Implicit and explicit racial prejudice among medical professionals: updated estimates from a population-based study

Tiffany L. Green,[a,*] Hoa Vu,[a] Laura E. T. Swan,[a] Dian Luo,[a] Ellen Hickman,[a] Marie Plaisime,[b] and Nao Hagiwara[c]

[a]Department of Population Health Sciences, University of Wisconsin–Madison, Madison, WI, USA
[b]FXB Center for Health & Human Rights, Harvard H.T. Chan School of Public Health, Boston, MA, USA
[c]Department of Psychology, Virginia Commonwealth University, Richmond, VA, USA

The Lancet Regional Health - Americas 2023;21: 100489

Published Online xxx
https://doi.org/10.1016/j.lana.2023.100489

Summary

Background Prior research provides evidence of implicit and explicit anti-Black prejudice among US physicians. However, we know little about whether racialized prejudice varies among physicians and non-physician healthcare workers relative to the general population.

Methods Using ordinary least squares models and data from Harvard's Project Implicit (2007–2019), we assessed the associations between self-reported occupational status (physician, non-physician healthcare worker) and implicit (N = 1,500,268) and explicit prejudice (N = 1,429,677) toward Black, Arab-Muslim, Asian, and Native American populations, net of demographic characteristics. We used STATA 17 for all statistical analyses.

Findings Physicians and non-physician healthcare workers exhibited more implicit and explicit anti-Black and anti-Arab-Muslim prejudice than the general population. After controlling for demographics, these differences became non-significant for physicians but remained for non-physician healthcare workers (β = 0.027 and 0.030, $p < 0.01$). Demographic controls largely explained anti-Asian prejudice among both groups, and physicians and non-physician healthcare workers exhibited comparatively lower (β = –0.124, $p < 0.01$) and similar levels of anti-Native implicit prejudice, respectively. Finally, white non-physician healthcare workers exhibited the highest levels of anti-Black prejudice.

Interpretation Demographic characteristics explained racialized prejudice among physicians, but not fully among non-physician healthcare workers. More research is needed to understand the causes and consequences of elevated levels of prejudice among non-physician healthcare workers. By acknowledging implicit and explicit prejudice as important reflections of systemic racism, this study highlights the need to understand the role of healthcare providers and systems in generating health disparities.

Funding UW-Madison Centennial Scholars Program, Society of Family Planning Research Fund, UW Center for Demography and Ecology, the County Health Rankings and Roadmaps Program and the National Institutes of Health (NIH).

Keywords: Structural racism; Implicit prejudice; Explicit prejudice; Discrimination; Healthcare; Health disparities

Introduction

Eliminating racial/ethnic disparities in healthcare access and outcomes has been an important focus of US policy efforts for the past several decades. Even after accounting for socioeconomic factors, non-Hispanic (NH) Blacks and Native Americans experience poorer access to health care, higher rates of chronic health conditions such as hypertension and diabetes, and lower life expectancies compared to their NH White counterparts.[1,2] While Asian Americans are often thought to exhibit uniformly better than average health outcomes, these trends mask significant within-group disparities in access to care, morbidity, and mortality.[3]

Although the causes of racial/ethnic disparities are multifaceted, two major potential sources of disparities in healthcare access and outcomes are implicit and

*Corresponding author. Department of Population Health Sciences, University of Wisconsin–Madison, 610 Walnut Street, Madison, WI, 53717, USA.
E-mail address: tlgreen2@wisc.edu (T.L. Green).

Research in context

Evidence before this study

We searched PubMed and Google Scholar for articles using the key terms: "implicit racial bias," "explicit racial bias," "physician bias," and "prejudice in healthcare." We screened paper titles and abstracts to identify research relevant to prejudice in healthcare settings. The literature provides critical historical evidence of anti-Black attitudes among physicians, but there have been no updated national estimates of this phenomenon for more than a decade. Given recent racial upheavals and demographic changes in the physician population (and the United States overall), it is critical to update existing evidence. Additionally, little research has focused on physician attitudes toward non-Black communities of color or otherwise racialized populations (e.g., Asian and Arab-Muslim Americans). Lastly, little is known about racialized prejudice among non-physician healthcare workers, some of whom spend far more time with patients compared to their physician colleagues.

Added value of this study

This study provides updated estimates of anti-Black prejudice among physicians using national data. For the first time, to our knowledge, we also explore physician attitudes toward other racialized populations (i.e., Asian, Native American, and Arab-Muslim) and compare such attitudes to their non-physician healthcare worker colleagues. Furthermore, by acknowledging implicit and explicit prejudice as important reflections of systemic racism, this study underscores the need to understand the role of healthcare providers and systems in generating health disparities.

Implications of all the available evidence

The findings from this study demonstrate that both physicians and non-physician healthcare workers in the study sample generally exhibited more implicit and explicit anti-Black and anti-Arab-Muslim prejudice than the general population. These differences decline and become non-significant for physicians when controlling for demographics (i.e., age, race, gender, and geography); significant and positive differences remain for non-physician healthcare workers even when controlling for these demographic factors. Demographic factors largely explained anti-Asian prejudice among physicians and non-physician healthcare workers. Compared to the general population, physicians exhibited lower levels of anti-Native implicit prejudice whereas implicit anti-Native prejudice was similar among the general population and non-physician healthcare workers. Finally, White and Asian male non-physician healthcare workers exhibited the highest levels of anti-Black prejudice, and Black women (especially physicians) displayed the lowest levels. More research is needed to better understand the causes and consequences of prejudice among non-physician healthcare workers.

explicit prejudice. Implicit prejudice refers to spontaneous negative feelings or attitudes, typically nonconscious, toward individuals of another racial group. Explicit prejudices, however, are deliberate negative attitudes that can be expressed verbally.[4] Studies of the general US population demonstrate that anti-Black/pro-White prejudice is pervasive but has decreased over time, with explicit prejudice decreasing faster than implicit prejudice.[5–9] Using the Implicit Association Test (IAT) —the most widely-used measure designed to assess implicit prejudice—researchers have estimated that average evaluative Black-White IAT scores have ranged from 0.30 to 0.37 over the past 20 years, indicating a strong preference for White people.[6–9] These prejudices are strongest among Whites and weaker among Black, Asian, and Hispanic individuals. While fewer studies have investigated anti-Asian prejudice, recent findings indicate that pro-White/anti-Asian implicit prejudice decreased over time prior to the COVID-19 pandemic (from 0.44 to 0.28 between January 2007 and February 2020) but increased thereafter at a rate that offset years of prior declines (increasing at a rate of 0.041 points per day in March 2020).[10]

Physicians are not immune to racial prejudice. A seminal 2009 study found that, on average, physicians exhibit levels of anti-Black/pro-White implicit and explicit prejudice that are at least as high as those measured among the general population.[6] Other researchers have broadly replicated this result among the general physician population and various subspecialities. For example, one study found that family and internal medicine physicians displayed a strong implicit preference for Whites over Blacks and perceived Whites as more medically cooperative.[11] While studies of physician prejudice directed toward other non-Black racial/ethnic groups are less common, a recent systematic review found evidence of pro-White/anti-Black, -Hispanic, -American Indian, and -dark skin prejudice among healthcare providers.[12] These patterns align with analyses of patient surveys demonstrating that NH Black and Hispanic patients are more likely to report experiencing racial bias in healthcare compared to NH White patients.[13]

These biases have important implications for patient care: implicit prejudice is linked to subpar patient-provider communication, an important predictor of subsequent patient outcomes such as medical adherence and utilization. Explicit prejudice may also moderate the associations between implicit prejudice and patient-provider communication.[14,15] Greater average implicit and explicit prejudice levels—arguably important reflections of systemic racism[16] —are associated

with larger Black-White disparities in county-level morbidity and mortality.[17] Intriguingly, one study found stronger associations between preterm birth and anti-Black prejudice in counties where Black birthing people deliver compared to counties where they reside,[18] highlighting the need to better understand how healthcare providers and systems contribute to health disparities.

While prior research provides critical historical evidence about anti-Black attitudes among physicians, we lack contemporary evidence about this phenomenon and the role of demographic characteristics in explaining average prejudice levels. Further, physician attitudes towards non-Black communities of color or otherwise racialized populations (e.g., Asian and Arab-Muslim Americans) have received far less attention. This is a crucial omission, given recent efforts to promote diversity, equity, and inclusion (DEI) training in medical settings and evidence that group-specific prejudice influences health in unique ways.[19] We also know little about how physicians' prejudice levels compare to those of non-physician healthcare workers even though the latter group (e.g., nurses, home health care aides) arguably spends far more time with patients.[20,21]

We address these knowledge gaps by leveraging a large sample of individuals who took the Race IAT through Harvard's Project Implicit public website between 2007 and 2019. We compare average levels of physician anti-Black implicit and explicit racial prejudice to those among non-physician healthcare workers and the general population. We then investigate whether average prejudice levels vary by physician race/ethnicity and sex. Finally, building on prior studies, we produce some of the first national estimates of physician implicit/explicit prejudice directed toward Asians, Arab-Muslims, and Native Americans.

Methods

Data

The present study uses data from Harvard's Project Implicit collected between 2007 and 2019.[22] Project Implicit is a publicly accessible website that has continuously collected data on implicit and explicit prejudice toward a variety of social groups, including racial/ethnic groups, since 1998. We update and expand upon previous estimates of physician prejudice using the same data source from 2004 to 2006.[6] Participants included in the current analysis voluntarily chose to access the website and take the Race IAT, the Asian IAT, the Native American IAT, or the Arab-Muslim IAT. While Project Implicit is a convenience sample due to voluntary participation, at present, it is the largest and most comprehensive source of implicit and explicit prejudice data for both the general US population and subpopulations of physicians and non-physician healthcare workers.

Sample derivation

Among the millions of test-takers who took either the Race, Native American, Asian American and/or Arab-Muslim IATs between 2007 and 2019, we excluded test-takers without an implicit or explicit score for the IAT of interest (n = 3,383,364). We also excluded test-takers with any missing information on important covariates, such as occupation, age, race/ethnicity, and sex (n = 4,786,988), and/or geographic location (n = 608,756). Finally, following previous literature, we excluded counties with less than 20 test-takers to prevent estimation problems associated with thinness in the data (n = 5993).[18] The final dataset contained 1,973,583 test-takers of which 16,336 are physicians and 53,441 are non-physician healthcare workers. The final sample size(s) vary by the specific IAT; details are contained within each table.

Ideally, we would have compared our findings from multiple imputation analyses with those from our complete case analyses. However, we chose not to pursue this approach given the large amounts of missing data and the fact that we had concerns about the validity of our proposed multiple imputation models. That is, the imputation models could be driving the findings rather than the observed data. When comparing test-taker characteristics across samples (to the extent possible given missing data), we found that the original sample had higher proportions of female, Black and White test takers and a small proportion of non-physician healthcare workers. We also observed that mean prejudice levels —especially explicit prejudice levels were higher in the complete case sample (see Tables A1 and A2). We acknowledge the potential drawbacks of our analytic choices and discuss their implications in the limitations section.

Measures

The primary outcomes of interest are participants' implicit and explicit prejudice, as measured by four separate IATs and self-reported measures, respectively.

Implicit prejudice

During the Race (i.e., Black American), Asian American, and Native American evaluative IATs, respondents are shown pictures of White and non-White (i.e., Black, Asian, and Native American) faces paired with either positive (e.g., joy or love) or negative (e.g., evil or horrible) words. In the case of the Arab-Muslim IAT, respondents are instead shown *names* of both Arab-Muslim and non-Arab-Muslim people paired with either positive or negative words. The IAT score is based on differences in response times when asked to associate "good" or "bad" words with pictures or names of a racial/ethnic group. Scores range between −2 (an implicit preference for non-Whites or Arab-Muslim) and +2 (an implicit preference for Whites or

non-Arab-Muslim), with a zero indicating no implicit preferences for either group.[23]

Explicit prejudice

Participants rated their feelings about White and non-White, as well as non-Arab-Muslim and Arab-Muslim groups, on a 7-point scale ranging from −3 (explicit preference for non-Whites or Arab-Muslim) to +3 (explicit preference for Whites or non-Arab-Muslim), with zero indicating no explicit preferences for either group.

Occupational and other control variables

Occupation. Using self-reported occupational data, we classified respondents as physicians, non-physician healthcare professionals (e.g., nurses and home healthcare aides), or general population members (i.e., those not working in healthcare). Specifically, if participants reported their highest education level was "MD," we classified them as physicians. General population respondents were used as the reference group throughout this analysis.

Other controls. All covariates in our analysis are self-reported. This includes age (in years), sex, race/ethnicity, and geographic location, which have previously shown to be associated with implicit and explicit prejudice.[12,13,24] Participants provided their own information via self-report. Before 3/2/2015, participants were only provided with the option to choose sex (i.e., male and female). After 3/2/2015, participants were able to choose the following sex and gender options: male, female, trans male/trans man, trans female/trans woman, genderqueer/gender nonconforming, and a different identity. In the present analysis, we retain only self-identified male and female participants due to our weighting strategy that relies on census data reported by sex (see Statistical Approach). Race/ethnicity options were North American Indian or First Nation, Asian or Pacific Islander, Black-Not of Hispanic Origin, Hispanic, White-Not of Hispanic Origin, Other or Unknown, Multi-racial (Black and White), Multi-racial (other). We use the following racial/ethnic groups in this analysis: NH (non-Hispanic) White, NH Black, Hispanic, NH Asian, NH North American Indian or First Nation, NH Other (which contains Other or Unknown or Multiracial groups). Geographic location was determined based on participants' self-reported state of residence.

Statistical approach

To document differences in implicit and explicit prejudice across various groups, and to examine the source(s) of these differences, we estimated ordinary least squares linear regression models comparing means for the implicit and explicit scores for physicians, non-physician healthcare workers, and the general population adjusting for age, race/ethnicity, sex, and geography. The dependent variables of our models were implicit prejudice and explicit prejudice scores. We estimate separate regression models for each IAT dataset (i.e., Race, Arab-Muslim, Asian, and Native American) (See Supplementary Material for more details.)

Importantly, because Project Implicit is a voluntary sample, test-takers are likely not fully representative of the populations in their respective areas. To address this, we followed prior research and assigned respondent weights using American Community Survey (ACS) data to more accurately reflect the characteristics of county populations.[18,25] In particular, as the sample skews younger and more female, we grouped respondents into four subgroups by their age and sex (15–35 and over 35; female and male). We combined these counts with annual estimates of the resident population from the 2019 five-year sample of the ACS to assign each respondent a weight based on their representativeness of the county population and used these weights in our regressions.

The University of Wisconsin–Madison Institutional Research Board declared this study exempt from review.

Role of the funding source

The study funders did not contribute to the design, interpretation, analysis, or writing of this manuscript.

Results

Weighted summary statistics for the general population, physicians, and non-physician healthcare workers is shown in Table 1. The mean age for the general population was 27.7 years (SD = 11.8), and 59.8 percent were female, compared to the US population average of 38.4 years of age and 50.8 percent female.[26] Among the general population, 12 percent were Black, 74.6 percent were White, 5.8 percent were Hispanic, and 5.6 percent were Asian. In comparison, mean ages for the subsample of physicians and non-physician healthcare workers were approximately 36.9 years (SD = 12.8) and 35.1 years (SD = 11.6), respectively. Among physicians, 8 percent were Black, 71.5 percent were White, 2.2 percent were Hispanic, and 17 percent were Asian. Among non-physician healthcare workers, 13.9 percent were Black, 75.7 percent were White, 3.6 percent were Hispanic, and 4.6 percent were Asian.

Figs. 1 and 2 summarize average levels of implicit and explicit prejudice, respectively, among the general population, physicians, and non-physician healthcare workers. In Fig. 1, the data show that both physicians and non-physician healthcare workers exhibited higher levels of implicit prejudice towards Black Americans and Arab-Muslim Americans compared to the general population. In contrast, physicians exhibit lower levels of implicit prejudice directed toward Asian Americans and Native Americans than the general population;

	Mean or Percentage (*SD*)		
	General population	Physicians	Non-physician healthcare workers
Age	27.7 (11.8)	36.9*(12.8)	35.1*(11.6)
Female	59.8% (49.0)	45.0%*(50.0)	80.4%*(39.7)
Race/ethnicity			
Black	12.0% (32.5)	8.0%*(27.0)	13.9%*(34.6)
White	74.6% (43.5)	71.5%*(45.1)	75.7%* (42.8)
Hispanic	5.8% (23.5)	2.2%*(14.8)	3.6%*(18.6)
Asian	5.6% (23.0)	17.0%*(37.5)	4.6%*(21.1)

Notes: Data are in means or percentages (standard deviations); t-tests compare physicians and non-physician healthcare workers to the general population (reference group). *$p < 0.01$.

Table 1: **Summary statistics for IAT test-takers from 2007 to 2019.**

other healthcare workers exhibited stronger implicit prejudice toward Asian Americans and Native Americans than the general population.

Fig. 2 shows that explicit prejudice toward Black Americans among physicians is higher than among the general population and explicit anti-Arab-Muslim prejudice was especially high among non-physician healthcare workers. Finally, explicit prejudice scores indicate that the general population and physicians in our sample have a slight preference for Asian Americans, but that physicians exhibit a slight bias against Native Americans.

Tables 2–5 display the results of regression analyses quantifying the relationships between self-reported profession (i.e., physician and non-physician healthcare workers) and the implicit and explicit prejudice scores from IAT measures. As noted above, each regression model controls for participants' age, sex, race/ethnicity, and geographic location (i.e., state of residence).

Race IAT/explicit Anti-Black prejudice

On average, both physicians and non-physician healthcare workers in the sample initially exhibit significantly more anti-Black implicit prejudice compared to the general population (Table 2, Column 1). However, IAT score differences between physicians and the general population narrow and eventually disappear after controlling for demographic characteristics. Non-physician healthcare workers still are significantly more likely to have higher average levels of implicit prejudice (0.027 percentage points, $p < 0.01$, Column 5). We observe similar patterns for explicit prejudice, where the full model (Column 10) shows that the explicit anti-Black prejudice gap between physicians and general population becomes statistically non-significant, while

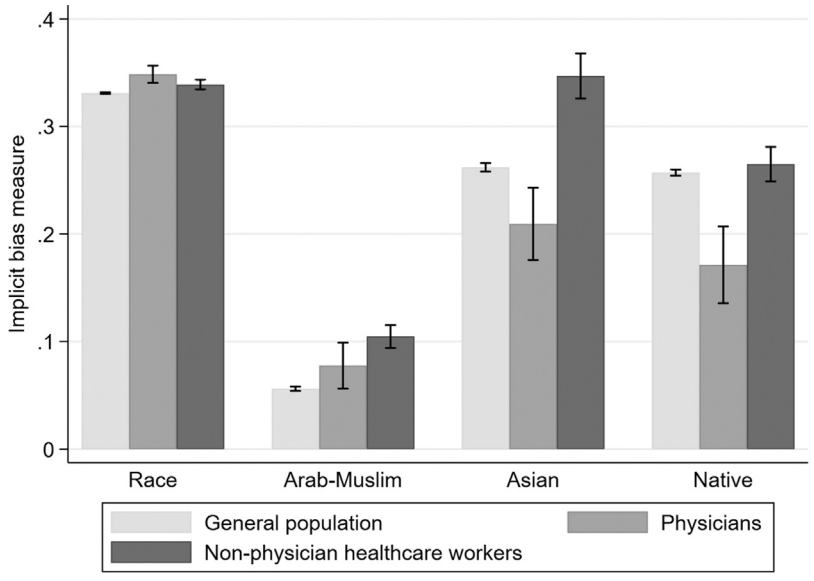

Fig. 1: **Mean and 95% confidence intervals for implicit prejudice measure.**

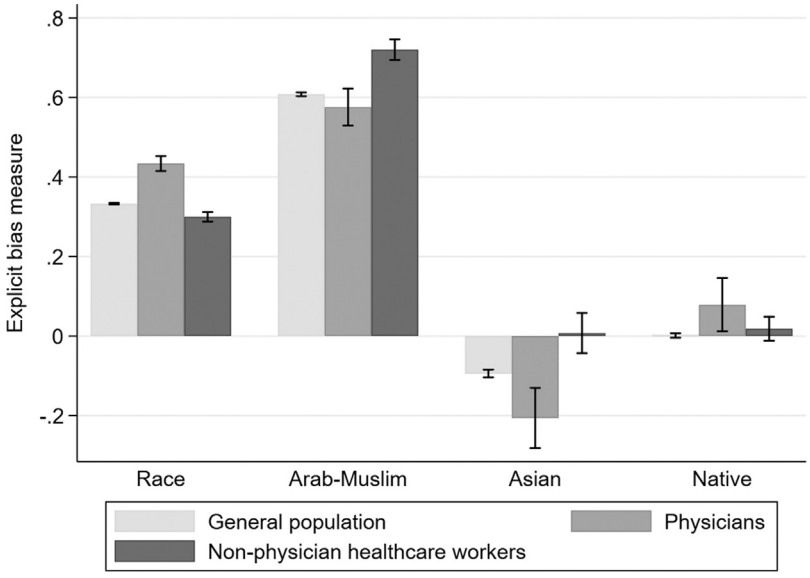

Fig. 2: **Mean and 95% confidence intervals for explicit prejudice measure.**

the gap between non-physician healthcare workers and the general population remains positive and statistically significant (0.030 percentage points, $p < 0.01$).

Arab-Muslim IAT/explicit Anti-Arab-Muslim prejudice

Results from parallel analyses of the IAT Arab-Muslim data indicate both physicians and non-physician healthcare workers initially exhibit more implicit and explicit prejudice against Arab-Muslims compared to the general population (Table 3, Columns 1 and 6). After controls for age, race, sex and geography are included (Column 5), however, the implicit anti-Arab-Muslim prejudice gap between physicians and the general population is rendered statistically non-significant, while the gap between non-physician healthcare workers and the general population remains positive and statistically significant (0.045 percentage points, $p < 0.01$). Non-physician healthcare workers have significantly higher explicit prejudice scores relative to the general population (0.076, $p < 0.01$, Column 10) while physicians exhibit explicit bias levels that are not significantly different from those of the general population.

Asian American IAT/explicit Anti-Asian prejudice

Results from analyses of the Asian American IAT data demonstrate that physicians and non-physician healthcare workers initially exhibit relatively higher levels of implicit anti-Asian prejudice (Table 4, Column 1). However, including controls for demographic characteristics also renders the association statistically non-significant for both physicians and non-physician healthcare workers. While physicians and non-physician healthcare workers initially display lower levels of explicit anti-Asian prejudice relative to the general population, the inclusion of demographic characteristics appears to account for these differences, which are rendered non-significant (Columns 7–10).

Native American IAT/explicit Anti-Native American prejudice

Table 5 displays findings from regression models examining the associations between profession and anti-Native American prejudice. We observe similar patterns for anti-Native American prejudice. Both physicians and non-physician healthcare workers in the sample initially exhibit significantly more implicit anti-Native American prejudice than the general population (Column 1). However, differences in implicit prejudice between physicians, other healthcare workers, and the general population become negative ($p < 0.01$) or statistically non-significant after controlling for demographic characteristics (Columns 2 through 5). In general, the differences in explicit prejudice between physicians, non-physician healthcare workers, and the general population in the sample remain statistically non-significant or marginally significant (Columns 6–10).

Finally, as an illustrative example, we include the differences in implicit and explicit anti-Black prejudice by physician race/ethnicity and sex using predictions from regression analyses (Table 2). Notably, due to sample size limitations, we were unable to generate robust race/ethnicity/sex predicted estimates for the Arab-Muslim, Asian, and Native American IAT and explicit prejudice scores, nor for Native American respondents for the Race IAT.

Variables	(1′)	(1)	(2)	(3)	(4)	(5)	(6′)	(6)	(7)	(8)	(9)	(10)
	Implicit prejudice score						Explicit prejudice score					
Physicians	0.315**	0.339**	0.026**	0.015*	0.010	0.009	0.237**	0.403**	0.144**	0.104**	0.077**	0.003
	(0.004)	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)	(0.011)	(0.018)	(0.018)	(0.017)	(0.017)	(0.016)
Non-physician healthcare workers	0.294**	0.300**	−0.006	0.018**	0.026**	0.027**	0.174**	0.186**	−0.068**	−0.008	0.014	0.030**
	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.012)	(0.013)	(0.013)	(0.011)	(0.011)	(0.011)
Observations	3,202,490	1,501,762	1,501,762	1,501,762	1,501,762	1,501,762	3,033,941	1,431,067	1,431,067	1,431,067	1,431,067	1,431,067
R-squared	0.007	0.012	0.254	0.398	0.399	0.400	0.0008	0.002	0.036	0.230	0.240	0.291
Add age control			X	X	X	X			X	X	X	X
Add race control				X	X	X				X	X	X
Add gender and race*gender controls					X	X					X	X
Add geography control						X						X

Notes: The reference group is the general population. Standard errors in parentheses. Columns (1′) and (6′) show regression results for the whole sample, Columns (1)–(10) show regression results for the study sample. Columns (1) and (2) show regression results without control variables. Columns (2) and (7) show results with test-taker age as a control variable. Columns (3) and (8) show results with test-taker age and four indicator variables for test-taker race/ethnicity as control variables. Columns (4) and (9) show results with test-taker age, four indicator variables for test-taker's race/ethnicity, an indicator variable for test-taker gender, and interactions between race and gender as control variables. Columns (5) and (10) show results with test-taker's age, four indicator variables for test-taker race/ethnicity, a dummy for test-taker gender, interactions between race and gender, an indicator variable for US residence, and state of residence as control variables. **p < 0.01, *p < 0.05. ***Complete case analysis.***

Table 2: **Differences in implicit and explicit anti-Black prejudice in 2007–2019 Race IAT data.**

Variables	(1′)	(1)	(2)	(3)	(4)	(5)	(6′)	(6)	(7)	(8)	(9)	(10)
	Implicit prejudice score						Explicit prejudice score					
Physicians	0.062**	0.087**	−0.008	0.006	−0.006	−0.013	0.468**	0.622**	−0.029	0.005	−0.017	−0.008
	(0.013)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.026)	(0.038)	(0.039)	(0.039)	(0.038)	(0.038)
Non-physician healthcare	0.104**	0.118**	0.024*	0.029**	0.043**	0.045**	0.625**	0.666**	0.011	0.043	0.080**	0.076**
	(0.010)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.023)	(0.024)	(0.024)	(0.024)	(0.025)	(0.025)
Observations	317,347	186,758	186,758	186,758	186,758	186,758	321,466	186,069	186,069	186,069	186,069	186,069
R-squared	0.001	0.003	0.036	0.042	0.051	0.058	0.009	0.015	0.243	0.267	0.272	0.274
Add age control			X	X	X	X			X	X	X	X
Add race control				X	X	X				X	X	X
Add gender and race*gender controls					X	X					X	X
Add geography control						X						X

Notes: The reference group is the general population. Standard errors in parentheses. Columns (1′) and (6′) show regression results for the whole sample, Columns (1)–(10) show regression results for the study sample. Columns (1) and (2) show regression results without control variables. Columns (2) and (7) show results with test-taker age as a control variable. Columns (3) and (8) show results with test-taker age and four indicator variables for test-taker race/ethnicity as control variables. Columns (4) and (9) show results with test-taker age, four indicator variables for test-taker's race/ethnicity, an indicator variable for test-taker gender, and interactions between race and gender as control variables. Columns (5) and (10) show results with test-taker's age, four indicator variables for test-taker race/ethnicity, a dummy for test-taker gender, interactions between race and gender, an indicator variable for US residence, and state of residence as control variables. **p < 0.01, *p < 0.05. ***Complete case analysis.***

Table 3: **Differences in implicit and explicit prejudice in 2007–2019 IAT Arab-Muslim data.**

Variables	(1′)	(1)	(2)	(3)	(4)	(5)	(6′)	(6)	(7)	(8)	(9)	(10)
	Implicit prejudice score						Explicit prejudice score					
Physicians	0.140**	0.165**	−0.080*	−0.028	−0.031	−0.035	−0.254**	−0.250**	−0.114#	0.0008	0.017	−0.010
	(0.019)	(0.031)	(0.031)	(0.030)	(0.030)	(0.030)	(0.040)	(0.058)	(0.060)	(0.060)	(0.060)	(0.059)
Non-physician healthcare workers	0.254**	0.257**	0.015	0.018	0.023	0.023	−0.135**	−0.123*	0.012	0.040	0.001	0.007
	(0.018)	(0.018)	(0.018)	(0.017)	(0.017)	(0.017)	(0.050)	(0.053)	(0.055)	(0.052)	(0.052)	(0.052)
Observations	167,360	59,272	59,272	59,272	59,272	59,272	175,113	61,738	61,738	61,738	61,738	61,738
R-squared	0.004	0.011	0.179	0.261	0.262	0.266	0.0008	0.001	0.010	0.086	0.096	0.137
Add age control			X	X	X	X			X	X	X	X
Add race control				X	X	X				X	X	X
Add gender and race*gender controls					X	X					X	X
Add geography control						X						X

Notes: The reference group is the general population. Standard errors in parentheses. Columns (1′) and (6′) show regression results for the whole sample, Columns (1)–(10) show regression results for the study sample. Columns (1) and (2) show regression results without control variables. Columns (2) and (7) show results with test-taker age as a control variable. Columns (3) and (8) show results with test-taker age and four indicator variables for test-taker race/ethnicity as control variables. Columns (4) and (9) show results with test-taker age, four indicator variables for test-taker's race/ethnicity, an indicator variable for test-taker gender, and interactions between race and gender as control variables. Columns (5) and (10) show results with test-taker's age, four indicator variables for test-taker race/ethnicity, a dummy for test-taker gender, interactions between race and gender, an indicator variable for US residence, and state of residence as control variables. **p < 0.01, *p < 0.05, #p = 0.057. ***Complete case analysis.***

Table 4: **Differences in implicit and explicit prejudice in 2007–2019 IAT Asian American data.**

Variables	(1′)	(1)	(2)	(3)	(4)	(5)	(6′)	(6)	(7)	(8)	(9)	(10)
	Implicit prejudice score						Explicit prejudice score					
Physicians	0.080**	0.127**	−0.123**	−0.122**	−0.127**	−0.124**	−0.072	0.038	0.093	0.064	0.038	0.020
	(0.024)	(0.037)	(0.037)	(0.036)	(0.036)	(0.036)	(0.049)	(0.064)	(0.064)	(0.060)	(0.0560)	(0.060)
Non-physician healthcare workers	0.226**	0.244**	−0.013	−0.006	−0.002	0.0007	−0.089**	−0.033	0.023	0.031	0.053	0.060#
	(0.018)	(0.018)	(0.019)	(0.018)	(0.018)	(0.018)	(0.034)	(0.034)	(0.035)	(0.033)	(0.033)	(0.033)
Observations	206,904	127,520	127,520	127,520	127,520	127,520	208,823	127,011	127,011	127,011	127,011	127,011
R-squared	0.003	0.007	0.173	0.211	0.213	0.221	0.0002	0.000	0.003	0.082	0.097	0.143
Add age control			X	X	X	X			X	X	X	X
Add race control				X	X	X				X	X	X
Add gender and race*gender controls					X	X					X	X
Add geography control						X						X

Notes: The reference group is the general population. Standard errors in parentheses. Columns (1′) and (6′) show regression results for the whole sample, Columns (1)–(10) show regression results for the study sample. Columns (1) and (2) show regression results without control variables. Columns (2) and (7) show results with test-taker age as a control variable. Columns (3) and (8) show results with test-taker age and four indicator variables for test-taker race/ethnicity as control variables. Columns (4) and (9) show results with test-taker age, four indicator variables for test-taker's race/ethnicity, an indicator variable for test-taker gender, and interactions between race and gender as control variables. Columns (5) and (10) show results with test-taker's age, four indicator variables for test-taker race/ethnicity, a dummy for test-taker gender, interactions between race and gender, an indicator variable for US residence, and state of residence as control variables. **p < 0.01, *p < 0.05, #p = 0.066. ***Complete case analysis***.

Table 5: **Differences in implicit and explicit prejudice in 2007–2019 IAT Native American data.**

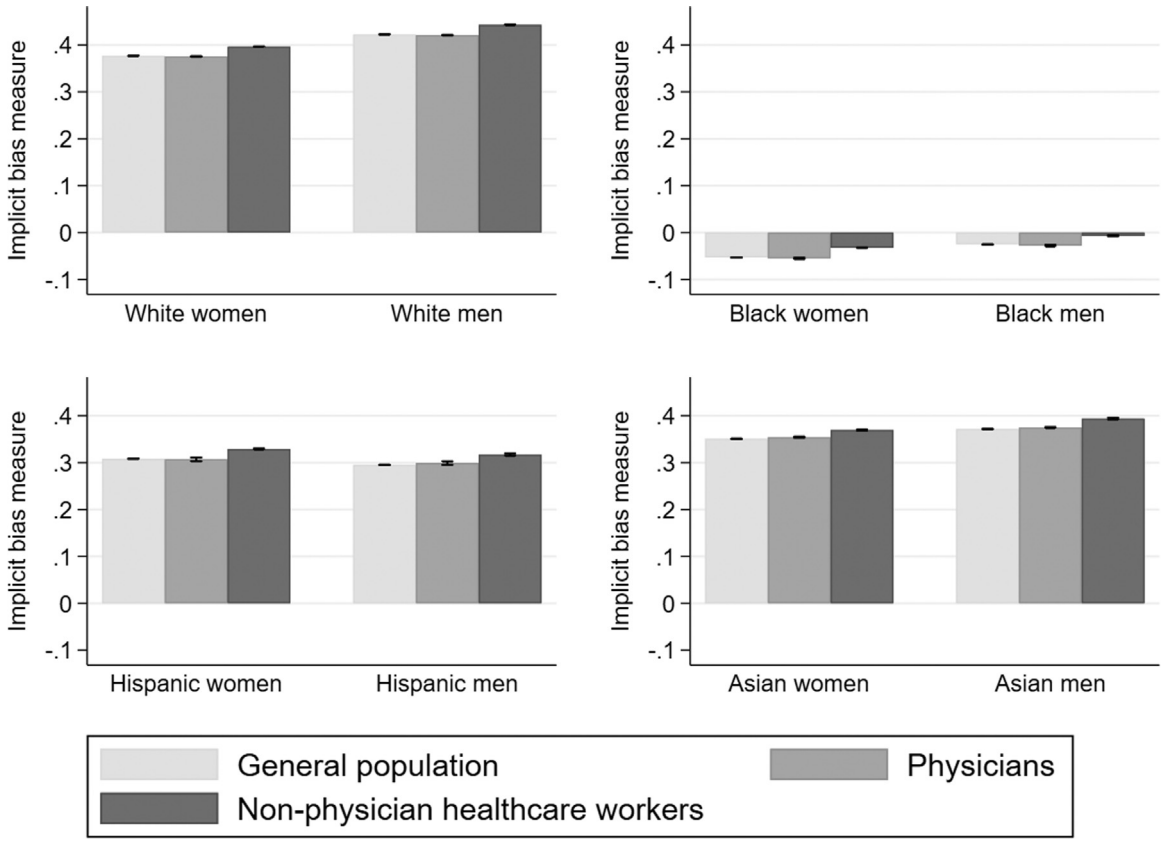

Fig. 3: **Anti-Black implicit prejudice by race and sex**. *Note.* Error bars denote 95-percent confidence intervals.

Figs. 3 and 4 show average predicted levels of anti-Black implicit and explicit prejudice, respectively, by race/ethnicity, sex, and occupation. First, within-race comparisons demonstrate that with few exceptions, men, regardless of occupation, generally exhibit higher anti-Black implicit and explicit prejudice relative to women. Second, non-physician healthcare workers uniformly exhibit slightly higher anti-Black implicit and explicit prejudice compared to the general population and physicians. Finally, White and Asian test-takers exhibit the highest average levels of anti-Black prejudice, and Black women test-takers exhibit the lowest levels (i.e., slight preference for Black Americans). Hispanic test takers' prejudice levels fall between those of the two former groups, where within-group implicit prejudice is lowest among Hispanic male general population members and physicians and explicit prejudice is lowest among Hispanic female physicians.

Discussion

The aim of the present study was to examine differences in implicit and explicit racialized prejudice among physicians, non-physician healthcare workers, and the general population. To do so, we presented both unadjusted and adjusted results in order to gain a more comprehensive understanding of the nature of racial prejudice among physicians and other healthcare workers relative to the general population. Specifically, the unadjusted results highlight the problem that racial prejudice—particularly directed towards Black and Arab-Muslim individuals is disproportionately found in healthcare professions compared to the general population—irrespective of its causes. While we adjusted our estimates to account for test-taker characteristics, this approach does not negate the racialized prejudice that patients face when seeking care. However, the adjusted results can also provide important additional information about the potential underlying mechanisms linking occupation and prejudice. That is, they shed light on whether physicians or other healthcare workers exhibit more prejudice because of the ways in which people select into these professions (e.g., age is positively associated with prejudice and physicians are older) or because healthcare training and/or work environments promote prejudice above and beyond what one might expect in the general population.

We focus on four key findings. First, physicians and non-physician healthcare workers generally exhibited significantly higher levels of anti-Black and anti-Arab-Muslim implicit and explicit prejudice relative to the

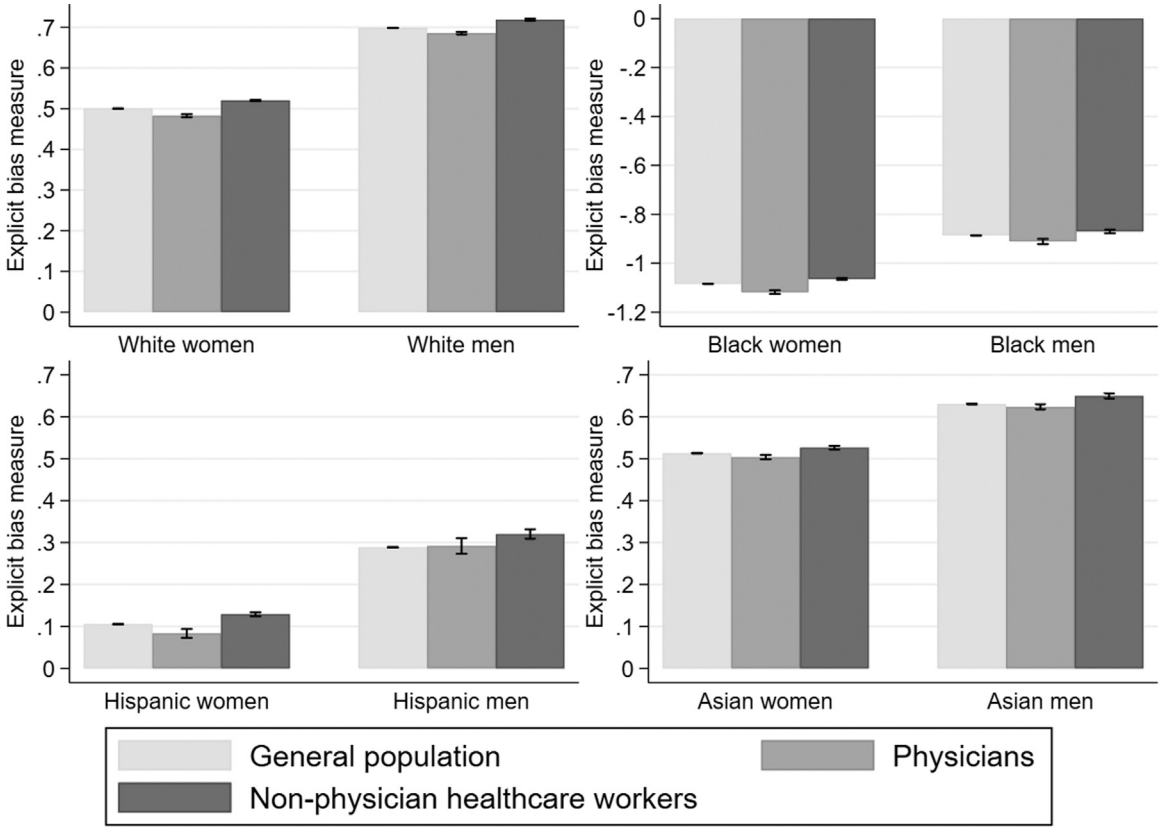

Fig. 4: **Anti-Black explicit prejudice by race and sex**. *Note.* Error bars denote 95-percent confidence intervals.

general population. While these associations were rendered non-significant for physicians when controlling for demographic characteristics, demographics cannot fully explain modestly higher levels of prejudice among non-physician healthcare workers. Second, demographic characteristics appeared to largely explain higher and lower levels of implicit and explicit anti-Asian prejudice among both physicians and non-physician healthcare workers. Third, compared to the general population, physicians and non-physician healthcare workers exhibited lower and similar levels of anti-Native implicit prejudice, respectively. Finally, White and Asian male non-physician healthcare workers exhibited the highest levels of anti-Black prejudice, and Black women displayed the lowest levels.

The finding that physicians display initially similar levels of anti-Black/pro-White prejudice to the general population after controlling for demographic characteristics is consistent with prior research.[6,12] We found that average anti-Black prejudice was higher among physicians relative to the other test takers, albeit slightly lower compared to previous estimates using data from 2007 to 2009.[6] While prior research on physicians did not control for demographic characteristics, others have found that average prejudice levels vary by age, race/ethnicity, and geography.[12,13,24] Thus, it is unsurprising that we found that accounting for these factors explained anti-Black, -Arab-Muslim, and -Asian prejudice gaps between physicians and the general population.

In contrast, we found that accounting for demographic characteristics reduced, but failed to completely eliminate anti-Black and -Arab-Muslim prejudice gaps between non-physician healthcare workers and the general population. This is a key contribution of the current study because research on prejudice among non-physician healthcare workers and/or non-medical trainees is limited, despite the fact that many healthcare encounters either involve or rely entirely on non-physician healthcare staff such as nurses, physician assistants, and social workers.[20,21] In an important exception, one study found that medical students exhibited higher levels of prejudice compared to nursing and pharmacy students, though these differences were not statistically significant.[24] Although data limitations do not allow us to directly identify the underlying mechanisms, we propose that economic deprivation could be one underlying factor. White-Means et al. (2009) found that racial prejudice was significantly higher when participants had experienced economic deprivation, even after controlling for participants' race/ethnicity and

history of living in segregated communities. Socioeconomic status is a far greater barrier to entry for aspiring physicians compared to other non-physician fields,[27] and this omitted factor could explain our finding. Like the authors, we emphasize that far more research is needed in this area. Further, we have no evidence that poverty in and of itself is a proximate cause of innate prejudice.

We also found that both physicians and non-physician healthcare workers exhibited initially higher anti-Native implicit prejudice levels, which is consistent with prior research documenting pro-White/anti-Native American preferences among physicians in general and emergency department care providers in particular.[28,29] Here too, controlling for provider characteristics eliminated prejudice gaps between non-physician healthcare workers and suggested that physician status was associated with lower prejudice levels than the first two groups. While neither of the two prior studies simultaneously accounted for demographic characteristics, one study found that implicit stereotyping was not moderated by participant sex, racial/ethnic identity, and age.[29] While this appears to conflict with our findings, we note that the authors' single-site study sample was far smaller (N = 111) and they examined implicit stereotyping and not prejudice as we do in the current study. The other study using a multi-site sample found similar levels of bias across providers (i.e., physicians and nurses) but that provider experience was linked to lower levels of prejudice. Future research should replicate our findings and explore controlling for these nuanced factors.

Finally, results from race/sex predictions from our models of the Race IAT show that female and non-White physicians generally (but not always) held less anti-Black prejudice than male and White physicians, which is consistent with most prior studies.[6,12,30] Of note is that anti-Black prejudice among Asian physicians was almost as high as that among White physicians. One interpretation of this finding is that demographic factors such as race and sex, including model minority status, influence a person's social position, power, and privilege, which shape identity as well as values and prejudices.[31] Future research exploring this topic could help better understand relationships between prejudice and physician race/ethnicity and sex.

Limitations and strengths

The present study has several limitations. First, Project Implicit data are derived from voluntary test-takers, some of whom may have taken the test multiple times, and may not be representative of the overall US population and/or states or counties of origin.[5] We partially addressed these concerns by including sample weights designed to make the sample more representative of the population. Importantly, our unweighted results were substantively similar to those that were weighted. Second, while our sample was large overall, sample size limitations made it difficult to generate robust estimates of implicit and explicit prejudice for certain IAT test categories and racial/ethnic groups of test takers (e.g., Arab-Muslim prejudice and Native American physicians) or among non-binary and explicitly non-cisgender participants. As more individuals take the various IATs, researchers should revisit our findings to ascertain whether observed patterns hold true. Relatedly, our original sample(s) contained significant proportion(s) of missing data. Thus, differences in the characteristics of the original and complete case samples could have impacted our findings. On one hand, the complete case sample had relatively higher proportions of female and Black test-takers, which could have downwardly biased prejudice levels. On the other hand, the complete case sample also had high proportions of test-takers that were White and non-physician healthcare workers, which likely biased mean prejudice levels across groups upward (Supplementary Table A1). However, we lacked evidence that these differences significantly impacted relative differences in prejudice across groups (i.e., physicians, non-physician healthcare workers, and the general population). We also lacked data on physician characteristics that might be important correlates of prejudice, including subspeciality, training, and experience with racially and socioeconomically diverse patient populations. However, we were able to partially account for individual characteristics associated with prejudice such as age and geographic location. Future original data collection should include more detailed information on these factors in order to explore novel correlates of implicit and explicit prejudice.

Importantly, IAT has been subject to robust debate about its psychometric validity and to what extent its findings have practical implications for real world settings. While a full accounting of these issues is well beyond the scope of the present article, we note that scholars have raised a number of important critiques of implicit bias tests, including low levels of temporal stability (i.e., test-takers failing to demonstrate similar levels of biases between tests over time).[32] Further, prior research finds that the IAT is a weak predictor of individual-level discriminatory behavior.[33] On the other hand, increasing evidence suggests that implicit and explicit prejudice in the aggregate are important markers of systemic racism and worthy of further study.

These limitations are counterbalanced by several important strengths. We are among the first to produce comparisons of physician implicit and explicit prejudice to that of other healthcare workers and the general population using national data. We also went beyond examining physicians' anti-Black prejudice to exploring prejudice directed at other racial/ethnic groups.

Conclusion

This study makes an important contribution to the growing literature on racialized prejudice among physicians and non-physician healthcare providers directed to

both Black Americans and other marginalized groups, including Asians, Arab-Muslims, and Native Americans. As policymakers grapple with the role of systemic racism in driving health disparities, understanding how healthcare providers contribute to this phenomenon is a crucial first step towards dismantling prejudices among healthcare providers, providing equitable health services, and reducing racial/ethnic disparities in health.

Contributors

TLG and NH conceptualized the article. LS conducted the literature review and TLG, HV, and LS wrote the manuscript. HV and DL conducted the statistical analyses and HV and EH constructed tables and figures with feedback and input from TLG, LS, and NH. HV, TLG, and DL accessed and verified the data. TLG, HV, LS, MP, EH, and NH contributed to interpretation of the findings and conclusions of the article.

Data sharing statement

Project Implicit Data are publicly available and can be found at the Project Implicit Demo Website Datasets: https://osf.io/y9hiq/

Declaration of interests

We have no competing interests to declare.

Acknowledgements

We thank Dr. James Spartz and the Institute for Research on Poverty for their editing services. All errors are our own.

Funding: The authors have received research support from UW-Madison Centennial Scholars Program, Society of Family Planning Research Fund (SFPRF13–CM4), UW Center for Demography and Ecology and the Wisconsin Partnership Program (TG), the County Health Rankings and Roadmaps Program (TG, HV), the National Science Foundation (MP), the JPB Foundation (MP) and NIH R01 DK112009 (NH). NH served as a consulting/mentor for Michigan Integrative Well-Being and Inequality Training Program; consulting/mentor for Mixed Methods Research Training Program; and presented at the American Neurological Association meetings.

The authors are responsible for the content of this article and these views do not necessarily represent those of our funders.

Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.lana.2023.100489.

References

1 Small-Rodriguez D, Akee R. Identifying disparities in health outcomes and mortality for American Indian and Alaska native populations using tribally disaggregated vital statistics and health survey data. *Am J Publ Health*. 2021;111(S2):S126–S132.
2 Smith NC. Black-White disparities in women's physical health: the role of socioeconomic status and racism-related stressors. *Soc Sci Res*. 2021:102593.
3 Iyer DG, Shah NS, Hastings KG, et al. Years of potential life lost because of cardiovascular disease in Asian-American subgroups, 2003–2012. *J Am Heart Assoc*. 2019;8(7):e010744.
4 Hagiwara N, Kron FW, Scerbo MW, Watson GS. A call for grounding implicit bias training in clinical and translational frameworks. *Lancet (London, England)*. 2020;395(10234):1457.
5 Charlesworth TE, Banaji MR. Patterns of implicit and explicit attitudes: I. Long-term change and stability from 2007 to 2016. *Psychol Sci*. 2019;30(2):174–192.
6 Sabin DJA, Nosek DBA, Greenwald DAG, Rivara DFP. Physicians' implicit and explicit attitudes about race by MD race, ethnicity, and gender. *J Health Care Poor Underserved*. 2009;20(3):896.
7 Rae JR, Newheiser A-K, Olson KR. Exposure to racial out-groups and implicit race bias in the United States. *Soc Psychol Personal Sci*. 2015;6(5):535–543.
8 Nosek BA, Smyth FL, Hansen JJ, et al. Pervasiveness and correlates of implicit attitudes and stereotypes. *Eur Rev Soc Psychol*. 2007;18(1):36–88.
9 Starck JG, Riddle T, Sinclair S, Warikoo N. Teachers are people too: examining the racial bias of teachers compared to other American adults. *Educ Res*. 2020;49(4):273–284.
10 Darling-Hammond S, Michaels EK, Allen AM, et al. After "the China virus" went viral: racially charged Coronavirus coverage and trends in bias against Asian Americans. *Health Educ Behav*. 2020;47(6):870–879.
11 Oliver MN, Wells KM, Joy-Gaba JA, Hawkins CB, Nosek BA. Do physicians' implicit views of African Americans affect clinical decision making? *J Am Board Fam Med*. 2014;27(2):177–188.
12 Maina IW, Belton TD, Ginzberg S, Singh A, Johnson TJ. A decade of studying implicit racial/ethnic bias in healthcare providers using the implicit association test. *Soc Sci Med*. 2018;199:219–229.
13 Stepanikova I, Cook KS. Effects of poverty and lack of insurance on perceptions of racial and ethnic bias in health care. *Health Serv Res*. 2008;43(3):915–930.
14 Hagiwara N, Dovidio JF, Eggly S, Penner LA. The effects of racial attitudes on affect and engagement in racially discordant medical interactions between non-Black physicians and Black patients. *Group Process Intergr Relat*. 2016;19(4):509–527.
15 Penner LA, Dovidio JF, West TV, et al. Aversive racism and medical interactions with Black patients: a field study. *J Exp Soc Psychol*. 2010;46(2):436–440.
16 Payne BK, Hannay JW. Implicit bias reflects systemic racism. *Trends Cognit Sci*. 2021;25(11):927–936.
17 Leitner JB, Hehman E, Ayduk O, Mendoza-Denton R. Blacks' death rate due to circulatory diseases is positively related to whites' explicit racial bias: a nationwide investigation using project implicit. *Psychol Sci*. 2016;27(10):1299–1311.
18 Orchard J, Price J. County-level racial prejudice and the black-white gap in infant health outcomes. *Soc Sci Med*. 2017;181:191–198.
19 Bakhtiari E. Health effects of Muslim racialization: evidence from birth outcomes in California before and after September 11, 2001. *SSM - Population Health*. 2020;12:100703.
20 Annis AM, Harris M, Kim HM, Rosland A-M, Krein SL. Trends in primary care encounters across professional roles in PCMH. *Am J Manag Care*. 2018;24(7):e222–e229.
21 Freund T, Everett C, Griffiths P, Hudon C, Naccarella L, Laurant M. Skill mix, roles and remuneration in the primary care workforce: who are the healthcare professionals in the primary care teams across the world? *Int J Nurs Stud*. 2015;52(3):727–743.
22 Project Implicit Demo Website Datasets. Race IAT, Asian American IAT, Native American IAT, Arab-Muslim IAT, 2007-2019. https://osf.io/y9hiq/.
23 Greenwald AG, Nosek BA, Banaji MR. Understanding and using the implicit association test: I. An improved scoring algorithm. *J Personal Social Psychol*. 2003;85(2):197.
24 White-Means S, Dong Z, Hufstader M, Brown LT. Cultural competency, race, and skin tone bias among pharmacy, nursing, and medical students: implications for addressing health disparities. *Med Care Res Rev*. 2009;66(4):436–455.
25 Lohr SL. *Sampling: design and analysis*. Chapman and Hall/CRC; 2019.
26 US Census Bureau. *2019 American community survey 1-year estimate*. 2020.
27 Baugh AD, Vanderbilt AA, Baugh RF. The dynamics of poverty, educational attainment, and the children of the disadvantaged entering medical school. *Adv Med Educ Pract*. 2019;10:667.
28 Puumala SE, Burgess KM, Kharbanda AB, et al. The role of bias by emergency department providers in care for American Indian children. *Med Care*. 2016;54(6):562.
29 Zestcott CA, Spece L, McDermott D, Stone J. Health care providers' negative implicit attitudes and stereotypes of American Indians. *J Racial Ethnic Health Disparities*. 2021;8:230–236.
30 Assari S. Interaction between race and gender and effect on implicit racial bias against blacks. *Int J Epidemiol Res*. 2018;5(2):43–49.
31 Coghlan D, Brydon-Miller M. *The SAGE encyclopedia of action research*. Sage; 2014.
32 Payne BK, Vuletich HA, Lundberg KB. The bias of crowds: how implicit bias bridges personal and systemic prejudice. *Psychol Inq*. 2017;28(4):233–248.
33 Oswald FL, Mitchell G, Blanton H, Jaccard J, Tetlock PE. Predicting ethnic and racial discrimination: a meta-analysis of IAT criterion studies. *J Personal Social Psychol*. 2013;105(2):171.