Race, Social Status, and Depressive Symptoms: A Moderated Mediation Analysis of Chronic Low Back Pain Interference and Severity

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Introduction

Globally, low back pain is the leading cause of disability, and its burden is projected to increase with the aging population.[1] It has been estimated that up to 80 percent of the population will have an episode of back pain in their lifetime.[2] For most individuals, acute low back pain resolves relatively quickly, but for about 5 to 10 percent of the cases, acute low back pain transitions into chronic low back pain (cLBP), lasting more than 12 weeks.[3,4] cLBP is associated with low quality of life, chronic stress, decreased productivity, and mood disorders such as major depression.[5,6] cLBP affects all segments of the population; however, compared to non-Hispanic Whites, non-Hispanic African Americans (Blacks) experience more severe, and disabling cLBP.[7–9] In addition, patients of low socioeconomic status are disproportionately affected by the disease burden of cLBP.[10]

Existing research supports a biopsychosocial model of pain, which considers other factors in addition to biological processes that may contribute to the etiology, experience, management, and outcomes of cLBP.[11–14] These additional factors may include psychological, social, and/or environmental influences.[10,13,14] For instance, in the context of cLBP, research has highlighted the importance of psychological factors such as depressive

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symptoms.[14] Depression has been shown to be a reliable predictor of cLBP development, chronification, and related disabilities,[12,15,16] and cLBP has been reported as a risk factor for depression.[17]

In thinking about depressive symptoms and racial differences in cLBP, it is critical to consider racial and ethnic differences in major depressive disorders. Compare to Blacks, White Americans have a higher lifetime prevalence of major depressive disorder.[18,19] However, Black individuals and people of lower socioeconomic status are less likely to seek treatment, follow recommendations, and complete treatment regimens for depression. As a result, they tend to have more serious, prolonged, and disabling depression than Whites.[20] Multiple studies have reported that among Black individuals, racial discrimination and perceived social status correlate with depression.[21,22] Specifically, for among black adolescents higher perceived social status (i.e., position in the social hierarchy) is associated with an increased risk of 30-days, 12-month, and lifetime major depressive disorder.[21]

Others have found that an individual's perception of his or her social status is independent of objective measures of SES, and predicts mental and physical health.[23–26] Thus, it has been proposed that subjective measures of SES (e.g., perceived social status) and objective measures of SES (e.g., household income, educational attainment, and work status) are not interchangeable.[26] Research further suggests that social status differs among racial/ethnic groups as well.[26,27] In particular, there is a strong association between objective measures of SES and perceived social status among White individuals; but for Black individuals, objective measures of SES "do not necessarily influence their" perceived social status. [26,28,29] Accordingly, an appreciation of racial differences in the experience of pain, which is essential for effective intervention, cannot be fully understood without consideration of SES. [30]

Although race/ethnicity, SES, and depressive symptoms have been examined in the context of pain, relatively minimal research has examined the potential interplay between these factors on cLBP outcomes. Thus, the purpose of this study was to examine the pathways by which self-identified race influences the relationship between subjective SES and cLBP outcomes. This study had two hypotheses. First, we hypothesized that race moderated the effect of perceived social status in predicting cLBP interference and severity. Second, we hypothesized that race moderated the relationship between perceived social status and depressive symptoms, which conditionally mediated the effect of perceived social status in predicting cLBP interference and severity.

Methods

Study Overview

This study is part of a more extensive ongoing investigation examining ethnic/racial differences in cLBP severity and disability (Examining Racial And SocioEconomic Disparities in cLBP; ERASED). The ERASED cLBP study incorporates a socioeconomic framework from which to consider differences in cLBP outcomes between Black and White adults, as well as the biopsychosocial variables that predict these differences. The participants described in the current analysis were recruited between November 2017 and

June 2019 and have not previously been included in any published literature. The measures and procedures described below are limited to those involved in the current study. Study procedures were consistent with the research standards for cLBP proposed by the Research Task Force of the NIH Pain Consortium.[31] All procedures were reviewed and approved by the Institutional Review Board at the University of Alabama at Birmingham (IRB-170119003) and carried out in accordance with guidelines for the ethical conduct of research.

Participants

Participants were recruited via flyers posted at the Pain Treatment Clinic within the University of Alabama at Birmingham (UAB), and the surrounding community. Participants were included in this study if they reported non-specific cLBP that had persisted for at least three consecutive months and was present on at least half the days in the past six months (4). Furthermore, participants were only included if they denied any type of surgery on the low back or trauma/accident within the past year. Low back pain had to be the primary pain complaint reported for all participants with cLBP. Participants were between the ages 19 to 85 years; able to read, write, and understand English; and self-identified as non-Hispanic Black/African American or non-Hispanic White/Caucasian. Informed consent for study participation was obtained from each participant before initiating study procedures.

Procedures

Initial screening and review of medical records.

All participants completed initial screening via telephone to determine eligibility for study inclusion. Sociodemographic and health data were also obtained during screening and included: sex, age, and ethnic/racial identity, as well as a brief health history. Review of medical records was subsequently completed for each potential participant to confirm cLBP diagnosis and corroborate self-reported brief health history, as well as document any other comorbid diagnoses and medications actively being prescribed.

Participants were excluded from participation for the following reasons: 1) cLBP attributable to other factors such as ankylosing spondylitis, infection, malignancy, compression fracture or other trauma; 2) Presence of systemic rheumatic conditions (e.g., rheumatoid arthritis, systemic lupus erythematosus, fibromyalgia); 3) Evidence of uncontrolled hypertension (i.e., SBP/DBP > 150/95), cardiovascular or peripheral arterial disease; 4) Poorly controlled diabetes (HbA1c > 7%); 5) Neurological disease (e.g., Parkinson's, multiple sclerosis, epilepsy); 6) Serious psychiatric disorder requiring hospitalization within the past 12 months; 7) Pregnancy.

Laboratory sessions.—A flow diagram depicting matriculation through the study sessions is presented in Figure 1. Study participants completed two separate study sessions. During the first study session, participants completed measures of clinical pain severity and interference, perceived social status, and depressive symptoms. They also provided information about their socioeconomic status, including annual household income, occupational status, and educational attainment. Approximately one week following the first

study session, participants returned to the laboratory and completed a second study session, which included additional measures of clinical pain severity and interference.

Given that participants were primarily recruited from a pain treatment clinic, many were actively prescribed daily analgesic medications, including opioids. Participants using daily opioids were not excluded as this could have undermined the generalizability of study results. Furthermore, they were not asked to withhold pain medications on the days of study participation. This is because temporary withdrawal from these medications could have affected pain perception. Instead, all medications currently prescribed for pain (e.g., opioids, NSAIDs, SSRIs, etc.) were recorded. Also, participants were asked to indicate whether they took any medications (prescription or over the counter) for pain management.

Measures

Ethnicity/Race/Objective SES.—Participants self-reported their ethnic and racial background using response options consistent with the United States census survey. All participants enrolled in the study identified their ethnic background as non-Hispanic and their racial background as either Black/African American or White/Caucasian. Participants self-reported their ethnicity and race during the initial telephone screening. During the first study session, participants self-reported their highest level of educational achievement, work status, and annual household income (money left over after taxes and other deductions).

The MacArthur Scale of Subjective Social Status.—The MacArthur scale is a commonly used measure of subjective social status that assesses an individual's sense of social status across the socioeconomic status indicators.[32] During the first study session, participants were given a drawing of the ladder with the following instructions:

> "Think of this ladder as representing where people stand in the United States. At the top of the ladder are the people who are the best off- those who have the most money, the most education, and the most respected jobs. At the bottom are the people who are the worst off- who have the least money, least education, and the least respected jobs, or no job. The higher up you are on this ladder, the closer you are to the people at the very top; the lower you are, the closer you are to the people at the very bottom. Please place a large "X" on the rung of the ladder for where you think you stand at this time in your life, relative to other people in the United States."

The ladder in the figure has 10 steps, and in the current study, the integer scores of social status range from 0 to 10 corresponding to the where participants placed the "X" on the ladder.

Center for Epidemiological Studies Depression Scale (CES-D).—The CES-D is one of the most commonly used measures of depressive symptoms; it assesses various aspects of depression including mood, guilt, worthlessness, helplessness, hopelessness, loss of appetite, sleep disturbance, and psychomotor retardation. The 20-item self-administered questionnaire is scored on a four-point scale (0 −3) with a possible score ranging from zero to 60, and higher scores reflecting more severe depressive symptoms. The CES-D was

administered during the first study session, and before the completion of laboratory pain task. The internal consistency of the CES-D in this current study was good (α = 0.85).

Brief Pain Inventory (BPI) – Short Form.—The BPI is a self-administered questionnaire used to assess pain severity and the impact of pain on the participant's daily activities (pain interference). To assess pain severity, participants are asked to rate their worst, least, average, and current pain intensity on a scale 0 (no pain) to 10 (pain as bad as you can imagine) in the past 24 hours. The average score on the four-items reflects pain severity in the past 24 hours. Participants also rate the impact of pain on general activity, mood, walking ability, normal work, relations with other people, sleep, and enjoyment of life during the past 24 hours, on a 10 point scale. Pain interference is determined by calculating the average of these items. Higher scores are indicative of greater pain severity and interference. The internal consistency of the BPI in this study was excellent (α = 0.94).

Data Analysis

Data were analyzed using IBM SPSS 24 statistical software. Before hypothesis testing, the distribution of variables was assessed and inspected for outliers. Chi-squared tests and Student's t-test (or Mann Whitney U test) were used to assess group differences in demographic and clinical features of pain when variables were categorical or continuous, respectively. Given evidence that depressive symptoms, pain interference, pain severity, and perceived social status do not follow normal distributions ($p < 0.05$ in Kolmogorov-Smirnov and Shapiro-Wilk tests), Mann Whitney U tests and Spearman's correlation were utilized for assessing relationships between variables of interest. Given no evidence of lack of normality in age distribution, student's t-test was used to assess group differences. Also, work status, household income, and educational achievement were measured at the ordinal level.

Moderation analysis using the PROCESS plugin for SPSS (Model 1) was used to test for main effects of race, perceived social status, and their interaction on BPI outcomes (pain interference and pain severity).[33] In a follow-up analysis, conditional PROCESS model 7 was computed to test the indirect effects of perceived social status (X) on pain outcomes (Y) through depressive symptoms (mediator). The age adjusted relationship between perceived social status and depressive symptoms was thought to depend on race; thus, race (W) was entered as a moderator in the model as recommended.[34] 95% bootstrapped confidence intervals were generated (with 5000 samples) to test for unconditional and conditional indirect effects. Also, an index of moderated mediation was estimated to test the association between the indirect effect of depressive symptoms and pain outcomes from bootstrapping 5,000 samples. Conceptually, bootstrapping is a non-parametric approach to effect-size estimation and hypothesis testing that makes no assumptions about the shape of the distribution of the variables within a given model (i.e., normal versus skewed).[35] All tests were two-tailed with statistical significance at 0.05.

Results

Participant characteristics

The sample was comprised of 105 eligible participants with cLBP. Most of the study sample was female (59%), and African American (54.3%), with a mean age of 45.8 years (SD = 14.03). Demographic and study variables are summarized in Table 1. On average, women were younger (M = 42.37 years; SD = 13.67) than men (M = 50.6 years; SD = 2.02). This difference was statistically significant (t(101) = 3.05, p = 0.003). There was no significant race difference in age (p = 0.84), and no significant sex difference in pain severity (p = 0.33) and pain interference (p = 0.23)). Participants who self-identified as Blacks reported significantly greater pain severity and pain interference than Whites. There were no statistically significant racial differences in work status, educational achievement, and medication status (whether the participants took pain medications or not) (p > 0.05).

Bivariate Correlations

Table 2 summarizes the bivariate relationship between study variables. As expected, there is a strong positive relationship between pain severity and pain interference. Both pain severity and pain interference were moderately positively correlated with depression, but modestly negatively correlated with perceived social status and race. Pain severity and pain interference were not significantly associated with age or sex. Depressive symptom severity was negatively correlated with perceived social status, age, educational achievement, household income. However, the relationship between depression and educational achievement was not statistically significant (p = 0.152). There were no significant relationships between depressive symptoms, race (p = 0.73), and sex (p = 0.50).

Perceived social status modestly positively correlated with household income. 67 percent of Black participants reported an annual household income of less than $50,000 compared with 49 percent of White participants. The relationship between race and household income was statistically significant (p = 0.03), but the relationship between race and perceived social status was not statistically significant (p = 0.16). On average, Whites reported lesser pain severity (t(101) = 3.71, p < 0.001) and pain interference (t(102) = 2.43, p = 0.02) than Blacks. These racial differences were statistically significant. In addition, perceived social status significantly correlated with work status and household income. Finally, as expected, there was a moderately significant relationship between educational achievement, household income, and work status.

Within group analyses revealed that the bivariate relationship between many variables were different between Black and White participants. Results of the Spearman's rho correlation for both Blacks and Whites are summarized in Supplemental Table 1 and Supplemental Table 2, respectively.

Moderation Analysis

To understand the relationship between perceived social status and pain outcomes among Blacks and Whites with cLBP, we tested whether race moderated the associations between unadjusted perceived social status pain interference as well as pain severity, respectively,

using Model 1 of Hayes' PROCESS (Hayes, 2012). The overall model accounted for approximately 13 percent of the variance in pain interference ($R^2 = 0.128$). There was a statistically significant interaction between race and perceived social status in relation to pain interference ($\beta = -0.59$ t(100) = -2.52, p = 0.01). As shown in Figure 2, the relationship between perceived social status and pain interference differed between Blacks and Whites. Specifically, among White participants pain interference decreases by 0.47 units for a 1 unit increase in perceived social status (95% CI [-0.805, -0.139]); however, Black participants pain interference increases by 0.12 units for a 1 unit increase in perceived social status (95% CI [-0.207, 0.439]). The relationship between perceived social status and pain interference among Black participants was not statistically significant (p = 0.48). The interaction between race and perceived social status in predicting pain interference remained statistically significant after controlling for the covariates (objective measures of SES: work status, household income, and education level) ($\beta = -0.48$, p = 0.04; 95% CI [-0.95, -0.01]).

We also examined whether the relationship between perceived social status and pain severity was moderated by race. The product term perceived social status x race was not statistically significant ($\beta = -0.154$, t (99) = -0.719, 95% CI [-0.580, 0.271]). As shown in Figure 3, the conditional effects of race suggested that higher perceived social status decreased pain severity for both Black ($\beta = -0.040$, t(99) = -0.272, 95% CI [-0.336, 0.255]) and White ($\beta = -0.195$, t(99) = -1.261, 95% CI [-0.501, 0.112]) participants. The interaction of race and perceived social status added 0.45% explained variance to the model and this was not statistically significant (p = 0.474).

For comparison, we also tested whether race moderated the relationship between objective measures of SES (educational achievement, work status, and household income) and pain outcomes (pain interference and pain severity). As summarized in Table 3, the product terms of race and the objective measures of SES in predicting pain interference were not statistically significant (p > 0.05). Similarly, race did not significantly moderate the relationship between objective measures of SES and pain severity (p > 0.05).

Moderated Mediation Analysis

To test our second hypothesis, we used Model 7 of the PROCESS macro to examine the conditional indirect effect of age adjusted perceived social status on pain outcomes through depressive symptoms (mediator). This model tested whether race moderated the relationship between perceived social status and depressive symptom severity, which mediated the relationship between perceived social status and pain outcomes.

First, we examined whether race moderated the relationship between perceived social support and depressive symptoms. After adjusting for age, the interaction term (race x perceived social support) was significant (p = 0.006), adding 8% of explained variance to the model. The conditional effect of race on perceived social support at 16th, 50th, and 84th percentile, depicted in figure 4, reveal that the association between perceived social support and depressive symptoms have a significant relationship only for White participants (95% CI [-3.93, -0.74]), but not for Black participants (95% CI [-0.73, 2.38]). Among White participants, depressive symptoms decrease by 2.33 units for a 1 unit increase in perceived

social status (p = 0.005), but for Black participants depressive symptoms increase by 0.83 units for 1 unit increase in perceived social status (p = 0.29). These results suggested that the indirect effect of perceived social status on pain interference through depressive symptoms may depend on the participant's race. Our model (Figure 5) accounted for about 32 percent of the variance in pain interference. The estimated index of moderated mediation (the effect of race on the indirect of perceived social status on pain interference through depressive symptom severity) of B = −0.39 (Boot 95% CI = −0.73, −0.10), which was statistically significant. Table 4 summarizes the conditional indirect effect of perceived social status on pain interference by race. As hypothesized, the indirect effect of perceived social status on pain interference via depressive symptoms was moderated by race. For white participants pain interference decreases by 0.29 units for a 1 unit increase in perceived social status (Boot 95% CI = −0.53, −0.09), while for Black participants pain interference increases by 0.10 units for every unit increase in perceived social status (Boot 95% CI = −0.10, 0.32).

For comparison, we performed a similar analysis to test the age adjusted conditional indirect effect of perceived social status on pain severity through depressive symptoms. Figure 6 shows the results of the moderated mediation analysis. The model accounted for about 19 percent of the variance in pain severity ($R^2 = 0.19$). The estimated index of the moderated mediation was B = −0.27 (Boot 95% CI = −0.5463, −0.0712). As expected, the indirect effect of perceived social status on pain severity via depressive symptoms (mediator) depended on the participant's race. For White participants pain severity decreases by 0.20 unit for every unit increase in perceived social status (Boot 95% CI = −0.41, −0.05), while for Black participants pain severity increases by 0.07 units for every unit increase in perceived social status. The indirect effect of perceived social status on pain severity via depressive symptoms was statistically significant for White participants, but not for Black participants (Table 5).

Discussion

To the best of our knowledge, this is the first study to empirically examine a moderated mediation model that integrates known predictors of pain outcomes (depressive symptoms, race, and SES) in patients with cLBP. Consistent with the biopsychosocial framework, our model assumed that race is a social construct shaped by lived experiences that affect the experience of pain.[36] Our study explicates the pathway by which perceived social status could predict racial differences in cLBP interference and severity through depressive symptoms. Other researchers have reported that perceived social status predicts depressive symptoms,[37] and depressive symptoms predict pain outcomes[16] in patients with chronic pain conditions. The interactions of race, perceived social status, depressive symptoms, and cLBP interference suggest potential differences in the use/effects of perceived social status between Blacks and Whites. Greater perceived social status is associated with less severe depressive symptoms, which in turn is associated with less pain severity and less pain interference for White participants with cLBP. Although not significantly, the results of the conditional indirect effect of depressive symptoms in Blacks show a positive effect on pain interference. In essence, they suggest that for Blacks individuals, increasing social status increases depressive symptoms that increase pain interference. Others have reported that when Black individuals climb the social ladder, systemic discrimination and organizational

structures often limit their potential by placing less value in their experience and rewarding them less economically. Their awareness of these limitations and discriminatory practices may result in more depressive symptoms and fewer health benefits of their perceived social status.[38] Hence, Blacks with cLBP, especially those with higher perceived social status, may require more aggressive screening and intervention of depressive symptoms. More studies are needed to understand the factors that mediate the relationship between perceived social status and pain interference in Blacks with cLBP.[38]

In our sample, race moderates the relationship between perceived social status and pain interference, but not pain severity. Despite the strong correlation between pain interference and pain severity, these findings point to the critical differences between the two measures of pain. Previous studies have shown that the differences in pain severity and pain interference may be because pain severity reflects pain intensity. In contrast, pain interference reflects pain intensity and the participant's perceptions of the magnitude of the pain and belief about their pain.[39] Thus, racial differences in factors such as catastrophizing, coping, and social support that affect pain perception, may influence pain interference. [40,41]

Both objective and subjective measures of SES correlated with pain interference. However, when analyzed in a regression model, race moderated only the relationship between the subjective measure of SES (perceived social status) and pain interference. Thus, despite the fact that the relationship between perceived social status and pain interference among Blacks with cLBP was not statistically significant, the results suggest potential opposing trends for Blacks and Whites: among Blacks with cLBP, pain interference appears to increase with higher perceived social status, but pain interference decreases with higher social status for Whites with cLBP. It has been reported that White individuals view their social status as a reflection of objective measures of SES, while Black individuals consider non-objective measures of SES.[27,28] Our findings corroborate the findings of other researchers that subjective and objective measures of SES are not interchangeable.[26] Investigators and clinicians should consider both objective and subjective SES, and pain severity (intensity) and pain interference when evaluating racial differences in chronic pain.

Depressive symptoms play a critical role in the cLBP experience (especially for White participants). We found that despite the strong positive correlation between pain interference and pain severity in our study, race did not moderate the relationship between perceived social status and pain severity, even after adding depressive symptoms was a covariate. However, when depressive symptoms were analyzed as a mediator, perceived social status predicted pain severity by race. Unlike a moderation analysis that shows when or under what conditions a predictors variable is related to an outcome variable, mediation analysis explains why or "how a causal effect operates"(p47).[34] Thus, the focus of mediation is on understanding the mechanism or underlying process. Our findings suggest depressive symptoms severity, is an underlying variable that drives the relationship between perceived social status and pain outcomes in patients with cLBP. This "causal effect" of depressive symptoms is consistent with previous studies which found that depressive symptoms reliably predict the course of cLBP.[12,16]

This study had some limitations regarding the interpretation of results that must be mentioned. First, the cross-sectional design limits our interpretation of mediation analysis. The time from the assessment of the independent variables (perceived social status and depressive symptoms) to the assessment of pain outcomes was about one week. This time frame is relatively short for the causal effect of the depressive symptoms to become evident in pain interference and pain severity. Thus, these findings must be interpreted with caution with regard to the causal effect of depressive symptoms. In addition, it is possible that the direction of the relationship between the predictor and outcome was reversed, such that the pain outcomes resulted in perceived social status via depressive symptoms. However, based on our theoretical model, these findings would still be valid under those circumstances. Thus, there is a need for a longitudinal assessment of the moderated mediation effect of perceived social status on pain outcomes through depressive symptoms to determine temporality and more robust causal inferences. Second, these findings are part of an extensive ongoing study, which implies that the results may change once the study is completed. From our estimates, a sample size of approximately 105 is large enough to power this study. Besides, boots strapping was used to increase the accuracy of the estimates. Finally, because of small cell sizes, we could not stratify the results by the type of pain medication used by participants. Instead, we categorized the participants by medication status: whether they used pain medications (prescription or over the counter) or not. However, this increases the generalizability of our findings as they reflect the real-life experiences of the participants since all participants were instructed to take their usual medications.

Conclusion

cLBP remains the leading cause of years lived with disability, despite advances in health care and pain management approaches. There are racial and SES differences in cLBP, and this study sheds some light on the complex inter-relationship between subjective SES, depressive symptoms, and racial differences in cLBP. Perceived social status seems to confer mental health and pain benefits for the White participants; however, perceived social status does not provide the same type of benefits for the Black participants. This may be because, among the Blacks, higher perceived social status is (contrary to what might be expected) associated with more pain interference and worse depressive symptoms. A more individualized approach to cLBP management that accounts for the role of depressive symptoms and perceived social status may decrease racial differences in cLBP.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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What's already known about this topic?

- Globally, low back pain is the leading cause of disability and it disproportionately affects non-Hispanic Blacks and individuals of lower socioeconomic status.

- Individual's perception of their social status can affect their health status.

What does this study add?

- Race moderates the indirect relationship between perceived social status and pain outcomes via depressive symptoms.

- Perceived social status seems to confer mental health and pain benefits for the Whites, but not for Blacks with chronic low back pain.

Significance-

It has been suggested that racial differences in chronic pain cannot be fully understood with consideration of socioeconomic status. Our findings suggest race moderates the indirect relationship between subjective social status and pain outcomes through depressive symptoms (mediators). Specifically, perceived social status seems to confer health benefits for the Whites, but not for Blacks, with chronic low back pain. Among the Blacks, higher perceived social status is associated with more pain interference and worsen depressive symptom
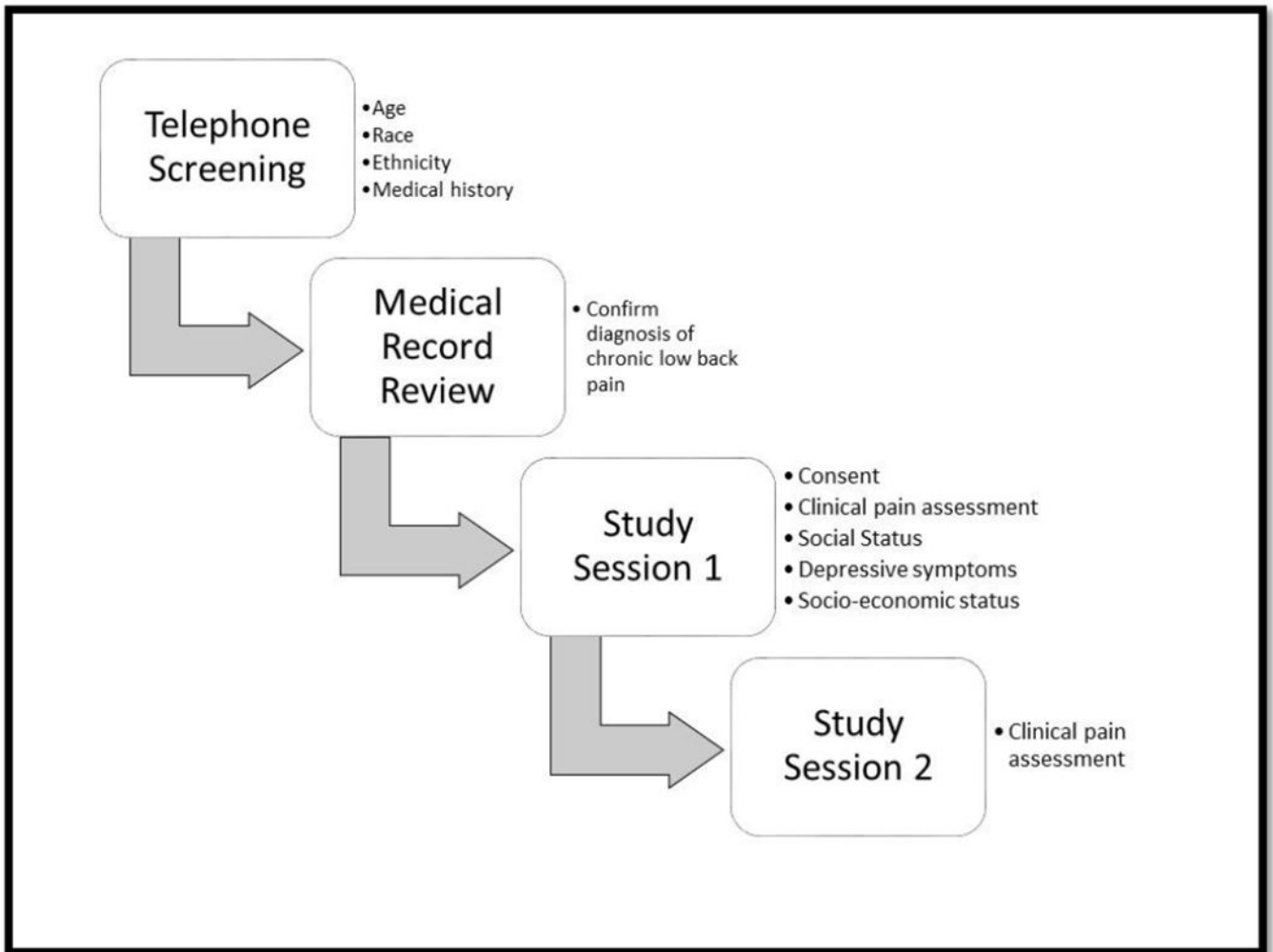
Figure 1.
Flow diagram of the study protocol.
Notes: Session two was completed about one week after session one.
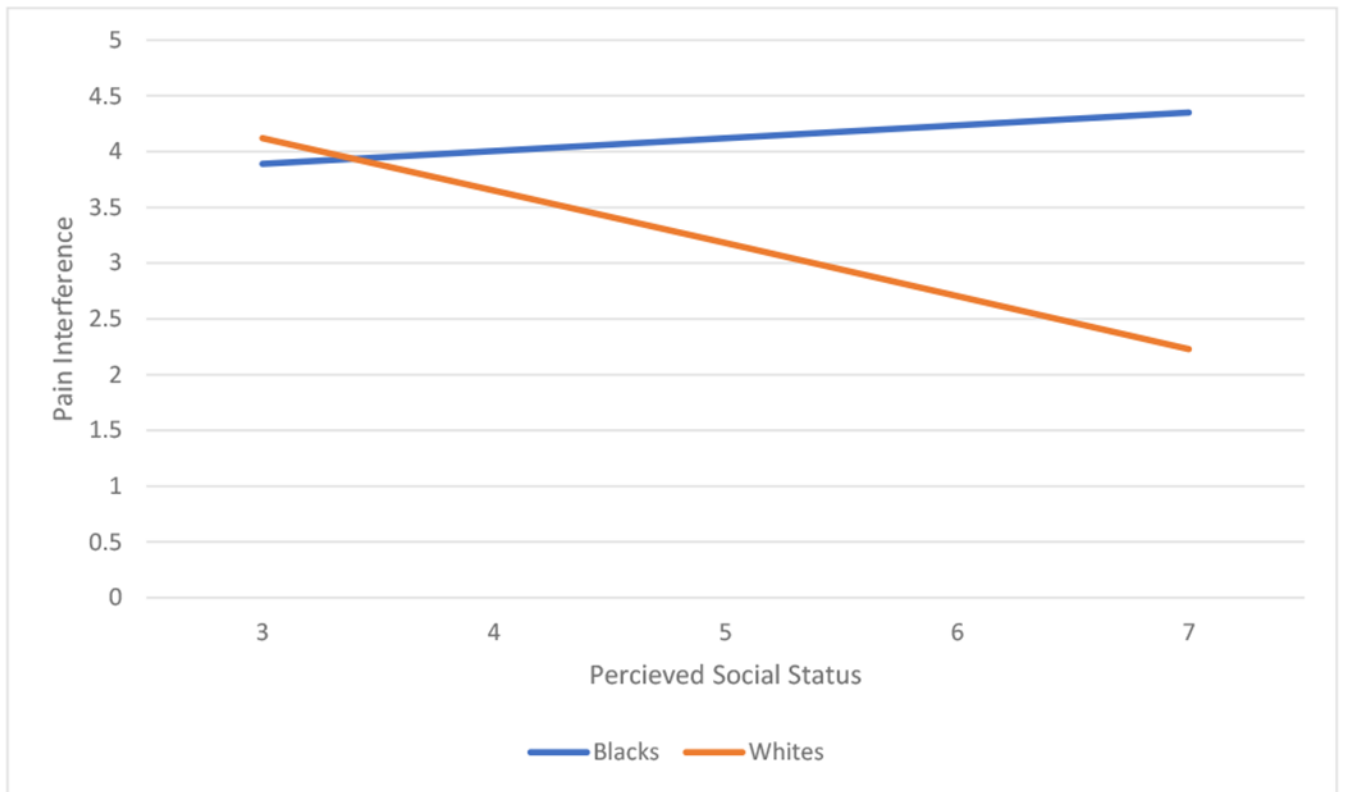
Figure 2.
Unadjusted Predicted Moderation Effects of Race on Perceived Social Status in Predicting Pain Interference. The plot shows predicted change in pain interference as a function of perceived social status for Blacks and Whites with chronic low back pain.
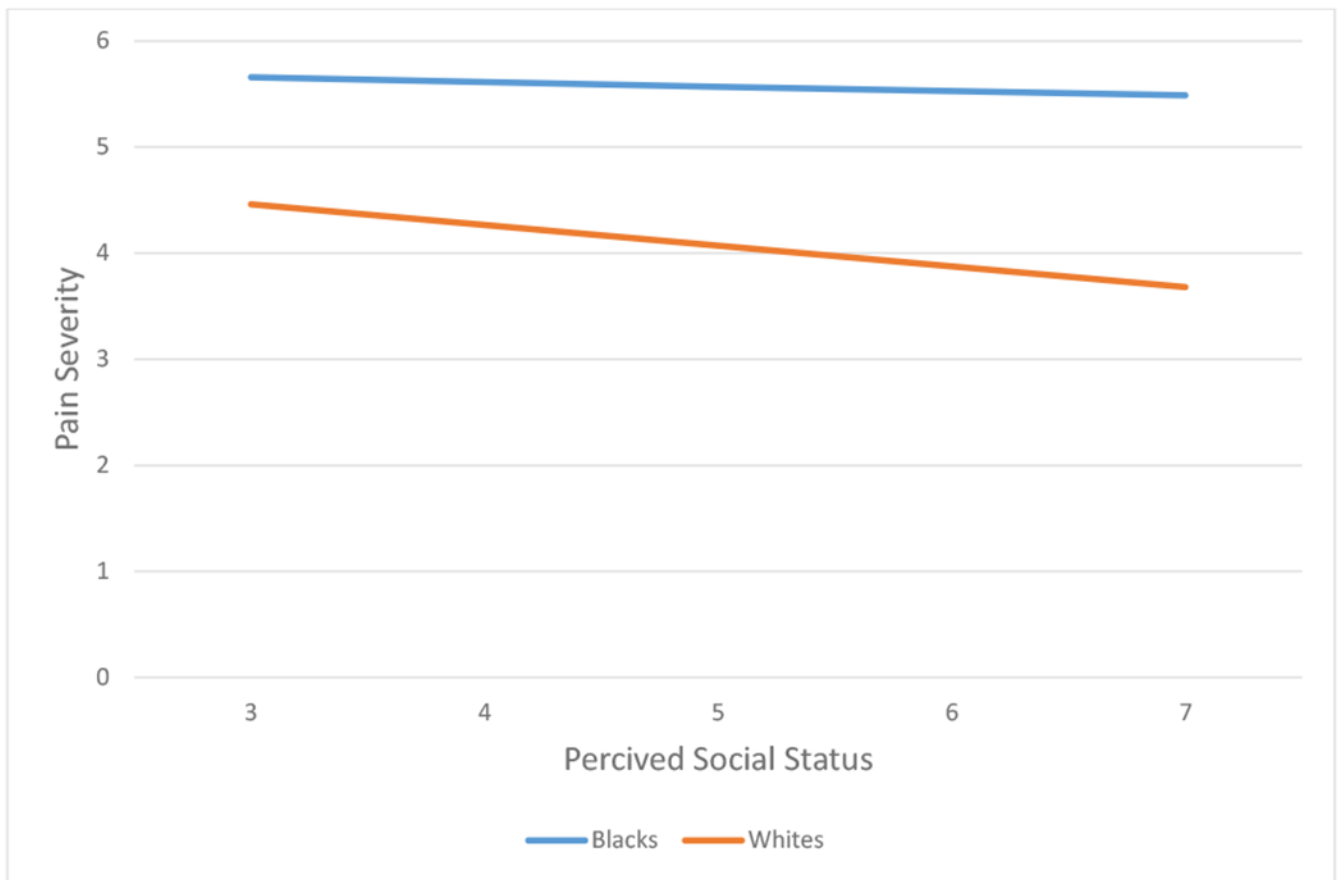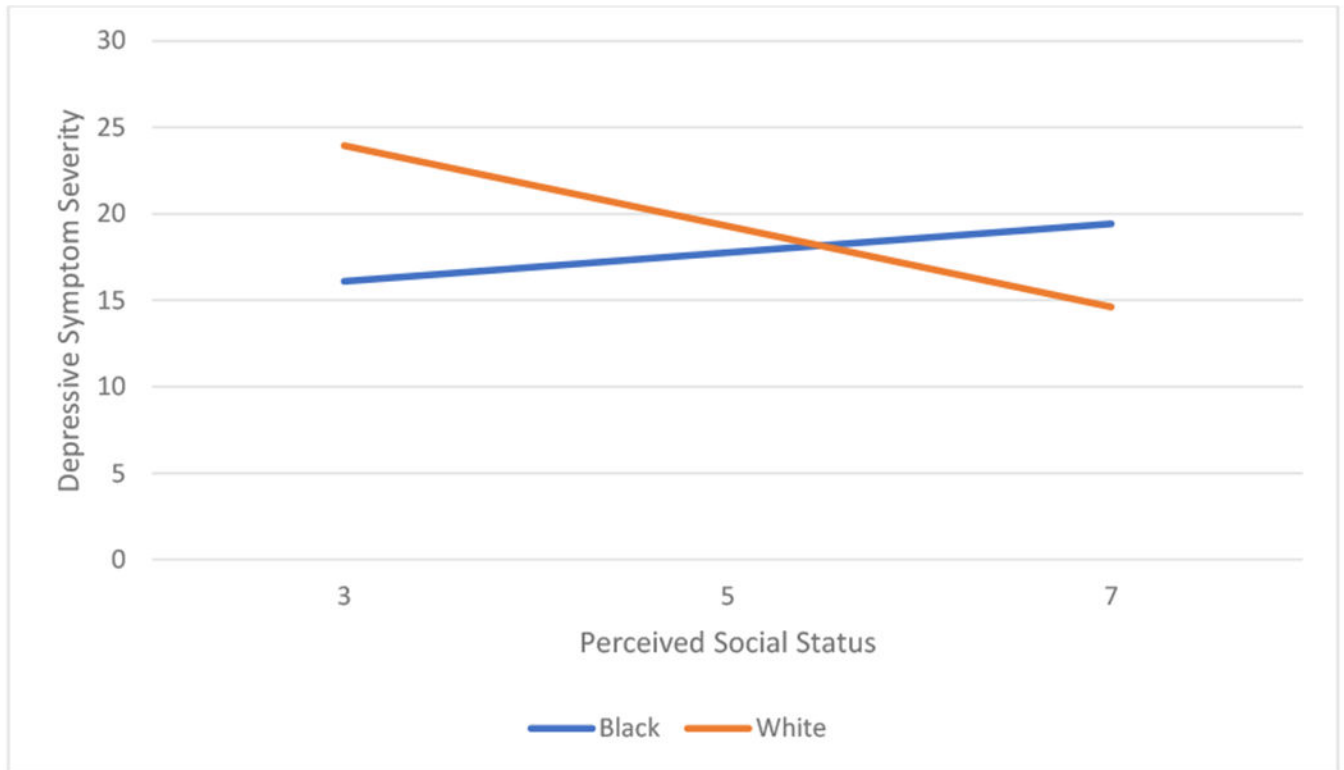
Figure 3.
Unadjusted Predicted Moderation Effects of Perceived Social Status on Pain Severity under
the Influence of Race. The plot shows predicted change in pain severity as a function of
perceived social status for Blacks and Whites with chronic low back pain.

Figure 4.
Age-adjusted Predicted Conditional Effect of Perceived Social Status on Depressive Symptom as a Function of Race. The plot shows age-adjusted predicted change in depressive symptoms as a function of perceived social status for Blacks and Whites with chronic low back pain.
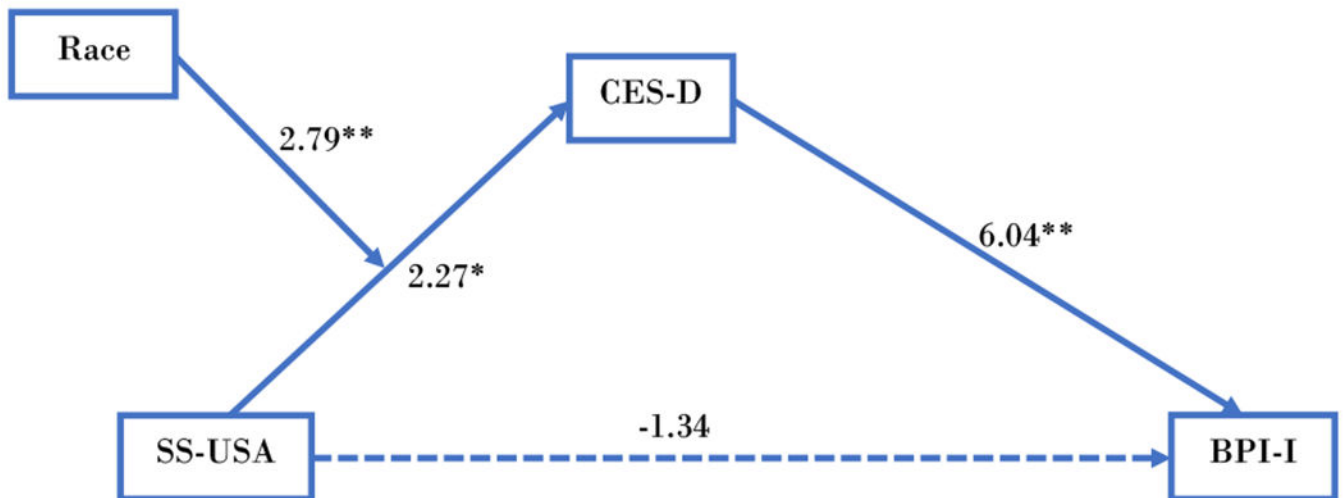
Figure 5.
The Interrelationship between Perceived Social Status, Race, Depressive Symptoms, and Pain Interference. Age-adjusted values on the figure are t-statistic. *= p<0.05; ** = p<0.01; SS-USA = Perceived social status in the USA; BPI-I = Brief pain inventory- interference; CES-D = Center for Epidemiological Studies of Depression.
Note: Age-adjusted values on the figure t-statistic. *= p<0.05; ** = p<0.01; SS-USA = Perceived social status in USA; BPI-I = Brief pain inventory- interference; CES-D = Center for Epidemiological Studies of Depression
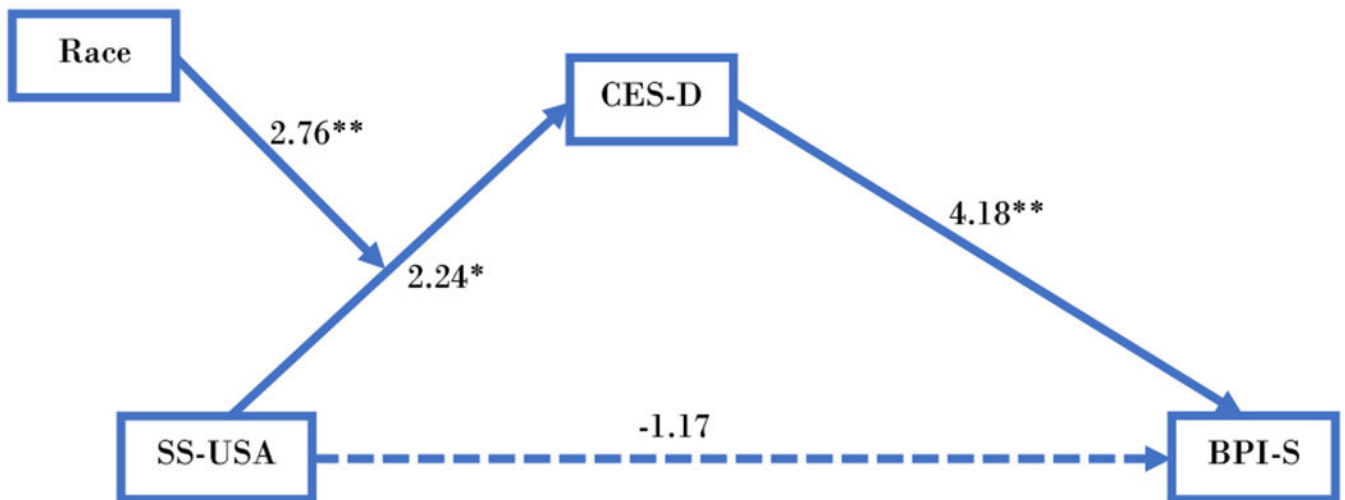
Figure 6.
The Interrelationship between Perceived Social Status, Race, Depressive Symptoms, and Pain Severity. Age-adjusted values on the figure t-statistic; *= p<0.05; ** = p<0.01; SS-USA = Perceived social status in USA; BPI-I = Brief pain inventory- severity; CES-D = Center for Epidemiological Studies of Depression.

Note: Age-adjusted values on the figure t-statistic; *= p<0.05; ** = p<0.01; SS-USA = Perceived social status in USA; BPI-I = Brief pain inventory- severity; CES-D = Center for Epidemiological Studies of Depression

Table 1.

Characteristics of the Participants

	Total n = 105	Blacks n = 57	Whites n = 48	p-value[a]
Sex n (%)				
Male	43 (41)	25 (43.9)	18 (37.5)	0.55
Female	62 (59)	32 (56.1)	30 (62.5)	
Age	45.8 ± 14.03	45.6 ± 13.1	46.1 ± 15.5	0.84
Education n (%)				
Partial high school	7 (6.70)	4 (7.02)	3 (6.25)	
High school graduate	22 (21)	14 (24.6)	8 (16.7)	
Partial College	31 (29.5)	18 (31.6)	13 (27.1)	0.64
College graduate	26 (24.8)	11 (19.3)	15 (31.3)	
Graduate/Professional training	19 (18.1)	10 (17.5)	9 (18.7)	
Work Status n (%)				
Employed	61 (58.7)	34 (59.6)	27 (57.4)	
Unemployed looking	8 (7.70)	5 (8.77)	3 (6.4)	
Retired, homemaker, not looking	16 (15.4)	5 (8.77)	11 (23.4)	0.12
Student	1 (0.95)	0	1 (2.08)	
Disabled	18 (17.3)	13 (22.8)	5 (10.6)	
Perceived Social status	5.17 ± 2.04	5.0 ± 1.94	5.38 ± 2.15	0.35
Household Income n (%)				
$ 0 to 24,999	40 (39.6)	24 (44.4)	16 (34)	
$ 25,000 to 49,999	19 (18.8)	12 (22.2)	7 (14.9)	
$ 50,000 to 74,999	18 (17.8)	11 (20.4)	7 (14.9)	0.08
$ 75,555 to 99,999	10 (9.9)	4 (7.4)	6 (12.8)	
$ 100,000 and greater	14 (13.9)	3 (5.6)	11 (23.4)	
Medication Status				
No	30 (28.8)	20 (35.7)	10 (20.8)	0.09
Yes	74 (71.2)	36 (64.3)	38 (79.2)	
CES-D	17.96 ± 11.48	17.73 ± 10	18.23 ± 13.12	0.73
Pain Interference	3.59 ± 2.49	4.12 ± 2.65	2.95 ± 2.13	0.02
Pain Severity	4.87 ± 2.28	5.57 ± 2.27	3.99 ± 1.99	<0.001

Notes: Values expressed as mean ± SD or n (%). CES-D = Center for Epidemiologic Studies Depression Scale; BPI-I = Brief pain inventory-pain interference; BPI-S = Brief pain inventory- pain severity;

[a] p-value pertains to tests for the difference between Blacks and White groups

Table 2.

Spearman correlation among Variables of Interest

	Variables	1	2	3	4	5	6	7	8	9	10	11
1	Pain severity	1										
2	Pain Interference	0.779[b]	1									
3	Depressive symptom severity	0.426[b]	0.562[b]	1								
4	Social Status	−0.207[a]	−0.224[a]	−0.224[a]	1							
5	Medication Use	0.112	0.215[a]	0.168	−0.144	1						
6	Race	−0.361[b]	−0.220[a]	−0.036	0.138	0.164	1					
7	Age	0.074	0.112	−0.205[a]	0.126	0.275[b]	−0.001	1				
8	Sex	−0.097	−0.117	0.069	0.167	−0.061	0.064	−0.300[b]	1			
9	Work Status	0.226[a]	0.422[b]	0.260[a]	−0.266[b]	0.297[b]	0.045	0.253[b]	−0.227[a]	1		
10	Household Income	−458[b]	−0.409[b]	−0.372[b]	0.346[b]	−0.196	0.253[a]	−0.032	0.121	−0.471[a]	1	
11	Education Achievement	−0.218[a]	−0.238[a]	−0.166	0.158	−0.053	0.109	−0.012	0.154	−0.325[a]	0.462[a]	1

[a] = p < 0.05

[b] = p<0.01

Table 3.

Effect of SES on Pain Interference and Pain Severity under the Influence of Race

Outcome	Predictor	β	SE B	p-value	95% CI LL	UL	Model R	Model R²	F	R²
Pain interference	Social status	0.7	0.37	0.06	−0.02	1.43				
	Race	1.99	1.31	0.13	−0.6	4.6	0.36	0.13	4.9	0.06
	Race X social status[a]	**−0.59**	**0.23**	**0.01**	**−1.05**	**−0.12**				
	Household income	−0.19	0.18	0.29	−0.55	0.17				
	Race	−0.62	0.96	0.52	−2.52	1.28	0.41	0.17	6.64	0.0002
	Race X income	−0.02	0.12	0.88	−0.25	0.22				
	Work status	0.35	0.25	0.16	−0.14	0.86				
	Race	−1.21	0.68	0.08	−2.57	0.15	0.43	0.19	7.67	0.0004
	Race X work status	−0.03	0.15	0.82	−0.34	0.27				
	Education	−0.43	0.63	0.49	−1.67	0.81				
	Race	−1.14	2.68	0.67	−6.45	4.17	0.3	0.09	3.35	<0.0001
	Race X Education	0.01	0.42	0.97	−0.81	0.84				
Pain Severity	Social status	0.11	0.33	0.73	−0.55	0.78				
	Race	−0.73	1.2	0.54	−3.11	1.65	0.37	0.13	5.14	0.004
	Race X social status	−0.15	0.21	0.47	−0.58	0.27				
	Household income	−0.18	0.16	0.26	−0.49	0.13				
	Race	−1.04	0.83	0.21	−2.69	0.6	0.5	0.25	10.63	0.0003
	Race X income	−0.02	0.1	0.84	−0.22	0.18				
	Work status	0.23	0.23	0.33	−0.23	0.69				
	Race	−1.51	0.64	0.02	−2.79	0.23	0.4	0.16	6.42	0.001
	Race X work status	−0.05	0.14	0.74	−0.33	0.23				
	Education	−0.63	0.56	0.26	−1.17	0.47				
	Race	−2.87	2.38	0.23	−7.59	1.86	0.39	0.15	5.82	0.0029
	Race X Education	0.22	0.37	0.56	−0.52	0.95				

[a]Statistically significant interaction; income = Annual household income; CI = confidence interval; LL = Lower limit of 95% CI; UL = Upper limit of 95% CI

Table 4.

Conditional Indirect Effect of Perceived Social Status on Pain Interference

Mediator: Depressive Symptoms	Effect	Boot SE	Boot 95% CI	
			LL	UL
Blacks	0.10	0.10	−0.10	0.31
Whites	−0.29	0.11	−0.53	−0.08
Index of moderated mediation				
Race	−0.40	0.16	−0.73	−0.10

Note. Bootstrap resample = 5000. SE = standard error; CI = confidence interval; LL = lower limit; UL = upper limit; Age adjusted estimates are calculated using the PROCESS macro.

Table 5.

Predicted Conditional Direct and Indirect Effects of Perceived Social Status on Pain Severity

Conditional Direct Effect		Effect	SE	t	p	95 % CI	
						LL	UL
Perceived Social Status		−0.13	0.11	−1.17	0.24	−0.36	0.09
Conditional Indirect Effect							
Mediator: Depressive symptoms		Effect	Boot SE	Boot 95% CI			
				LL	UL		
	Black	0.07	0.08	−0.08	0.23		
	Whites	−0.20	0.09	−0.41	−0.04		
Index of Moderated Mediation							
	Race	−0.27	0.13	−0.55	−0.05		

Note. Bootstrap resample = 5000. SE = standard error; CI = confidence interval; LL = lower limit; UL = upper limit; Age adjusted estimates are calculated using the PROCESS macro