenced by biological and psychosocial factors (Gatchel, 2004). Some scholars have proposed biological bases for race differences in pain perception. Specific genetic factors related to pain have been identified (Fillingim, Wallace, Herbstman, Ribeiro-Dasilva, & Staud, 2008); however, these have not been specifically linked to race differences in pain. Hormones also play a role in the pain experience. Sensitivity to noxious stimuli varies across the menstrual cycle (Fillingim & Ness, 2000) and is reduced with hormonal contraceptive use (Máximo et al., 2015). Studies have also found differences in hormones (e.g., Agouti-related Protein (AgRP) and ghrelin) and hormone receptors (e.g., estrogen and

progesterone receptors) between White and Black participants (Bacha & Arslanian, 2006; Gapstur, Dupuis, Gann, Collila, & Winchester, 1996; Patel et al., 2013); however, these hormone differences have yet to be linked to pain.

Psychosocial factors such as pain history, emotions, and coping also influence the way pain is experienced (Alabas, Tashani, & Johnson, 2013; Fillingim, Edwards, & Powell, 2000; Forsythe, Thorn, Day, & Shelby, 2011; Riley, Robinson, Wade, Myers, & Price, 2001). For example, Rollman, Abdel-Shaheed, Gillespie, & Jones (2004) found that individuals with previous experimental and clinical pain experiences had lower pain tolerance during an experimental pain task compared to participants without previous pain experience. In terms of emotional modulation of pain, Villemure and Bushnell (2002) found that pain perception can be reduced through humor and other pleasant stimuli. Additionally, symptoms of depression and anxiety can influence pain perception, but the directionality of the relationship between emotions and pain perceptions is inconsistent across studies (Ahmadi, Kiakojori, & Moudi, 2018; Alabsi & Rokke, 1991; Dickens, McGowan, & Dale, 2003; Edens & Gil, 1995; Wiech & Tracey, 2009). Coping strategies can also affect the pain experience. Coping is "the cognitive and behavioral efforts made to master, tolerate, or reduce external and internal demands and conflicts" (Folkman & Lazarus, 1980, p. 223). Coping strategies can be characterized as active or passive, which may have different adaptive value given the specific stressor. In terms of coping with pain, Meints and colleagues (2016) found that Black and White individuals tend to use different strategies, which may partly explain race differences in pain sensitivity. Black individuals more often use passive strategies such as catastrophizing and praying, that are associated with poorer outcomes, whereas White individuals more often use active strategies, such as task persistence, that are

associated with better outcomes (Meints et al., 2016). In addition to history of pain, emotions, and coping, beliefs about pain can powerfully influence pain perception.

Beliefs are views that the knowledge acquired about a referent is correct or that an event or state of affairs has or will occur (Wyer & Albarracín, 2005). Beliefs influence the way events, including pain, are interpreted. Beliefs can be categorized as explicit or implicit. Explicit beliefs reflect reasoned evaluations that, through deliberation and motivation, influence actions (Hofmann, Gschwendner, Castelli, & Schmitt, 2008). They are generally measured with self-report questionnaires that ask respondents to endorse their level of agreement with a list of beliefs. In contrast, implicit beliefs are spontaneous, are effortlessly activated, and do not depend on conscious awareness or control (Hofmann et al., 2008). One of the most commonly used implicit measures is the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998), which measures the strength of association between two concepts (Greenwald et al., 1998). Although scores on implicit and explicit measures may correlate, these are unique constructs that frequently diverge and are differentially associated with behavior in a number of situations (Green et al., 2007; Hofmann et al., 2008; Hofmann, Gschwendner, Nosek, & Schmitt, 2005; Shoda, McConnell, & Rydell, 2014).

In the context of pain, previous studies have used explicit measures to examine the relationships between pain-specific beliefs and pain outcomes. Pain beliefs are individuals' conceptualizations of what pain is and what pain means (Williams & Thorn, 1989). Jensen and Karoly (1992) found that participants who believed that they were unable to function because of the pain had lower activity levels, lower psychological functioning, and higher service utilization (Jensen & Karoly, 1992). Additionally, patients who believed there is a medical cure had higher service utilization, whereas patients who believed they should ask for help from their family

members and were reporting low levels of pain had lower psychological functioning (Jensen & Karoly, 1992) . Furthermore, Jensen and colleagues (2001) found that when negative beliefs about pain (i.e., that one does not have control over pain) were reduced by a tailored intervention, patient rated disability also decreased.

Beliefs about pain may systematically differ between groups. For example, one study found that men and women differed in their explicit beliefs about pain tolerance, pain sensitivity, and willingness to report pain (Defrin, Shramm, & Eli, 2009). Moreover, explicit beliefs about their gender group's pain tolerance, sensitivity, and willingness to report pain significantly predicted participants' pain threshold, tolerance, and participant-reported unpleasantness in an experimental pain task (Wise, Price, Myers, Heft, & Robinson, 2002). Participants rated the typical male as less pain sensitive, more pain tolerant, and less likely to report pain compared to the typical female; these beliefs predicted a higher pain threshold and pain tolerance and a lower participant-reported unpleasantness on the pain task for males compared to females (Wise et al., 2002). Group differences in beliefs about pain have also been identified along racial lines. Hollingshead, Meints, Miller, Robinson, and Hirsh (2016) found, on an explicit measure of beliefs, both White and Black participants rated the typical White person as being more pain sensitive and willing to report pain than the typical Black person. Additionally, Black participants rated themselves as more pain sensitive than the typical Black person, while White participants rated themselves as less pain sensitive than the typical White person (Hollingshead et al., 2016). However, to my knowledge, research has yet to examine the association between these beliefs and race differences in pain. In particular, the previous findings suggest that explicit beliefs may augment (i.e., moderate) the relationship between race and pain sensitivity.

Implicit measures have also been used to examine beliefs about pain. Grumm, Erbe, von Collani, and Nestler (2008) created a pain IAT to measure the implicit association between pain and self. They administered the pain IAT to a group of chronic pain patients before and after a 4-week course of Cognitive Behavioral Therapy (CBT), as well as a group of untreated healthy controls who completed the measure twice, separated by 4 weeks. Results indicated that the pain IAT differentiated between the two groups at baseline, and that patients' implicit beliefs about pain and self changed – specifically, the pain-self association weakened – over the course of treatment (Grumm et al., 2008). Van Ryckeghem et al. (2013) used the same pain IAT and found that pain and self-schemas were more strongly associated in chronic pain patients than healthy controls. Moreover, a stronger association between pain and self-schemas among patients was related to more pain, suffering, and helplessness (Van Ryckeghem et al., 2013). Compared to the literature on explicit beliefs about pain, much remains to be known about implicit beliefs. In particular, possible race group differences in these implicit beliefs have not been explored. Given the substantial literature on general implicit beliefs about race, as well as recent findings of race differences in explicit beliefs about pain, clear next steps in this line of work include examining race differences in implicit beliefs about pain and examining how these differences are related to race differences in pain sensitivity.

Current Study

In summary, previous literature has identified race differences in pain. More recent evidence suggests that beliefs about race differences in pain sensitivity may contribute to race differences in the actual experience of pain. The current study seeks to move this literature forward by measuring both implicit and explicit beliefs about race differences in pain and examining them as moderators of the relationship between race and pain sensitivity during a cold

pressor task. Results of this study will enhance understanding of psychosocial factors contributing to racial disparities in pain.

Hypotheses

1. Black participants will have lower pain tolerance on the cold pressor task than White participants.

2. Participants, regardless of race, will rate the typical White person as more pain sensitive compared to the typical Black person on the explicit belief measure.

3. Participants, regardless of race, will show a stronger association between White people and pain sensitivity than Black people and pain sensitivity on the implicit belief measure.

4. The relationship between race and pain tolerance will be moderated by implicit and explicit beliefs about race and pain.

METHODS

Participants

Participants in the study were undergraduates enrolled in Introduction to Psychology (B110). African-American/Black and Caucasian/ White participants from both genders were recruited. Participants were excluded through a screener phone call for the following reasons: history of chronic pain, history of fainting spells, history of allergic skin reactions or excessive bruising, previous frostbite on non-dominant hand, recent arm fracture or wrist sprain, circulatory problems, hypertension, diabetes, heart or vascular disease, seizure disorder, Raynaud's Disease, Sickle Cell Anemia, pregnancy, being under psychiatric care, or previous participation in a cold pressor pain experiment. These conditions could have made participation in this study dangerous or influence the participant's pain tolerance. Participants did not take analgesic medication within 24 hours of the study or consume caffeine or alcohol or use nicotine within 2 hours prior to the testing.

Measures

Eligible participants completed a series of questionnaires and the IAT task in the laboratory. The online questionnaires included: demographics, the Race/Ethnicity Expectations of Pain Questionnaire (REPQ), Coping Strategies Questionnaire-Revised (CSQ-R), and Profile of Mood States-Short Form (POMS-SF).

Demographic Information

Participants provided information regarding their age, sex, race, ethnicity, marital status, education, income, work status, and personal experience with chronic pain.

Explicit Beliefs about Race Differences in Pain

Explicit beliefs about race and pain were measured by the Race/Ethnicity Expectations of Pain Questionnaire (REPQ). The REPQ is a 10-item measure of beliefs about pain sensitivity and willingness to report pain (Hollingshead et al., 2016). It uses visual analog scales to assess respondents' views on pain sensitivity (0=Not at all sensitive; 100=Most sensitive imaginable) and willingness to report pain (0=Not at all willing; 100=Most willing imaginable) of different races, as well as their own pain sensitivity and willingness to report pain.

Given that the sample only had two race groups (Black or White participants), I only included participants' ratings of the typical Black person and White person. Hollingshead et al. (2016) reported evidence of the measure's reliability and validity. I compared the items related to pain sensitivity and willingness to report pain separately for the typical Black person, the typical White person, and the self. As there were only two items in each group, a correlation was run in place of the Cronbach's alpha to assess internal consistency. The correlation for the typical Black person, $r = .53$, $p<.01$, the typical White person, $r = .47$, $p<.01$, and the self, $r = .48$, $p<.01$, were all medium to large indicating a good internal consistency. This measure can be found in Appendix A.

Implicit Beliefs about Race Differences in Pain

Implicit beliefs about race and pain sensitivity were measured using the Implicit Associations Test (IAT: Greenwald et al., 1998). The IAT has participants categorize a series of items that appear on a computer screen. At the beginning of each trial, participants are presented a category rule that they must use to categorize each item correctly. During the trial, a word or picture appears in the middle of the screen, and the participant sorts the item as quickly as possible into the correct category by using keys on the computer.

The classification categories for this IAT are "White American" or "Black American" and "Pain Tolerant" or "Pain Sensitive." The items for Black and White Americans consist of 6 pictures of Black American faces and 6 pictures of White American faces taken from the existing race IAT. The items for Pain Tolerant and Pain Sensitive are synonyms of these terms and other related words. The 8 pain tolerant words (hardy, tough, strong, unbreakable, tolerant, resilient, withstanding, and durable) and 8 pain sensitive words (sensitive, fragile, vulnerable, delicate, frail, weak, susceptible, and wimpy) were selected based on their superior performance during pilot testing using Amazon's Mechanical Turk. During this pilot testing, participants evaluated 26 words on one of three tasks. In the first task, participants ranked 13 pain tolerant words from most to least "pain-tolerant" and ranked 13 pain sensitive words from most to least "pain-sensitive." For the second task, participants rated each of the 26 words on a VAS that ranged from "pain-sensitive" to "pain-tolerant." On the third task, participants rated pain sensitive words on a VAS that ranged from "not at all pain-sensitive" to "extremely pain-sensitive," and they rated pain tolerant words on a VAS ranging from "not at all pain-tolerant" to "extremely pain-tolerant." The words that were most strongly associated with the categories "pain-sensitive" or "pain-tolerant" across all tasks were selected to create the new IAT.

On critical trials, participants press a designated key if the stimulus is a picture of a Black person's face or a pain tolerant word and press another key if the stimulus is a picture of a White person's face or a pain sensitive word. On reverse trials, the categories Black and pain sensitive share a response key, and White and pain tolerant share a key. The trial order is counterbalanced. The IAT score is equivalent to the difference in average response time on these 2 blocks of trials divided by the pooled SD. This is the most widely accepted method for calculating IAT scores, given its superior measurement properties relative to the use of raw scores or other

transformations (Greenwald, Nosek, & Banaji, 2003). IAT scores range from -2 to +2 with scores of .15, .35, and .65 as the customary break points to indicate, respectively, slight, moderate, and strong implicit preference for White s over Blacks (https://implicit.harvard.edu/implicit/demo/background/raceinfo.html). The underlying assumption is that concepts that are readily associated are sorted faster than concepts that are more weakly associated. Thus, faster responses to the White + pain tolerant/Black + pain sensitive combined task compared to responses to the Black + pain tolerant/ White + pain sensitive combined task indicate a stronger association of White with pain tolerance versus pain sensitive than of Black with pain tolerance. This response difference is interpreted as an implicit belief that White s are more pain tolerant than are Blacks. The original race IAT demonstrates good reliability and validity (Fazio & Olson, 2003). In a second pilot study, 52 undergraduates enrolled in Introduction to Psychology (B110) completed the new IAT along with explicit measures of racial stereotypes and explicit beliefs about race differences in pain sensitivity. These findings indicated that the IAT significantly correlated with measures related to racial stereotypes and preferences as expected, thus supporting the validity of the IAT (Mehok et al., 2018). This measure can be found in Appendix B.

Coping/Emotions

Cognitive and behavioral coping strategies for pain were assessed by the Coping Strategies Questionnaire-Revised (CSQ-R: Riley III & Robinson, 1997). The CSQ-R is a 27-item scale, revised from the original 42-item CSQ, which assesses the frequency and effectiveness of different coping methods to control pain. Participants use a 7-point Likert scale (0="never", 3="sometimes", and 6="always") to indicate the frequency and effectiveness of these methods in controlling their pain. The CSQ-R assesses 6 pain coping strategies: praying/hoping,

catastrophizing, diverting attention, reinterpreting pain sensations, coping self-statements, and ignoring pain sensations. Previous research supports the reliability and validity of the CSQ-R when using the 6 factor model (Riley III & Robinson, 1997). The Cronbach's alphas for the individual scales were at acceptable levels and ranged from α= .80 to α=.92. This measure can be found in Appendix C.

Feelings of anxiety and depression were measured using the Profile of Mood States-Short Form (POMS-SF). The POMS-SF contains 37 items, from the original 65-item POMS, that participants respond to on a 5-point Likert scale (0="not at all", 1="a little", 2="moderately", 3="quite a bit", and 4="extremely"). The POMS-SF yields a total distress score and scores for 6 subscales: Tension-Anxiety, Anger-Hostility, Fatigue-Inertia, Depression-Dejection, Vigor-Activity, and Confusion-Bewilderment (Shacham, 1983). The POMS-SF has been found to be reliable and valid in previous studies (Curran, Andrykowski, & Studts, 1995; Shacham, 1983). The Cronbach's alphas for the individual scales were at acceptable levels and ranged from α= .79 to α=.93. This measure can be found in Appendix D.

Apparatus

Pain was induced with a NESLAB RTE Series Refrigerated Bath/Circulator maintaining a constant water temperature of 2-5 degrees Celsius. This device will be referred to as a cold pressor. The cold pressor pain task has been found to be relevant to clinical pain and a reliable and valid way to measure pain tolerance (Chapman et al., 1985; Edens & Gil, 1995; Rainville, Feine, Bushnell, & Duncan, 1992).

Procedure

All study procedures were completed in a laboratory setting. Prior to arriving in the laboratory, potential participants were contacted via telephone and asked several screening questions to ensure that they did not have any of the disqualifying medical conditions or experiences. Participants who were not able to be contacted via phone were screened in person upon their arrival in the laboratory. Eligible participants were instructed not to take any analgesic or pain medication 24 hours prior to the pain task and not consume caffeine or alcohol or use nicotine 2 hours prior to the pain task.

Upon arrival at the laboratory, participants underwent informed consent procedures. After the informed consent process, participants completed the eligibility questionnaire to ensure that they did not consume caffeine, alcohol, analgesic medication, or nicotine prior to the study as instructed during the telephone screening process. If participants had not followed instructions, they would have been rescheduled to a different time. After confirming they had followed study instructions, participants completed a series of questionnaires, the IAT, and a cold pressor pain task – the order of these tasks was counterbalanced to reduce order effects. Before the pain task was completed, participants placed their hand in room temperature water (20-22 degrees Celsius) for two minutes in order to standardize the temperature of their skin. During the standardization, participants received the following instructions: "In a moment, I will ask you to place your non-dominant hand, palm facing down, in the water until the water reaches one inch above your wrist. Please keep your hand in the water as long as you can. Withdraw your hand only when you can no longer tolerate the sensation. At that time, withdraw your hand from the water and say 'pain limit'." After agreeing to the instructions, participants completed the cold pressor task. The cold pressor task had a maximum time of 5 minutes.

After completing the cold pressor task and the surveys, participants were debriefed about the purposes of the study and compensated with course credit. This study received approval from the Indiana University Institutional Review Board (IRB #1611140508).

Data Analyses

IBM SPSS Statistics 24 and Mplus version 8 were used for all analyses.

Scoring

To examine participants' explicit beliefs about race and pain, I subtracted each participant's response to the REPQ item that asks "What is the typical White person's sensitivity to pain?" from their response to the item that asks "What is the typical Black person's sensitivity to pain?" A positive value for this difference score indicates that the participant believes the typical Black person is more pain sensitive than the typical White person, whereas a negative value indicates that the participant believes the typical White person is more pain sensitive than the typical Black person. A value of zero indicates that the participant believes the typical White and Black person are equally pain sensitive. This difference score was used to test hypothesis 4.

Assumptions and Descriptives

I examined the data to ensure that all statistical assumptions were met for parametric tests. When assumptions were not met, appropriate adjustments were made (as indicated below). I ran descriptive statistics on participants' demographic characteristics. I checked for reliability of the study measures and computed a correlation matrix for all of the variables of interest.

Hypothesis 1

Due to a non-normal distribution in cold pressor pain tolerance, I tested hypothesis one using a Mann-Whitney U test to examine race differences in actual pain tolerance on the cold pressor task.

Hypothesis 2

I used a paired samples t-test to examine participants' ratings on the REPQ (explicit beliefs) of the pain sensitivity of the typical White person and Black person.

Hypothesis 3

To test hypothesis three, I began by calculating the mean and standard deviation of participants' scores on the implicit measure (Coudeyre et al.). Then, I used a one-sample t-test to determine if the average IAT score was significantly different from zero (a theoretically bias-free score).

Hypothesis 4

Moderation analyses were used to test hypothesis four that the relationship between race and pain tolerance is moderated by implicit and explicit beliefs about race and pain. Separate analyses were used for explicit and implicit beliefs. Figure 1 and 2 represent the models for hypothesis four.

Two moderation analyses were conducted to test explicit and implicit beliefs about race differences in pain. Robust moderation analyses were conducted in Mplus version 8 (Muthén & Muthén, 1998-2017). As the outcome variable was not normally distributed, a robust test was used for both hypotheses. An interaction term was created for both explicit and implicit beliefs

and used in separate moderation models in Mplus to determine if the moderation was significant. Covariates that were determined to have race differences and predict pain tolerance in prior literature were identified a priori and included in the model.

Power Analysis

Power was determined by conducting a power analysis using G*Power. Effect sizes were estimated from a study that examined the influence of explicit beliefs about gender and pain (Robinson et al., 2003). Robinson and colleagues (2003) experimentally manipulated participants' beliefs about gender and pain tolerance. Prior to the cold pressor pain task, participants were given one of three sets of instructions: no expectations, 30 second expectation, or 90 second expectation. When given the 30 or 90 second expectation instructions, participants were told the following: "The typical man/woman lasts 30/90 seconds in this task." – the gender of the instruction sets was matched to the gender of the participant. Participants in the control group were not provided a specific time expectation. For the control group, men had a significantly higher pain tolerance and lower pain rating than women; however, when men and women were given the same time expectation, there were no significant sex differences in pain tolerance or ratings (Robinson et al., 2003). The average of the effect sizes from all three conditions was 0.36 – this average effect size was used to power the current study. Using G*Power (Faul et al., 2007) and setting the effect size to 0.36, the power to 0.80, and probability of making a type I error to 5%, it was determined that 105 participants were needed for the current study.

RESULTS

Sample Characteristics

One hundred forty-six participants were recruited for the study. Thirteen participants were excluded for not identifying as White or Black, and one participant withdrew before completing the study. The final sample consisted of 132 participants, 68 (51.5%) White and 64 (48.5%) Black. Seven participants (5.3%) identified as Hispanic, Latino, or Spanish. The sample was 48.5% female and had a mean age of 20.48 (SD=5.40). Most of the sample identified as single (94.7%), not working (45.5%) or a part-time employee (47.7%), and as making less than $25,000 a year (93.9%). Demographic information is presented in Table 1. Tables 2 through 4 contain means and standard deviations for primary variables of interest. Correlations between variables of interest can be found in Tables 5 and 6. Two participants broke protocol when the researcher failed to stop them from exceeding the time limit on the cold pressor task. Sensitivity analyses were conducted to determine whether their inclusion/exclusion affected the overall pattern of findings. As the pattern of findings remained the same, the two participants were included in all reported analyses to provide a fuller data set.

Hypothesis 1

The results of the Mann-Whitney U test indicated that Black participants had a lower pain tolerance (*Mdn*=23.34) than White participants (*Mdn*=53.94), U=1165.50, p<.01, r=0.40.

Hypothesis 2

The results of the paired samples t-test indicated that, on average, participants rated the typical Black person (M=44.56, SD=15.71) as less sensitive to pain than the typical White person (M=56.74, SD=14.67), $t_{(131)}$=-6.83, p<.01, d_{rm}=0.80.

Hypothesis 3

On average, participants demonstrated a stronger implicit association between White Americans and pain sensitivity than Black Americans and pain sensitivity (M=.19, SD=.34), and the results of the one-sample t-test indicated that this association significantly differed from a theoretical neutral point of 0, indicating no association, $t_{(131)}$=6.35, p<.01, d=0.55.

Hypothesis 4

A robust moderation analysis was conducted to determine if participants' explicit beliefs about race differences in pain sensitivity moderated the relationship between race and pain tolerance while controlling for race differences in anxiety, depression, and pain coping (i.e., distraction, catastrophizing, and prayer). The interactive effect indicated that explicit beliefs about race differences in pain sensitivity did not significantly moderate the relationship between race and pain tolerance, b=-0.37, p=.71. Model results can be seen in Table 7.

A robust moderation analysis was conducted to determine if participants' implicit beliefs about race differences in pain sensitivity moderated the relationship between race and pain tolerance while controlling for race differences in anxiety, depression, and pain coping (i.e., distraction, catastrophizing, and prayer). The interactive effect indicated that implicit beliefs about race differences in pain sensitivity did not significantly moderate the relationship between race and pain tolerance, b=-21.87, p=.65. Model results can be seen in Table 8.

Additional Analyses

In addition to the above planned analyses, I conducted the following analyses to more fully explore the findings. Analyses for hypothesis 2 and 3 found that participants tended to rate the typical White person as more pain sensitive than the typical Black person for both explicit and implicit beliefs. Additional analyses were used to examine potential race differences in implicit and explicit beliefs between White and Black participants. Furthermore, it was observed that Black and White participants compared their own pain sensitivity to that of their own race group differently. To explore the potential impact of these differences, I examined how participants' explicit beliefs about their own pain sensitivity (compared to that of their race group) moderated race differences in actual pain tolerance.

Race Differences in Explicit Beliefs

A two-way repeated measures ANOVA indicated that participants rated the typical White person as more pain sensitive compared to the typical Black person, $F_{(1, 130)}=54.80$, $p<.01$, $\eta^2=.297$. The results also indicated that there was a significant interaction between the race of the participants and the REPQ items, $F_{(1, 130)}=18.75$, $p<.01$, $\eta^2=.126$. While both White and Black participants rated the typical Black person as less pain sensitive than the typical White person, White participants rated the typical Black person as significantly more pain sensitive than Black participants did (*MD*=7.00, *SE*=2.68, *p*=.01) and Black participants rated the typical White person as significantly more pain sensitive than White participants did (*MD*=-7.51, *SE*=2.48, *p*<.01). Thus, compared to their racial counterparts, participants rated same-race "typical" people as less pain sensitive and other-race "typical" people as more pain sensitive – this in-group favoritism was demonstrated similarly by Black and White participants. This relationship is demonstrated in Figure 3.

Race Differences in Implicit Beliefs

The results of the independent samples t-test indicated that Black and White participants had significantly different IAT scores, $t_{(130)}$= -3.38, p<.01, d=0.59. Both Black participants (M=.29, SD=.35) and White participants (M=.09, SD=.30) demonstrated a stronger implicit association between White Americans and pain sensitivity than Black Americans and pain sensitivity, but Black participants demonstrated a stronger implicit association than White participants. For both Black participants, $t_{(63)}$=6.59, p<.01, d=0.82, and White participants, $t_{(67)}$=2.55, p=.01, d=0.31, the association was significantly different from a theoretical neutral point of 0, indicating no association.

Self-Other Comparison

A robust moderation analysis was conducted to determine if participants' comparison of their own pain sensitivity to their race group (self-other comparison) moderates the relationship between race and pain tolerance. For the first analysis, the self-other comparison variable was a continuous variable created by subtracting participants' pain sensitivity ratings for their own race group from participants' pain sensitivity ratings for themselves (M=-0.92, SD=22.79). The interactive effect indicated that self-other comparison significantly moderated the relationship between race and pain tolerance, b=-51.99, p<.01. The simple slopes for the association between race and pain tolerance were tested for low (1 standard deviation below the mean), moderate (mean), and high (1 standard deviation above the mean) values of self-other comparison. For low, b=-65.20, p<.01, and moderate, b=-51.99, p<.01, values of self-other comparison, a significant negative association was found between race and pain tolerance, but this association was not significant for high values of self-other comparisons, b=-0.08, p=1.00

To further understand this relationship, 3 self-other comparison groups were created. Participants who rated themselves as less pain sensitive than their own race group were classified as "less pain sensitive" (n=64). Participants who rated themselves as more pain sensitive than their own race group were classified as "more pain sensitive" (n=62). Participants who rated themselves as having equal pain sensitivity to that of their own race group were classified as "equally pain sensitive" (n=6) – this group was excluded from subsequent analyses due to the small cell count. A robust multiple group moderation analysis was conducted in order to determine if the categorical self-other comparison moderated the relationship between race and pain tolerance. The Wald chi-square test indicated that self-other comparison significantly moderates the relationship between race and pain tolerance, ω=4.40, p=.04. Black and White participants had significantly different pain tolerance times for the "less pain sensitive" group, b=-97.74, p<.01, but not for the "more pain sensitive" group, b=-28.91, p=.25. White participants in the "less pain sensitive" group had a higher pain tolerance than Black participants in the "less pain sensitive" group. In contrast, Black and White participants in the "more pain sensitive" group did not differ in pain tolerance. This relationship is demonstrated in Figures 4 and 5.

DISCUSSION

The purpose of this study was to investigate race differences in pain tolerance and beliefs about pain sensitivity. First, I examined race differences in actual pain tolerance. Then I explored explicit and implicit beliefs about race differences in pain tolerance for Black and White participants. Lastly, I examined the roles that these beliefs play in actual race differences in pain tolerance. I found that there were race differences in actual pain tolerance and that participants had explicit and implicit beliefs that there were race differences in pain. However, contrary to expectations, beliefs about race differences in pain did not moderate the race differences in actual pain tolerance.

Consistent with hypothesis one, I found there were race differences in pain tolerance. Similar to previous findings (Campbell et al., 2005; Edwards et al., 2001; Edwards & Fillingim, 1999; Meints et al., 2016; Rahim-Williams et al., 2007; Sheffield et al., 2000; Woodrow et al., 1972), Black participants had a lower pain tolerance than White participants on the cold pressor task. Extant literature suggests that race differences in coping styles (Jordan, Lumley, & Leisen, 1998; Linton & Shaw, 2011; Meints et al., 2016; Moore & Brodsgaard, 1999; Sullivan & Neish, 1998; Sullivan et al., 2001) and emotions (Ahmadi et al., 2018; Alabsi & Rokke, 1991; Dickens et al., 2003; Edens & Gil, 1995; Wiech & Tracey, 2009) may account for race differences in pain tolerance. In my study, these variables were controlled in the models for hypothesis four.

In support of hypothesis two, I found that participants held the explicit belief that Black people have a higher pain tolerance than White people.[1] While these results are consistent with

[1] Note: While the REPQ examined pain sensitivity, pain sensitivity and pain tolerance can be viewed as being at opposite ends of the spectrum. For clarity of interpretation, results will be reported in terms of pain tolerance in place of pain sensitivity throughout this section.

previous findings (Hoffman, Trawalter, Axt, & Oliver, 2016; Hollingshead et al., 2016), these beliefs are not consistent with actual race differences in pain tolerance in this study or in previous literature (Edwards, Fillingim, & Keefe, 2001). One reason that people may believe that Black people have a higher pain tolerance could be related to the dehumanization process. Dehumanization involves the process of viewing a person or group of people, often from a minority group, as lacking fundamental qualities of humanness (Haslam, 2006; Haslam, Kashima, Loughnan, Shi, & Suitner, 2008). This process may unfold through superhumanization, such as when individuals attribute supernatural abilities or physical qualities to a group of people (Trawalter & Hoffman, 2015; Waytz, Hoffman, & Trawalter, 2014). Research suggests that both White and Black participants view Black people as "superhuman" and believe that they feel less pain (Trawalter & Hoffman, 2015; Waytz et al., 2014). Dehumanization may also occur when individuals compare a group of people to nonhuman objects (Haslam, 2006). Previous research suggests that White people have associated Black people with animals or non-human objects such as robots (Haslam, 2006; Haslam & Loughnan, 2014; Waytz et al., 2014). When individuals are associated with non-human objects or animals, their perceived ability to experience emotions and pain is thought to be diminished (Haslam et al., 2008). Alternatively, there is evidence to suggest that these beliefs about race differences in pain may be related to perceived life hardship (Trawalter & Hoffman, 2015). For instance, one study found that individuals believe that Black people have a higher pain tolerance because they have experienced greater suffering and hardship throughout their lives, which leads to an increase in the ability to endure pain (Hoffman & Trawalter, 2016). Despite these beliefs, research suggests that in reality, the opposite is true and that high stress from discrimination often leads to worse health outcomes such as increased stress and reduced immune response

(Major, Dovidio, Link, & Calabrese, 2018; Morey, Boggero, Scott, & Segerstrom, 2015; Morey & Segersfrom, 2015). This may help to explain the discrepancy between beliefs and actual pain outcomes.

Hypothesis three was also supported as participants showed a stronger association between Black people and pain tolerance than White people and pain tolerance. This was the first study to explore implicit beliefs related to race differences in pain sensitivity. In this study, participants' explicit and implicit beliefs were positively correlated. Similar to explicit beliefs, participants may have the implicit belief that Black people are more pain tolerant because of stereotypes related to superhuman attributes (Trawalter & Hoffman, 2015; Waytz et al., 2014), dehumanization processes (Haslam et al., 2008; Haslam & Loughnan, 2014), or beliefs about life hardship (Hoffman & Trawalter, 2016). Even though implicit and explicit beliefs correlated, the correlation was only moderate, and the implicit and explicit beliefs correlated differently with other variables suggesting that they are two distinct constructs. Given these differences, my study is in line with previous findings about general race biases that suggest implicit beliefs about race should be examined in addition to explicit beliefs (Green et al., 2007; Hofmann et al., 2005; Shoda et al., 2014).

Hypothesis four was not supported. Unlike the findings for gender (Wise et al., 2002), explicit and implicit beliefs did not significantly moderate the relationship between race and pain tolerance on the cold pressor task. These beliefs about race differences in pain tolerance did not predict pain tolerance for Black or White participants. While this study found that participants hold beliefs about race differences in pain much like they do for gender (Wise et al., 2002), the moderation analyses suggest that the beliefs about race differences in pain function differently than beliefs about gender differences in pain. This could be related to the mismatch in the

directionality between beliefs and actual race difference in pain tolerance. For gender, participants held the belief that the typical man has a higher pain tolerance than the typical woman, which matches the gender differences in actual pain tolerance (Wise et al., 2002). In contrast, participants in my study believed that Black participants were more pain tolerant than White participants, which was the opposite of race differences in actual pain tolerance. This mismatch may have led to these beliefs about race functioning differently than beliefs about gender. Another reason that beliefs about race differences in pain did not moderate the relationship between race and pain tolerance could be that the beliefs measured were not specific or personal enough to be related to participants' pain tolerance. Previous findings that have used pain beliefs to predict outcomes have often been specific to the individual rather than the group to which they belong (Jensen & Karoly, 1992; Williams & Thorn, 1989). For example, Jensen and Karoly (1992) found that when individuals rated their own disability as high, they were more likely to have higher service utilization and lower psychological functioning. Furthermore, previous research examining implicit pain beliefs found that a more personal IAT was a better predictor of beliefs over the traditional IAT (Dambrun, Villate, & Richetin, 2008). It is possible that beliefs about race differences in pain were not personal enough to influence actual pain tolerance. Based off of the previous literature and the additional findings, more personal beliefs may be more relevant to race differences in actual pain tolerance.

In addition to analyses testing the main hypotheses, exploratory analyses were conducted to better understand the findings. As explained above and in line with previous findings (Dore, Hoffman, Lillard, & Trawalter, 2017; Hollingshead et al., 2016; Trawalter & Hoffman, 2015), I found that participants endorsed the explicit belief that Black people are more pain tolerant than White people. I further explored this relationship by examining if White and Black participants

rated the typical White and Black person's pain tolerance differently. Compared to their racial counterparts, participants rated their own group members as more pain tolerant and the other race group members as less pain tolerant. While participants endorsed the stereotype that Black people had a higher pain tolerance, they also appeared to demonstrate in-group favoritism. Research has yet to explore if having a higher pain tolerance is viewed in a positive way, but prior research indicates that being resilient is viewed as a positive trait and is highly promoted among health care professionals (Greene, 2002; Greene & Cohen, 2005). Furthermore, one study found that most race groups endorse having a more stoic approach to pain, and Black participants in particular highly endorsed that they would not complain about their pain because it does not do any good (Lipton & Marbach, 1984). Moreover, if being pain tolerant is associated with the idea of being superhuman (Trawalter & Hoffman, 2015), it is possible that participants believe that their own race group is superior to the typical human. Assuming that pain tolerance could be viewed in a similar way to resilience or as a form of stoicism, the current findings were in line with previous findings indicating that people tended to rate their own group as superior compared to other groups (Efferson, Lalive, & Fehr, 2008; Taylor & Doria, 1981; Yamagishi, Jin, & Kiyonari, 1999).

When exploring race differences in implicit beliefs, I found a similar pattern to the race differences in explicit beliefs. While both Black and White participants believed that Black people have a higher pain tolerance, this belief was significantly stronger in Black participants than it was for White participants. This could be another example of in group favoritism (Efferson et al., 2008; Taylor & Doria, 1981; Yamagishi et al., 1999). Alternatively, these findings suggest that Black participants have internalized the stereotypes related to superhuman attributes (Trawalter & Hoffman, 2015; Waytz et al., 2014), dehumanization (Haslam, 2006;

Haslam et al., 2008; Haslam & Loughnan, 2014), or life hardship (Hoffman & Trawalter, 2016) which may have led to a strongly held belief that Black people have a higher pain tolerance. Consistent with findings related to internalized racism (Pyke, 2010; Speight, 2007; Tull et al., 1999), my findings indicated that Black participants accepted and believed in the stereotype. Given that internalized racism has been linked to many negative health outcomes (Smedley, 2012), future research should examine how internalizing the belief that Black people are more pain tolerant may affect pain care and outcomes.

I also explored the role that comparisons between the self and one's own race group (self-other comparison) play in race differences in actual pain tolerance. Similar to findings from Hollingshead and colleagues (2016), I found that on average, White participants rated themselves as "less pain sensitive" (i.e. more pain tolerant) than the typical White person, and Black participants rated themselves as "more pain sensitive" (i.e. less pain tolerant) than the typical Black person. Race differences in the self-other comparison ratings can be viewed in Table 9. These findings could be explained by the superhuman beliefs that Black participants may have held. While Black participants may believe that Black people are "superhuman" (Trawalter & Hoffman, 2015; Waytz et al., 2014) and thus have a higher pain tolerance, they may also recognize that they themselves are human; therefore, they rated their own pain tolerance as lower than the typical Black person. In contrast, Black participants may have internalized the "dehumanization" stereotype that Black people resemble non-human objects and do not feel pain as intensely as members of other race groups (Haslam, 2006; Haslam et al., 2008; Haslam & Loughnan, 2014). However, in recognizing that they, themselves, do feel pain and other emotions, participants may have distanced themselves from this more general stereotype. Alternatively, Black participants may believe that having more life hardship increases pain

tolerance. Prior research indicates that people believe that having more life hardship leads to an increase in pain tolerance (Hoffman & Trawalter, 2016). Given that my sample is made up of college students, it is possible that the Black participants in this study believed that they had less life hardship than the typical Black person, and thus had a lower pain tolerance.

These findings may also be understood in the context of Social Comparison Theory (Buunk, Gibbons, & Buunk, 2013). Social Comparison Theory can be defined as the process of, consciously or unconsciously, thinking about others and identifying similarities or differences from oneself (Festinger, 1954; Wood, 1996). Previous findings indicate that individuals tend to compare themselves to similar others (Festinger, 1954; Hakmiller, 1966); in this case, the typical person of their own race would be the most likely group for participants to compare themselves to. There are two types of social comparisons that may be used, upward and downward comparisons (Buunk et al., 2013). Participants in the "less pain sensitive" group were likely engaging in a downward social comparison, meaning that they were comparing themselves to a group that had a lower pain tolerance than themselves (Wills, 1981). Participants in the "more pain sensitive" group may have been using an upward social comparison, meaning that they were comparing themselves to a group that had a higher pain tolerance (Festinger, 1954; Tesser, Millar, & Moore, 1988). The majority of Black participants were in the "more pain sensitive" group whereas the majority of White participants were in the "less pain sensitive" group. These differences in social comparison could be due to the findings that participants tended to believe that Black people were more pain tolerant than White people. Seeing as previous findings suggest that upward and downward comparisons may lead to different outcomes, Social Comparison Theory should be used to further examine race differences in pain tolerance.

The self-other comparison measure significantly moderated the relationship between race and pain tolerance on the cold pressor task. White participants in the "less pain sensitive" group had a significantly higher pain tolerance than Black participants in the "less pain sensitive" group. In contrast, White and Black participants in the "more pain sensitive" group did not have significantly different pain tolerances. The reason for these differences are unclear at this time and future research should explore this more thoroughly.

Limitations

This study had several limitations. First, participants were recruited from a single university in the Midwestern United States, which could limit the generalizability of the results. College students may have different beliefs than people who do not go to college or who are older and part of another generation. Future research with more diverse samples in terms of age and education is necessary.

Second, participants were excluded if they were receiving pain care, and it is unlikely that any participants were providing pain care to others in a professional setting due to the education, employment status, and income of participants; therefore, it is unclear if any findings from this study would generalize to pain patients or providers. Third, because the study design is cross-sectional and does not involve manipulating any of the variables of interest, causal conclusions cannot be made about the relationships examined.

Fourth, it is possible that the explicit belief measure (REPQ) did not have enough variability to find an effect. While the findings indicated that on average, participants believed that the typical Black person was more pain tolerant than the typical White person, about a quarter of participants felt that there was not a difference between the typical White and Black person's pain sensitivity. However, the results indicate that the explicit measure of race

difference in pain had adequate variability. That being said, a sample with participants that strongly believe that the typical White and Black person have significantly different sensitivities to pain may find that these beliefs then predict actual race differences in pain tolerance.

Fifth, while the IAT in general has been well supported (Greenwald et al., 2003; Greenwald, Nosek, Banaji, & Klauer, 2005; Greenwald, Nosek, & Sriram, 2006; Greenwald, Poehlman, Uhlmann, & Banaji, 2009; Mierke & Klauer, 2003; Nosek, Greenwald, & Banaji, 2005; Pinter & Greenwald, 2005), there are many criticisms related to the IAT (Arkes & Tetlock, 2004; Blanton & Jaccard, 2006). Even though some evidence suggests that there are factors other than implicit beliefs that influence the IAT response patterns (Brendl, Markman, & Messner, 2001; Karpinski & Hilton, 2001; Olson & Fazio, 2004), there is a significant body of literature that supports the reliability and validity of the IAT (BANAJI, 2013; Greenwald & Nosek, 2001; Greenwald et al., 2005; Greenwald et al., 2006; Greenwald et al., 2009; Nosek et al., 2005). Furthermore, the pilot study mentioned in the methods section lends support to the construct validity of the IAT used in this study. The findings from the pilot study and the current study support the validity of this new IAT. Mainly, the IAT correlated with measures of explicit beliefs about race differences in pain and racial stereotypes and preferences as expected. Overall, the evidence suggests that the IAT in this study was measuring implicit beliefs about race differences in pain sensitivity and tolerance.

Potential Implications

Results of this investigation may have potential clinical and research implications. The current study contributes to the growing body of literature that has found race differences in pain (Edwards, Fillingim, & Keefe, 2001). The results provide further support to the findings that Black patients may experience more severe pain than White patients (Cintron & Morrison, 2006;

Meghani et al., 2012). My results also extend previous findings about beliefs related to race differences in pain. My study provides further evidence that both Black and White people feel that Black people have a higher pain tolerance. These findings could have important clinical implications for disparities in pain treatment. Black patients consistently have their pain undertreated (Bonham, 2001; Freeman & Payne, 2000; Green et al., 2007). If it is found that providers and chronic pain patients hold similar beliefs, the impact these beliefs have on pain care disparities should be further explored. Interventions that address the misconceptions about life hardship leading to a higher pain tolerance (Hoffman & Trawalter, 2016) may address these beliefs about race differences in pain and thus help to reduce disparities in pain treatment.

My exploration of implicit beliefs about race differences in pain further extends the literature about beliefs on race differences in pain. Previous research has found that implicit measures could be a useful assessment tool throughout the course of therapy (De Houwer, 2002; Grumm et al., 2008). If a similar pattern of implicit beliefs are found in chronic pain patients and these beliefs are linked with poor outcomes, then the use of an implicit measure of beliefs about race differences in pain may be a useful assessment tool in treatment practices. These implicit beliefs should also be examined in health care providers to determine if they influence provider decision making. Given that these beliefs may be more relevant to how others are viewed, it is important to explore the role they play in provider decision making. If it is found that these beliefs influence provider decision making in a negative way, then interventions can be developed to reduce the negative consequences.

The nonsignificant findings of hypothesis four and my additional findings suggest that more specific beliefs should be explored. Previous findings indicate that patients' actual health status is influenced by individuals' perceptions of how their status compares to that of others

(Buunk et al., 2013). Given these findings about the role that social comparisons play in health perceptions and the current study findings, comparison beliefs related to race and pain sensitivity should be further explored in a clinical setting using both explicit and implicit measures. If future research finds that these comparisons are important in chronic pain patients, interventions that target these comparison beliefs can be developed to help improve pain care. Furthermore, a more in depth understanding of Social Comparison Theory in the context of race will lead to a fuller understanding of race differences in pain.

Conclusion

In conclusion, my results indicate that White participants have a higher pain tolerance than Black participants. In contrast, participants tend to believe that the typical White person is more pain sensitive than the typical Black person. I did not find that the beliefs about race differences moderate race differences in actual pain tolerance. My results indicate that participants' comparison ratings of their own pain sensitivity compared to their race group's pain sensitivity may be more important for understanding race differences in actual pain tolerance. If future research indicates that these beliefs are important in a clinical setting, interventions related to these beliefs should be developed to improve the quality of life of chronic pain patients.

TABLES

Table 1.
Descriptive Sample Statistics

		All Participants (N=132)	Black Participants (n=64)	White Participants (n=68)
Gender	Female	64	33	31
	Male	68	31	37
Age	18-19	89	44	45
	20+	43	20	23
Work Status	Not working	60	27	33
	Part-time	63	31	32
	Full-time	8	5	3
	Disabled	1	1	0
Income	<$25,000	124	60	64
	>$25,000	8	4	4
Marital Status	Single	125	63	62
	Married	6	0	6
	Divorced	1	1	0
Personal Experience with Chronic Pain	None	81	39	42
	Minimal	36	19	17
	Some	11	4	7
	Much	4	2	2

Table 2.
Descriptive Statistics for the Race/Ethnicity Expectations of Pain Questionnaire

	Total Sample		Participant Race			
			White		Black	
Individual Items	**M**	**SD**	**M**	**SD**	**M**	**SD**
1. What is the typical Black person's *sensitivity* to pain?	44.56	15.71	47.96	14.34	40.95	16.40
2. What is the typical White person's *sensitivity* to pain?	56.74	14.67	53.10	12.02	60.61	16.26
3. Your *sensitivity* to pain is	46.29	22.27	42.28	21.37	50.55	22.57
1. What is the typical Black person's *willingness* to report pain?	39.65	22.94	44.56	19.67	34.44	25.09
2. What is the typical White person's *willingness* to report pain?	63.74	19.72	56.81	17.81	71.11	19.08
3. Your *willingness* to report pain is	50.42	25.06	48.24	23.88	52.75	26.24

Note. These variables were all measured on a VAS scale that ranged from 0 to 100.

Table 3.
Descriptive Statistics for the POMS

	Total Sample		Race			
			White		Black	
	M	**SD**	**M**	**SD**	**M**	**SD**
Anxiety	13.97	4.96	13.44	4.53	14.53	5.37
Anger	12.55	4.64	11.90	4.02	13.23	5.16
Fatigue	11.83	4.00	11.35	3.59	12.33	4.36
Depression	13.20	6.33	11.91	4.88	14.56	7.37
Vigor	16.83	4.86	16.74	4.91	16.94	4.84
Confusion	10.59	4.23	9.51	3.52	11.73	4.63

Note. These variables were all measured on a Likert scale that ranges from 1 to 5. Bold indicates that the variable was used as a covariate in hypothesis 4.

Table 4.
Descriptive Statistics for the CSQ_R

	Total Sample		Race			
			White		Black	
	M	**SD**	**M**	**SD**	**M**	**SD**
Distraction	2.87	1.39	2.58	1.39	3.19	1.32
Catastrophizing	1.50	1.13	1.20	0.91	1.82	1.25
Ignoring	2.99	1.34	3.15	1.24	2.82	1.43
Distancing	1.71	1.46	1.77	1.50	1.65	1.41
Self-Talk	4.29	1.21	4.23	1.16	4.35	1.26
Prayer	2.78	2.09	1.64	1.79	3.98	1.68

Note. These variables were all measured on a Likert scale that ranges from 0 to 6. Bold indicates that the variable was used as a covariate in hypothesis 4.

Table 5.
Correlations among key variables and POMS-SF

	1	2	3	4	5	6	7	8	9
1. REPQ sub	1								
2. IAT	.251**	1							
3. Tolerance	-.020	-.104	1						
4. Anxiety	.103	-.046	-.035	1					
5. Anger	.061	-.038	-.077	.596**	1				
6. Fatigue	.098	.093	-.101	.595**	.425**	1			
7. Depression	.125	.035	-.042	.683**	.680**	.522**	1		
8. Vigor	.158	.064	.136	-.190*	-.060	-.222*	-.231**	1	
9. Confusion	.198*	.049	-.139	.723**	.609**	.514**	.657**	-.109	1

Notes. N = 132 for all variables.
Abbreviations: REPQ sub= REPQ item about the typical White person minus the REPQ item about the typical Black person, IAT = Pain and Race Implicit Association Test, Tolerance = Pain tolerance measured by cold pressor task, and all other variables are emotional states from the POMS_SF.
*Significance is indicated by * p < .05; **p<.01.*

Table 6.
Correlations among key variables and CSQ_R

	1	2	3	4	5	6	7	8	9
1. REPQ sub	1								
2. IAT	.251**	1							
3. Tolerance	-.020	-.104	1						
4. Distraction	.173*	.070	-.213*	1					
5. Catastrophizing	.198*	.126	-.223*	.375**	1				
6. Ignoring	.073	.017	.133	.057	.010	1			
7. Distancing	.115	.012	.207*	.236**	.145	.386**	1		
8. Self-Talk	.129	.096	.031	.294**	.023	.420*	-.283**	1	
9. Prayer	.337**	.263**	-.193*	.382**	.291**	-.133	.067	.150	1

Notes. N = 132 for all variables.
Abbreviations: REPQ sub = REPQ item about the typical White person minus the REPQ item about the typical Black person, IAT = Pain and Race Implicit Association Test, Tolerance = Pain tolerance measured by cold pressor task, and all other variables are coping styles from the CSQ_R.
*Significance is indicated by * p < .05; **p<.01.*

Table 7.
Relationship between Explicit Beliefs about Race Differences in Pain and Actual Pain Tolerance

Regressed on Pain Tolerance	***b***	***S.E.***	***Est./S.E.***
Race	-81.51*	19.77	-4.12
Explicit Belief	1.40	1.90	0.73
Race x Explicit Belief	-0.37	1.01	-0.37
Anxiety	-0.35	2.03	-0.17
Depression	2.41	1.83	1.32
Distraction	-9.01	6.50	-1.39
Catastrophizing	-16.91	9.42	-1.80
Prayer	2.66	5.03	0.53

*Note. Significance is indicated by *p<.01.*
Model Covariates are italicized.

Table 8.
Relationship between Implicit Beliefs about Race Differences in Pain and Actual Pain Tolerance

Regressed on Pain Tolerance	***b***	***S.E.***	***Est./S.E.***
Race	-73.66*	20.13	-3.66
Implicit Belief	35.31	94.29	0.37
Race x Implicit Belief	-21.87	48.03	-0.46
Anxiety	-0.39	2.06	-0.19
Depression	2.32	1.78	1.30
Distraction	-9.13	6.64	-1.38
Catastrophizing	-16.08	9.17	-1.75
Prayer	4.01	5.06	0.79

*Note. Significance is indicated by *p<.01.*
Model Covariates are italicized.

Table 9.
Race Differences in Self-Other Comparison Groups.

Compared to Own Race	All Participants	Black Participants	White Participants
Less Sensitive	64	19	45
Equally Sensitive	6	3	3
More Sensitive	62	42	20

Note. Less Sensitive means that participants rated themselves as less pain sensitive compared to their own race group. More sensitive means that participants rated themselves as more pain sensitive than their own race group. Equally Sensitive means that participants rated themselves the same as their race group.

FIGURES

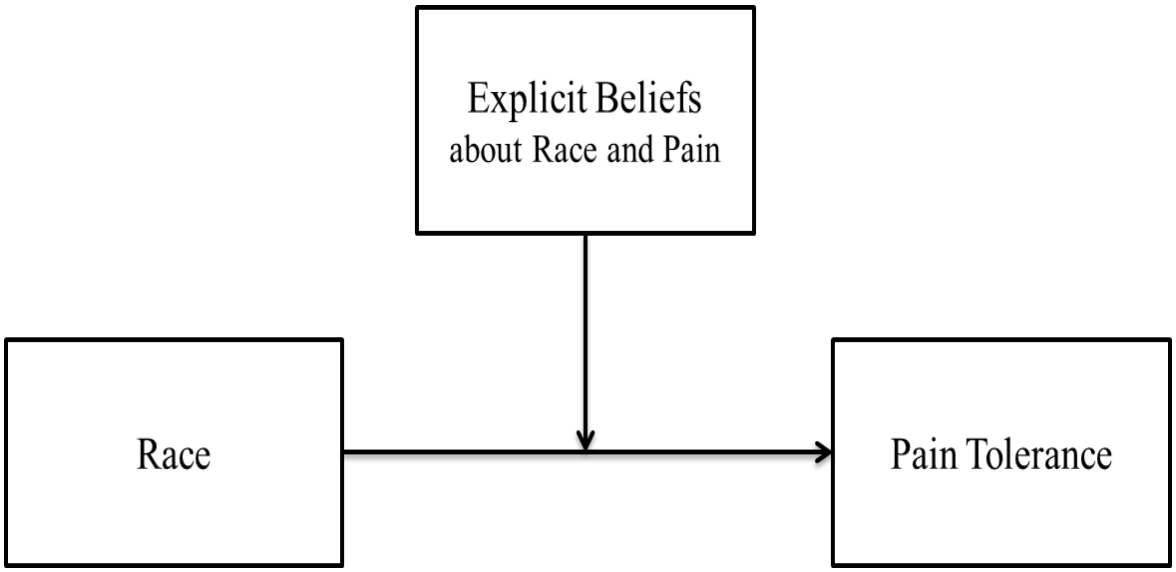

Figure 1. Hypothesis 4: Basic Moderation Model for Explicit Beliefs

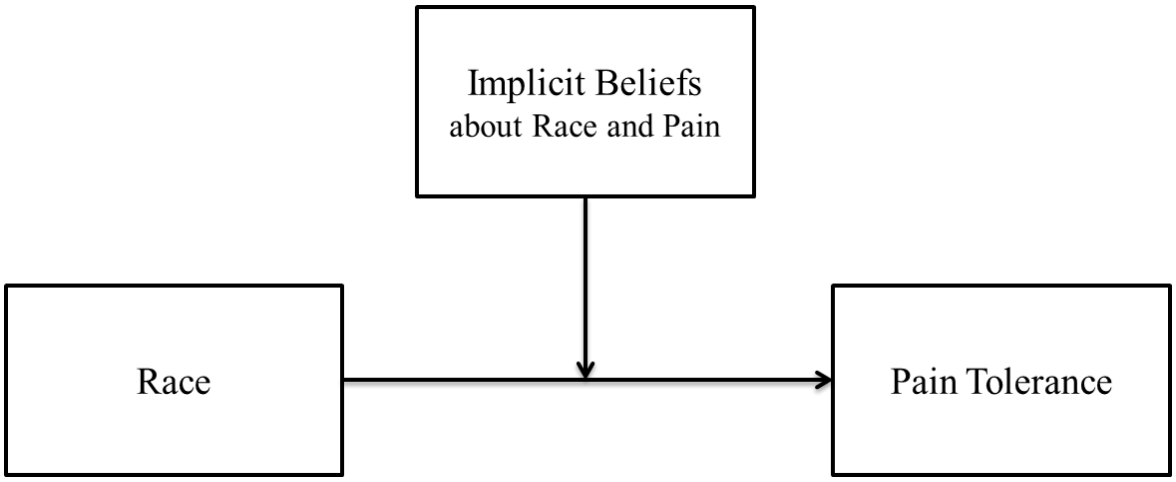

Figure 2. Hypothesis 4: Basic Moderation Model for Implicit Beliefs

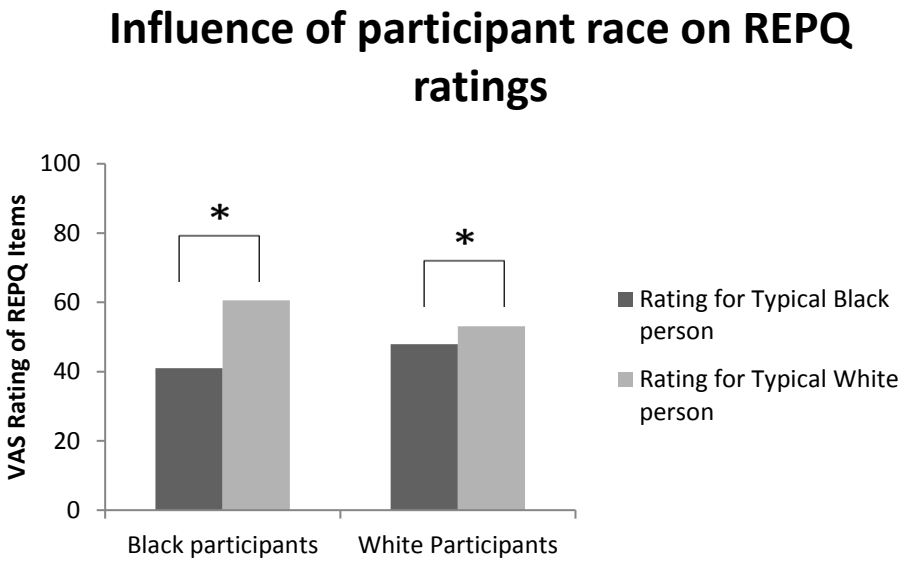

Figure 3. Influence of Participant Race on REPQ Ratings. Significance is indicated by * p=.01. REPQ_B refers to the REPQ item that asks "What is the typical Black person's sensitivity to Pain?" REPQ_W refers to the REPQ item that asks "What is the typical White person's sensitivity to Pain?"

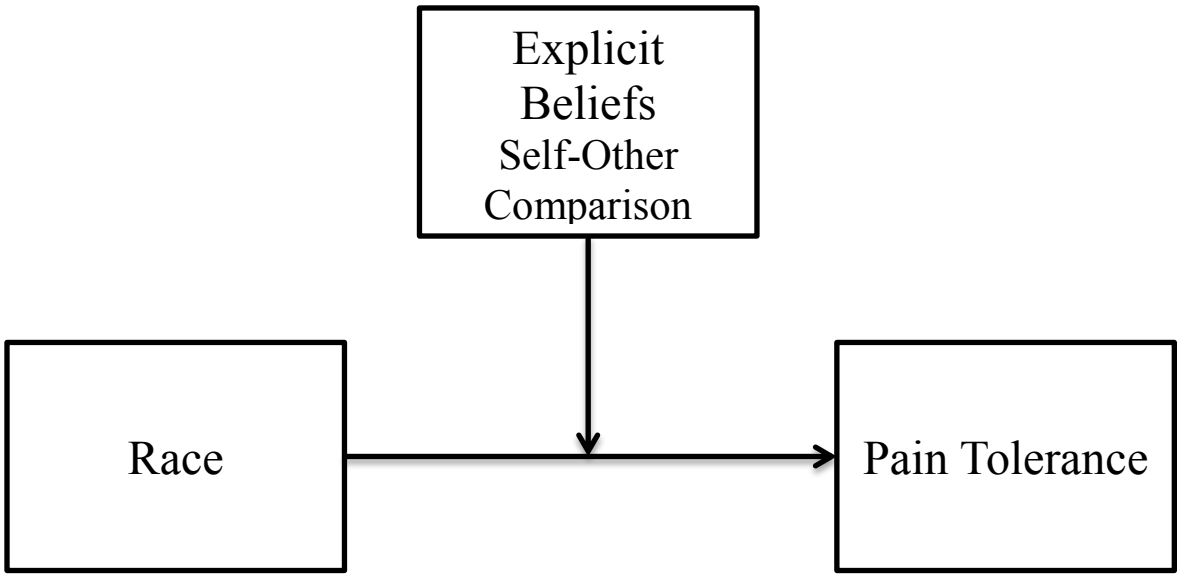

Figure 4. Additional Analyses: Basic Moderation Model for Self-Other Comparison

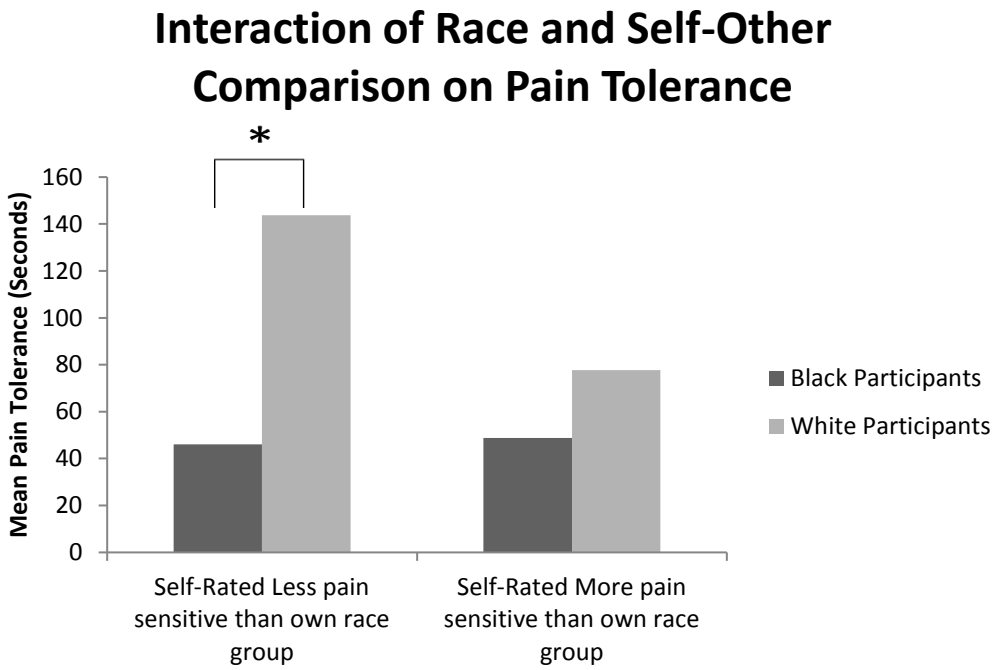

Figure 5 Interaction of Race and Self-Other Comparison on Pain Tolerance. Significance is indicated by * p=.05

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APPENDIX A: RACE/ETHNICITY EXPECTATIONS OF PAIN QUESTIONNAIRE

Race

Please put a mark on each line below to show your estimation of **pain sensitivity**. Pain sensitivity levels can be individualized. For example, two people with the same type of physical injury may each experience pain at a different time following the injury.

1. What is the typical Asian person's sensitivity to pain
   Not at all sensitive ----------Most sensitive imaginable

2. What is the typical Black person's sensitivity to pain
   Not at all sensitive ----------Most sensitive imaginable

3. What is the typical Hispanic person's sensitivity to pain
   Not at all sensitive ----------Most sensitive imaginable

4. What is the typical White person's sensitivity to pain
   Not at all sensitive ----------Most sensitive imaginable

5. Your sensitivity to pain is
   Not at all sensitive ----------Most sensitive imaginable

APPENDIX B: IMPLICIT ASSOCIATION TASK

APPENDIX C: COPING STRATEGIES QUESTIONNAIRE-REVISED

Name: _____ Date: _____

Individuals who experience pain have developed a number of ways to cope, or deal with their pain. Below are a list of things that patients have reported doing when they feel pain. For each activity, I want you to indicate, using the scale below, how much you engage in that activity when you feel pain and how effective this activity is in controlling pain, where a 0 indicates never, a 3 indicates sometimes, and a 6 indicates always. You can use **any point along the scale.** Remember, for each item you will be making two ratings.

Frequency

0 1 2 3 4 5 6

Never Sometimes Always

Effectiveness in controlling pain

0 1 2 3 4 5 6

Never Sometimes Always

1. When I feel pain, I try to feel distant from the pain, almost as if the pain was in somebody else's body.

Frequency _____ Effectiveness in controlling pain _____

2. I try to think of something pleasant.

Frequency _____ Effectiveness in controlling pain _____

3. It's terrible and I feel it's never going to get any better.

Frequency _____ Effectiveness in controlling pain _____

4. I tell myself to be brave and carry on despite the pain.

Frequency _____ Effectiveness in controlling pain _____

5. I tell myself that I can overcome the pain.

Frequency _____ Effectiveness in controlling pain _____

6. It's awful and I feel that it overwhelms me.

Frequency _____ Effectiveness in controlling pain _____

7. I feel my life isn't worth living.

Frequency _____ Effectiveness in controlling pain _____

8. I pray to God it won't last long.

Frequency _____ Effectiveness in controlling pain _____

9. I try not to think of it as my body, but rather as something separate from me.

Frequency _____ Effectiveness in controlling pain _____

10. I don't think about the pain.

Frequency _____ Effectiveness in controlling pain _____

11. I tell myself I can't let the pain stand in the way of what I have to do.

Frequency _____ Effectiveness in controlling pain _____

12. I don't pay any attention to it.

Frequency _____ Effectiveness in controlling pain _____

13. I pretend it's not there.

Frequency _____ Effectiveness in controlling pain _____

Frequency

0 1 2 3 4 5 6

Never Sometimes Always

Effectiveness in controlling pain

0 1 2 3 4 5 6

Never Sometimes Always

14. I worry all the time about whether it will end.

Frequency _____ Effectiveness in controlling pain _____

15. I replay in my mind pleasant experiences in the past.

Frequency _____ Effectiveness in controlling pain _____

16. I think of people I enjoy doing things with.

Frequency _____ Effectiveness in controlling pain _____

17. I pray for the pain to stop.

Frequency _____ Effectiveness in controlling pain _____

18. I imagine that the pain is outside of my body.

Frequency _____ Effectiveness in controlling pain _____

19. I just go on as if nothing happened.

Frequency _____ Effectiveness in controlling pain _____

20. Although it hurts, I just keep on going.

Frequency _____ Effectiveness in controlling pain _____

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

Frequency _____ Effectiveness in controlling pain _____

22. I ignore it.

Frequency _____ Effectiveness in controlling pain _____

23. I rely on my faith in God.

Frequency _____ Effectiveness in controlling pain _____

24. I feel like I can't go on.

Frequency _____ Effectiveness in controlling pain _____

25. I think of things I enjoy doing.

Frequency _____ Effectiveness in controlling pain _____

26. I do something I enjoy, such as watching TV or listening to music.

Frequency _____ Effectiveness in controlling pain _____

27. I pretend it's not a part of me.

Frequency _____ Effectiveness in controlling pain _____

APPENDIX D: PROFILE OF MOOD STATES-SHORT FORM

POMS-SF

Below is a list of words that describe feelings people have. Please read each one carefully. Then circle ONE answer to the right which best describes HOW YOU HAVE BEEN FEELING DURING THE PAST WEEK INCLUDING TODAY.

The numbers refer to these phrases:

0 = not at all
1 = a little
2 = moderately
3 = quite a bit
4 = extremely

1. Tense	0	1	2	3	4	**20. Discouraged**	0	1	2	3	4
2. Angry	0	1	2	3	4	**21. Resentful**	0	1	2	3	4
3. Worn out	0	1	2	3	4	**22. Nervous**	0	1	2	3	4
4. Unhappy	0	1	2	3	4	**23. Miserable**	0	1	2	3	4
5. Lively	0	1	2	3	4	**24. Cheerful**	0	1	2	3	4
6. Confused	0	1	2	3	4	**25. Bitter**	0	1	2	3	4
7. Peeved	0	1	2	3	4	**26. Exhausted**	0	1	2	3	4
8. Sad	0	1	2	3	4	**27. Anxious**	0	1	2	3	4
9. Active	0	1	2	3	4	**28. Helpless**	0	1	2	3	4
10. On edge	0	1	2	3	4	**29. Weary**	0	1	2	3	4
11. Grouchy	0	1	2	3	4	**30. Bewildered**	0	1	2	3	4
12. Blue	0	1	2	3	4	**31. Furious**	0	1	2	3	4
13. Energetic	0	1	2	3	4	**32. Full of pep**	0	1	2	3	4
14. Hopeless	0	1	2	3	4	**33. Worthless**	0	1	2	3	4
15. Uneasy	0	1	2	3	4	**34. Forgetful**	0	1	2	3	4
16. Restless	0	1	2	3	4	**35. Vigorous**	0	1	2	3	4
17. Unable to concentrate	0	1	2	3	4	**36. Uncertain about things**	0	1	2	3	4
18. Fatigued	0	1	2	3	4	**37. Bushed**	0	1	2	3	4
19. Annoyed	0	1	2	3	4						