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Racial Bias in Pain Perception and Response: Experimental Examination of Automatic and Deliberate Processes

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Abstract: **Racial disparities in pain treatment pose a significant public health and scientific problem. Prior studies have demonstrated that clinicians and nonclinicians are less perceptive of, and suggest less treatment for, the pain of African Americans relative to European Americans. Here we investigate the effects of explicit/implicit patient race presentation, patient race, and perceiver race on pain perception and response. African American and European American participants rated pain perception, empathy, helping motivation, and treatment suggestion in response to vignettes about patients' pain. Vignettes were accompanied by a rapid (implicit) or static (explicit) presentation of an African or European American patient's face. Participants perceived and responded more to European American patients in the implicit prime condition, when the effect of patient race was below the level of conscious regulation. This effect was reversed when patient race was presented explicitly. Additionally, female participants perceived and responded more to the pain of all patients, relative to male participants, and in the implicit prime condition, African American participants were more perceptive and responsive than European Americans to the pain of all patients. Taken together, these results suggest that known disparities in pain treatment may be largely due to automatic (below the level of conscious regulation) rather than deliberate (subject to conscious regulation) biases. These biases were not associated with traditional implicit measures of racial attitudes, suggesting that biases in pain perception and response may be independent of general prejudice.**

Perspective: ***Results suggest that racial biases in pain perception and treatment are at least partially due to automatic processes. When the relevance of patient race is made explicit, however, biases are attenuated and even reversed. We also find preliminary evidence that African Americans may be more sensitive to the pain of others than are European Americans.***

Key words: *Racial disparities, pain, empathy, implicit racial bias, explicit racial bias.*

Racial disparities and inequity in pain treatment pose a significant public health and scientific problem. Disparities in people's response to the pain of others, as well as clinical pain treatment, have been well documented. Compared to the racial majority in America, African Americans (AAs) are more likely to receive inferior or inadequate pain treatment.[2,3,8,11,14,29,47,62,63] Evidence suggests that these disparities may, in part, be related to racial disparities in clinician perception and response to pain.[12,14,65] However, the mechanisms underlying these disparities are not well understood.

The subjective nature of pain and the clinical reliance on subjective patient reports for pain assessment may contribute to disparities in clinician response. Several studies have demonstrated that physician pain perception differs from patient pain ratings[36,42,55,60] and can

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influence decisions about diagnosis and treatment.[7] Clinicians' stereotypes about sociodemographic groups[24,32,42,66] also affect medical judgments. Importantly, in the absence of objective measures of pain, medical judgments related to pain appear particularly vulnerable to physician bias.[5,28]

In addition to the influence of stereotypes, disparities in clinician pain treatment may be influenced by cognitive differences in pain perception, empathy, trust, or other intra- and interindividual factors. Although much of the research on disparities in pain treatment has used observational or epidemiologic methods, a few recent controlled experiments have demonstrated corresponding racial disparities that favor European Americans (EAs) in pain perception,[64] empathy,[20] and treatment recommendation.[20,64] However, other experiments have found no racial bias in pain perception,[33,35] patient trust,[33] or treatment recommendation,[59,68] and one found a bias favoring AAs.[58] One possible reason for the somewhat inconsistent experimental evidence is the reliance of all of these studies on explicit experimental methods that make the relevance of patient race apparent.

Whereas methods that present race explicitly primarily capture deliberate and consciously held beliefs and values, subtle implicit methods are designed to capture automatic reactions, which may be more reflective of common biases in the culture.[23,53] Explicit and implicit measures do not exclusively capture variance due to deliberate and automatic cognitive processing, respectively. Meta-analysis suggests that implicit and explicit measures yield somewhat correlated responses (ρ = .24), but that higher-order cognitive processes decrease the relationship between automatic bias and responses to explicit methods of bias assessment.[37] Therefore, it is likely that prior explicit assessments of the effects of patient race on pain perception have underestimated the effect of automatic biases.

Experimental examination of automatic effects of race on pain perception and response is important because automatic and deliberate (consciously held) biases often have differential effects on behavior,[18,30] and the most effective interventions to combat automatic and deliberate biases may differ.[9,10] Moreover, given the intention of most clinicians to provide equal care, clinician contributions to racial biases in health care likely result from automatic, rather than controlled and deliberate, processes. In the context of these egalitarian values, however, automatic biases may be particularly insidious and result in unintended discrimination and health disparities.[17]

One way to disentangle the effects of automatic and deliberate mechanisms on racial bias is through priming (testing the effect of very subtle exposure to a stimulus on subsequent behavior). Racial priming (eg, through the rapid exposure to a black or white face) has been shown to alter visual perception. For example, studies have shown that people are more likely to detect a weapon within a scrambled image[22] or misperceive a tool as a gun[50] after exposure to the face of a black, relative to white, male. Recently, researchers found that physicians implicitly primed with the words *black* or *African* before reading about a patient with chest pain responded with decreased perception of cardiac risk and fewer referrals to a specialist than did physicians primed with the words *white* or *Caucasian*.[56] Interestingly, this effect was only observed when the physicians were under experimentally induced time pressure and not among physicians who had sufficient time to decide on treatment recommendation. However, implicit racial priming has yet to be applied to the study of racial disparities in pain perception.

Furthermore, experimental tests of the effects of perceiver race on racial biases in pain perception or treatment are largely lacking from the literature (but see relevant studies for independent examination of racial bias within EA and AA samples,[64] and a comparison within a small sample[1]). The first known study to examine the effect of perceiver race in the context of pain perception included 13 AA participants and 62 EA participants, and found that EAs perceived greater pain-related negative mood among virtual patients compared to AAs, suggesting there may be a main effect of perceiver race on pain perception.[1] The clinical literature suggests that physician-patient racial congruence can affect the length of, and satisfaction with, medical encounters[15]; however, research on the effects on patient health outcomes has revealed mixed results (see meta-analytic review[46]). Experiments on intergroup empathy for acute pain have demonstrated in-group biases in physiological[4] and neural empathic[34,70] responses, suggesting that there may be in-group biases in pain perception as well.

Here we sought to bridge several gaps in the literature. We used a 2 (racial prime: explicit vs implicit) $\times$ 2 (perceiver race: EA, AA) $\times$ 2 (primed patient race: EA, AA) factorial design to examine the effects of priming patient race on pain perception and response in people of one's same or of a different race. We hypothesized that 1) there would be a main effect of patient race consistent with known disparities in pain, such that EA patients are perceived to be in more pain and elicit a greater response from participants; 2) there would be an interaction between prime and patient race such that racial bias would be smaller in the explicit condition; and 3) participants would reveal an in-group bias in pain perception and response, perceiving and responding more to the pain of same-race patients. Portions of this research were presented in abstract form at annual meetings of the American Pain Society.[43,44]

Methods

Participants

Three hundred twenty-four student volunteers, 120 self-identified AAs (76 female, mean = 19.11 years old, standard deviation = 2.59) and 204 self-identified EAs (103 female, mean = 18.99 years old, standard deviation = .99), participated in this study and were either given course credit or compensated $5 for a half hour of their time. This study was approved by the

Northwestern University institutional review board, and informed written consent was obtained from each participant prior to the experiment.

Procedure

Participants were told to imagine they were working at the Student Health Center at Northwestern University as part of a work-study job. Participants then read 10 case reports, which included patients' names, patients' description of their pain symptoms, and a pain rating, presented on a computer screen. Ten racially ambiguous names (ie, Aaron, Chris, Calvin, Erik, Jason, John, Greg, Mark, Carl, Dennis) were chosen from common American male names (www.ssa.gov/oact/babynames). Each case report included a subjective pain rating made by the patient on a scale from 0 to 10 (0 = no pain, 10 = worst pain imaginable). Pain complaints included back pain, shoulder pain, neck pain, foot pain, finger pain, headache, and toothache. Pain ratings ranged from 2 to 9 on a 0 to 10 scale.

Sample Case Report

Aaron is a sophomore at NU. He has pain in his lower back. He tells you that he thinks he hurt it lifting a heavy cooler earlier that day. He seems to be otherwise healthy, but tells you on a scale from 0 to 10, he would rate his pain an 8.

Racial Priming

Racial priming was used to identify ways in which automatic (below the level of conscious regulation) and deliberate (subject to conscious regulation) racial biases might influence perceptions of, and responses to, pain as well as judgments related to treatment. Participants were randomly assigned to either an implicit or explicit racial prime condition.

In the implicit racial prime condition, case studies were preceded by a facial photograph of either an AA or EA male that was presented for 30 milliseconds. This experimental timing has been used in similar racial priming studies[13,19,22,26] and was chosen based on results from prior studies suggesting that an image presented for 30 milliseconds is perceptually detectable (people know they saw something) but unidentifiable (people do not know what they saw).[69] The reliability and validity of racial priming methods have been demonstrated across numerous studies and in the context of several outcomes of interest.[23,39]

Facial stimuli were adapted from a prior study,[27] with permission from the authors. Photographs depict young adult males with neutral facial expressions (facial expression was controlled for across racial groups[27]). Consistent with the implicit priming procedures used in prior studies of automatic racial bias,[22] the faces were embedded in a forward and backward mask (ie, a scrambled image). Masks were presented for 100 milliseconds each. In the explicit racial prime condition, the first 7 seconds of case report presentations were accompanied by a photograph of either an AA or EA male face (Fig 1).

Two pseudorandomized versions of each condition were used to control for potential differences across case studies, such that case studies paired with black racial primes for half the participants were paired with white racial primes for the other half. Versions were counterbalanced within each participant group (by participant gender and race). This design was chosen as it provides considerable control for various extraneous variables and allows differences to be attributed to patient race as opposed to other factors.

Experimenters

Procedures were facilitated by 1 of 2 experimenters —an EA man (M.M.) or a multiracial women (V.A.M.). Post hoc analyses controlling for experimenter did not alter reported results.

Measures

Pain Perception and Response Questionnaire

After reading each case study, participants were asked to answer 7 questions aimed at targeting the source(s) of racial disparities in pain perception: 1) pain perception: "How much pain do you think [patient name] is in?" 2) empathy: "How badly do you feel for [patient name]?" 3) helping motivation: "How likely would you be to help [patient name] out today?" 4) excused absence: "Do you think [patient name] should be excused from his exam today and offered a make-up exam?" 5) treatment recommendation: "Do you think [patient name] should be given prescription pain medication?" 6) perceived trustworthiness: "How trustworthy do you think [patient name] is?" and 7) perceived responsibility: "How responsible do you think [patient name] is for his current pain?" Each of these questions was answered on an 11-point Likert-type scale (0 = not at all to 10 = very much). Faces were not present when participants made these responses.

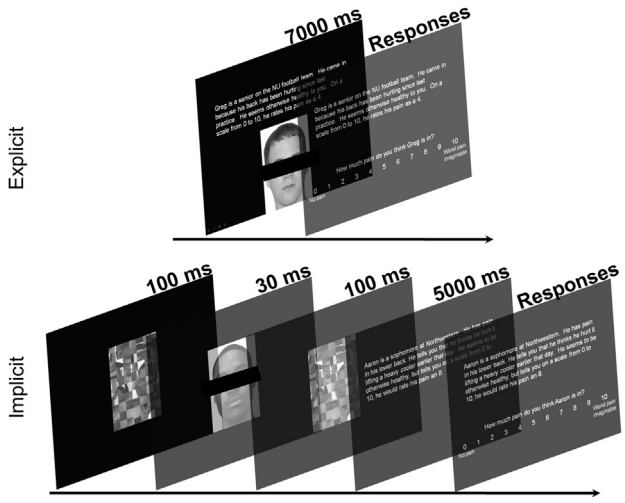

Figure 1. Sample trials. Black bars were not included in the experimental stimuli but are added here to protect the privacy of volunteers.

Data Reduction. Preliminary analyses revealed a similar pattern of response across, and significant correlation among (Table 1), individual outcome variables. Principal axis factoring with direct oblimin rotation ($\delta = 0$) was chosen to determine the factor structure of the pain perception and response questionnaire. Factor intercorrelation was not restricted. The Kaiser-Meyer-Olkin index of sampling adequacy (ie, .69) and Bartlett's test of sphericity ($P < .001$) suggested that factor analysis was appropriate. A scree test suggested either a 1- or 2-factor solution. A 2-factor solution resulted in 2 correlated subscales ($R = .34$, $P < .001$) and 1 item that did not load well onto either factor (perceived responsibility). Given this result, a single 6-item composite score (including all questions except perceived responsibility) was created. The 6 included variables (pain perception, empathy, helping motivation, excused absence, treatment recommendation, and perceived trustworthiness) were z-score transformed and then averaged to form a composite pain perception and response score. Separate pain perception and response scores were calculated across patient races ($\alpha_{total} = .72$), in response to AA patients only ($\alpha_{AA\ patients} = .73$), and in response to EA patients only ($\alpha_{EA\ patients} = .72$). Alpha coefficients suggested that the composite score is reliable according to standards in behavioral research and that the variables are assessing the same latent construct.

Implicit and Explicit Measures of Racial Attitudes

Following the experiment, all participants were asked to complete the Implicit Association Task (IAT[31]) as a measure of automatic race-based evaluations. The IAT is a computer task designed to assess relatively automatic associations between concepts. Participants in the present study completed an IAT wherein the speed with which they matched AA and EA faces with "good" and "bad" nouns was assessed. The IAT score (*D*, an effect size for an individual's responses in the task) represents the extent to which participants tend to more easily (more quickly) associate AAs with "bad" and EAs with "good" —that is, a pro-EA attitudinal bias.

EA participants were additionally asked to complete 2 scales designed to assess prejudice against AAs: the Modern Racism Scale (MRS[45]) and the Motivation to Control Prejudice Scale (MCP[21]). The MRS is a measure of overt racial attitudes (eg, "Discrimination against blacks is no longer a problem in the United States.") The MCP assesses motivation to appear nonprejudiced (eg, "It's important to me that other people not think I'm prejudiced.") This is not a measure of bias per se but rather a measure of consciously held motivation to avoid revealing racial biases. Both of these scales are widely used, highly reliable, and well validated.[25]

Table 1. Correlation (*R*) Between Outcome Variables

	Pain	Empathy	Help	Exam	Rx	Trust
Empathy	.31**	—	—	—	—	—
Help	.19**	.64**	—	—	—	—
Exam	.26**	.33**	.22**	—	—	—
Rx	.24**	.22**	.13*	.45**	—	—
Trust	.11*	.47**	.52**	.13*	.23**	—
Responsibility	.12*	.18**	.00	.12*	.12*	.04

*$P < .05$.
**$P \leq .001$.

Results

A 2 (participant race: AA, EA) × 2 (primed patient race: AA, EA) × 2 (prime: Implicit, Explicit) analysis of variance revealed a significant interaction between prime type and primed patient race, $F(1, 320) = 11.17$, $P = .001$, $\eta^2_p = .03$, such that participants perceived and responded more to the pain of AA patients than EA patients in the explicit prime condition, but more to EA patients than AA patients in the implicit prime condition (Fig 2). This interaction remained significant when controlling for individual differences in automatic racial attitude bias (IAT), $F(1, 304) = 10.21$, $P = .002$, $\eta^2_p = .03$. Within-group analyses reveal that this interaction is marginal among AA participants, $F(1, 118) = 3.38$, $P = .07$, $\eta^2_p = .03$, and significant among EA participants, $F(1, 202) = 9.57$, $P = .002$, $\eta^2_p = .05$. Results among AA participants remain marginal after controlling for automatic racial attitude bias (IAT), $F(1, 108) = 2.90$, $P = .09$, $\eta^2_p = .03$. Results among EA participants remain significant when automatic racial attitude bias (IAT), $F(1, 195) = 8.95$, $P = .003$, $\eta^2_p = .04$), motivation to control prejudice (MCP), $F(1, 189) = 8.67$, $P = .004$, $\eta^2_p = .04$, or overt racial attitude bias (MRS), $F(1, 190) = 8.81$, $P = .003$, $\eta^2_p = .04$) were included as covariates in the analyses.

When participant sex was entered into the model as a covariate, the interaction between prime type and primed patient race remained significant, $F(1, 316) = 11.21$, $P = .001$, $\eta^2_p = .03$, and a main effect of participant sex emerged, $F(1, 316) = 4.35$, $P = .04$, $\eta^2_p = .01$, such that female participants perceived and responded more to the pain of all patients, relative to male participants. We further explore the significant patient race by prime

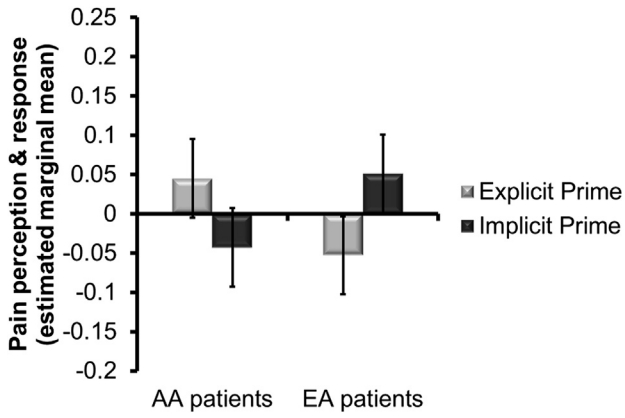

Figure 2. Interaction between prime type and primed patient race. Error bars depict standard error.

type interaction by examining the results for the explicit and implicit prime conditions separately.

Explicit Prime

In the explicit prime condition, as noted previously, there was a significant main effect of primed patient race, $F(1, 157) = 6.17$, $P = .01$, $\eta^2_p = .04$, such that participants perceived and responded to the pain of AA patients ($M_{z\text{-score}} = .05$, standard error [SE] = .05) more strongly than EA patients ($M_{z\text{-score}} = -.05$, SE = .05), $t(158) = 2.51$, $P = .01$, Cohen's $d = .40$ (Fig 3). When participant sex was entered as a covariate into the model, the main effect of primed patient race remained significant, $F(1, 155) = 5.14$, $P = .03$, $\eta^2_p = .03$. There were no significant direct effects of participant sex. No other main effects or interactions were significant (all Ps > .10).

Implicit Prime

When patient race was implicitly primed, there was a significant main effect of primed patient race, $F(1, 163) = 5.00$, $P = .03$, $\eta^2_p = .03$, such that participants perceived and responded to the pain of EA patients ($M_{z\text{-score}} = .05$, SE = .05) more strongly than AA patients ($M_{z\text{-score}} = -.04$, SE = .05), $t(164) = 2.55$, $P = .01$, Cohen's $d = .40$ (Fig 3). Interestingly, there was also a significant main effect of participant race, $F(1, 163) = 4.10$, $P = .05$, $\eta^2_p = .02$, such that AA participants were more perceptive of and responsive to pain across all patients ($M_{z\text{-score}} = .12$, SE = .07), relative to EA participants ($M_{z\text{-score}} = -.06$, SE = .06), $t(163) = 2.02$, $P = .05$, Cohen's $d = .32$ (Fig 3). When participant sex was entered as a covariate into the model, the main effect of primed patient race remained significant, $F(1, 161) = 6.11$, $P = .01$, $\eta^2_p = .04$. However, the main effect of participant race, controlling for participant sex, became marginally significant, $F(1, 161) = 3.13$, $P = .08$, $\eta^2_p = .02$. There were no significant direct effects of participant sex. No other main effects or interactions were significant (all Ps > .10).

In-Group Biases

No in-group bias in pain perception and response was found in the group comparison (Fig 3). Individual differences in in-group bias (IAT, MRS) or concerns about bias (MCP) were not significantly correlated with individual differences in in-group bias (own race patient > other race patient) in pain perception and response (all Ps > .10).

Discussion

Here we demonstrate that implicit and explicit race cues can lead to opposing racial biases in pain perception and response. There is extensive epidemiologic and clinical evidence of racial disparities in pain, as well as some experimental evidence that people perceive and respond less to the pain of AAs compared to that of EAs. The experimental evidence to date is inconsistent, however, with some studies finding a bias favoring EAs, and other studies finding opposite or no racial biases. The majority of prior studies have employed explicit methods such that participants were aware they were responding to, and likely being assessed on their differential responses to, AA and EA patients.

To test our hypothesis that automatic, rather than deliberate, processes are primarily associated with racial biases in pain perception and response, as well as provide a potential explanation for the inconsistencies in prior results, we directly compared explicit and implicit experimental manipulation of patient race. Consistent with our hypotheses, we found that participants tended to perceive and respond more to EA patients than AA patients in the implicit prime condition, when the effect of patient race was presumably below the level of conscious control or regulation. The opposite effect was found within the explicit prime condition, such that participants perceived and responded more to the pain of AA patients than that of EA patients, when patient race was presented explicitly. We hypothesized that racial bias in the explicit prime condition would be attenuated because of the influence of conscious motivations to respond without prejudice and regulation of bias. However, we found that the preferential bias toward AA patients in the explicit prime condition was not fully explained by individual differences in motivation to control prejudice, nor by overt or automatic racial attitudes. Future studies are needed to investigate other motivations to not conform to stereotypes or appear biased that may be more closely related to biases in pain. For example, it is possible that a motivation to compensate for known disparities or injustices that have resulted in unequal suffering by AAs may contribute to enhanced pain perception and response toward AA patients when race is explicitly manipulated. Taken

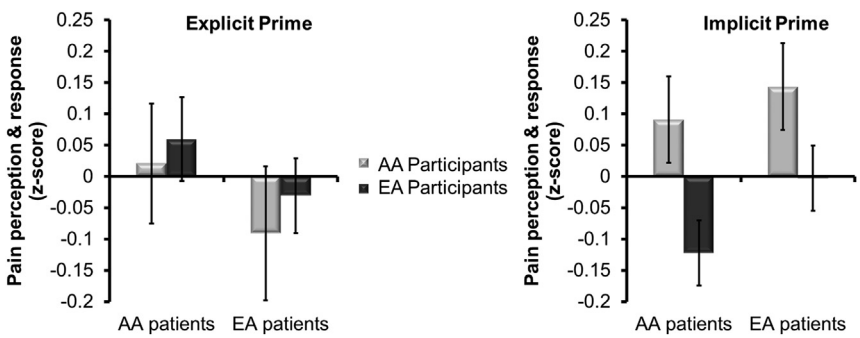

Figure 3. Pain perception and response by prime condition. Error bars depict standard error.

together, these results suggest that known disparities in pain treatment may be largely due to automatic, rather than deliberate, processes. Furthermore, this suggests that stereotypes or more specific biases, rather than general racial attitude bias, may be responsible for observed race-based differences in pain perception and response.

We also found a main effect of perceiver sex on pain perception and response across, but not within, experimental conditions. When explicit and implicit results are examined together, female participants were more perceptive and responsive to patient pain than male participants. Although we did not have specific hypothesis related to perceiver sex, this main effect is consistent with a recent study suggesting that women may rate the pain of others as more intense than do men.[51] Although there are few studies on perceiver sex differences in the perception of the pain of other people, and most do not find main effects of perceiver sex on pain perception,[1,67] hypotheses can be made based on the empathy literature. Several studies have shown that sex differences in empathy are related to differences in motivation, not ability, and are due to empathy-related gender role expectations.[38,40] Future studies should control for potential confounding factors, such as gender role–related demand characteristics.

Here we also demonstrate an effect of perceiver race on pain perception such that when conscious regulatory processes are not readily available (ie, in the implicit prime condition), AA participants tended to be more perceptive and responsive than EAs to the pain of all patients, irrespective of patient race. Though this effect was partially accounted for by participant sex, the participant race effect remained relatively robust, albeit only marginally significant, even after controlling for sex. This is somewhat contrary to prior results that found that EAs were more perceptive of pain-related negative mood among patients than were AAs.[1] However, this prior study included only a small sample of AA participants, and only 1 AA male, and therefore may not have been sufficiently powered to identify racial differences in pain perception. To our knowledge, the present study is the first experiment of racial biases in pain perception and response designed to examine the effects of perceiver race and to recruit a balanced sample of AA and EA participants.

Some complementary findings have been reported that lend support to our current results. A large survey employing the IAT found that AA physicians did not show general automatic racial biases, whereas physicians of other races (European/white, Hispanic, and Asian) did reveal culturally congruent racial biases.[54] A patient-physician interaction study found that AA physicians display more positive nonverbal communication with AA patients than do EA physicians, though these researchers also found an in-group bias among AA physicians such that they displayed fewer positive nonverbal behaviors when interacting with EA patients.[57] Prior research in nonphysician samples has demonstrated that AAs sometimes display general automatic biases against racial in-group members,[52] particularly under certain circumstances (eg, when perceived negativity toward one's group is high),[41] but that the content, contributions, and outcomes of these biases may differ from those of EAs.[48] Given the small percentage of AA physicians, and the challenges and discrimination AA physicians may themselves face,[49] clinical studies of the effect of perceiver race on disparities in pain perception and treatment are difficult. Nonetheless, future studies should further investigate this interesting effect.

We found no relationship between general automatic racial attitude bias (IAT score) and biases in pain perception and response, suggesting that bias in perception and response to pain is different from more general good versus bad automatic racial evaluations. Other studies have demonstrated general automatic racial biases among clinicians similar to that of the general population.[30,54] However, consistent with the present results, other studies of racial bias in pain perception and response have not found a relationship between traditional measures of general automatic racial evaluations and racial biases in pain perception.[33,64] Therefore, biases in pain perception may be more domain and/or stereotype specific. In other words, people may have specific biases in the domain of pain, such as that AAs are tougher, feel less pain, or are less sensitive to pain than EAs,[64,67] that are at least partially independent from their more general tendency to evaluate AAs less positively overall than EAs.

Strengths and Limitations

This is the first study to directly compare implicit and explicit methods in the study of pain perception biases. Prior studies have largely cued patient race explicitly (in words, pictures, or videos) and have found mixed results.[20,33,35,58,59,64,68] The present results suggest that patterns of bias may vary depending on the level at which patient race is processed, and presumably the degree to which implicit biases can be consciously regulated. Furthermore, to our knowledge, this is one of the first studies to incorporate a full perceiver race by patient race factorial design. However, future studies using similar designs to investigate automatic and deliberate racial biases in pain perception and response among clinicians (eg, physicians, nurses, and others providing direct care) are still needed. There is some experimental evidence that nurses respond with less bias in pain perception than student samples, perceiving AAs to be in more pain and need of medical treatment than EA patients[54] and reporting equal empathy in response to the pain of AA and EA patients.[20]

In the present study, the order of the pain perception and response questions was the same across all vignettes and all participants. We found a similar effect of race on all question responses and, therefore, created a composite score of pain perception and response. However, future studies are needed that are designed to disentangle potential separable effects of patient race on pain perception, empathy, and treatment decisions (eg, controlling for order effects by randomizing the order of questions). Additionally, experimenter and

participant demographics were not matched in this study. Though we did not find any effects of experimenter in these analyses, future studies may further explore potential experimenter effects.

Finally, future studies should probe the influence of potential mediators of the relationship between patient race and pain perception and response. For example, the effect of socioeconomic factors, such as education, insurance, and access to health care, on the influence of race on pain perception and treatment may be particularly important to understand when translating these findings within a clinical setting.

Future Directions: Toward Reducing Racial Biases in Pain Perception and Treatment

We suggest that future studies employ both implicit and explicit measures to examine pain-specific racial biases arising in clinical settings. Both automatic and controlled processes contribute to bias in real-world interactions. Therefore, to understand the source and develop interventions for combating racial disparities in pain, we must assess both types of cognitive processing. Although skin color and other cues to patient race are often readily observable in real-world interactions, people may not consciously examine and regulate the effect of these cues on their reactions and behaviors. Specifically, patient race-relevant cues may trigger clinicians' consciously held beliefs and automatic associations, which may differentially affect perception, diagnosis, and treatment of pain. Experimental methods, such as implicit racial priming, provide useful tools to examine automatic, unconscious, or unchecked influences of patient race on clinician perception and response. Similar examinations have shed light on racial inequalities in other fields such as law enforcement and criminal justice.[6,22]

Future studies are also needed to assess the extent to which racial biases in pain perception and response are due to pain-specific stereotypes and attitudes. The development of pain-specific tools to assess bias may be more appropriate than measures of general racial attitudes when examining racial bias in pain perception and response. Should future studies confirm the influence of pain-specific stereotypes and attitudes on pain perception and treatment, we suggest that interventions targeted at automatic biases may be most effective among a population of clinicians with consciously held egalitarian motivations and goals. Social psychologists have found that perspective-taking interventions (whereby one imagines the thoughts, feelings, and or experiences of another person)[61] and prejudice habit-breaking interventions (whereby participants receive training in, practice, and reflect on the success of automatic bias–reducing strategies in their daily lives)[16] can decrease automatic racial biases in behavior. These interventions might be beneficially incorporated into medical school and nursing courses and implemented in clinical practice. Perspective-taking and habit-breaking interventions also lead to increased awareness of and concern about discrimination, inequalities, and injustice, which may be of particular value in the context of disparities in pain, given the extent of these disparities[29] and the insistence of many clinicians that bias does not affect patient care in their own practices.[17] Laboratory and clinical investigations of the effectiveness of these interventions in the context of reducing racial biases in pain perception and treatment are needed.

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References

1. Alqudah AF, Hirsh AT, Stutts LA, Scipio CD, Robinson ME: Sex and race differences in rating others' pain, pain-related negative mood, pain coping, and recommending medical help. J Cyber Ther Rehabil 3:63, 2010

2. Anderson KO, Green CR, Payne R: Racial and ethnic disparities in pain: Causes and consequences of unequal care. J Pain 10:1187-1204, 2009

3. Anderson KO, Mendoza TR, Valero V, Richman SP, Russell C, Hurley J, DeLeon C, Washington P, Palos G, Payne R, Cleeland CS: Minority cancer patients and their providers. Cancer 88:1929-1938, 2000

4. Avenanti A, Sirigu A, Aglioti SM: Racial bias reduces empathic sensorimotor resonance with other-race pain. Curr Biol 20:1018-1022, 2010

5. Balsa AI, McGuire TG: Prejudice, clinical uncertainty and stereotyping as sources of health disparities. J Health Econ 22:89-116, 2003

6. Banks RR, Eberhardt JL, Ross L: Discrimination and implicit bias in a racially unequal society. Cal Law Rev 94:1169-1190, 2006

7. Bartfield JM, Salluzzo RF, Raccio-Robak N, Funk DL, Verdile VP: Physician and patient factors influencing the treatment of low back pain. Pain 73:209-211, 1997

8. Bonham VL: Race, ethnicity, and pain treatment: Striving to understand the causes and solutions to the disparities in pain treatment. J Law Med Ethics 28:52-68, 2001

9. Burgess DJ, van Ryn M, Crowley-Matoka M, Malat J: Understanding the provider contribution to race/ethnicity disparities in pain treatment: Insights from dual process models of stereotyping. Pain Med 7:119-134, 2006

10. Burgess DJ, van Ryn M, Dovidio JF, Saha S: Reducing racial bias among health care providers: Lessons from social-cognitive psychology. J Gen Intern Med 22:882-887, 2007

11. Campbell CM, Edwards RR: Ethnic differences in pain and pain management. Pain Manage 2:219-230, 2012

12. Carey TS, Mills Garrett J: The relation of race to outcomes and the use of health care services for acute low back pain. Spine 28:390-394, 2003

13. Chen M, Bargh JA: Nonconscious behavioral confirmation processes: The self-fulfilling consequences of automatic stereotype activation. J Exp Soc Psychol 33:541-560, 1997

14. Cintron A, Morrison RS: Pain and ethnicity in the United States: A systematic review. J Palliat Med 9:1454-1473, 2006

15. Cooper LA, Roter DL, Johnson RL, Ford DE, Steinwachs DM, Powe NR: Patient-centered communication, ratings of care, and concordance of patient and physician race. Ann Intern Med 139:907-915, 2003

16. Devine PG, Forscher PS, Austin AJ, Cox WTL: Long-term reduction in implicit race bias: A prejudice habit-breaking intervention. J Exp Soc Psychol 48:1267-1278, 2012

17. Dovidio JF, Fiske ST: Under the radar: How unexamined bias in decision-making processed in clinical interaction can contribute to health care disparities. Am J Public Health 102:945-952, 2012

18. Dovidio JF, Kawakami K, Gaertner SL: Implicit and explicit prejudice and interracial interaction. J Pers Soc Psychol 82:62-68, 2002

19. Dovidio JF, Kawakami K, Johnson C, Johnson B, Howard A: On the nature of prejudice: Automatic and controlled processes. J Exp Soc Psychol 33:510-540, 1997

20. Drwecki BB, Moore CF, Ward SE, Prkachin KM: Reducing racial disparities in pain treatment: The role of empathy and perspective-taking. Pain 152:1001-1006, 2011

21. Dunton BC, Fazio RH: An individual difference measure of motivation to control prejudiced reactions. Pers Soc Psychol Bull 23:316, 1997

22. Eberhardt JL, Goff PA, Purdie VJ, Davies PG: Seeing black: Race, crime, and visual processing. J Pers Soc Psychol 87:876-893, 2004

23. Fazio RH, Olson MA: Implicit measures in social cognition research: Their meaning and use. Ann Rev Psychol 54: 297-327, 2003

24. Freeman HP, Payne R: Racial injustice in health care. N Engl J Med 342:1045-1047, 2000

25. Gamst GC, Liang CTH, Der-Karabetian A: Racism- and prejudice-related measures, in Handbook of Multicultural Measures. Thousand Oaks, CA, Sage Publications, 2010, pp 251-334

26. Goff PA, Eberhardt JL, Williams MJ, Jackson MC: Not yet human: Implicit knowledge, historical dehumanization, and contemporary consequences. J Pers Soc Psychol 94:292, 2008

27. Golby AJ, Gabrieli JD, Chiao JY, Eberhardt JL: Differential responses in the fusiform region to same-race and other-race faces. Nat Neurosci 4:845, 2001

28. Goldman B: Chronic-pain patients must cope with chronic lack of physician understanding. Can Med Assoc J 144:1492, 1991

29. Green CR, Anderson KO, Baker TA, Campbell LC, Decker S, Fillingim RB, Kaloukalani DA, Lasch KE, Myers C, Tait RC, Todd KH, Vallerand AH: The unequal burden of pain: Confronting racial and ethnic disparities in pain. Pain Med 4:277-294, 2003

30. Green AR, Carney DR, Oallin DJ, Ngo LH, Raymond KL, Iezzoni LI, Banaji MR: Implicit bias among physicians and its prediction of thrombolysis decisions for black and white patients. J Gen Intern Med 22:1231-1238, 2007

31. Greenwald AG, Nosek BA, Banaji MR: Understanding and using the Implicit Association Test: I. An improved scoring algorithm. J Pers Soc Psychol 85:197-216, 2003

32. Hadjistavropoulos T, LaChapelle D, Hale C, MacLeod FK: Age- and appearance-related stereotypes about patients undergoing a painful medical procedure. Pain Clin 12: 25-33, 2000

33. Haider AH, Sexton J, Sriram NN, Cooper LA, Efron DT, Swoboda S, Villegas CV, Haut ER, Bonds M, Pronovost PJ, Lipsett PA, Freischlag JA, Cornwell EE: Association of unconscious race and social class bias with vignette-based clinical assessments by medical students. J Am Med Assoc 306: 942-951, 2011

34. Hein G, Silani G, Preuschoff K, Batson CD, Singer T: Neural responses to ingroup and outgroup members' suffering predict individual differences in costly helping. Neuron 68: 149-160, 2010

35. Hirsh AT, Alqudah AF, Stutts LA, Robinson ME: Virtual human technology: Capturing sex, race, and age influences in individual pain decision policies. Pain 140: 231-238, 2008

36. Hodgkins M, Albert D, Daltroy L: Comparing patients' and their physicians' assessment of pain. Pain 23:273-277, 1987

37. Hofmann W, Gawronski B, Gschwendner T, Le H, Schmitt M: A meta-analysis on the correlation between the Implicit Association Test and explicit self-report measures. Pers Soc Psychol Bull 31:1369-1385, 2005

38. Ickes W, Gesn PR, Graham T: Gender differences in empathic accuracy: Differential ability or differential motivation? Pers Relationship 7:95-109, 2000

39. Kawakami K, Dovidio JF: The reliability of implicit stereotyping. Pers Soc Psychol Bull 27:212-225, 2001

40. Klein KJK, Hodges SD: Gender differences, motivation, and empathic accuracy: When it pays to understand. Pers Soc Psychol Bull 27:720-730, 2001

41. Livingston RW: The role of perceived negativity in the moderation of African Americans' implicit and explicit racial attitudes. J Exp Soc Psychol 38:405-413, 2002

42. Marquié L, Raufaste E, Lauque D, Mariné C, Ecoiffier M, Sorum P: Pain rating by patients and physicians: Evidence of systematic pain miscalibration. Pain 102:289-296, 2003

43. Mathur V, Paice J, Chiao J: The effects of implicit racial priming on the relationship between trust and empathy for pain. J Pain 11:S62, 2010

44. Mathur V, Paice J, Chiao J: Independent effects of perceiver race on pain perception and empathy. J Pain 13: S105, 2012

45. McConahay JB: Modern racism, ambivalence, and the modern racism scale, in Dovidio JF, Gaertner SL (eds): Prejudice, Discrimination, and Racism. San Diego, CA, Academic Press, 1986, pp 91-125

46. Meghani SH, Brooks JM, Gipson-Jones T, Waite R, Whitfield-Harris L, Deatrick JA: Patient–provider race-concordance: Does it matter in improving minority patients' health outcomes? Ethnic Health 14:107-130, 2009

47. Meghani SH, Byun E, Gallagher RM: Time to take stock: A meta-analysis and systematic review of analgesic treatment disparities for pain in the United States. Pain Med 13:150-174, 2012

48. Monteith MJ, Spicer CV: Contents and correlates of whites' and blacks' racial attitudes. J Exp Soc Psychol 36: 125-154, 2000

49. Nunez-Smith M, Pilgrim N, Wynia M, Desai MM, Bright C, Krumholz HM, Bradley EH: Health care workplace discrimination and physician turnover. J Natl Med Assoc 101:1274-1282, 2009

50. Payne BK: Prejudice and perception: The role of automatic and controlled processes in misperceiving a weapon. J Pers Soc Psychol 81:181-192, 2001

51. Preis MA, Kroener-Herwig B: Empathy for pain: The effects of prior experience and sex. Eur J Pain 16:1311-1319, 2012

52. Richeson JA, Trawalter S, Shelton JN: African Americans' implicit racial attitudes and the depletion of executive function after interracial interactions. Soc Cogn 23:336-352, 2005

53. Rudman LA: Sources of implicit attitudes. Curr Dir Psychol Sci 13:79-82, 2004

54. Sabin JA, Nosek BA, Greenwald AG, Rivara FP: Physicians' implicit and explicit attitudes about race by MD race, ethnicity, and gender. J Health Care Poor Underserved 20:896-913, 2009

55. Stanton LJ, Panda M, Chen I, Genao I, Kurz J, Pasanen M, Mechaber AJ, Menon M, O'Rorke J, Wood J, Rosenberg E, Faeslis C, Carey T, Calleson D, Cykert S: When race matters: Disagreement in pain perception between patients and their physicians in primary care. J Natl Med Assoc 99:532-538, 2007

56. Stepanikova I: Racial-ethnic biases, time pressure, and medical decisions. J Health Soc Behav 53:329-343, 2012

57. Stepanikova I, Zhang Q, Wieland D, Eleazer GP, Stewart T: Non-verbal communication between primary care physicians and older patients: How does race matter? J Gen Int Med 27:576-581, 2012

58. Stutts LA, Hirsh AT, George SZ, Robinson ME: Investigating patient characteristics on pain assessment using virtual human technology. Eur J Pain 14:1040-1045, 2010

59. Tamayo-Sarver JH, Dawson NV, Hinze SW, Cydulka RK, Wigton RS, Albert JM, Ibrahim SA, Baker DW: The effects of race/ethnicity and desirable social characteristics on physicians' decisions to prescribe opioid analgesics. Acad Emerg Med 10:1239-1248, 2003

60. Thomas SH, Borczuk P, Shackelford J, Ostrander J, Silver D, Evans M, Stein J: Patient and physician agreement on abdominal pain severity and need for opioid analgesia. Am J Emerg Med 17:586-590, 1999

61. Todd AR, Bodenhausen GV, Richeson JA, Galinsky AD: Perspective taking combats automatic expressions of racial bias. J Pers Soc Psychol 100:1027-1042, 2011

62. Todd KH, Deaton C, D'Adamo AP, Goe L: Ethnicity and analgesic practice. Ann Emerg Med 35:11-16, 2000

63. Todd KH, Samaroo N, Hoffman JR: Ethnicity as a risk factor for inadequate emergency department analgesia. J Am Med Assoc 269:1537-1539, 1993

64. Trawalter S, Hoffman KM, Waytz A: Racial bias in perceptions of others' pain. PLoS One 7:e48546, 2012

65. van Ryn M: Research on the provider contribution to race/ethnicity disparities in medical care. Med Care 40: 140-151, 2002

66. van Ryn M, Burke J: The effect of patient race and socioeconomic status on physicians' perceptions of patients. Soc Sci Med 50:813-828, 2000

67. Wandner LD, Scipio CD, Hirsh AT, Torres CA, Robinson ME: The perception of pain in others: How gender, race, and age influence pain expectations. J Pain 13:220-227, 2012

68. Weisse CS, Sorum PC, Dominguez RE: The influence of gender and race on physicians' pain management decisions. J Pain 4:505-510, 2003

69. Wittenbrink B, Judd CM, Park B: Evidence for racial prejudice at the implicit level and its relationship with questionnaire measures. J Pers Soc Psychol 72:262-274, 1997

70. Xu X, Zuo X, Wang X, Han S: Do you feel my pain? Racial group membership modulates empathic neural responses. J Neurosci 29:8525-8529, 2009