Racial bias in pain assessment and treatment recommendations, and false beliefs about biological differences between blacks and whites

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Black Americans are systematically undertreated for pain relative to white Americans. We examine whether this racial bias is related to false beliefs about biological differences between blacks and whites (e.g., "black people's skin is thicker than white people's skin"). Study 1 documented these beliefs among white laypersons and revealed that participants who more strongly endorsed false beliefs about biological differences reported lower pain ratings for a black (vs. white) target. Study 2 extended these findings to the medical context and found that half of a sample of white medical students and residents endorsed these beliefs. Moreover, participants who endorsed these beliefs rated the black (vs. white) patient's pain as lower and made less accurate treatment recommendations. Participants who did not endorse these beliefs rated the black (vs. white) patient's pain as higher, but showed no bias in treatment recommendations. These findings suggest that individuals with at least some medical training hold and may use false beliefs about biological differences between blacks and whites to inform medical judgments, which may contribute to racial disparities in pain assessment and treatment.

racial bias | pain perception | health care disparities | pain treatment

A young man goes to the doctor complaining of severe pain in his back. He expects and trusts that a medical expert, his physician, will assess his pain and prescribe the appropriate treatment to reduce his suffering. After all, a primary goal of health care is to reduce pain and suffering. Whether he receives the standard of care that he expects, however, is likely contingent on his race/ethnicity. Prior research suggests that if he is black, then his pain will likely be underestimated and undertreated compared with if he is white (1–10). The present work investigates one potential factor associated with this racial bias. Specifically, in the present research, we provide evidence that white laypeople and medical students and residents believe that the black body is biologically different—and in many cases, stronger—than the white body. Moreover, we provide evidence that these beliefs are associated with racial bias in perceptions of others' pain, which in turn predict accuracy in pain treatment recommendations. The current work, then, addresses an important social factor that may contribute to racial bias in health and health care.

Extant research has shown that, relative to white patients, black patients are less likely to be given pain medications and, if given pain medications, they receive lower quantities (1–10). For example, in a retrospective study, Todd et al. (10) found that black patients were significantly less likely than white patients to receive analgesics for extremity fractures in the emergency room (57% vs. 74%), despite having similar self-reports of pain. This disparity in pain treatment is true even among young children. For instance, a study of nearly one million children diagnosed with appendicitis revealed that, relative to white patients, black patients were less likely to receive any pain medication for moderate pain and were less likely to receive opioids—the appropriate treatment—for severe pain (6).

These disparities in pain treatment could reflect an overprescription of medications for white patients, underprescription of medications for black patients, or, more likely, both. Indeed, there is evidence that overprescription is an issue, but there is also clear evidence that the underprescription of pain medications for black patients is a real, documented phenomenon (1, 4). For example, a study examining pain management among patients with metastatic or recurrent cancer found that only 35% of racial minority patients received the appropriate prescriptions—as established by the World Health Organization guidelines—compared with 50% of nonminority patients (4).

Broadly speaking, there are two potential ways by which racial disparities in pain management could arise. The first possibility is that physicians recognize black patients' pain, but do not to treat it, perhaps due to concerns about noncompliance or access to health care (7, 8). The second possibility is that physicians do not recognize black patients' pain in the first place, and thus cannot treat it. In fact, recent work suggests that racial bias in pain treatment may stem, in part, from racial bias in perceptions of others' pain. This research has shown that people assume a priori that blacks feel less pain than do whites (11–17). In a study by Staton et al. (14), for instance, patients were asked to report how much pain they were experiencing, and physicians were asked to rate how much pain they thought the patients were experiencing. Physicians were more likely to underestimate the pain of black patients (47%) relative to nonblack patients (33.5%). Of note,

Significance

The present work examines beliefs associated with racial bias in pain management, a critical health care domain with well-documented racial disparities. Specifically, this work reveals that a substantial number of white laypeople and medical students and residents hold false beliefs about biological differences between blacks and whites and demonstrates that these beliefs predict racial bias in pain perception and treatment recommendation accuracy. It also provides the first evidence that racial bias in pain perception is associated with racial bias in pain treatment recommendations. Taken together, this work provides evidence that false beliefs about biological differences between blacks and whites continue to shape the way we perceive and treat black people—they are associated with racial disparities in pain assessment and treatment recommendations.

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this research has also shown that racial attitudes, measured both implicitly and explicitly, do not predict racial bias in pain perception or treatment (11, 15, 18), with the exception of one study showing that implicit pro-white attitudes predicted physicians' likelihood of recommending thrombolysis treatment (19). Racial bias in perceptions of pain (and possibly treatment) does not appear to be borne out of racist attitudes. In other words, it is likely not the result of racist individuals acting in racist ways. To date, then, it is unclear what beliefs account for disparities in pain assessment and treatment. Here, we examine the extent to which beliefs about biological differences between blacks and whites (e.g., beliefs that blacks have thicker skin than do white people or that black people's blood coagulates more quickly than white people's blood) are associated with racial bias in pain perception and treatment recommendations.

Beliefs that blacks and whites are fundamentally and biologically different have been prevalent in various forms for centuries. In the United States, these beliefs were championed by scientists, physicians, and slave owners alike to justify slavery and the inhumane treatment of black men and women in medical research (20–25). In the 19th century, prominent physicians sought to establish the "physical peculiarities" of blacks that could "serve to distinguish him from the white man" (23). Such "peculiarities" included thicker skulls, less sensitive nervous systems, and diseases inherent in dark skin (20, 21, 23). Dr. Samuel Cartright, for instance, wrote that blacks bore a "Negro disease [making them] insensible to pain when subjected to punishment" (20). Other physicians believed that blacks could tolerate surgical operations with little, if any, pain at all (22, 25). Well into the 20th century, researchers continued to experiment on black people based in part on the assumption that the black body was more resistant to pain and injury. The military covertly tested mustard gas and other chemicals on black soldiers during World War II, and the US Public Health Service, in collaboration with the Tuskegee Institute, studied the progression of untreated syphilis in black men from 1932 to 1972.

Today, many laypeople, scientists, and scholars continue to believe that the black body is biologically and fundamentally different from the white body and that race is a fixed marker of group membership, rooted in biology (26–28). In fact, many people insist that black people are better athletes—stronger, faster, and more agile—as a result of natural selection and deliberate breeding practices during slavery (29–33). Research suggests that people even believe that black people are more likely than white people to be capable of fantastical mental and physical feats, such as withstanding extreme heat from burning coals (17). These biological conceptions of race are only weakly if at all correlated with racial attitudes (27, 34). They are nonetheless consequential. Research has shown that biological conceptions and related beliefs are associated with greater acceptance of racial disparities (27) and even racial bias in pain perception (17). Indeed, in one study, white participants who believed black people can tolerate extreme heat more than white people can, for example, were more likely to think that black people feel less pain than do white people (17).

In the present work, we examine whether beliefs about biological differences are associated with racial bias in pain perception and treatment recommendations. Specifically, we test whether people—including people with some medical training—believe that black people feel less pain than do white people, and we test whether people with some medical training recommend fewer or weaker pain medications to black vs. white patients. In addition, the present work extends prior work in three important ways. First, it documents whether people with some medical training (medical students and residents who already treat patients) hold false beliefs about biological differences between blacks and whites in contemporary times. Second, it tests whether these beliefs predict racial bias in perceptions of others' pain and racial bias in the accuracy of treatment recommendations among a sample of white medical students and residents. Third, it investigates whether racial bias in pain perception is related to racial bias in pain management. We focus on white participants given the historical context of black–white relations, particularly in the medical context (20–25). Analyses for nonwhite participants can be found in the *SI Text* for the interested reader.

In two studies, we asked people to make judgments about another person's pain. In study 1, we used a between-participants design in which laypeople were randomly assigned to rate the pain of either a black or a white target. In study 2, we used a within-participants design in which medical students and residents provided pain ratings and treatment recommendations for both a black and a white target. In addition to pain ratings, we measured beliefs about biological differences between blacks and whites using 15 items (e.g., black people's skin is thicker than white people's skin; see *SI Text* for the full list of items). We predicted that these beliefs would be associated with racial bias in pain perception.

Study 1

In study 1, we first establish that individuals without medical training endorse beliefs about biological differences between blacks and whites and demonstrate that these beliefs are related to racial bias in pain perception. We recruited 121 participants, 92 of whom met our a priori criteria (i.e., white, born in the United States, native English speakers). Participants gave informed consent in accordance with policies of the Institutional Review Board (IRB) of the University of Virginia. Participants reported the amount of pain they would feel across 18 scenarios (e.g., "I slam my hand in a car door"; scale: 1 = not painful, 2 = somewhat painful, 3 = moderately painful, 4 = extremely painful) and were then randomly assigned to rate the pain of a gender-matched black or white target across the same scenarios.

Participants also rated the extent to which 15 biological differences between blacks and whites are true or untrue on a six-point scale (1 = definitely untrue, 2 = probably untrue, 3 = possibly untrue, 4 = possibly true, 5 = probably true, 6 = definitely true; see Table 1 for a list of the items, and *SI Text* and Table S1 for additional descriptive information for the measure). Here, we report results using a composite averaging the false items about biological differences between the black body and the white body for each participant ($\alpha = 0.92$). We provide analyses using all items in Table S2.

We conducted all of the analyses using continuous measures of false beliefs and pain ratings. On average, participants endorsed 23.82% (SD = 24.01) of the biological beliefs and 22.43% (SD = 22.93) of the false beliefs specifically. About 73% of the sample endorsed at least one of the false items (i.e., indicated that an item was possibly, probably, or definitely true; Table 1). We regressed pain ratings on target race, false beliefs, and their interaction, controlling for age, gender, and self-ratings of pain (see Table S3 for the correlations between covariates and dependent measures for both studies). Consistent with previous work, results revealed a main effect of target race [$\beta = -0.07$, SE = 0.03, $F(1,85) = 5.50$, $P = 0.021$, $\eta_p^2 = 0.06$, such that participants reported lower pain ratings for the black vs. white target. This effect was qualified by the predicted interaction between target race and false beliefs [$\beta = -0.07$, SE = 0.03, $F(1,85) = 4.36$, $P = 0.040$, $\eta_p^2 = 0.05$; Fig. 1]. Simple slope analyses revealed that participants who endorsed fewer false beliefs (−1 SD) did not differ in their pain estimates for a black vs. a white target [$\beta = -0.01$, SE = 0.05, $F(1, 85) = 0.02$, $P > 0.250$]. However, target race did predict racial bias in pain ratings among participants who endorsed more false beliefs (+1 SD) [$\beta = -0.14$, SE = 0.05, $F(1,85) = 9.78$, $P = 0.002$, $\eta_p^2 = 0.10$], such that participants who rated the black target reported lower pain estimates than did participants who rated the white target. Interestingly, among this sample, the bias emerged because participants high in false beliefs

Table 1. Percentage of white participants endorsing beliefs about biological differences between blacks and whites

Item	Study 1: Online sample (n = 92)	Study 2			
		First years (n = 63)	Second years (n = 72)	Third years (n = 59)	Residents (n = 28)
Blacks age more slowly than whites	23	21	28	12	14
Blacks' nerve endings are less sensitive than whites'	20	8	14	0	4
Black people's blood coagulates more quickly than whites'	39	29	17	3	4
Whites have larger brains than blacks	12	2	1	0	0
Whites are less susceptible to heart disease than blacks*	43	63	83	66	50
Blacks are less likely to contract spinal cord diseases*	42	46	67	56	57
Whites have a better sense of hearing compared with blacks	10	3	7	0	0
Blacks' skin is thicker than whites'	58	40	42	22	25
Blacks have denser, stronger bones than whites*	39	25	78	41	29
Blacks have a more sensitive sense of smell than whites	20	10	18	3	7
Whites have a more efficient respiratory system than blacks	16	8	3	2	4
Black couples are significantly more fertile than white couples	17	10	15	2	7
Whites are less likely to have a stroke than blacks*	29	49	63	44	46
Blacks are better at detecting movement than whites	18	14	15	5	11
Blacks have stronger immune systems than whites	14	21	15	3	4
False beliefs composite (11 items), mean (SD)	22.43 (22.93)	14.86 (19.48)	15.91 (19.34)	4.78 (9.89)	7.14 (14.50)
Range	0–100	0–81.82	0–90.91	0–54.55	0–63.64
Combined mean (SD) (medical sample only)			11.55 (17.38)		

For ease of presentation, we shortened the items; see *SI Text* for full items and additional information. For ease of interpretation and ease of presentation, we collapsed the scale and coded responses marked as possibly, probably, or definitely untrue as 0 and possibly, probably, or definitely true, as 1, resulting in percentages of individuals who endorsed each item. Bold entries represent the items included in the false beliefs about biological differences between blacks and whites composite.
*Items that are factual or true.

rated the pain of the black target lower and the pain of the white target higher than did participants low in false beliefs. In other words, relative to participants low in false beliefs, they seemed to assume that the black body is stronger and that the white body is weaker.

Study 1 thus demonstrates that white adults without medical training endorse at least some beliefs about biological differences between blacks and whites, many of which are false and fantastical in nature (e.g., black people's blood coagulates more quickly than white people's blood). Study 1 also demonstrates that these beliefs are related to racial bias in pain perception among a sample of white adults without medical training. Given the well-documented, pervasive racial disparities in pain management, understanding who might contribute to this racial bias and why is of paramount importance. Thus, we next examined whether people with some degree of medical training also endorse these beliefs, and if so, whether these beliefs are associated with racial bias in pain perception and pain treatment recommendations. Study 2 extends the findings of study 1 in at least three important ways: (*i*) it examines racial bias in a relevant context—medicine—using medical cases similar to those used in medical training; (*ii*) it extends our investigation to a sample with at least some medical training—medical students and residents; and (*iii*) it considers a critical downstream outcome—racial bias in pain treatment recommendations.

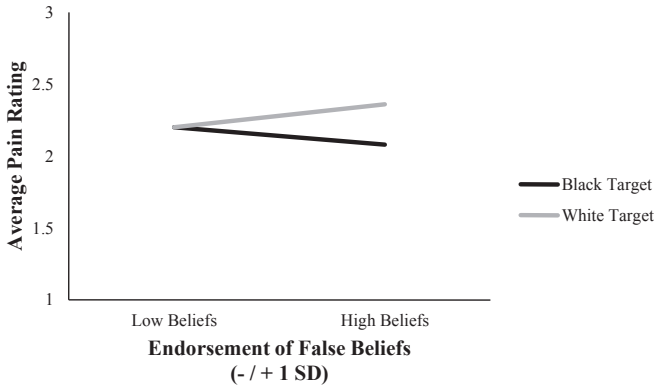

Fig. 1. Nonmedical sample estimated mean pain ratings for black and white targets as a function of false belief endorsement (scale: 1–6; plotted 1 SD below and above the mean). Pain rating scale: 1 = not painful, 2 = somewhat painful, 3 = moderately painful, 4 = extremely painful.

Study 2

We collected data from a total of 418 medical students and residents. Two hundred twenty-two met the same a priori criteria as in study 1 and completed the study (first years, n = 63; second years, n = 72; third years, n = 59; residents, n = 28). Participants gave informed consent in accordance with policies of the IRB of the University of Virginia. After consenting, participants read two mock medical cases about a black and a white patient and made pain ratings (scale: 0 = no pain to 10 = worst possible pain) and medication recommendations (dummy coded for accuracy: 1 = accurate, 0 = inaccurate) for each.[†] They also completed the same measure of beliefs about biological differences between blacks and whites as in study 1. We again averaged the 11 items that captured our variable of interest (α = 0.92) (see Table 1 and Table S1 for descriptive information; analyses for the composite with all items can be found in Table S4). On average, participants endorsed 11.55% (SD = 17.38) of the false beliefs. About 50% reported that at least one of the false belief items was possibly, probably, or definitely true (Table 1). These percentages are noticeably lower compared with those in study 1 (50% vs. 73%); however, given this sample (medical students and residents), the percentages for false beliefs are surprisingly high.

[†]We counterbalanced the order of target race (black, white) and medical case (kidney stone, ankle fracture) across participants. Preliminary analyses revealed that the order of target race and medical case did not moderate the effects, and we thus exclude them from our models for parsimony. Including them does not change the pattern of results.

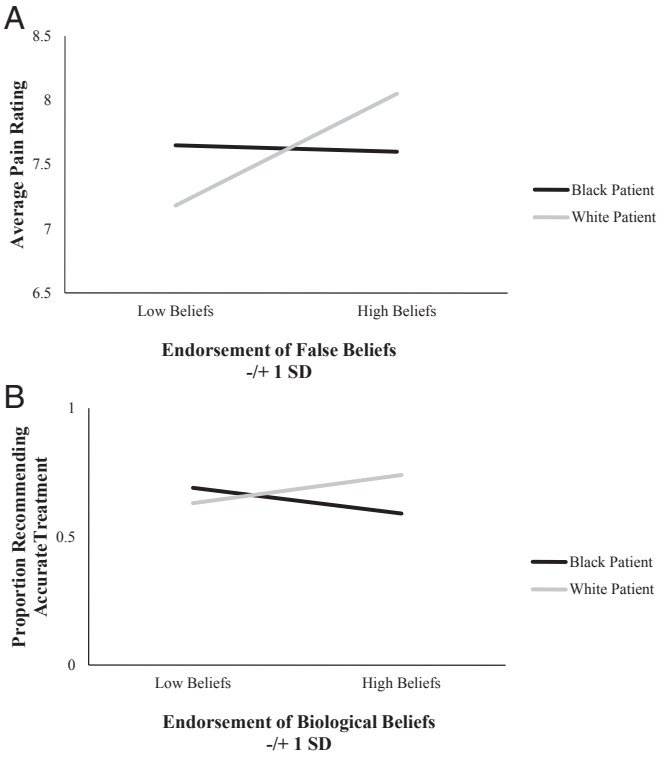

Fig. 2. Medical sample estimated mean pain ratings and treatment recommendation accuracy as a function of false belief endorsement (plotted 1 SD below and above the mean). (*A*) Average pain ratings (pain rating scale: 0 = no pain; 1; 2 = mild pain; 3; 4 = moderate pain; 5; 6 = severe pain; 7; 8 = very severe pain; 9; 10 = worst possible pain). (*B*) Proportion of participants recommending accurate treatment for black and white target patients (treatment recommendation accuracy scale: 1 = accurate, 0 = inaccurate).

First, we examined whether those who endorsed false beliefs exhibited a racial bias in pain assessment. We modeled pain ratings as a function of target race (as a repeated measure), false beliefs (as a between-participants measure), and their interaction, controlling for age, gender, and medical cohort.[‡,§] Results revealed only the predicted target race by false beliefs interaction [$F(1,211) = 9.56$, $P = 0.002$, $\eta^2_G = 0.02$; Fig. 2*A*]. To decompose this interaction, we conducted simple slope analyses. We constructed a difference score to reflect racial bias in pain perception, subtracting black pain scores from white pain scores; greater, positive scores indicate that a participant rated the white patient as feeling more pain than the black patient. The simple slope analyses indicated that participants who endorsed more false beliefs (+1 SD) rated the black target as feeling less pain than the white target [$\beta = 0.45$, SE = 0.20, $t(211) = 2.24$, $P = 0.026$]. Conversely, participants who endorsed fewer false beliefs (−1 SD) rated the black target as feeling more pain than the white target [$\beta = -0.48$, SE = 0.20, $t(211) = -2.34$, $P = 0.020$]. In other words, as in study 1, participants in study 2 who endorsed false beliefs about biological differences between blacks and whites exhibited a racial bias in pain perception similar to the bias shown in previous work (11–17). Unexpectedly, participants who did not endorse such beliefs exhibited a bias in the opposite direction.

We next modeled the accuracy of treatment recommendations (coded as 1 = accurate, 0 = inaccurate) as a function of target race (as a repeated measure), false beliefs (as a between-participants measure), and their interaction, controlling for age, gender, and medical cohort. Once again, we found only the predicted interaction between target race and false beliefs [$F(1,192) = 5.68$, $P = 0.018$, $\eta^2_G = 0.01$; Fig. 2*B*]. To decompose this interaction, we again conducted simple slope analyses on the difference score in treatment recommendation accuracy for the black vs. white target (white accuracy minus black accuracy; greater, positive scores indicate greater likelihood of recommending an accurate treatment for a white vs. black target). These analyses indicated that participants who endorsed more false beliefs (+1 SD) were less accurate in their treatment recommendations for the black target compared with the white target [$\beta = 0.15$, SE = 0.06, $t(192) = 2.47$, $P = 0.014$]. Conversely, participants who endorsed fewer false beliefs (−1 SD) did not differ in their treatment recommendation accuracy [$\beta = -0.06$, SE = 0.06, $t(192) = -1.05$, $P > 0.250$]. In other words, participants who endorsed more false beliefs about biological differences between blacks and whites showed a racial bias in the accuracy of their treatment recommendations. Participants who did not endorse such beliefs showed no bias in treatment recommendation accuracy.

We also examined the relationship between racial bias in pain perception and racial bias in treatment recommendation accuracy. We correlated racial bias in pain perception (white pain minus black pain) with racial bias in treatment recommendation accuracy (accuracy for white patient minus accuracy for black patient), covarying out age, gender, and medical cohort. This analysis revealed a significant and sizable positive correlation, such that greater racial bias in pain ratings was associated with greater racial bias in the accuracy of treatment recommendations ($r = 0.46$, $P < 0.0001$). As predicted, racial bias in pain perception is related to racial bias in the accuracy of treatment recommendations.

Last, we conducted a mediation analysis to test whether racial bias in pain perception mediated the racial bias in treatment recommendation accuracy. When adding racial bias in pain assessment (white pain minus black pain) to the model predicting racial bias in treatment recommendation accuracy, false beliefs was no longer a significant predictor [$B = 0.05$, SE = 0.04, $F(1,191) = 1.22$, $P > 0.250$, $\eta^2_p = 0.01$], whereas racial bias in pain perception continued to predict racial bias in treatment recommendation accuracy [$B = 0.25$, SE = 0.04, $F(1,191) = 44.44$, $P < 0.0001$, $\eta^2_p = 0.19$], suggesting mediation.

Study 2 demonstrates that, similar to white laypersons in study 1, many white medical students and residents hold beliefs about biological differences between blacks and whites, many of which are false and fantastical in nature, and that these false beliefs are related to racial bias in pain perception. Furthermore, study 2 also reveals that white medical students and residents who endorsed false beliefs showed racial bias in the accuracy of their pain treatment recommendations. Specifically, participants who

[‡]We present analyses using ordinary least squares (OLS) regressions. For the continuous pain measure in study 2, we provide the mixed-effects model for comparison in Table S5. For binary outcomes, such as treatment recommendation accuracy in study 2, logistic or OLS regressions are appropriate and produce similar results. The OLS regression is our preferred specification because interpretation requires weaker functional form assumptions than a linear dependent variable model (35) and provides unbiased, reliable estimates of a variable's average effect (36–40). However, because the outcome is binary, some may prefer a logit and/or probit specification; we provide these specifications in Table S6.

[§]This analysis also revealed that medical cohort was a significant predictor of both pain ratings and treatment recommendation accuracy irrespective of patient race [$F(1,211) = 38.79$, $P < 0.0001$ and $F(1,192) = 8.08$, $P = .005$, respectively]. As participants progressed in their training from first-year students through residents, they rated the targets as feeling more pain and they were more accurate in their treatment recommendations. This finding is interesting given the common perception that medical training hardens physicians to others' pain and suffering (see ref. 41 for a review). At least in our sample, people with more medical training were actually more, not less, sensitive to others' pain. Perhaps in the present sample, as more senior medical students and residents gained "hands-on" experience on the medical wards and witnessed patients in pain, they perceived greater pain for the scenarios we provided—both of which would be extremely painful. In addition, it is perhaps not surprising that treatment recommendation accuracy was higher among more senior students, as additional training and experience should yield greater accuracy. Medical cohort did not moderate the interaction between target race and false beliefs for pain ratings or treatment recommendation accuracy (Fs < 1). We thus included medical cohort as a covariate and not as a moderator of the target race × false beliefs interaction term in all of our analyses.

endorsed more of these beliefs reported that a black (vs. white) target patient would feel less pain and they were less accurate in their treatment recommendations for the black (vs. white) patient. Although the effect sizes for these findings were not large ($\eta_p^2 = 0.03$ and 0.04), the practical importance is significant: those endorsing more false beliefs rated the pain of a black (vs. white) patient half a scale point lower and were less accurate in their treatment recommendations 15% of the time.

In contrast to white medical students and residents who endorsed false beliefs, those who did not endorse (or endorsed fewer) false beliefs reported that a white (vs. black) target patient would feel less pain. This opposite bias perhaps reflects real-world differences, as previous work has shown that black patients tend to report greater pain than do white patients (7, 24, 42). This opposite bias could also reflect participants' attempt to compensate for known racial disparities (see ref. 13 for a similar explanation). Of note, these medical students and residents did not exhibit a racial bias in treatment recommendations. In other words, endorsing fewer false beliefs was associated with the perception that whites feel less pain but not with insufficient treatment recommendations for white patients. In contrast, endorsing more false beliefs was associated with perceptions that blacks feel less pain and a "commensurate" insufficient treatment recommendation for black patients. It thus seems that racial bias in pain perception has pernicious consequences for accuracy in treatment recommendations for black patients and not for white patients.

Unexpectedly, shifts in racial bias as a function of false beliefs stemmed from shifts in perceptions of the white target and not the black target in study 2 (it stemmed from both shifts in perceptions of the white target and black target in study 1). Although perhaps counterintuitive, this pattern of results is consistent with research on intergroup bias demonstrating that discrimination often occurs due to ingroup favoritism rather than outgroup hostility (43). In the present case, it is possible that shifts in perceptions of the white target (and not the black target) reflect this kind of bias; it is possible that these shifts reflect positive (empathic) cognitions about white ingroup members rather than negative (callous) cognitions about black outgroup members.

Limitations of the present work offer avenues for future research. For practical reasons, we used survey methods to document medical students' and residents' beliefs and racial bias. Future work will need to test whether white and nonwhite medical personnel in more advanced stages of their career also hold beliefs about biological differences between blacks and whites, and if so, whether these beliefs have consequences for pain assessment and treatment in real medical contexts. Future work may also delve into the nature of the racial bias: whether it reflects ingroup favoritism rather than outgroup derogation. This distinction may be useful for the development of interventions. These limitations aside, studies 1 and 2 make at least three important contributions. First, they provide the first evidence that racial bias in pain assessment is associated with racial bias in the accuracy of pain treatment recommendations. Second, they reveal that a substantial number of white people—laypersons with no medical training and medical students and residents—hold beliefs about biological differences between blacks and whites, many of which are false and even fantastical in nature. To our knowledge, this is the first demonstration of medical personnel (students and residents with at least some medical training) endorsing such beliefs in modern times. Third, the current studies demonstrate that these beliefs are associated with racial bias in perceptions of others' pain. Interestingly, in study 2, that bias seemed to result from shifts in perceptions of the white target's pain more so than perceptions of the black target's pain, suggesting that perceptions of whites' frailty may shape racial bias in pain perception as much, if not more, than perceptions of blacks' strength.

Concluding Remarks

This last year marks the 30th anniversary of the landmark 1985 *Report of the Secretary's Task Force on Black and Minority Health*—more commonly known as the *Heckler Report*—the first comprehensive documentation of racial disparities in health by medical experts. This report put a national spotlight on the pervasive racial inequities in health and issued a resounding call to eliminate health disparities. Although this call was met with a surge in research efforts and substantial changes in medical programs, policy, and legislation, the ultimate goal of eliminating racial disparities remains elusive. Racial disparities in health and health care continue to be a problem in the United States, a point underscored by the US Department of Health and Human Services' "clarion call to continue to take action toward ending health disparities" (minorityhealth.hhs.gov/Blog/BlogPost.aspx?BlogID=68). The present work sheds light on a heretofore unexplored source of racial bias in pain assessment and treatment recommendations within a relevant population (i.e., medical students and residents), in a context where racial disparities are well documented (i.e., pain management). It demonstrates that beliefs about biological differences between blacks and whites—beliefs dating back to slavery—are associated with the perception that black people feel less pain than do white people and with inadequate treatment recommendations for black patients' pain.

Materials and Methods

Study 1.

Participants. We recruited a sample of 121 adults on Amazon's Mechanical Turk in exchange for a small amount of money. As in previous work (15), we excluded participants who were not born in the United States or native English speakers, as well as participants who did not complete all of the relevant measures. We also excluded all nonwhite participants, given the historical context of black–white relations, particularly in the medical context (20–25). Our final sample consisted of 92 participants (28% female; $M_{age} = 26.70$, SD = 8.76).

Procedure and materials. Participants gave informed consent in accordance with policies of the IRB of the University of Virginia. After consenting, participants were asked to provide their age and gender so the survey program could route the participant to a gender-matched target. They then rated the amount of physical pain they would feel across 18 scenarios and were randomly assigned to rate the pain of a gender-matched black or white target across the same 18 scenarios (*SI Text*). Next, participants completed a 15-item measure of beliefs about biological differences between blacks and whites that are true or untrue (see Table 1 and *SI Text* for a list of items and descriptive information). To compose our conceptual variable of interest—false beliefs about biological differences between blacks and whites—we created an average rating of 11 of the items ($\alpha = 0.92$; see bold items in Table 1 and see *SI Text* for additional information on the measure). All analyses were conducted using continuous measures of beliefs and pain ratings. After this measure, participants provided demographic information, including their race/ethnicity, nationality, and primary language. *SI Text* provides additional information on materials, methods, and results. Data and study materials are also available at https://osf.io/crxwa/.

Study 2.

Participants. We recruited cohorts of first-, second-, and third-year medical students from a large public university, who completed the study online during class sessions. We also recruited medical residents from multiple sites, who completed the study online at their convenience. The sample included 418 participants (first years, $n = 134$; second years, $n = 133$; third years, $n = 117$; residents, $n = 34$); we had no set sample size, but rather collected data from as many participants as we were able to obtain. As in previous work (15), we excluded participants who were not native English speakers and/or American because racial bias in pain perception is likely a cultural phenomenon. Including these participants in our analyses does not change the pattern of results. We again excluded nonwhite participants given the historical context of black–white relations, particularly in the medical context (20–25). The final sample consisted of 222 participants (first years, $n = 63$; second years, $n = 72$; third years, $n = 59$; residents, $n = 28$; 48% female; $M_{age} = 25.18$, SD = 2.66). Some participants did not report age, gender, and/or race/ethnicity and thus degrees of freedom vary across analyses.

Procedure and materials. Participants gave informed consent in accordance with policies of the IRB of the University of Virginia. After consenting, participants were asked to provide their age and gender so the survey program

could route the participant to gender-matched targets. Participants then read two mock medical cases about a black and a white patient. They were asked to estimate the pain of each patient and to make a recommendation to treat the patient's pain. Next, participants were asked to provide demographic information and to complete the same measure of beliefs about biological differences between blacks and whites as in study 1, averaging the 11 false items to create a measure of false beliefs ($\alpha = 0.92$). Last, participants responded to debriefing questions about the study and then were debriefed in person (medical students) or read an electronic debriefing (medical residents). *SI Text* provides additional information on materials, methods, and results. Data and study materials are also available at https://osf.io/crxwa/.

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