

Running Head = TRAINING AND BIAS AGAINST AFRICAN AMERICANS

**Informal Training Experiences and Explicit Bias Against African Americans among Medical Students**

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**Abstract**

Despite the widespread inclusion of diversity-related curricula in US medical training, racial disparities in the quality of care and physician bias in medical treatment persist. The present study examined the effects of both formal and informal experiences on non-African American medical students' ( $N=2922$ ) attitudes toward African Americans in a longitudinal study of 49 randomly selected US medical schools. We assessed the effects experiences related to medical training, accounting for prior experiences and attitudes. Contact with African Americans predicted positive attitudes toward African Americans relative to White people, even beyond the effects of prior attitudes. Furthermore, students who reported witnessing instructors making negative racial comments or jokes were significantly more willing to express racial bias themselves, even after accounting for the effects of contact. Examining the effects of informal experiences on racial attitudes may help develop a more effective medical training environment and reduce racial disparities in healthcare.

**Keywords**

contact, intergroup relations, medical school, prejudice, racial attitudes

**BACKGROUND**

Diversity, in the context of positive intergroup relations, can facilitate problem solving and lead to better outcomes than homogeneity (Apfelbaum, Phillips, and Richeson 2014; Crisp and Turner 2011; Sommers 2006). When intergroup relations are negative, however, racial and ethnic diversity can undermine cohesion and productivity (Chicchio and Essiembre 2009; Putnam 2007). Identifying factors that promote positive intergroup relations in training contexts can contribute significantly to the success of the training program by harnessing the benefits of diversity while avoiding its perceived costs. The present study examined the effects of both

formal and informal experiences in the context of medical training on medical students' attitudes toward African Americans across 49 geographically distributed US medical schools.

For over sixty years, intergroup contact theory has been the foundation of some of sociology and social psychology's most effective strategies for improving intergroup relations (Allport 1954; Pettigrew and Tropp 2011). This framework proposes that contact between members of different groups can facilitate the development of more positive attitudes toward each other, especially under certain conditions such as equal status and shared goals (Pettigrew and Tropp 2006). Sociological theory and evidence suggest that contact facilitates more harmonious forms of diversity both by signaling that mixed interactions are normal and by decreasing intergroup anxiety (Christ et al. 2014; Emerson, Kimbro, and Yancey 2002; Pettigrew and Tropp 2011). Both the amount and the favorability of informal intergroup contact are potent factors for improving intergroup attitudes (Dovidio, Eller, and Hewstone 2011; Dovidio, Gaertner, and Kawakami 2003; Niu et al. 2012).

Many White Americans have only infrequent interactions with African Americans due to persistent residential segregation coupled with majority status (Jackman 1994; Rugh and Massey 2014), and sometimes avoid contact because of anxiety or negative expectations (Mallett, Wilson, and Gilbert 2008; Shelton and Richeson 2005). Therefore, variability in individual levels of intergroup contact may be especially important in understanding attitudes toward disadvantaged minority groups such as African Americans (Tropp 2007).

Additional research on intergroup communication suggests that it does not have to be personally experienced to affect intergroup attitudes (Christ et al. 2014). Through social learning processes, witnessing how members of one's own social group, particularly those who occupy positions of high status in the group, relate to members of another group can signal norms and

affect personal attitudes toward members of the other group (Crandall and Stangor 2005). For example, learning that an ingroup member has a friend in another group improves attitudes toward that group (Gómez, Tropp, and Fernández 2011; Wright et al. 1997). Analogously, observing negative comments or actions by a member of one's group toward an outgroup can signal that bias is normative and exacerbate personal bias.

Specifically, students who heard another student express racist views (Blanchard et al. 1994) or use a derogatory racial label for African Americans (Kirkland, Greenberg, and Pyszczynski 1987) subsequently expressed more negative attitudes toward African Americans than those not exposed to such statements. Moreover, witnessing disparagement of another group, even in the form of humor, cues people that discrimination is more acceptable (Ford and Ferguson 2004). In the context of training for the medical profession, indications of bias from authority figures may represent part of an informal "hidden curriculum" that can negatively affect the intergroup attitudes of medical students of all racial/ethnic groups without being an intentional part of the training plan (van Ryn et al. 2015; Kripalani et al. 2006; Hafferty 1998; Wear 1998).

In an effort to improve intergroup relations and achieve the potential benefits of diversity, organizations in the US invest hundreds of millions of dollars per year in formal diversity training. Within the medical community, for example, the Liaison Committee on Medical Education requires training on diversity and cultural competency (AAMC 2005; AAMC and ASPH 2012), and many medical schools have developed curricula aimed at reducing the biases of physicians in training (Kripalani et al. 2006; Smedley, Stith, and Nelson 2003). The effectiveness of such interventions on enduring intergroup attitudes is rarely tested (Stephan and Stephan 2005; Moss-Racusin et al. 2014), and there is some evidence that anti-bias education has

only limited effectiveness (Homan et al. 2015). In industry, for instance, Kalev, Dobbin, and Kelly (2006) found that anti-bias education did not systematically predict subsequent increases in the representation of women and people of color in management positions. In healthcare, despite the widespread inclusion of diversity-related education in the medical curriculum, racial disparities in the quality of care and physician bias in medical treatment persist (Penner et al. 2013; Sabin et al. 2009; Shavers et al. 2012; Smedley et al. 2003; van Ryn et al. 2011).

The persistent racial disparities likely stem at least in part from biased racial attitudes among physicians, which have been shown to predict biased behavior in interactions between non-African American providers and African American patients (Bogart et al. 2001; Calabrese et al. 2014; van Ryn et al. 2006). More generally, meta-analysis suggests that explicit racial attitudes predict discrimination across a wide range of contexts (Greenwald et al. 2009; Oswald et al. 2013).

The present research examined self-reported attitudes toward African Americans longitudinally, at the start and end of medical school, in a large national sample of non-African American medical students from a random sample of US medical schools. Our longitudinal design allowed us to assess the specific effects of experiences related to medical training over and above prior experiences and attitudes. We tested the effects of three key predictors relating to (a) contact with African Americans before and during medical training, (b) observation of negative racial remarks about patients from people in positions of authority, and (c) the amount of diversity-related training students reported receiving. A previous report on the same sample identified negative contact experiences and modeling of bias from authority figures, but not number of hours of formal training, as independent predictors of *implicit* racial bias in students finishing medical school (van Ryn et al. 2015). Implicit bias is based largely on activation of

mental associations rather than propositional reasoning (involving the validation of evaluations and beliefs; Gawronski and Bodenhausen 2006) and thus may be affected more by contact experiences, and less by formal training, than explicit bias (Rydell et al. 2006; Smith and DeCoster 2000; Turner, Hewstone, and Voci 2007). Additionally, explicit attitudes, which are only weakly correlated with implicit attitudes, predict discriminatory behavior in ways over and above implicit attitudes (Derous, Ryan, and Serlie 2014; Greenwald et al. 2009; Oswald et al. 2013).

We hypothesized that each of the key predictors in our study would have independent effects on medical students' explicit attitudes toward African Americans at the end of medical school, even accounting for racial attitudes at the beginning of medical school. Our hypotheses pertained to predictors of attitudes toward African Americans accounting for attitudes toward White people (Caucasians) in order to capture *biased* attitudes rather than capturing individual response tendencies toward all people (Wilcox, Sigelman, and Cook 1989).

### *Hypotheses*

*Hypothesis 1.* Consistent with work on the long-lasting effects of intergroup contact on intergroup attitudes, we expected that experiencing more contact (Hypothesis 1a) and more favorable contact (Hypothesis 1b) with African Americans before medical school would predict more positive attitudes toward African Americans at the end of medical school.

*Hypothesis 2.* Consistent with work on the short-term effects of contact experiences, we predicted that, beyond the effects of contact prior to medical school, the amount (Hypothesis 2a) and favorability (Hypothesis 2b) of contact with African Americans during medical school would predict more positive attitudes toward African Americans at the end of medical school.

*Hypothesis 3.* Based on research showing that observing others' expressions of racial bias

can affect personal racial attitudes, we predicted that witnessing professors or other authority figures making disparaging remarks about African Americans would predict more negative attitudes toward African Americans at the end of medical school.

*Hypothesis 4.* Based on some evidence that anti-bias education can improve intergroup attitudes (Devine et al. 2012; but see Kalev et al. 2006), we predicted that more hours of training on reducing racial bias would be associated with more positive attitudes toward African Americans at the end of medical school.

## METHODS

The Medical Student Cognitive Habits and Growth Evaluation (CHANGE) Study was conducted on a stratified random sample of 49 US medical schools. Baseline data were collected during students' first year of medical school in Fall 2010, and followup data were collected in Spring 2014 at the end of medical school. Participants were assured of confidentiality at both timepoints. The survey was conducted online.

### *Participants*

In the first stage of our sampling design, we stratified medical schools by geographic region (6 regions) and public/private status. Because there were no private schools in the Northwest, there were 11 strata. Schools were sampled from each stratum in roughly the same proportion (43 percent) using a proportional to (first-year class) size method (Sarndal, Swensson, and Wretman 1992). In the second stage, we sent recruitment materials via e-mail or postal mail to the 5823 first-year students at these 49 medical schools whose e-mail address or mailing address we were able to obtain from the Association of American Medical Colleges, snowball sampling, or a list we purchased from a vendor. The baseline response rate was 81 percent ( $N=4732$ ; 55 percent of the 8594 first-year students enrolled at the 49 sampled schools). In 2014, we invited all baseline

participants to complete the followup measures, and 3959 (84 percent) responded. More details about the sampling procedure can be found in other published reports from the CHANGE sample (e.g., Burke et al. 2015; Phelan et al. 2015; van Ryn et al. 2014, van Ryn et al. 2015).

We excluded 203 participants who had left medical school or delayed their training so that they were not in their third or fourth year by the time of followup data collection. To focus on attitudes toward African Americans as an outgroup in the present report, we excluded an additional 209 participants who checked off “Black” as one of their racial identities (even if they were multiracial) and 81 participants who did not specify any race or ethnicity. We then excluded 544 participants who declined to respond to any of our measures of interest in the present report, leaving a sample size of 2922 for analysis.

Participants indicated their ethnic and racial identities in the baseline survey. Most were exclusively White (67.1 percent; 1960/2922); 21.6 percent were Asian (631/2922), 4.7 percent were Hispanic or Latino/a (138/2922), 4.7 percent were multiracial and White (138/2922), and 1.9 percent indicated another racial or ethnic identity or multiple non-White identities (55/2922). Participants also indicated their gender in the baseline survey; 49 percent were female (1431/2922) and 51 percent were male (1491/2922). In the year 4 survey, participants responded to an item asking for “the annual household income for your family during the time period you attended high school.” There were ten response options, but a plurality of participants fell in the third-highest category (“\$100,000 to \$249,999”), so we categorized participants as below \$100,000 (42.6 percent; 1246/2922), \$100,000-\$249,999 (38.0 percent; 1109/2922), and over \$250,000 (19.4 percent; 567/2922). These demographic characteristics were used as covariates in some of our analysis procedures because they are sometimes associated with racial attitudes (Sabin et al. 2009).



## *Measures*

*Racial attitudes.* Participants responded to several feeling thermometers measuring self-reported attitudes toward various groups. Feeling thermometers provide simple but reliable measures of positive or negative attitudes toward social groups (Alwin 1997; Kinder and Drake 2009). The instructions for these measures read, “We’d like to get your feelings about the groups of people listed below. Below you will see categories of people with sliders next to them. Indicate how you feel towards each group by moving the slider all the way to the left (very cold or unfavorable), all the way to the right (very warm or favorable), or somewhere in between.” The response scale ranged from 0 to 100. These measures were included in the baseline and year 4 surveys. The two target groups of interest for the present report were “African Americans,” a traditionally disadvantaged group in the US, and “Caucasians,” a relevant comparison group.

*Racial contact.* We measured the amount and favorability of interactions with African Americans that participants had experienced prior to medical school and during medical school using self-report scales. Contact prior to medical school was measured at baseline using one item for amount and one for favorability, and contact during medical school was measured at year 4 using items referring to specific subgroups such as “Black medical students” as described below. Response options for all items measuring amount of contact were “None,” “Little,” “Some,” and “Substantial.” Response options for items measuring favorability of contact were “Very unfavorable,” “Unfavorable,” “Favorable,” and “Very favorable.”

Before medical school, only 206 participants (7.0 percent of the sample) indicated “very unfavorable” or “unfavorable” interactions with “Blacks/African-Americans.” Most participants instead indicated “favorable” ( $N=1715$ ; 58.7 percent) or “very favorable” interactions ( $N=1001$ ; 34.3 percent). To reflect the dominant pattern of responses, our primary analysis treated

favorability of contact as a binary variable, with “very favorable” compared to all other responses. We also used a binary version of amount of contact (with “substantial” compared to all three lower amounts) so that the effect sizes for amount and favorability would be directly comparable. As a secondary analysis, we constructed alternative specifications of each model using the raw numeric amount and favorability measures as continuous predictors.

Contact during medical school was measured in four forms—contact with “Black medical students,” “Black faculty, attending physicians and residents,” “Black allied health staff,” and “Black clerical, administrative and secretarial staff.” We added the responses for the four groups together to create a composite measure of amount of contact ( $\alpha=.82$ ) and a composite measure of favorability of contact ( $\alpha=.88$ ) with Black people in medical school (possible scores ranged from 4 to 16). Only 73 participants (2.5 percent) indicated “very unfavorable” or “unfavorable” interactions with students, 51 (1.7 percent) with faculty/physicians, 186 (6.4 percent) with health staff, and 270 (9.2 percent) with clerical staff, so we again focused our primary analysis on comparing the two dominant patterns of responses (very favorable vs. all others). Participants with a sum of 15 or 16 (very favorable to all or all but one group) were classified as having the most favorable experiences ( $N=1211$ ; 41.4 percent), and participants with a sum of 14 or less were classified as having less favorable experiences ( $N=1711$ ; 58.6 percent). Again, for the sake of consistency, we split amount of contact into two categories as well, with all those having a sum greater than 12 ( $N=1360$ ; 46.5 percent) compared to those with 12 or lower ( $N=1562$ ; 53.5 percent). In other words, the group with a “high” amount of contact indicated “substantial” interaction with Black people in at least one of the four categories. Our secondary analysis examined the raw numeric sums as continuous predictors.

*Informal modeling of racial bias.* In the year 4 survey, participants were asked “While in

medical school, how often have you heard/witnessed professors, instructors, attendings and/or residents make negative comments, disparaging remarks, or jokes about..." followed by a list of groups, each with its own response scale. The group of interest to the present report was "Black patients." Relatively few participants indicated that witnessing disparaging remarks was a frequent occurrence, so we split the variable into two categories—those who had never encountered such comments ( $N=1443$ ; 49.4 percent) and those who had encountered such comments at least once ( $N=1479$ ; 50.6 percent). Our secondary analysis examined the raw numeric response as a continuous predictor.

*Formal training on racial bias.* In the year 4 survey, participants were asked, "In the past 4 years, about how many training hours did your medical school provide on each of the topics or skills below? Please give us your best estimate." Among the several topics or skills mentioned, the two pertinent to the present report were "Racial disparities in health care," and "The potential effect of unintended racial bias on the care you provide,"  $r(2920)=.69$ ,  $p<.001$ . We added the hours for these two topics together to form a composite measure of training on racial issues ( $M=23.17$ ,  $SD=20.37$ ). Responses were provided using a sliding scale that stopped at 50 hours for each topic, but only 41 participants (1.4 percent of the sample) reached the maximum of 100 total hours of training on racial bias, so the upper limit to the range did not alter most responses. We kept this variable in its raw numeric form for our primary analysis.

## RESULTS

Descriptive statistics for the variables of interest and demographics can be found in Table 1, and correlations among the variables can be found in Table 2. At year 4, mean feeling thermometer ratings of African Americans ( $M=80.77$ ,  $SD=20.27$ ) were significantly less positive than ratings of Caucasians ( $M=83.78$ ,  $SD=18.93$ ),  $t(2921)=13.48$ ,  $p<.001$ ,  $d=0.25$ . Feeling thermometer

ratings of African Americans did not significantly change from baseline ( $M=81.01$ ,  $SD=19.58$ ) to year 4 ( $M=80.77$ ,  $SD=20.27$ ),  $t(2921)=0.65$ ,  $p=.52$ ,  $d=0.01$ . Feeling thermometer ratings of Caucasians became more negative from baseline ( $M=85.87$ ,  $SD=17.53$ ) to year 4 ( $M=83.78$ ,  $SD=18.93$ ),  $t(2921)=5.83$ ,  $p<.001$ ,  $d=0.11$ .

[Tables 1 and 2 About Here]

Our hypotheses were not about the absolute levels of attitudes, but rather about elements of training that might predict attitudes toward African Americans at the end of medical school. We tested these hypotheses by building models using contact experiences, informal modeling of bias from authority figures, and formal training on racial bias to predict attitudes. Using IBM SPSS Statistics 21, we constructed linear mixed models predicting the year 4 feeling thermometer rating for African Americans. These models included stratum as a covariate and estimated a random intercept by school in order to account for the defining elements of the sampling strategy. There were six predictors of interest—amount of contact with African Americans before medical school, favorability of contact before medical school, amount of contact during medical school, favorability of contact during medical school, informal modeling of racial bias from authority figures, and hours of formal training on racial bias. All six predictors were dichotomous except for hours of formal training.<sup>1</sup>

Our primary statistical model predicted the year 4 feeling thermometer rating for African Americans on the basis of all six of our predictors of interest simultaneously. This model included the feeling thermometer rating of Caucasians as a covariate to capture biased attitudes toward African Americans relative to a comparison group (see Wilcox et al. 1989). We also included the baseline (Year 1) feeling thermometer ratings for both African Americans and Caucasians to account for attitudinal differences that existed before medical school, and we

included race, gender, and family income categories as demographic covariates. The details of this model can be found in Table 3.

[Table 3 About Here]

Supporting Hypothesis 1a, Table 3 illustrates that having more contact with African Americans before medical school predicted more positive attitudes toward African Americans at the end of medical school, over and above the effects of the covariates and other predictors of interest. Similarly, supporting Hypothesis 1b, more favorable contact with African Americans before medical school predicted more positive attitudes.

The results in Table 3 did not fully support Hypothesis 2a: the amount of contact with African Americans during medical school did not significantly predict attitudes accounting for the other variables of interest. It is worth noting that amount of contact during medical school was correlated with positive attitudes toward African Americans (Table 2), and remained a significant predictor of attitudes accounting for all of the covariates,  $b=1.25$ ,  $SE=0.40$ ,  $p=.002$ ,  $\beta=0.03$  (see Appendix 1 in the Supplemental Online Materials for details), but was not statistically distinguishable from the other predictors of interest included in Table 3.

Supporting Hypothesis 2b, Table 3 illustrates that more favorable contact with African Americans during medical school significantly predicted positive attitudes accounting for the other variables of interest. Supporting Hypothesis 3, witnessing informal racial bias from authority figures was associated with more negative attitudes toward African Americans accounting for the other variables. Contrary to Hypothesis 4, however, the number of hours of formal training on racial bias students received was not significantly associated with their attitudes toward African Americans at the end of medical school in our full model (Table 3).

We examined a number of supplementary models testing the hypothesized linear

relationships in the absence of various covariates to establish the robustness of the effects of interest. None of the effects reported above depended on the presence of covariates, and formal training was not a significant predictor of bias even in the absence of other covariates.<sup>2</sup> We also examined variants of the modeling strategy that included different subsets of participants, tested the effect of missing data, and addressed distributional concerns about the predictor variables. The tests of our core hypotheses were consistent across these variants.<sup>3</sup>

## DISCUSSION

Medical schools, like numerous other types of organizations, currently devote significant resources to promoting positive intergroup relations, in part because diversity can enhance the quality of training and contribute to achieving organizational goals (e.g., Crisp and Turner 2011). The present national longitudinal study examined bias against African Americans among medical students. Evaluations of African Americans were generally closer to the favorable end of the feeling thermometer scale than to the unfavorable end, but they were nonetheless less favorable than evaluations of Caucasians. Even for positive attitudes, favoring one group can be harmful, because it may lead to preferential provision of positive treatment (Greenwald and Pettigrew 2014) and undermine trust in medical care (Lillie-Blanton, Brodie, Rowland, Altman, and McIntosh 2000; Sewell and Ray 2015; Smedley et al. 2003). Several components of the medical school experience represent promising avenues for mitigating this bias. In particular, our findings underscored the importance of informal, experiential elements of medical training in shaping racial bias among future medical providers.

Consistent with a large body of literature on intergroup contact (Pettigrew and Tropp 2011), interracial contact was an important predictor of positive attitudes toward African Americans, even accounting for attitudes toward Caucasians. Specifically, amount and

favorability of contact prior to medical school, reported at the beginning of medical school, continued to influence attitudes three years later, even accounting for the effects of baseline attitudes and contact during medical school. Positive contact experiences can have sustained, long-term effects on intergroup attitudes, beyond the effects of the current social context. This result coheres with theoretical explanations for contact effects that focus on increasing personal comfort or similarity rather than changing social norms (e.g., Emerson et al. 2002; Tropp 2007).

In addition to the long-term effects of earlier contact experiences, the favorability of new contact experiences during medical school predicted more positive racial attitudes, even accounting for the effects of earlier contact experiences. This result evokes explanations for contact effects that focus on the local environment, such as the idea that contact provides information about norms regarding expression of racial attitudes (see Christ et al. 2014). The fact that features of contact both before and during medical school explained unique variance reinforces the idea that individual and contextual explanations for attitude change are compatible and underscores the complexity of contact's role in intergroup relations. Indeed, in research on the general population, interracial affiliation was facilitated by the combination of a current social context permitting positive contact experiences *and* a history of such experiences prior to the current social context (Jackman 1994; Jackman and Crane 1986).

Consistent with previous research (see Dovidio et al. 2003; Pettigrew and Tropp 2011), favorability, rather than amount, of contact during medical school was associated with positive attitudes accounting for the other predictors of interest, suggesting that medical training might focus on ensuring that non-African American students have at least a small number of highly positive interactions with African American faculty, students, and staff. Rather than attempting to place an additional burden on African Americans in the medical education system, schools

might consider the possibility that admitting and hiring more African Americans could increase the likelihood of positive contact experiences organically. Indeed, sociological evidence suggests that more diversity in a given setting can provide more opportunities for contact and thereby increase positive attitudes (Schlueter and Scheepers 2010; Wagner et al. 2006), even among people who merely perceive an increasing norm toward intergroup contact without experiencing it directly themselves (Christ et al. 2014).

These processes of direct and indirect contact may be especially effective in an organizational career-related setting such as medical school in light of research demonstrating that incidental work-related contact is more likely to lead to informal affiliative behavior than mere neighborhood proximity (Jackman 1994). It is also important to work toward a more diverse medical training climate rather than promoting interactions with a small number of token African American students, because positive racial attitudes are associated with having interracial interactions varying in levels of intimacy bolstered by everyday instances of proximity and familiarity (Dixon 2006; Jackman and Crane 1986).

We also found that students who reported witnessing professors, instructors, attending physicians, or residents making negative comments, disparaging remarks, or jokes about Black patients were significantly more willing to express racial bias themselves, even after accounting for the effects of contact. This result highlights the powerful influence of normative context on racial attitudes. Disparaging remarks against a group, even in the form of humor, tacitly suggest that bias against that group is acceptable (Ford and Ferguson 2004). Interventions to create a more positive racial environment could include sanctions for such remarks, although it might be difficult for administrators to reliably detect when they occur, and students may be reluctant to report them.



Additionally, because a large portion of Americans profess egalitarian values, making authority figures aware of the cascading negative impact of racially biased remarks might make them more aware that their behavior does not align with their principles and intentions, initiating more effective personal efforts to regulate their behavior (Monteith et al. 2002; Perry, Murphy, and Dovidio 2015). This latter possibility further suggests that targeted diversity training that regularly includes physicians and professors, emphasizing their status as role models, might have indirect benefits for improving students' racial attitudes. Developing such a training program, however, would require overcoming possible backlash and carefully testing training strategies for long-term effectiveness (see Devine et al. 2012; Homan et al. 2015). Medical schools should aim to make combating racism at the individual and institutional level part of their core organizational values and not merely part of their curriculum. Representation without inclusive policies is not likely sufficient for lasting attitude change.

Formal training on issues related to racial bias was not significantly associated with attitudes toward African Americans relative to Caucasians. This null result might be seen as reflecting a failure of anti-bias education to have an enduring influence on racial bias (see also Homan et al. 2015; Kalev et al. 2006), fitting in with the more general argument that formal education alone does not contribute much to the reduction of racial bias (Jackman and Muha 1984). Such an interpretation would be premature, however, because there are several features of the present study that might have prevented it from identifying strong evidence for the effectiveness of formal training. For example, we measured the relationship between number of hours of diversity training and expressed attitudes, and it is possible that this operationalization of training was not sufficiently sensitive to detect changes in those attitudes. In compliance with the Liaison Committee on Medical Education's guidelines, almost all of the participants

experienced some diversity training. Less than 2 percent of students indicated no training at all, while 75 percent indicated more than eight hours. It is possible that the typical amount of diversity training offered at US medical schools during the study period was sufficient to achieve benefits for reducing racial bias, although we did not observe an overall increase in positive attitudes toward African Americans from year 1 to year 4.

Our study may also have failed to capture the effects of formal training due to the heterogeneity in types of training available—some types of training work better than others (Devine et al. 2012), and recording only the total hours of training could not identify these differences. Still, given the current investment of extensive resources in formal diversity training, there is a clear need for more systematic evaluation of the overall impact of such interventions and the effectiveness of various types of anti-bias education programs (Kalev et al. 2006; Moss-Racusin et al. 2014; Yeager and Walton 2011).

A further limitation of the present work is that it does not directly measure discriminatory behavior. Our results may nonetheless inform future efforts to study and mitigate discriminatory behavior, as past work provides evidence that biased racial attitudes predict biased behavior in interactions between non-African American providers and African American patients (Bogart et al. 2001; Calabrese et al. 2014; van Ryn et al. 2006).

Interactions with patients may be a particularly important opportunity for intergroup contact for medical students, especially because patient interactions are a key context for provider bias expression. Unfortunately, we did not measure amount or favorability of contact with Black patients, resulting in a disconnect between the item about informal negative remarks directed at Black patients and the items about contact, which asked about Black medical students, faculty, and staff.

As with much of the contact literature (Pettigrew and Tropp 2011), our study relied on self-report measures of all variables of interest. As a result, we cannot rule out the possibility that participants misremembered or misreported their experiences in medical school (e.g., amount of interracial contact). It is possible that people who report positive attitudes toward African Americans may also be prone to recall and report positive experiences. Under this interpretation, the baseline measures would be susceptible to the same reporting bias, but we identified significant effects of informal experiences in models accounting for baseline attitudes.

Due to participant time constraints, our constructs of interest were measured with few items (in some cases one item), potentially exacerbating measurement error.

Finally, we acknowledge that our measures of contact and informal modeling of bias referred to “Black people,” while our measure of racial attitudes referred to “African Americans.” We initially selected these items featuring different labels by drawing on different scales used in previous research. The terms “Black people” and “African Americans” historically refer to the same social category in the US, and are sometimes used interchangeably in research on intergroup relations (Greenwald, McGhee, and Schwartz 1998). Nevertheless, it is possible that participants view “Black” as a more inclusive term (e.g., referring to people with African Caribbean heritage) or have different affective associations with the two labels. We note, though, that referring to “Black people” for some predictors and “African Americans” for the feeling thermometer would likely *underestimate* of the magnitude of bias and of the predictors’ relationships with bias (Hall, Phillips, and Townsend 2015).

In the US, medical schools constitute a significant organizational training environment, because the bulk of healthcare services are performed by people who have undergone this form of training. Examining the details of training experiences as they relate to racial bias is essential

to building an understanding of how to improve the interracial attitudes of medical providers and thereby reduce racial disparities in healthcare outcomes (Hoberman 2012). Our results point to informal training experiences—contact with African Americans as coworkers within the healthcare system and the examples set by authority figures with regard to treatment of African American patients—as vital elements of the organizational experience contributing to changes in racial bias.

Efforts to enact long-term change in racial biases among providers will not be simple—they will depend on changes to the demographic composition and core organizational values of medical schools (see Hoberman 2012; Jackman 1994). Such efforts are vital in light of the documented widespread harm of medical racism (Hoberman 2012). For example, there is evidence that (some subgroups of) Black Americans trust medical providers less than White Americans do because of firsthand and secondhand experiences of bias (Lillie-Blanton et al. 2000; Sewell and Ray 2015; Smedley et al. 2003). One recent study documented an alarmingly pervasive view among medical students that Black people have higher pain tolerance than White people, resulting in inadequate pain management recommendations for hypothetical Black patients (Hoffman, Trawalter, Axt, and Oliver 2016). Such findings reiterate that explicit anti-Black attitudes remain an active and pressing concern in medical training, and demonstrate the urgency of addressing racial bias in the informal culture of medicine.

## SUPPLEMENTAL MATERIAL

Additional supporting information may be found at [insert link].

## FUNDING

Support for the research was provided by the National Heart, Lung, and Blood Institute of the National Institutes of Health under award number R01 HL085631.

## ENDNOTES

1. In order to include a dimensionless measure of effect size, we use the letter  $\beta$  to denote standardized slopes, computed by standardizing both the predictor of interest (even for dichotomous predictors) and the response variable.

2. Details about this procedure can be found in Appendix A in the Supplemental Online Materials.

3. The details of these alternative analysis strategies can be found in Appendix B in the Supplemental Online Materials.

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## AUTHOR BIOS

Placeholder text.

Table 1  
*Description of Major Variables and Covariates*

Variable	Mean (SD)	Count (%)	Response scale
Year 4 evaluation of African Americans	80.77 (20.27)	-	0 to 100
Year 4 evaluation of Caucasians	83.78 (18.93)	-	0 to 100
Baseline evaluation of African Americans	81.01 (19.58)	-	0 to 100
Baseline evaluation of Caucasians	85.87 (17.53)	-	0 to 100
Amount of contact during medical school	12.34 (2.57)	High: 1360 (46.5%) Low: 1562 (53.5%)	1 to 4
Favorability of contact during medical school	13.67 (2.09)	High: 1211 (41.4%) Low: 1711 (58.6%)	1 to 4
Amount of contact prior to medical school	3.04 (0.78)	High: 912 (31.2%) Low: 2010 (68.8%)	4 to 16 (sum of four 1 to 4 items)
Favorability of contact prior to medical school	3.26 (0.61)	High: 1001 (34.3%) Low: 1921 (65.7%)	4 to 16 (sum of four 1 to 4 items)
Informal racial bias from authority figures	1.75 (0.90)	Any: 1479 (50.6%) None: 1443 (49.4%)	1 to 5
Hours of formal training on racial bias	23.17 (20.37)	-	0 to 100 (sum of two 0 to 50 items)
Race/ethnicity: Hispanic or Latino/a	-	138 (4.7%)	
Race/ethnicity: Asian	-	631 (21.6%)	
Race/ethnicity: Other or multiracial, non-White	-	55 (1.9%)	
Race/ethnicity: Multiracial and White	-	138 (4.7%)	
Race/ethnicity: Exclusively White	-	1960 (67.1%)	
Gender: Male	-	1491 (51.0%)	
Gender: Female	-	1431 (49.0%)	
Family income: Below \$100,000	-	1246 (42.6%)	
Family income: \$100,000 to \$249,999	-	1109 (38.0%)	
Family income: Above \$250,000	-	567 (19.4%)	

Table 2  
*Correlations Among All Variables in Model*

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Year 4 eval African Americans																
2. Year 4 eval Caucasians	.81**															
3. Baseline eval African Americans	.49**	.37**														
4. Baseline eval Caucasians	.37**	.44**	.77**													
5. Amount of prior contact	.13**	.04*	.18**	.07**												
6. Favorability of prior contact	.28**	.14**	.43**	.21**	.28**											
7. Amount of med school contact	.10**	.05**	.05**	.01	.23**	.07**										
8. Favorability of med sch contact	.34**	.24**	.24**	.17**	.13**	.26**	.21**									
9. Informal bias— authority figures	-.10**	-.03	-.05**	.00	.01	-.08**	.04*	-.15**								
10. Hours formal training on bias	.05*	.04	.01	.00	.03	-.01	.15**	.07**	.01							
11. Male	-.09**	-.07**	-.11**	-.09**	-.05**	-.04*	.05**	-.01	-.05**	.04*						
12. Family income below \$100,000	-.02	-.02	-.04*	-.06**	.02	-.03	-.07**	-.02	.04*	-.05**	.03					
13. Family income above \$250,000	-.01	-.01	.03	.04	-.02	.01	.03	.02	-.02	.02	-.04*	-.42**				
14. Hispanic or Latino/a	.03	.03	.04*	.02	.02	.07**	-.04*	.02	.01	.00	.01	.07**	-.03			
15. Asian	-.14**	-.17**	-.15**	-.17**	-.18**	-.09**	-.05**	-.08**	.10**	.06**	-.02	.05**	-.05**	-.12**		
16. Other/multiple (non-White)	-.01	-.03	-.01	-.03	-.03	-.02	.00	.02	.01	.03	.01	.02	-.02	-.03	-.07**	
17. Multiracial White	.01	.00	.00	-.01	.04*	.02	.03	.01	-.02	-.02	.01	.00	-.03	-.05**	-.12**	-.03

\*\*  $p < .01$ ; \*  $p < .05$ ; two-tailed

Table 3  
*Contact, Informal Bias, and Formal Training as Predictors of Racial Bias at the Conclusion of Medical School*

Term	Slope	SE	Standardized Slope <sup>a</sup>
Intercept	6.31**	1.52	-0.03
Sampling stratum A	0.07	1.35	0.00
Sampling stratum B	-0.39	1.20	-0.00
Sampling stratum C	0.16	1.05	0.00
Sampling stratum D	-0.48	1.19	-0.01
Sampling stratum E	-0.87	1.72	-0.01
Sampling stratum F	-0.28	1.10	-0.00
Sampling stratum G	-0.31	1.02	-0.01
Sampling stratum H	-0.55	1.15	0.01
Sampling stratum I	1.34	1.38	0.01
Sampling stratum J	-1.02	1.08	-0.02
Baseline evaluation of African Americans	0.41**	0.02	0.39
Baseline evaluation of Caucasians	-0.34**	0.02	-0.29
Year 4 evaluation of African Americans	0.83**	0.01	0.79
Male	-0.83*	0.38	-0.02
Family income below \$100,000	-0.27	0.43	-0.01
Family income above \$250,000	-0.47	0.53	-0.01
Hispanic or Latino/a	0.18	0.91	0.00
Asian	0.67	0.49	0.01
Other/multiple race/ethnicity (non-White)	0.96	1.40	0.01
Multiracial White	0.13	0.90	0.00
Amount of contact prior to medical school	1.09*	0.44	0.03
Favorability of contact prior to medical school	1.40**	0.45	0.03
Amount of contact during medical school	0.47	0.41	0.01
Favorability of contact during medical school	3.16**	0.41	0.08
Informal racial bias from authority figures	-1.21**	0.39	-0.03
Hours of formal training on racial bias	0.00	0.01	0.00

\*\*  $p < .01$ ; \*  $p < .05$ ; two-tailed

*Note.* This table summarizes the results of a linear mixed model including all six predictors of interest together (shown below the dotted line) in addition to the effects of gender, race, household income, the baseline feeling thermometers, the year 4 Caucasian feeling thermometer, stratum, and a random intercept by school. The comparison group for race/ethnicity was participants who indicated that they were White and not multiracial, and the comparison group for family income during high school was between \$100,000 and \$250,000.

<sup>a</sup> Standardized slopes were computed using centered and standardized versions of all predictors and the response variable; the overall intercept is not exactly zero because of the additional random effect in the model.