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# Osteopathic medical students' understanding of race-based medicine

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## Abstract

**Context:** Race is a social construct, not a biological or genetic construct, utilized to categorize people based on observable traits, behaviors, and geographic location. Findings from the Human Genome Project demonstrated that humans share 99.9% of their DNA; despite this evidence, race is frequently utilized as a risk factor for diagnosis and prescribing practices. Diagnosing and treating people based on race is known as race-based medicine. Race-based medicine perpetuates biases and diverts attention and resources from the social determinants of health that cause racial health inequities. Minimal research has examined medical students' understanding of race-based medicine.

**Objectives:** The purpose of this study was to assess osteopathic medical students' knowledge, beliefs, and experiences with race-based medicine.

**Methods:** We conducted a descriptive, cross-sectional survey study to assess osteopathic medical students' knowledge, beliefs, and experiences with race-based medicine. An electronic, anonymous survey was distributed to all osteopathic medical students enrolled at a medical school in the Midwest with three campuses during the 2019–2020 academic year. Participants completed a brief demographic questionnaire and the Race-Based Medicine Questionnaire. Descriptive and inferential statistics were conducted utilizing SPSS statistical software version 28.0, and statistical

significance was defined as a  $p < 0.05$ . Open-ended questions were analyzed utilizing content and thematic analyses.

**Results:** A total of 438 of the 995 osteopathic medical students consented to participate in the study, for a response rate of 44.0%. Among those participants, 221 (52.0%) reported that they had heard of the term “race-based medicine.” Familiarity with the term differed by racial background ( $\chi^2 [2] = 24.598, p < 0.001$ ), with Black or African American participants indicating greater familiarity with the term compared to all other races. Of the participants familiar with race-based medicine, 79 (44.4%) provided the correct definition for the term; this finding did not differ by any sociodemographic variable. Part of the way through the questionnaire, all participants were provided the correct definition of “race-based medicine” and asked if they thought medical schools should teach race-based medicine. The majority of participants ( $n = 231, 61.4%$ ) supported the teaching of race-based medicine. Qualitative findings elaborated on participants' support or opposition for teaching race-based medicine in medical school. Those in support explained the importance of teaching historical perspectives of race-based medicine as well as race as a data point in epidemiology and its presence on board examinations, whereas those in opposition believed it contradicted osteopathic principles and practice.

**Conclusions:** Findings showed half of the participants were familiar with race-based medicine, and among those, less than half knew the definition of the term. Highlighting osteopathic philosophy and its focus on the whole person may be one approach to educating osteopathic medical students about race-based medicine.

**Keywords:** diversity and inclusion; osteopathic medical education; public health; survey research.

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Race is a social construct utilized to categorize people based on observable traits, behaviors, and geographic location [1]. It is not a biological or genetic concept [2]. Findings from the Human Genome Project showed that humans share 99.9% of their DNA [3, 4]. Of the remaining 0.1% of unshared DNA, 85% of the genetic variation occurs within geographically distinct groups, thereby

demonstrating that there is no genetic basis for race [3]. While race is not biological or genetic, it is a construct that may identify populations at increased risk for structural racism, which contributes to social inequalities, health inequities, and increased risk for adverse disease outcomes [5].

Despite this DNA evidence, race continues to be utilized as a biological or genetic category [2]. In medicine, race is frequently utilized as risk factor for diagnosis and prescribing practices [6]. The practice of diagnosing and treating people based on race is known as “race-based medicine.” [7] In medical education, students are often taught to associate specific diseases with race, such as sickle cell disease with Black people [8, 9]. A perspective piece written in 2020 by Nieblas-Bedolla and colleagues [10] observed that medical students were rewarded for connecting race to a diagnosis without having to utilize other details in the questions on the licensure examinations. Tsai and colleagues [11] reviewed the slides of 350 preclinical lectures created by faculty at an allopathic medical school and found that race was mentioned on 102 slides. Further review of the lecture slides revealed that 96.0% of the references to race portrayed it as an explicit or implied biological difference as compared to 4.0% of the lecture slides addressing the social and structural causes for race-based associations [11]. Finally, a study in 2021 by Amutah et al. [12] examined 880 lectures from a preclinical curriculum of an allopathic medical school and observed five domains in which race was misrepresented: (1) semantics, (2) prevalence without context, (3) race-based diagnostic bias, (4) pathologizing race, and (5) race-based clinical guidelines. The review of these preclinical lectures by Tsai and colleagues [11] and Amutah and colleagues [12] demonstrated that race is misrepresented in medical education at these institutions, which may reinforce the belief that there are race-based biological or genetic differences.

The problem with medical education teaching students to apply race as a biological category or genetic risk factor is the propagation of race-based medicine. To our knowledge, no research has examined medical students' understanding of race-based medicine. Thus, the purpose of this research was to assess medical students' knowledge, beliefs, and experiences with race-based medicine. Findings from this study may identify areas for curricular reform to work toward dismantling racial bias in medical education.

## Methods

This descriptive, cross-sectional study explored osteopathic medical students' knowledge, beliefs, and experiences with race-based medicine. The Ohio University Office of Research Compliance approved the protocol (19-E-323) and all recruitment procedures and materials.

## Participants

An anonymous electronic survey was distributed to all osteopathic medical students enrolled at a medical school in the Midwest with three campuses (Campuses A, B, and C) during the 2019–2020 academic year. The email invitation was sent by the study investigator (MJ) via school-maintained class listservs. All osteopathic medical students enrolled during the 2019–2020 academic year were eligible to participate in the study; there were no exclusion criteria. The survey opened on February 26, 2020 and closed on May 27, 2020. Two reminder emails were sent on April 1, 2020 and May 20, 2020. Participation in the study was completely voluntary.

## Measures

Participants completed a short demographic form asking participants to report their age, self-identified gender (i.e., woman, man, prefer to self-describe, prefer not to answer) self-identified race, year in medical school, medical school campus, and intention to pursue a career in primary care. The race categories listed on the demographic form followed the Racial and Ethnic Categories and Definitions for National Institutes of Health (NIH) Diversity Programs and for Other Reporting Purposes (i.e., American Indian/Alaskan Native, Asian, Black/African American, Hispanic/Latinx, Native Hawaiian/Pacific Islander, White, and another race not listed) [13]. The reason we collected self-identified race in this study was to examine potential differences in knowledge, beliefs, and experiences with race-based medicine. We propose that racial differences may indicate a source of structural racism in the curriculum that can be assessed in future research.

Next, participants completed the Race-Based Medicine Questionnaire. Created for the present study, the Race-Based Medicine Questionnaire consisted of eight close-ended questions and four open-ended questions exploring students' knowledge of race-based medicine, experiences with race-based medicine in the classroom, and beliefs about the application of race-based medicine (Table 1). Two osteopathic physicians (MJ, IO), and a researcher who is an expert in behavioral medicine and qualitative methods (EAB), developed the questions. To establish face and content validity, the researcher team reviewed and rated each question to determine whether it was necessary, useful, and relevant to be included in the questionnaire. Next, the questionnaire was piloted by MJ, IO, and EAB on February 26, 2020 with a subset of participants (n=22) to identify any weak or irrelevant questions; no questions were removed after the pilot test. The research team did not conduct reliability and validity testing because no specific constructs (e.g., implicit bias, racism, curriculum satisfaction) were measured with this questionnaire. Rather, the questionnaire explored knowledge via: open-ended questions; prior experiences with race-based medicine during their undergraduate, graduate, or clinical education; and personal beliefs about the use of race-based medicine in education and medicine.

## Data collection

Participants completed the demographic form and Race-Based Medicine Questionnaire via the online questionnaire service Qualtrics (Provo, UT). All participants provided online informed consent. To consent, participants clicked a radio button indicating “Yes, I consent to participate in this study. I may withdraw my participation at any

**Table 1:** Participants' responses to the race-based medicine questionnaire (n=438).

Question	n (%)
1. Have you ever heard of the term "race-based medicine"?	
Yes	221 (52.0)
No	204 (48.0)
2. If yes, where did you first hear the term?	–
3. In your own words, explain what "race-based medicine" is.	–
Definition: "Race-based medicine" refers to utilizing race or ethnic groups as a means of diagnosing and treating patients.	–
4. After reading the definition of "race-based medicine," have you ever had a teacher or professor teach race-based medicine in class or lecture?	
Yes	233 (53.2)
No	139 (31.7)
Did not respond	66 (15.1)
5. If yes, please give an example of when "race-based medicine" was utilized.	–
6. Do you think medical schools should teach "race-based medicine"?	
Yes	231 (61.4)
No	145 (38.6)
7. Please explain your answer to the previous question.	–
8. Currently "race-based medicine" is practiced in our society.	
Strongly agree	53 (14.6)
Agree	175 (48.2)
Neutral	100 (27.5)
Disagree	33 (9.1)
Strongly disagree	2 (0.6)
9. Race should be considered when diagnosing patients.	
Strongly agree	28 (7.7)
Agree	170 (46.8)
Neutral	104 (28.7)
Disagree	45 (12.4)
Strongly disagree	16 (4.4)
10. Race should be considered a risk factor in diseases.	
Strongly agree	63 (17.4)
Agree	199 (54.8)
Neutral	64 (17.6)
Disagree	28 (7.7)
Strongly disagree	9 (2.5)
11. "Race-based medicine" is taught in the current curriculum.	
Strongly agree	26 (7.2)

**Table 1:** (continued)

Question	n (%)
Agree	135 (37.2)
Neutral	126 (34.7)
Disagree	65 (17.9)
Strongly disagree	11 (3.0)
12. Medical school has taught me how to treat patients regardless of race.	
Strongly agree	114 (31.4)
Agree	169 (46.6)
Neutral	57 (15.7)
Disagree	21 (5.8)
Strongly disagree	2 (0.6)

Values were missing for Question 1 (n=13), Question 4 (n=66), Question 6 (n=62), Question 8–12 (n=75).

time." To decline, participants clicked a radio button indicating "I decline to participate." Completion of the survey took approximately 15 min. Participants received a \$5.00 gift card as compensation for participating in the study. To receive compensation, participants were presented with a new link at the end of the questionnaire. This new link opened a second Qualtrics survey where the participant could provide their information to receive a gift card. This way, participants' questionnaire responses were not linked to their identity. Due to the anonymous nature of the study, a participant did not have to complete the questionnaire to receive the gift card. Participant compensation was funded by the Osteopathic Heritage Foundation by a Ralph S. Licklider, D.O. Endowed Fellowship to the senior investigator on the study. EAB provided all participant compensation.

### Quantitative data analysis

Basic sociodemographic characteristics of participants were assessed utilizing descriptive statistics (EAB). Frequencies of individual question responses were also calculated. Chi-square tests with Bonferroni corrections, independent sample t-tests, and one-way ANOVA were conducted to examine differences in knowledge, beliefs, and experiences by age, race, gender, year in medical school, medical school campus, and desire to pursue a career in primary care (EAB). Primary care was defined by the American Osteopathic Association and comprised family medicine, internal medicine, and pediatric specialties [14]. Statistical significance was defined as a  $p < 0.05$ . All analyses were conducted with SPSS statistical software version 26.0 (SPSS Inc, Chicago, IL).

### Qualitative data analysis

The research team analyzed the open-ended short-answer questions via content and thematic analyses. First, three researchers (MJ, IO, EAB) independently coded the participants' definition of "race-based medicine" [7] as correct or incorrect; this variable was dichotomized

(yes = 1, no = 0) for statistical analysis. Second, the research team performed content analysis by marking and categorizing key words, phrases, and texts to identify codes that described students' experiences with race-based medicine in order to facilitate thematic analysis and illustrated patterns across the data [15, 16]. The investigators revised, discussed, and resolved coding discrepancies through consensus to establish inter-coder reliability [17]. The Cohen's kappa coefficient between the three coders was 0.957, indicating almost perfect agreement [18]. After the transcripts were coded and reviewed, one member of the research team (EAB) entered the coded transcripts in NVivo 12 software (QSR International, Victoria Australia) to organize the data and derive themes. The selected themes described examples of race-based medicine and support vs opposition for the teaching of race-based medicine in medical school. The research team derived themes from data that occurred multiple times, both within and across short-answer responses.

## Results

Of the 995 osteopathic medical students enrolled at the three campuses, 438 consented to participate in the study, for a response rate of 44.0%. The mean age plus standard deviation of the participants was  $25.6 \pm 2.4$  years (range 20–34 years); 261 (59.6%) identified as women, 176 (40.2%) identified as men, and 1 (0.2%) preferred to self-describe their gender. The self-identified racial background of the participants included 318 (72.6%) as identifying White, 54 (12.3%) identifying as Asian, 40 (9.1%) identifying as Black or African American, 17 (3.9%) identifying as another race not listed, and 9 (2.1%) identifying as Hispanic or Latinx. Participants were distributed somewhat evenly across year in medical school with 108 (24.7%) in Year 1, 88 (20.1%) in Year 2, 109 (24.9%), and 130 (29.7%) in Year 4. The majority of participants ( $n=235$ , Campus A: 53.7%) were from the main campus of the medical school; however, proportionally, participation rates were equivalent based on campus enrollment numbers (Campus B:  $n=104$ , 23.7%; Campus C:  $n=99$ , 22.6%). Slightly less than half of the participants ( $n=197$ , 45.0%) planned to pursue a medical career in primary care. Demographic data are presented in Table 2.

A total of 221 participants (52.0%; Table 1) reported that they had heard of the term “race-based medicine.” Familiarity with the term differed by racial background ( $\chi^2=24.598$ ,  $p<0.001$ ). Bonferroni corrections showed that participants self-identifying as Black or African American indicated greater familiarity with the term ( $n=34/39$ , 87.2%) compared to participants self-identifying as Asian ( $n=25/54$ , 46.3%), Hispanic or Latinx ( $n=4/9$ , 44.4%), White ( $n=154/308$ , 50.0%), or another race not listed ( $n=4/15$ , 26.7%). Familiarity with the term did not differ by age ( $t=-1.213$ ,  $p=0.226$ ), gender ( $\chi^2=0.275$ ,  $p=0.600$ ), year in

**Table 2:** Participants' demographic characteristics ( $n=438$ ).

Variable	n (%)
Age, years	$25.6 \pm 2.4$
Gender	
Woman	261 (59.6)
Man	176 (40.2)
Prefer to self-describe	1 (0.2)
Prefer not to answer	0 (0)
Race	
American Indian/Alaska Native	0 (0)
Asian	54 (12.3)
Black/African american	40 (9.1)
Hispanic/Latinx	9 (2.1)
Pacific Islander/Native Hawaiian	0 (0)
White	318 (72.6)
Another race not listed	17 (3.9)
Year in medical school	
OMS I	108 (24.7)
OMS II	88 (20.1)
OMS III	109 (24.9)
OMS IV	130 (29.7)
Medical school campus	
Athens	235 (53.7)
Dublin	104 (23.7)
Cleveland	99 (22.6)
Do you plan on pursuing a career in primary care? <sup>a</sup>	
Yes	197 (45.0)
No	241 (55.0)

<sup>a</sup>Primary care was defined by the American Osteopathic Association, and it comprised family medicine, internal medicine, and pediatric specialties; OMS, osteopathic medical student.

medical school ( $\chi^2=9.831$ ,  $p=0.043$ ; Note, a  $p<0.00625$  was necessary to achieve statistical significance with the Bonferroni correction), or medical school campus ( $\chi^2=1.601$ ,  $p=0.449$ ). Interestingly, participants who intended to pursue a career in primary care were more likely to have heard of the term “race-based medicine” ( $n=12/190$ , 58.9%) compared to students intending to pursue other specialties ( $n=109/235$ , 46.4%;  $\chi^2=6.645$ ,  $p=0.010$ ). Intention to pursue a career in primary care did not differ by self-identified race ( $\chi^2=13.749$ ,  $p=0.008$ ; Note, a  $p<0.007$  was necessary to achieve statistical significance with the Bonferroni correction).

Participants familiar with the term “race-based medicine” were prompted to explain the meaning of race-based medicine. Less than half ( $n=79$ , 44.4%) of these participants provided the correct definition of race-based medicine. Participants who provided the correct definition of race-based medicine did not differ by age ( $t=0.132$ ,  $p=0.895$ ), race ( $\chi^2=6.194$ ,  $p=0.185$ ), gender ( $\chi^2=0.408$ ,  $p=0.523$ ), year in medical school ( $\chi^2=1.921$ ,  $p=0.589$ ), medical school campus ( $\chi^2=0.693$ ,  $p=0.707$ ), or desire to pursue primary care ( $\chi^2=0.789$ ,  $p=0.374$ ). Next,

**Table 3:** Themes and representative quotations.

Theme	Quotations
Examples of race-based medicine	<p>“A cardiology lesson taught that Black people are treated with CCBs or thiazides as first line for hypertension and everyone else should be given ACEs or ARBs first line. Nephrology lecture taught that Black people have an adjusted GRF on lab reports because ‘they have different genetics in the kidney that need to be accounted for.’ Black people have worse morbidity for hypertension and stroke because of high salt cultural diet (soul food). Black people can’t wash their hair that often or it will break off, therefore the treatment for dandruff is different.” [ID 124]</p> <p>“Another example would be the higher rates of diabetes in Hispanic and African American populations, sickle cell anemia in African American populations, inherited disorders in Ashkenazi Jewish populations, higher rates of hyperlipidemia and alcoholism in Native American populations, and certain blood disorders in patients of Mediterranean descent. The list goes on and on. We’ve been taught how to successfully take board exams and in the clinical vignettes on board exams a patient’s race often clues you into the diagnosis.” [ID 383]</p> <p>“The USPSTF BP recommendations include first line treatment guidelines for Black (TZD or CCB) vs. non-Black (TZD, CCB, ACEi or ARB) patients. When studying for boards, if any question begins with middle-aged female African American, we’re taught to automatically think of sarcoidosis because the answer is almost always that.” [ID 101]</p>
Support and opposition for race-based medicine	<p>“No, I do not think race-based medicine should be taught because there is no evidence to back it up. We preach evidence-based medicine nowadays and I have not seen or heard of the evidence to justify race-based medicine.” [ID 366]</p> <p>I don’t think medical schools should teach race-based medicine. Not all patients are the same. To paint one patient with the same brush would be an abhorrent practice and failure to see the uniqueness in all patients. Though some diseases do show more preference in certain races (and larger, demographics), it should not justify ordering different tests and treatments based on race alone. Race is only a small (and of little significance, in my opinion) piece of the clinical picture. [ID 391]</p> <p>I find that many examples of race-based medicine lack substantiated and scientific support. Additionally, assuming the race of persons or assuming that a person is or is/is not multiracial is not appropriate for a practitioner to do. Furthermore, for learners at our stage we should be looking to keep our differential diagnoses and treatment options as broad as possible. We do learn ‘you can’t diagnose it if you don’t think of it.’ If you discount your ideas of what could be going on with a patient based on race-based medicine that you were forced to memorize to answer some board questions, that is an extraordinary disservice to your patients. [ID 100]</p> <p>“There are diseases that are more prevalent in specific ethnicities, such as Thalassemia in Mediterranean populations. Things like this with firm genetic evidence should be taught because they’re true.” [ID 230]</p> <p>I think that race is very intricately related with medicine and truthfully cannot be ignored, nor should it. Race is one of the social determinants of health that most influences a person’s health and access to health. Race-based medicine can be positive for health outcomes if taught and used in the correct manner. What race-based medicine should not do is cause physicians to group, stereotype, and overlook potential diagnoses just because they believe another diagnosis fits better due to that person’s race. What race-based medicine can do is help the field of medicine grow and understand why people of a certain race suffer from different diseases more often than people of a different race. When you have a public health problem, such as a maternal mortality rate over twice the national average in Black women, you HAVE to ask why and you have to consider if their race is influencing the implicit bias of the physician’s caring for them that causes them to overlook something that might not have been overlooked for a person of a different race. I think race-based medicine should be taught in the context of making medical students aware that implicit bias is a very real thing and can have devastating consequences on a patient’s health outcomes and that we are not exempt from overcoming our own bias and from continuously advocating for our patients. [ID 106]</p> <p>“Yes, and no. Yes, ONLY because that’s how the boards test it (unfortunately). No because it’s not good medicine. So ideally, I would like to see medical schools teach to the boards, but then mention that in practice, it’s different, and then talk about the pitfalls of race-based medicine in practice. So basically, this is an unfortunate reality of the situation, and it’s not entirely up to medical schools whether they get to decide to teach it or not, but how they approach the subject is up to the medical schools.” [ID 364]</p>

Table 3: (continued)

Theme	Quotations
	This is tricky. I think that there is a place to mention what race-based medicine is so that we are aware of its existence. However, every patient is an individual with specific needs, regardless of race, so it is up to the doctor and patient to come up with the best plan. Medical judgment shouldn't be based blindly on an individual's race without further exploring the patient's needs. [ID 139]
	I think a lot of people don't know about it, just like the term "microaggressions." It is necessary for people of different races and backgrounds to understand the meaning behind it especially in medical school since we'll be caring for people of various races. [ID 31]

ACE, angiotensin converting enzyme; ACEi, angiotensin converting enzyme inhibitor; ARB, angiotensin receptor blocker; BP, blood pressure; CCB, calcium channel blocker; GRF, glomerular filtration rate; TZD, thiazolidinedione; USPTF, United States Preventive Services Task Force.

participants familiar with the term were asked to report where they first heard the term "race-based medicine." A total of 178 out of 221 (80.5% response rate) participants provided an open-ended response. The majority (n=105, 59.0%) first heard the term during medical school, followed by 31 (17.4%) in undergraduate school, 22 (12.4%) in the medical or lay literature, seven (3.9%) from peers, five (2.8%) during cultural competency training, and eight (4.5%) from other places. Where participants first heard race-based medicine was not associated with knowing the correct definition of the term ( $\chi^2=5.393$ ,  $p=0.370$ ).

Part of the way through the questionnaire, all participants were provided the definition of race-based medicine: race-based medicine refers to utilizing race or ethnic groups as a means of diagnosing and treating patients [19]. Then, participants were asked if they ever had a teacher or professor teach race-based medicine in class or lecture. More than half (n=233, 53.2%) of the participants indicated 'yes' to this question. This finding did not differ by age ( $t=1.645$ ,  $p=0.101$ ), race ( $\chi^2=7.323$ ,  $p=0.120$ ), gender ( $\chi^2=0.119$ ,  $p=0.730$ ), medical school campus ( $\chi^2=2.808$ ,  $p=0.246$ ), or intention to pursue primary care ( $\chi^2=1.837$ ,  $p=0.175$ ); however, medical students in years 2, 3, and 4 were more likely to indicate that they had a teacher or professor teach race-based medicine compared to first-year medical students ( $\chi^2=14.386$ ,  $p=0.002$ ). Next, participants were asked if they thought medical schools should teach race-based medicine. A total of 231 (61.4%) participants endorsed 'yes' to this question. This finding did not differ by age ( $t=-0.642$ ,  $p=0.521$ ), race ( $\chi^2=8.185$ ,  $p=0.085$ ), gender ( $\chi^2=0.511$ ,  $p=0.475$ ), year in medical school ( $\chi^2=5.522$ ,  $p=0.137$ ), medical school campus ( $\chi^2=1.673$ ,  $p=0.433$ ), or intention to pursue primary care ( $\chi^2=0.194$ ,  $p=0.660$ ).

Lastly, participants were presented with five agree-disagree statements about race-based medicine (Table 1). A total of 228 (62.8%) of participants 'agreed' or 'strongly agreed' that race-based medicine was practiced in society. Bonferroni corrections showed that participants who self-identified as Black or African American were more likely to

'strongly agree' with this statement compared to participants who self-identified as Asian, Hispanic or Latinx, White, or another race not listed ( $\chi^2=54.836$ ,  $p<0.001$ ). Sixty-one participants (16.8%) 'disagreed' or 'strongly disagreed' that race should be considered when diagnosing patients, and 37 (10.2%) 'disagreed' or 'strongly disagreed' that race should be considered a risk factor in diseases. Both of these findings differed by racial identity, such that participants who self-identified as Black or African American were more likely to 'strongly disagree' compared to participants who self-identified as Asian, Hispanic or Latinx, White, or another race not listed ( $\chi^2=55.713$ ,  $p<0.001$ ;  $\chi^2=42.643$ ,  $p<0.001$ , respectively). Nearly half (n=161, 44.4%) of participants 'agreed' or 'strongly agreed' that race-based medicine was taught in the medical school curriculum; participants who self-identified as Black or African American were more likely to 'strongly agree' with this statement compared to all other participants ( $\chi^2=52.233$ ,  $p<0.001$ ). Finally, 283 (78.0%) participants 'agreed' or 'strongly agreed' that medical school taught them how to treat patients regardless of race. Participants who self-identified as White were more likely to 'strongly agree' with this statement compared to participants who self-identified as Asian, Black or African American, Hispanic or Latinx, or another race not listed ( $\chi^2=57.458$ ,  $p<0.001$ ). In addition, participants who identified as men were more likely to 'strongly agree' that medical school taught them how to treat patients regardless of race compared to participants who identified as women or self-described gender ( $\chi^2=14.980$ ,  $p=0.005$ ). No other differences were observed by age, year in medical school, medical school campus, or desire to pursue a career in primary care.

## Qualitative themes

### Examples of race-based medicine

Participants were asked to provide examples of when they heard or experienced race-based medicine (see Table 3 for

additional quotations). A total of 216 (49.3%) participants offered written descriptions of their experiences with race-based medicine. The majority of examples included references to blood pressure medication, glomerular filtration rate (GFR) and kidney function, and screening for sickle cell, sarcoidosis, lupus, and type 2 diabetes:

“It happens frequently when dealing with hypertension medication. It is routinely taught to start a Black patient on a CCB [calcium channel blocker] when the general first line is usually a thiazide medication. The research that pointed toward this race-based prescribing practice had flaws in its design bringing into question the need to change prescribing practices based on a patient being Black.” [ID 15]

“In our cardiovascular block in the first year of medical school, we had a few lectures on treatment guidelines for hypertension. In these guidelines, the first anti-hypertensive medicine you prescribe could differ whether you identified as Black or non-Black. Additionally, in our labs on spirometry, there were settings on the meter to choose your race. Now even in the hospital, I see renal function panels come back with estimated GFR (eGFR) values split into eGFR for African American patients and for non-African American patients. These two values while close were different and could potentially change diagnosis and treatment.” [ID 174]

Participants also noted its presence on board examinations. They stated that race was utilized frequently to indicate specific diagnoses:

“Specifically, when referring to review questions for board exams, race is often used as a clue. For example. A young African American woman with certain symptoms is guaranteed to be sarcoidosis. Every question stem will mention an African American female if it is about sarcoidosis.” [ID 368]

“For board exams knowing the buzz words gives you a huge leg up. If they say it's an Asian infant with bruising on the buttocks that needs to trigger Mongolian spots for a student.” [ID 204]

“Board examinations contain race-based questions.” [ID 147]

Several students went on to say that board examinations needed to be changed first before medical education could be changed:

“In a perfect world, race-based medicine would not be taught because it is not exactly accurate. I would discuss socially based medicine in terms of different socioeconomic groups who are at more risk of diabetes/hypertension and immigrant populations who are at risk of certain illnesses due to difference of immunization schedules. But the problem is that [board examination name] still has race-based questions. So not touching on this and not teaching students how to do the test would be a disservice to students. So, I think board exams need changed first.” [ID 114]

## Support and opposition for race-based medicine

Justifications varied greatly for the participants who supported the teaching of race-based medicine in medical school. Some students argued their stance from an epidemiological perspective, utilizing race as a data point:

“Just as women are more likely to get breast cancer, certain races are more likely to acquire certain diseases. Using this information is no different than utilizing patient details such as gender, age, and occupation.” [ID 340]

“I believe it is important to include the specific data associated with various populations when practicing medicine. There are other population groups that have increased risk factors including gender, age, etc. Therefore, I believe it is important to attempt to boil a very detailed set of data points down into the most concise but accurate information possible.” [ID 140]

Others offered a practical point of view, maintaining that race-based medicine should be taught because board examinations included race-based questions:

“Currently, yes. Board examinations contains race-based questions.” [ID 147]

“If it is on board exams, yes. With the caveat that it's on boards.” [ID 368]

Alternatively, many participants explained that medical school should teach students about race-based medicine from a historical perspective to address bias and correct unethical medical practices. While these students indicated support for the teaching of race-based medicine, in actuality, they advocated for increasing awareness about dangers of race-based medicine rather than the endorsing the practice of race-based medicine:

“I believe medical schools should teach about race-based medicine, but not teach race based medical practice. Students should be aware of the concept but not be taught practice it.” [ID 58]

“I think medical schools should make students aware it exists. They should not teach students that different races should receive less quality of care due to racial differences. Students should be aware that this bias exists.” [ID 12]

The participants who opposed the teaching of race-based medicine explained that race-based medicine contradicted osteopathic principles and practice. They pointed out that the patient should be the priority and that treatment should focus on the whole person. Further, many felt that utilizing race for a diagnosis and/or treatment introduced bias,

which could lead to stereotypes, discrimination, and adverse health outcomes:

“No, I believe that medicine should be individualized and tailored to the patient. Using race as a means to treat and diagnose a patient completely contradicts the foundation of osteopathic medicine, that is to treat the whole person. By singling out one small aspect of a patient's history and prioritizing that information over other markers, is wrong. We should not treat a patient based on the statistics of a group of people from similar racial backgrounds.” [ID 57]

“You cannot accurately determine someone's race or ethnicity on appearance alone. Relying on race-based medicine opens many avenues for bias and discrimination.” [ID 145]

“I don't think medical school should teach race-based medicine because I think it can lead to medical students thinking there are biological differences between races even though it is a social concept.” [ID 144]

## Discussion

In this cross-sectional survey study, we examined osteopathic medical students' knowledge, beliefs, and experiences with race-based medicine. Prior to the study, half (52.0%) of the participants had heard of the term “race-based medicine.” Among those participants, slightly less than half (44.4%) provided the correct definition for the term. Participants self-identifying as Black or African American indicated greater familiarity with the term compared to all other races; however, race was not associated with providing the correct definition of race-based medicine. This finding is important because familiarity with race-based medicine may be a new indicator of structural racism in medical education, which in turn, could lead to negative outcomes (e.g., emotional distress, feelings of isolation) [20]. For example, participants who are familiar with race-based medicine may have had personal experience with it or bear the emotional burden of explaining it to their peers. More research is needed to test this hypothesis to see if there is an association among familiarity with race-based medicine, structural racism, and mental health in osteopathic medical students.

After reading the definition of race-based medicine, the majority of participants (62.8%) agreed that race-based medicine was practiced in society; however, few disagreed that race should be utilized to diagnose patients (16.8%) or be considered a risk factor in disease (10.2%). Further, 61.4% supported the teaching of race-based medicine in medical school. Qualitative findings expounded on participants' support and opposition for teaching race-based

medicine in medical school. Those in support explained that medical school should teach students about the history of race-based medicine in order to address bias in medicine. Others cited race as a data point in epidemiology and the use of race-based questions on board examinations. Participants in opposition of teaching race-based medicine reasoned that it contradicted osteopathic principles and practice. Along those lines, osteopathic philosophy articulates that osteopathic physicians are trained to treat the whole person [21]. This means that osteopathic medical education teaches students to look beyond organ systems and body parts, which includes skin color. Thus, a holistic approach to care that acknowledges the person as a unit of body, mind, and spirit would not rely on racial or ethnic group to make a diagnosis or prescribe a treatment.

In the last two years, several medical institutions released public statements condemning racism and race-based medicine. In 2020, the American Osteopathic Association released a statement denouncing racism and pledging to commit themselves to address health inequities [22]. Similarly, the American Association of Colleges of Osteopathic Medicine released a statement in 2020 calling upon the osteopathic community to speak out against racism and injustice and called for change in overtly and implicitly racist practices [23]. The American Medical Association also denounced racism, referring to it as a serious public health threat, and committed themselves to the development of education and policy to dismantle structural racism and advance social justice [24, 25]. Further, the American Academy of Family Physicians defined race as a social construct and published a statement that opposed the practice of race-based medicine [26]. Moreover, several top medical journals, including the *Lancet* [27] and the *New England Journal of Medicine* [28], published commentaries that addressed racism and the dangers of race-based medicine [7]. These statements reflect the current and future practice of medicine. Integrating these statements into the osteopathic medical curriculum may be an innovative approach to educating students about race-based medicine, structural racism, and health inequities.

Racial inequities in health and healthcare are well-documented [29]. For example, Badreldin and colleagues [30] in 2019 conducted a retrospective cohort study with 9,900 women and found racial and ethnic differences in women's postpartum pain scores, inpatient opioid dosing, and receipt of an opioid prescription at discharge, such that Hispanic and non-Hispanic Black women had greater odds of reporting higher pain scores but decreased odds of receiving inpatient opioid medication and opioid prescriptions at discharge. Further, Goyal and colleagues [31] in 2015 examined 940,000 emergency department visits

from the National Hospital Ambulatory Medical Care Survey and found that only 12.2% of Black pediatric patients with appendicitis received opioids for severe pain as compared to 33.9% of White pediatric patients. Another retrospective cohort study by Tangel and colleagues [32] in 2020 evaluated 6,879,332 women who underwent deliveries and found that Black women were more likely to experience severe maternal morbidity during childbirth compared to White women. In addition, Black women were more likely to receive general anesthesia for cesarean delivery and less likely to receive analgesia for vaginal delivery compared to White women [32]. Racial inequities in medicine affect the health and well-being of people of color. Utilizing evidence-based examples to teach osteopathic medical students about race-based medicine and how it contributes to racial bias and systemic health inequities, may transform the way race is discussed in medical education. Participants in our study supported the teaching of historical examples of race-based medicine in order to learn about individual and structural racial bias. Tsai and colleagues [11] state that discussing race and denouncing race-based medicine are essential to promoting an antiracist educational environment.

This cross-sectional survey study of osteopathic medical students' understanding of race-based medicine was a first step in opening a dialog about race-based medicine in osteopathic medical education. The recommendation to denounce race-based medicine from osteopathic medical education does not dismiss the value of race in epidemiology. Race captures important epidemiological information (e.g., racism, discrimination) that can be utilized to identify populations at increased risk for health inequities [33]. Importantly, students must understand the difference between epidemiological statistics and genetic risk factors. The problem with listing race as a risk factor is that it infers a biological or genetic component to a diagnosis and/or treatment, which diverts attention and resources from the social determinants of health that contribute to racial health inequities [7]. A 2019 study by Krishnan and colleagues [34] demonstrated the problem with listing race as a risk factor in medical cases. Krishnan and colleagues [34] reviewed 63 Aquifer virtual teaching cases to examine the presentation of race and culture. They found that the cases did not distinguish race as a genetic risk factor from race as a social construct [34]. Further, the language utilized in the cases placed value judgments on the patients' characteristics and behaviors, further perpetuating racial and cultural stereotypes [34]. To address these racial and cultural biases, Krishnan and colleagues [34] developed a structured guide to revise medical cases, with suggested edits, language examples, and evidence for these recommendations.

White-Davis and colleagues [35] developed an interactive training module to address the historical context of race and unconscious processes that create bias when interacting with people of color. A total of 120 participants completed this interactive training module, and the findings showed changes in participants' knowledge and attitudes toward racism and health inequities and improved confidence in teaching about racism [35]. Both studies recommend that medical educators utilize these teaching resources to address racism and health inequities in the curricula.

## Limitations

The current study had several limitations, including the study sample from one osteopathic medical school with three campuses in a Midwestern state, the lack of a validated questionnaire, participants' self-reported data, and missing data. Data from one osteopathic medical school limits the ability to generalize the findings to other colleges of osteopathic medicine; therefore, the findings do not reflect all osteopathic medical students' knowledge and beliefs of race-based medicine or the profession's understanding of race-based medicine. Further, this study did not collect data from practicing physicians' knowledge, beliefs, and experiences with race-based medicine. Practicing physicians create, implement, and oversee medical school curricula, serve as preceptors for students during rotations, and mentor students throughout their career development. Thus, future research should examine osteopathic physicians' and medical students' understanding of race-based medicine. Data should be collected from multiple colleges of osteopathic medicine representing different geographic regions across the United States in order to reflect the profession.

Next, the response rate (44.0%) was moderate, and therefore the findings are susceptible to response bias and selection bias, such that the participants who volunteered to participate in the study may have differed in some ways from the students who chose not to participate in the study. Thus, our findings, particularly the group comparisons, may not reflect the knowledge, beliefs, and experiences of all osteopathic medical students at this institution. To minimize these biases, we informed participants that their responses were anonymous and could not be linked back to their personal identity. In addition, we emphasized that participation was voluntary and explicitly informed participants that their responses would not affect their academic performance in any way. Participants also self-reported their knowledge, beliefs, and experiences with race-based medicine. Thus, it is possible that students may

not recall previous experiences with race-based medicine in their education. Finally, several of the questions have missing data where participants chose not to respond to certain questions. Missing data reduce statistical power, introduce nonresponse bias, and reduce the representativeness of the sample. Future longitudinal research should assess medical students' knowledge, beliefs, and experiences with race-based medicine at multiple time points throughout the year with a larger, more racially and ethnically diverse sample of osteopathic medical students, from multiple schools in different geographic regions.

## Conclusions

In this cross-sectional survey study, half of the participants were familiar with race-based medicine, and of those, less than half knew the definition of the term. This identifies a gap in knowledge that medical educators may want to address given the numerous public statements released by many medical organizations addressing racism. Importantly, participants in this study expressed a desire to learn more about the historical perspectives of race-based medicine as well as recognized the contradiction between osteopathic philosophy and race-based medicine. Highlighting osteopathic philosophy and its focus on the whole person may be an impactful approach to denouncing race-based medicine in osteopathic medical education.

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