# Underrepresented Minorities and the Pipeline into Medical School with Undergraduate STEM Studies

Nika Daryooni

College of Professional Studies, Marywood University

SLAS 6013: Qualifying Seminar

Dr. Alexander R. Dawoody

October 15, 2025

**Abstract**

While the racial diversity of the United States (US) is increasing, Black/African American, Hispanic/Latino, American Indian, and Alaska Native physicians continue to remain underrepresented in medicine, mostly commonly referred to as URiM (underrepresented in medicine). A disproportionate physician workforce to the general US population contributes to healthcare inequities, particularly in minority, underserved communities. This paper examines the educational pipeline into medical school, with a focus on the undergraduate STEM experience for URiM students, which serves as a gateway into medical school to begin the process of physician training and education. A detailed literature review was conducted and analyzed using the following theories: critical race theory, social capital theory, human capital theory, and ecological systems theory. From the literature, systemic barriers were identified including a lack of access to mentorship, academic support, and institutional resources. This paper challenges to increase physician diversity requires reforms and policy changes at the undergraduate education level. This includes expanding and incorporating mentorship programs, embedding experiential learning into the curriculum, and expanding the holistic admissions process into medical schools. Addressing the challenges is not only essential for the educational attainment of students but also for improving public health outcomes and creating opportunities for intergenerational mobility within URiM communities.

*Keywords: underrepresented in minorities in medicine (URiM), STEM education, physician workforce diversity, educational pipeline*

**Table of Contents**

**Underrepresented Minorities and the Pipeline into Medical School with Undergraduate STEM Studies**

**Introduction**

The racial demographics of the United States have become more diverse, with over one-third of the population identifying as Black/African American, Hispanic, Alaskan Native, or American Indian. However, only 9% of practicing physicians come from these backgrounds, which highlights a significant shortage of minority-identifying physicians (Osseo-Asare et al., 2018). As a result, the American Association of Medical Colleges has labeled students and physicians from these groups as Underrepresented Minorities in Medicine (URiM) (Roche et al., 2020; Underrepresented in Medicine Definition, 2019).

Despite initiatives to increase diversity within healthcare, underrepresented minorities continue to be significantly underrepresented in both medical schools and practicing physicians. The lack of underrepresentation is shown throughout the educational pipeline as they build upon each other from primary school, undergraduate studies, and medical school which are all steps in becoming a physician. As a result, in order to increase physician diversity, systematic inequalities need to be addressed. Without matriculation into medical school, physician education and training cannot begin. Currently, in comparison to the general population, URiM students represent a small percentage of medical school enrollments in the US. The roots of this issue extend beyond the admissions process itself, as a combination of factors that contribute to the challenges faced by URiM students in gaining admission to medical schools.

Studies have shown that physicians from underserved backgrounds are more likely to return to their communities to practice medicine (Fenton et al., 2016; Grumbach & Mendoza, 2008; Ogunyemi et al., 2007; Xierali et al., 2018). Achieving a physician workforce that mirrors the diversity of the U.S. population not only enhances the quality of care but also helps to reduce

health disparities (Xierali et al., 2018). Increased diversity leads to better health outcomes and access to care for underserved communities, fostering improved communication and patient satisfaction (Mason et al., 2022).

The United States Census Bureau anticipates that between 2040 to 2050, the racial minority population will be larger than the current majority in the country. It is important to recognize that, while only 9% of physicians identifies as a URiM, over half of all minority patients, as well as 70% of non-English-speaking patients, seek care from URiM physicians. To tackle the systemic issue of the minority physician shortage, it is essential to create a more diverse pool of medical school applicants, which begins with addressing educational inequalities faced by URiM students at an early stage. For a student to be accepted into medical school, they need to have completed an undergraduate education with STEM prerequisites.

This paper examines the experiences of URiM undergraduate students as they work towards achieving medical school admissions. To understand how to increase the diversity of physicians, a dive into the systems is needed. It will focus on three key perspectives: educational policy, socioeconomic factors, and institutional culture. Drawing on four theoretical frameworks, including critical race theory, social capital theory, human capital theory and ecological systems theory, this analysis will examine the structural forces that contribute to inequality and propose policy recommendations aimed at improving access, representation, and outcomes for URiM STEM undergraduate students matriculating into medical school and addressing the pipeline.

## Literature Review

### Medicine and Physician Workforce

One factor in combating health disparities is the need to increase the racial diversity of healthcare professionals (Bannerman et al., 2020; Marrast et al., 2014; Xierali et al., 2018). With

the current increases in diversity in medicine, the effects have shown that quality care and access for underserved communities have improved, resulting in vital communication and patient satisfaction (Mason et al., 2022). The population of the racial minorities in the United States (US) is predicted to surpass Whites between 2040 and 2050, as projected by the United States Census Bureau (Craig et al., 2018).

However, roughly 20% of all healthcare professionals identify as members of one or more of the underrepresented racial minority groups, creating a shortage of minority physicians (Marrast et al., 2014; Thompson-Rogers et al., 2018). The Association of American Medical Colleges (AAMC) defines underrepresented minorities in medicine as racial and ethnic groups that lack equal representation to the general population (Underrepresented in Medicine Definition, 2019). Underrepresented minorities (URiM or URM) identify with one or more of the following racial and ethnic groups: Black or African American, American Indian, Alaska Native, and Hispanic or Latino (Facts Glossery, n.d). In terms of defining underrepresented minorities in medicine, Asian minorities are not considered. Asian students are not categorized as underrepresented minorities because Asian backgrounds are the second-largest racial representation in medicine (Zhang et al., 2017). Traditionally, Asian minorities are viewed as a model minority group because they have higher income and educational attainment levels than any other minority group in the United States (Mcgee et al., 2017).

Currently, minority physicians provide most of the care to underserved minorities in healthcare, serving approximately 54% of minority patients and 70% of non-English-speaking patients in the United States (Higgins et al., 2016; Marrast et al., 2014). A shortage of physicians practicing in communities with disadvantaged patients is a significant contributor to healthcare inequalities (Higgins et al., 2016; Komaromy et al., 1996; Marrast et al., 2014; Morris et al.,

2021). Access to healthcare and physicians within US communities remains a challenge in areas where communities lack convenient access to healthcare (Ogunyemi et al., 2007; Xierali et al., 2018). Studies have found that underrepresented minority physicians have a higher rate of serving as primary care physicians and within underserved communities (Grumbach & Mendoza, 2008; Ogunyemi et al., 2007; Xierali et al., 2018).

Given the general growth of the US population, the number of Black/African American or Latino/Hispanic physicians has seen little to no growth (Xierali et al., 2018). From retrieval data, approximately 13% of the United States population identifies as Black/African American, but around 5% of physicians identify (Castillo-Page et al., 2019; Roche et al., 2020). Data indicates that the number of practicing physicians from underrepresented groups is not representative of the US population. For instance, around 1.3% of the general US population identifies as Native American or Alaska Native, but roughly 0.3% of all physicians identify as such. Additionally, roughly 5.8% of the physician workforce identifies as Hispanic/Latino, as compared to where around 18.5% of the general US population identifies (Castillo-Page et al., 2019; United States Census, n.d.).

**Medical School**

To alleviate disparities within medicine and build a more diverse physician workforce, recruiting a more diverse student body for medical school is critical. Increasing the diversity of medical school students will ultimately lead to a greater number of minority physicians serving minority communities and help alleviate medical disparities (Cestone et al., 2018; Goode & Talbot, 2016; Marrast et al., 2014; Mason et al., 2022). Historically, the enrollment of minority students in medical school has been low. In 1964, approximately 2% of all medical school students were. During this time, because so few Hispanic/Latino and Native American students

were in medical school, the AAMC identified all minority students as Black/African American (Hutchins et al., 1967; Poole et al., 2020). The AAMC did not establish unique racial categories for student demographics until 1970. In 1971, with the unique categories established, 8% of all medical school students identified as one of the four underrepresented URiM categories (Poole et al., 2020).

Examining the 2024-2025 enrollment data sets from the AAMC for a Fall 2024 matriculation into medical schools in the US, 7.03% of students matriculating in Fall 2024 identified as Black/African American, and the matriculation patterns for other URiM students is lower. 5.86% of matriculating students identified as Hispanic/Latino. 0.15% of all students matriculated identified as American Indian or Alaska Native, only 35 students identified while there was an overall matriculation of 23,156 students in Fall 2024 (Association of American Medical Colleges, n.d.). In comparison to their peers that identified as White or Asian, as their races together comprised of 68.76% of all Fall 2024 matriculants; 27.66% Asian and 41.10% White (Association of American Medical Colleges, n.d.).

Racial minority representation in the general population is increasing; however, the rate of medical school students identifying as a racial minority is not proportionately represented. The general population has seen an increase in Black /African American, Hispanic/Latino minorities, but their medical school matriculation rates are not parallel to those of the general population. There is a significant underrepresentation of minority students in the medical field (Acosta et al., 2017; Lett et al., 2019; Morris et al., 2021). The number of minority students in medical school has increased minimally from 1980 to 2024. In 1980, 6% of matriculating medical school students identified as Black/African American, while in 2024, the percentage identified as 7.03%, roughly one percentage point between 44 years. Hispanic/Latino student enrollment has

also slightly increased, with 4.9% of all students identifying as Hispanic/Latino in 1980 and rising to 5.86% in 2024. While there has been an increase for some racial minority categories, for Native American or Alaskan Native students, more students enrolled in 1980 than in 2024. In 1980, 0.4% of all students identified as Native American or Alaska Native, compared to 0.15% of the enrollment in 2024 (Acosta et al., 2017; Association of American Medical Colleges, 2025).

URiM enrollment into medical schools is highly visible, and medical schools have taken steps in addressing the shortage of URiM students matriculating into medical schools. A review of all 148 medical schools in the United States by researchers Chen et al. (2018) found that 112 of the medical schools reviewed had a diversity office. Many of the diversity offices employed staff members from underrepresented backgrounds. The diversity offices on medical school campuses all ultimately have similar roles, which is to recruit, retain and support underrepresented minority students in their institutions (Chen et al., 2018). In addition to diversity offices on campus, medical schools are adding diverse learning environments and clinical settings to increase diversity and awareness among their student bodies (Acosta et al., 2019).

Medical schools have also increased their efforts beyond diversity offices to recruit students from underrepresented backgrounds. One example is a pilot program from Virginia Commonwealth University (VCU) to increase Hispanic/Latino students matriculating into medical school. From this, they conducted a longitudinal study by establishing a centralized student organization for Hispanic students, engaging in philanthropic activities, offering student mentorship, and promoting leadership development. By implementing additional support and

resources, the medical school at VCU observed an increase in medical school enrollment among Hispanic students (Diaz et al., 2019).

Further, research indicates that a diverse student population enhances the understanding of other cultures and experiences among the student body. The experience of a more diverse student body has demonstrated that students find greater comfort in working with multicultural patient populations (Acosta et al., 2019; Sherrill et al., 2016). All students, regardless of racial background, have shown benefits from being in a diverse classroom by being more motivated and engaged in serving more diverse backgrounds by gaining an understanding of diverse backgrounds, including perspectives, philanthropic involvement, and cultural competency and understanding of others (Gurin et al., 2002). A study conducted by Morrison et al. (2013), researchers examined survey data of fourth year medical school students within 118 medical schools to examine the relationship of students' perspectives within diverse student populations. The researchers concluded that medical school students in graduating classes with a more diverse student population validated previous literature, indicating that they had learned more from others and were more accepting of racial diversity (Morrison et al., 2013).

### *Medical School Admissions Processes*

The core mission of medical schools is to provide education to create the physician workforce (Stegers-Jager, 2018). Medical schools admit students based on both academic and non-academic criteria that are stated as determining factors in students to complete a medical degree (Gay et al., 2018). Medical school admissions boards aim to admit talented students who also demonstrate characteristics that will enable them to complete their curriculum and fulfill the medical school's mission. Admissions reviews for medical school applicants focus on a holistic review process (Gay et al., 2018). The AAMC has established guidelines for 15 core

competencies, categorized into four sections: interpersonal, intrapersonal, thinking and reasoning, and science, for entering medical school students (Core Competencies for Entering Medical Students, 2020).

Upon reviewing the student's medical school application and materials submitted, admissions officers review to ensure that students are meeting these competencies through the admissions process. The admissions process for US medical schools is standardized through a common application service. This includes grade point averages (GPA) of all post-secondary coursework which includes undergraduate courses and if a student has graduate coursework. In addition to an overall GPA, applicants' GPAs are broken down into a science GPA, as well. Additional numerical metrics include the Medical College Admissions Test (MCAT) score. Outside of metrics, students report on experiences such as employment, volunteer opportunities, research, internship, and leadership experiences. Students include a personal narrative to support their application, and recommendation letters are submitted on their behalf to support their application. The application process includes both standardized numerical metrics and student experiences, narratives and recommendations (Agahi et al., 2018; Aditya & Fan, 2017; Cooper et al., 2019; Gay et al., 2018; Hirshfield et al., 2019).

Jones et al. (2021) report that URiM students who are accepted into medical school had a more rigorous and scrutinized process than their peers. In addition to the process, gaps in academic metrics and student experiences are prevalent in URiM students. This can be contributing to the fact that the source or inequity is observed throughout a student's entire life. Some of these inequities include that URiM students have limited financial resources while attending college which can contribute to URiM students having to prioritize paid employment

to support their education versus gaining internships, shadowing and clinical experiences to further enhance the requirement of their medical school applications (Lucey & Saguil, 2020).

In addition to GPAs, all students entering medical school are required to take prerequisite coursework to demonstrate their mastery in specific science courses. It has been indicated that these sets of prerequisite coursework are considered the groundwork for student success in medical school (Hirshfield et al., 2019). In a review of survey data, medical schools have consistently emphasized that a student's undergraduate GPA and MCAT score are the most impactful criteria used to determine which applicants receive an interview (Agahi et al., 2018; Corridon, 2021; Henderson et al., 2018; Sladek et al., 2016). Research has found that underrepresented minority students tend to score lower on the MCAT exam and have lower GPAs when compared to their peers. With lower indicators, their acceptance rate into medical school decreases (DeCarvalho et al., 2018). The influence and weight that MCAT test scores hold within the medical school admissions process create persistent challenges for underrepresented minority students seeking admission (Lucey & Sagui, 2020). Even when students from underrepresented minority backgrounds are admitted to medical school, they are more likely to have lower test scores and science grade point averages (Jones et al., 2020; Lucey & Saguil, 2020).

**Undergraduate GPA and Prerequisite Coursework.**

Research has demonstrated that a student's undergraduate GPA is a strong predictor of future performance in medical school (Kotter et al., 2016; Sladek et al., 2016; Puddey & Mercer, 2019). A student's GPA is calculated through various methods in the medical school admissions process. The student's overall GPA is a factor in the process. Apart from the overall GPA, a student's science GPA is considered in the admissions process (Agahi et al., 2018; Association of

American Medical Colleges, 2020). The science GPA measures coursework completed in Biology, Chemistry, Physics, and Mathematics, commonly known as "BCPM" (Association of American Medical Colleges, 2020).

While all students aspiring to matriculate into medical school are required to complete prerequisite coursework, research has shown that specific courses in the sequencing of pre-med coursework, especially within Chemistry, have been identified as a barrier for pre-medical students, particularly in organic chemistry. Research at elite colleges and a large public university yielded that students from underrepresented racial minority backgrounds cited that coursework, one or more courses in Chemistry, yielded higher attrition rates for URiM students than their White and Asian peers (Harris et al., 2020). Gaps in grades within STEM courses are highly prevalent among URiM students who underperform compared to their peers.

Furthermore, in a 15-year longitudinal study at a large public university, researchers tracked the grades of over 25,000 students enrolled in General Chemistry and Organic Chemistry coursework. The researchers found that students from underrepresented racial backgrounds scored .54 grade points less than their peers. Another indicator was that the rate of not persisting in the Chemistry course sequence was higher for underrepresented racial minority students than their peers. Without persisting from the first course into the next course of the sequence, students cannot complete the chemistry course sequences to meet the prerequisite requirements for medical school (Harris, 2020).

**MCAT Exam.**

The MCAT is the required standardized medical school admissions exam for all students seeking admission into medical school (The Parts of Your Medical School Application, n.d.).

The exam consists of four sections that test students on the chemical and physical foundations of biological systems, the biological and biochemical foundations, critical analysis and reasoning, and the psychological, social, and biological foundations of behavior (What's on the MCAT Exam?, n.d.). The four sections are assessed individually on a scale of 118-132, with a median score of 125 for each section, for a maximum total score of 528. The overall median and mean of MCAT test scores fall around 500 points (The MCAT Exam Score Scale, n.d.). However, the range of acceptable MCAT scores is vast, and that does not include a minimum or maximum score for admissibility. While the medical school admissions process is holistic, research has found that there is a correlation between MCAT exam scores and a predictor of academic success as a medical school student and passing of the licensing board exams (Lucey & Sagui, 2020)

Research has shown that applicants with lower MCAT scores tend to have lower acceptance rates (Lucey & Sagui, 2020). When examining MCAT scores in the medical school admissions process, it has been found that the mean scores differ between test takers of self-identified races within African American and Latinx groups versus their peers (Davis et al., 2013; Lucey & Sagui, 2020). Disparities and gaps exist within the different racial groups of test-takers. Students from different backgrounds have varying educational preparedness and unequal opportunities, which contribute to the gap in MCAT test scores (Lucey & Sagui, 2020).

**Pre-Med Student Services**

Becoming a physician starts before the first day of medical school (Gross et al., 2008; Michalec et al., 2018). Although not widely accepted, professional structures are cultivated during the pre-professional experience before matriculating into medical school. The impact of pre-medical and health profession offices on the admissions process into medical school is

increasingly growing and is a powerful component in a student's pre-med journey. While medical schools establish admissions standards, pre-medical offices are responsible for implementing these requirements to matriculate students into medical schools (Michalc et al., 2018). Students who participate in pre-medical programs and research programs contribute to the success of aspiring pre-medical students, especially students from underrepresented minority backgrounds ("Altering the Course Black Males in Medicine," 2015).

Pre-medical students exhibit higher levels of burnout and depression when compared with their peers who are not on the pre-medical pathway (Aditya & Fan, 2017; Fang et al., 2010). Students attending lower-resourced post-secondary institutions, many of which are minority-serving institutions, have less access to coursework, research, and activities that can enrich their application service, given the lack of pre-med services. Many of these schools also lack access to pre-med and health professions, advisors, and services (Lucey & Sagui, 2020).

Undergraduate success as a pre-medical student is a key factor in determining matriculation into medical school ("2026 AMCAS Applicant Guide", 2025). Researcher Hadinger (2017) interviewed 33 underrepresented medical school students who identified as African American/Black or Hispanic/Latino and were enrolled in allopathic medical programs (MD) at various institutions, regarding the reasons for pursuing a medical school education. The major themes for persistence and seeking medical school admissions were mentorship, a drive to help others, and an interest in science and medicine. However, the participants cited barriers present before and during the admissions process, including a lack of information, financial strains, and a lack of social support that the students faced while applying to medical school (Hadinger, 2017).

Recent research on underrepresented minority pre-med students in the University of California system found that study participants rated their undergraduate experiences as pre-med students. URiM students' pre-med experiences were explicitly lower than their overall collegiate experience (Uwaezuoke, 2018). A significant theme among underrepresented pre-medical students surveyed was a lack of support from the institution or peers, or feeling unprepared for their experiences as pre-med students (Dumke et al., 2018; Grace, 2017; Hadinger, 2017; Uwaezuoke, 2018). Furthermore, a recent study from Bannerman et al. (2020) found that underrepresented minority students faced challenges that included inadequate exposure to the field and the lack of mentorship and guidance. Due to a lack of institutional support, underrepresented pre-med students who participated in mentorship and guidance programs experienced an increase in medical school matriculation and felt more supported throughout the process (Castleman et al., 2017; Dumke et al., 2018).

Among Hispanic/Latino students, researchers found that those in their study expressed an interest in pursuing medicine based on their experiences and the adversity they faced with the healthcare system (Talamantes et al., 2016). The students cited barriers they faced as pre-med students, including the need for additional guidance and assistance throughout their time in this role, feeling a lack of preparation, and financial obstacles, which added to the stressors and common issues faced while working towards achieving medical school admissions (Talamantes et al., 2016).

Among all underrepresented minority student populations, American Indian and Alaskan Native students comprise the smallest of all minorities as pre-med students (Ballejos et al., 2018). To address the challenges of recruiting and increasing participation in, and medical school admission among, this population of students, the Association of American Indian Physicians

provided support to increase the number of American Indian and Alaska Native students matriculating into medical school. Through a series of workshops, 21% of the program attendees enrolled in medical school. Those who entered cited additional support from the organization to help them achieve admission to medical school (Ballejos et al., 2018).

Additionally, researchers interviewed a group of Black/African American and Hispanic/Latino surgeons who had completed both their medical school education and residency training in general surgery to learn more insight into the barriers they faced in becoming surgeons (Ulloa et al., 2018). The significant themes regarding participants included their pathway into medicine, which included that they felt their path into medical school was unstructured, which included the lack of guidance, financial barriers, and attributed their experiences about being minority students in the process and feeling like they were being categorized or stereotyped based on their race in the process (Ulloa et al., 2018).

Literature continues to demonstrate that student support is vital, and administrators' support is essential in addressing students' challenges (Dumke et al., 2018). Students in the pre-health profession track have different academic needs and demonstrate increased academic pressures, as defined by the participants' understanding of academic success (Dumke et al., 2018). Regardless of their racial background, students reported that they felt their institution could provide better student support services in their pursuit of health professions programs (Dumke et al., 2018).

**Underrepresented Racial Minorities in STEM/Undergraduate Education**

Similar themes emerge from the literature about underrepresented minority students within higher education and STEM fields which is short for Science, Technology, Engineering, Mathematics field. Nationally, there is a shortage of students pursuing careers in the STEM

fields. Roughly half of students who start as a STEM major continue to complete an undergraduate degree within the field (Feng et al., 2025; Ikuma et al., 2019; Ellis et al., 2016). The disparities further exacerbate the underrepresentation of students from underrepresented minorities within the STEM field (Feng et al., 2025; Mau, 2016). Data from the National Science Board indicates a significant gap between Black/African American and Hispanic/Latino students achieving in STEM disciplines compared with their White and Asian peers (Wiebe et al., 2018; Wolfe & Riggs, 2017). Students from one of the four underrepresented groups (Black/African American, Hispanic/Latino, American Indian, and Alaska Native) have a higher rate of switching out of a STEM major to a non-STEM major (Ikuma et al., 2019; Williams et al., 2018). Although the interest in a STEM major is the same among students from all backgrounds entering college, the rate of underrepresented minority students graduating with a STEM major is significantly lower than that of their counterparts (Williams et al., 2018). Asian students are also not identified as underrepresented minority students in STEM because the proportion of Asian students in STEM is comparable to that of White students (Rainely et al., 2018).

Data points have demonstrated the inequalities present within the post-secondary education system (Carmichael et al., 2016). One of the more significant issues in higher education is the achievement gaps between underrepresented racial minority students and their peers (Harris et al., 2020). The number of undergraduate students entering post-secondary institutions who aspire to pursue STEM fields is equal among underrepresented racial minority students and their peers (Bottia et al., 2020). However, six-year percentage completion rates for Black/African Americans, Hispanic/Latinos, American Indian and Alaska Native in the STEM fields hover within the twentieth percentile range, while those of White and Asian students are significantly higher, in the fiftieth percentile range (Bottia et al., 2020; Harris, 2020). Students

from underrepresented minority groups who persist and continue to study STEM academic disciplines take longer to complete their studies than their White and Asian peers (Bottia et al., 2021; Whalen & Shelley, 2010).

Graduation and retention rates for undergraduate minority students remain a challenge and are critical to meet the demands of society (Estrada et al., 2016). This is increasingly crucial for students aspiring to apply to medical school as a bachelor's degree is required. Overall, the number of bachelor's degrees in the US conferred within any of the STEM fields is lower than other programs of study. With the most current data available from the National Center for Education Statistics, which is a part of the US Department of Education, it shows that out of the 1,920,632 bachelor's degree awarded, 0.5% degrees were awarded to American Indian and Alaska Native students, with 10.4% of all degrees awarded to Black/African American students, and 17% of awarded to Hispanic/Latino students in 2021-2022 (Fast Facts, 2024).

Since STEM attrition and completion rates for underrepresented minority students are significantly lower, literature indicates that researchers aim to explore the gaps further. Many different, yet recurring themes persist from a review of the literature. These themes include gaps in preparation of science and math in high school, unsupportive and hostile climates in higher education for minority STEM students, and difficulties navigating college, including finances (Holcombe & Kezar., 2020). In a qualitative study, Green et al. (2019) interviewed Black/African American students who did not persist as STEM majors at a mid-sized, primarily White institution (PWI). Four major themes emerged: faculty, peers, institutional, and societal factors contributing to students not persisting as STEM majors. African American students felt isolated and had difficulty building rapport with their peers in STEM classes, lacking a supportive environment that would facilitate their success (Green et al., 2019).

For persistence in the STEM field, researchers have noted that institutional structure, opportunities, and student experiences contribute to students' persistence in their STEM studies (Ikuma et al., 2019). Research by Rattan et al. (2015) found that minority students did not feel they belonged in their academic and career pursuits within higher education. According to the researchers' study, when minority students felt a sense of belonging and value within the institution and among their peers, they exhibited lower stress levels and higher academic achievement (Rattan et al., 2015). However, when students from underrepresented backgrounds in STEM participated in mentoring programs, it led to increased student success and retention (Lisberg & Woods, 2018). In addition, a recent study conducted by the University of Wisconsin-Whitewater studied the effects of unique programming tailored to underrepresented students (Lisberg & Woods, 2018). Program participants experienced increased retention and persistence rates among their underrepresented students who enrolled in the program compared to those who did not participate. The retention rates in year two were 96% for students who participated in the program, compared to an expected retention rate of 71.5% for underrepresented minorities. Additionally, 80% of the students who participated in the program early in their STEM careers retained their enrollment up to their third year (Lisberg & Woods, 2018).

Some programs target and support first-generation, low-income, and underrepresented minority students, including TRIO/Student Support Services, scholars' programs, and STEM programs. Students whose parents did not attend or earn a college degree are known as first-generation (Gallegos et al., 2022). Program participants in these programs have higher rates of retention, graduation, and overall success at both the collegiate level and among those pursuing STEM studies (Holcomb et al., 2020). In a large-scale study, eight different campuses across the California State University system conducted a case study under a program known as CSU

STEM Collaboratives, focusing on first-generation, low-income, underrepresented minority STEM students within various programs and interventions. Data was collected through documents, self-reporting, observations, surveying, focus groups, and interviews. The researchers found that the students who participated in the programs across different campuses had a "unified community of support" among students and faculty throughout the study. The identified support community indicated that underrepresented students felt supported and showed academic success through programming and supportive environments (Holcombe & Kezar, 2020).

Outside of organized mentorship programs, underrepresented students who reported having a supportive friend group had higher success rates as STEM majors than those who did not (Hall et al., 2017). Furthermore, underrepresented minority students surveyed noted that social support, competence, and relatedness were essential for achieving and retaining their status as STEM students. The students who persisted also noted that contacts with their classmates were necessary for their success as STEM students (Hilts et al., 2018). Academically, introductory coursework is fundamental to student retention in STEM (Jordt et al., 2017; Lisberg & Woods, 2018). Within the STEM population, a longitudinal research study was conducted with the purpose of a psychosocial intervention to measure the effectiveness and achievement gap between underrepresented minority and White STEM students (Jordt et al., 2017). It was found that having an assignment through experimental research focused on value and emotions removed psychological and emotional barriers to success for students identifying themselves as members of an underrepresented minority group (Jordt et al., 2017).

General post-secondary education data from the Consortium for Student Retention Data Exchange (as cited in Tachine et al., 2017) found that students identifying as White had the

highest first-year retention rate at 82.2%, followed by Black/African American students at 75.1%, and American Indian students at 70.5%. The statistics indicate that American Indian students have the lowest retention rates in higher education. For their study, the researchers found that many American Indian students felt alone, faced racial microaggressions, and disconnected, and could not feel a sense of belonging which has also shown in further research (Fong et al., 2021; Tachine et al., 2017). Literature suggests that the importance of cultural identity for American Indian students is crucial to their academic success. Furthermore, given the cultural and social identities of American Indian students, where space and culture are considered sacred, building trust in the campus community is vital for student success (Bingham et al., 2014; Fong et al., 2021; Lundberg, 2007).

Research has demonstrated that American Indian students who build positive relationships with faculty members in their programs have higher persistence rates. These connections alleviate some of the discomforts American Indian students face, and increased connections have a higher impact on student development (Chelberg & Bosman, 2020). Researchers Greenfield et al., (2021) administered the Everyday Discrimination Scale, Microaggressions Distress Scale, and Experiences of Discrimination measure to 347 American Indian and Native Alaskan students, 65% of whom identified as female. Respondents responded that they faced discrimination regarding their race, gender, physical appearance, and microaggressions, and some respondents identified as facing discrimination (Greenfield et al., 2021).

A longitudinal study of 203 Hispanic/Latino students at a public southwestern US post-secondary institution was conducted to measure perceived discrimination amongst students within this population and academic distress. Researchers found that with Hispanic/Latino

students reporting perceived discrimination as college students, their academic difficulty and concerns heightened, including concerns regarding their GPAs and persistence (Cheng et al., 2019). Flores et al., (2024) examined Hispanic/Latino and Black/African American undergraduate students in STEM enrolled at a dually designated minority-serving institution, Hispanic Serving Institution and an Asian American and Native American Pacific Islander Serving Institution. From their research, they noted that Hispanic/Latino and Black/African American students were struggling while enrolled a minority serving institution. The struggles included classroom cultures that felt exclusive, threats and perceptions of stereotypes, and racism by faculty and peers. Study participants described to the researchers their experiences of marginalization, being either invisible or too conspicuous in STEM study spaces. Additionally, these students stated that they feel a lack of access to academic and cooperative networks. The experiences highlighted that even within a minority serving institution, undergraduate students of Black/African American and Hispanic/Latino backgrounds faced challenges in their studies (Flores et al., 2024).

**Conclusion**

This literature review demonstrates the inequity pipeline for URiM students and the goal of achieving a more diversified physician workforce in the US. While research has consistently demonstrated that importance of diversifying physician workforce to be more representative of the US population, minorities face barriers throughout their educational journey at the post-secondary level which is crucial to attend medical school and become a physician. For medical school matriculation, the undergraduate experience is important as it builds a student's application to study medicine. URiM students have significantly lower rates of enrollment in medical schools than their peers. A review of literature of undergraduate STEM education,

which is a vital component of a student's journey into medical school in both their application and MCAT exam, highlights disparities and higher attrition rates. Research indicated feelings of isolation, discrimination, and lack of support. Literature indicated that targeted programs such as mentorship, creation of diversity offices, and support systems designed specifically for URiM students to have positive impacts on retention and performance in undergraduate STEM studies. The literature indicates that for physician diversity to increase, there is a need for strategies to address the educational pipeline into medical school.

## Analysis

A review of literature highlights that the current US physician workforce is not representative of the general US population. Without equal representation, systemic disparities in healthcare continue to occur, which have implications for overall access to healthcare, quality, and equity, especially in racially underserved communities. While the US population continues to diversify and is expected to outpace Whites between 2040 and 2050, the medical profession remains mostly White and Asian. Black/African American, Hispanic/Latino, American Indian, and Alaska Natives continue to be underrepresented in medicine (Castillo-Page et al., 2019). To address the central issue of increasing physician diversity, the pipeline through which students become physicians needs to be studied, as it encompasses the path from undergraduate education to medical school and ultimately to becoming a physician. To diversify the physician workforce, medical schools need to recruit and admit a more diverse group of applicants. For students to be competitive in medical school admissions, they typically require a strong STEM background in preparation for medical studies. Literature continues to show barriers that prevent the pipeline from entering the physician workforce. Upon a detailed review and analysis of the literature, several emerging themes have been identified, including the underrepresentation of minorities in

medicine, barriers to medical school admissions, challenges in STEM education, and the critical role of institutional support and mentorship. There are many ways to examine these themes. For this analysis, they are examined through the lenses of education, healthcare, and socioeconomic factors, and analyzed using critical race theory, social capital theory, human capital theory, and ecological systems theory.  By addressing how undergraduate programs can increase STEM student success, more URiM students will be enabled to matriculate into medical school, thereby helping to break down the systemic barriers they face in becoming physicians.

**Underrepresentation in the Physician Workforce**

The literature consistently highlights that the representation of minority physicians is not representative of the general US population. For example, while Black/African Americans are approximately 13% of the US population, roughly 5% of physicians identify as such. The Hispanic/Latino population comprises roughly 18.5% of the US population, but only 5.8% of the physician workforce. American Indian and Alaska Native populations are the most underrepresented in the physician workforce, with only 0.3% of physicians identifying as such, with an overall US population of 1.3% identifying as either American Indian or Alaska native (Castillo-Page et al., 2019; Craig et al., 2018; United States Census, n.d.). The statistics highlight the underrepresentation in healthcare.

Unequal representation has shown that there are disadvantages to the general population and minority communities. Traditionally, URiM physicians tend to return to their communities to practice medicine and have higher rates of becoming primary care physicians. Statistics show that over half of minorities receive care from URiM physicians, and over two-thirds of non-English speakers in the United States.  Increasing the number of URiM physicians will allow access and improve outcomes for the general minority population (Higgins et al., 2016; Marrast

et al., 2014). Continuing underrepresentation from the healthcare system's perspective undermines the ability to achieve a diverse physician population in relation to the general US population to provide culturally sensitive care to minorities. If equity is increased in the diversity of physicians, better communication, patient satisfaction, and outcomes are expected, especially for US patients who share a similar cultural and language background (Mason et al., 2022).

**Barriers in Medical School Admissions**

The journey to becoming a physician begins well before the first day of medical school, as students must meet specific admission criteria and gain relevant experiences. The rates of URiM students entering medical schools today are roughly the same as those from 40 years ago, with a slight increase in percentage points among Black/African American and Hispanic/Latino students, while American Indian and Alaska Native students are entering at lower rates today than they did previously. While the medical school admissions process promotes holistic admissions based on the AAMC's core competencies, the application process requires experiences, a personal narrative, and letters of recommendation that are obtained from mentorship and opportunities such as clinical and research. However, GPA and MCAT scores are still heavily involved in the admissions process (Agahi et al., 2018; Gay et al., 2018). The admissions process negatively impacts URiM students, mainly due to limited access to enrichment opportunities, financial constraints, and educational inequities (Lucey & Saguil, 2020). Faced with systematic barriers, research also highlights that URiM students have been subject to more scrutiny during the admissions process (Jones et al., 2021).

Analyzing the barriers in the medical school admissions process from an educational perspective reveals that the admissions process highlights broader inequalities within the educational system. URiM students have a higher rate of attending under-resourced schools. In

addition to their schools, they have less access to mentorship, research opportunities, and preparatory programs that enhance the medical school application and process (Michalec et al., 2018; Lucey & Saguil, 2020). These components can hinder a URiM student's application to medical school. Mentorship, especially in clinical and research experiences, can hinder the student's experience requirements for medical school admissions and support and prep programs to enhance a student's academic studies and preparation for the MCAT. Especially since holistic admissions is stated as the standard in medical admissions, the numerical values of GPAs and MCAT scores still hold a significant weight in the process. As a result, research has shown that URiM students struggle with undergraduate STEM fields, particularly those that require STEM course prerequisites for admission. Research has found that the challenges in the STEM classes are due to gaps in prior educational preparation (Harris et al, 2020). This highlights a larger systemic issue in the educational pipeline.

The barriers that URiM students face in the medical school admissions process can be rooted in critical race theory. In general, viewing the challenges that URiM students face in the medical school admissions process through the lens of critical race theory shifts the focus from placing blame directly on the individual to examining the system (Crewe, 2021). With CRT and the medical school admissions process, students view the system as flawed for URiM students. Critical race theory (CRT) has consistently stated that White supremacy and White privilege play a role in the disparities that exist in society (Crewe, 2021), which, for this analysis, is the barrier to the medical school admissions process, which ultimately has led to the underrepresentation of a diverse physician workforce that mirrors the general US population. Viewing the barriers in the medical school admissions process with CRT, the idea that racism is not simply a mistake. It insists that racism is a part of society, and items such as the MCAT exam and GPA requirements

for the medical school admissions requirements are in place to continue to create a gap between URiM students and their peers. With numerical metrics that have shown differences between URiM students, these practices continue to create a gap between them and their peers. The continuation of standardized exams and GPA, despite holistic admissions processes, perpetuates the exclusion of URiM students.

With CRT, it is essential that the systems that continue to perpetuate disparities be challenged. To challenge the barriers to medical school admissions, reforms are needed to address the systems that have created these barriers. With CRT, the barriers and historical systems in place need to be challenged in the way the medical school admissions process is conducted. It is essential to view the issue through the lens of how the medical school admissions process contributes to this problem and how the outcomes of exclusionary and systematic processes create negative consequences not only for students vying for admissions into medical school but also contribute to the lack of diversity among physicians in the US.

**Challenges in STEM Undergraduate Education**

To foster and increase the rate of URiM students attending medical school, ultimately growing the diverse physician population. Undergraduate education is essential for creating that pipeline, especially within STEM fields. All students seeking admission to medical school are required to complete a specific set of prerequisite coursework in the sciences. Literature and STEM persistence rates continue to highlight the challenges that URiM students face. These challenges lead to higher attrition rates, and students often feel that they are met with unsupportive environments and are isolated from others in these areas (Ikuma et al., 2019; Williams et al., 2018). Traditionally, STEM interest at the undergraduate level has been similar across all racial groups at the start of undergraduate education; URiM students are less likely to

persist and graduate with STEM degrees. This is further evidenced by the percentage of STEM degrees awarded by race, with 0.5% of STEM degrees in 2021-2022 being awarded to American Indians and Alaska Natives; 10.4% to Black/African Americans, and 17% to Hispanics (Fast Facts, 2024). URiM students' attrition has been attributed in the literature to hostile learning environments, feelings of not belonging, and limited access to support (Green et al., 2019; Flores et al., 2024).

The challenges that URiM undergraduate students face in their STEM undergraduate studies are analyzed through a socioeconomic perspective. As URiM students have a higher percentage of low-income and first-generation students (Gallegos et al., 2022), the challenges that they face in their undergraduate studies are in several areas of inequity. The literature indicates that many URiM students often face financial obligations that must be prioritized over enrichment activities, such as internships and research, which are vital components of the medical school application process (Lucey & Saguil, 2020). Additionally, Uwaezuoke (2018) found that many minority-serving institutions lack resources to provide support services to pre-med students.

In all aspects, multiple factors work in tandem to explain the student's undergraduate outcomes, which is viewed through the ecological systems theory that highlights that a person's development, in this case, the undergraduate student's development, is shaped by various environmental structures and systems that are interconnected (Guy-Evans, 2025). The current systems in place often negatively impact URiM students' ability to succeed as high as they can in their STEM studies. From a general perspective, the persistence of these inequities is rooted in the macrosystem. This includes the societal ideologies and cultural values that continue to shape the systems and the barriers that have led to a lack of support and understanding of URiM

students in these spaces. Furthermore, the requirements expected of students outside the classroom for medical school admissions (i.e., experience) conflict with the financial pressures they face, which aligns with the ecological systems theory. Scaling further from the student, many minority-serving institutions lack funding and access, which also prohibits students at the larger level. Students are also impacted by institutional barriers that exist in general society. The system cannot support them and their specialized needs. Since there is limited culturally responsible pedagogy, lack of mentorship, and institutional support, these factors contribute to their underrepresentation in STEM, which ultimately leads to medical school and the physician workforce, as STEM undergraduate education is part of the pipeline into medical school to begin the training to become a physician (Chelberg & Bosman, 2020; Greenfiled et al., 2021).

**Institutional Support and Mentorship**

As referenced throughout literature, student support continued to show the importance of building URiM students into medical school students and ultimately into physicians. While strides have been made to provide institutional support and mentorship to URiM students, including diversity offices, mentorship programs, and the creation of more culturally inclusive learning environments, there remains an overarching lack of support and mentorship, as indicated by the percentage points of STEM URiM completion. The systems that have already been developed have shown that retention and success among URiM students who have had the opportunity to participate have benefited positively from them. For instance, Chen et al. (2018) reported that medical schools with diversity offices have higher rates of URiM enrollment and better student success. It continues to show in literature the importance of mentorship, developing of the student, and creating opportunities as crucial pieces in supporting URiM students' sense of belonging and higher success (Diaz et al., 2019; Castleman et al., 2017).

With literature indicating that when support and systems are put in place to support URiM students, results show a sense of belonging and higher academic success, it validates the notion of critical race theory that is prevalent. This is because when systems and processes are put in place to support URiM students, they succeed, and the barriers and challenges that URiM students face are systemic, not just individual. The support and inclusion of programming to support students challenges the current system in place, which is hindering URM students. In addition to institutional support and mentorship challenging critical race theory, the social capital theory is evident.

For mentorship and institutional programs to achieve their goal of providing support and academic success to URiM minority students, the social capital theory is crucial in building the social relationships that benefit URiM students through a structure of trust, shared values, and mutual commitment. URiM students often lack the social capital that can support their journey into medical school, as evident in their classroom experiences and opportunities for mentorship. Mentorship programs and diversity initiatives, as indicated in the literature, highlight the need for these programs to connect URiM students with the support, guidance, resources, and connections to navigate their journey as a STEM student and ultimately an applicant into medical school to begin their training to become a physician (Dumke et al., 2018; Hadinger, 2017).

Lastly, this theme highlights the importance of human capital theory. Students in this example can increase their capacity as successful STEM students, ultimately leading to medical school and becoming physicians. This can be achieved through the human capital theory, which involves greater resources, skills, and education, a goal that mentorship and institutional support programs aim to provide. With institutions supporting URiM students in their educational and professional development, not only do the students benefiting from the programs become more

successful, but it also creates a more equitable and diversified physician workforce in the end. It is important to keep the end of increasing physician diversity, because it has overall public health implications in the US (Acosta et al., 2019; Morrison et al., 2013).

**Conclusion**

The lack of a diverse physician workforce is not a sole issue; however, it is a series of issues and challenges that permeate educational, socioeconomic, and institutional structures. From the start of their undergraduate education, URiM students face several barriers, including limited access to mentorship, support, and a sense of exclusion, which contribute to higher rates of attrition in STEM studies —a key component of the medical school admissions process. Without undergraduate education and support to build students' experiences, along with numerical metrics to gain acceptance into medical school, URiM students are at a disadvantage. This trend continues into the medical school admissions process, where URiM students face additional hurdles. While medical schools and the AAMC highlight that there are holistic admissions practices in place, numerical metrics (GPA and MCAT) still play a significant role in the admissions process. Generally, the barriers that URiM students face are not random or all based on the individual student. Critical race theory posits that systemic processes are integral to the experiences and outcomes of URiM students.

The literature viewed through the lens of social capital and human capital theory, further demonstrates how inequality and limited access to resources, mentorship, and opportunities contribute to URiM students' ability to maximize their resources and bolster their pathway into medical school. URiM students have higher rates of attending minority-serving institutions. These institutions are traditionally underfunded and under-resourced, exacerbating the lack of institutional support, which can further contribute to the challenges and barriers that URiM

students face. The lack of institutional structure and resources as viewed through the ecological systems theory. The ecological systems theory indicates how larger structures, ideologies, and institutional practices shape the environment, ultimately affecting the URiM student.

Additionally, the literature continues to highlight that when support systems are in place, URiM students feel supported and have a more positive academic experience, which can lead to persistence in undergraduate STEM fields and ultimately increase the rate of medical school matriculation for URiM students. The literature and analysis reveal that URiM students' lack of medical school matriculation does not solely rest with the student and their lack of ability or ambition; the systems and structures in place are also contributing factors. This solidifies that to diversify the physician workforce; it is not just a matter of recruiting more URiM students into medical school; it also challenges the current structure and pipeline to be reinvented. As a result, it can bring positive benefits to the broader US general population by providing more diverse physicians, regardless of the population, to achieve better public health outcomes, student success, and ultimately lead to changes in both intergenerational and intragenerational mobility for students and their families.

**Ethical Implications**

The continuing lack of physician diversity, which trickles down into medical school matriculation and ultimately affects URiM undergraduate STEM success, highlights ethical concerns that extend beyond the academic level and create challenges to general US public health, overall social justice, and the institutional systems in place. If the challenges and inequity continue, the challenges will further expand, especially when it comes to overall healthcare access in the US, and especially minorities and their healthcare quality. Based on an analysis and

review of the literature, the following ethical implications are grounded in social justice, responsibility, and accountability.

Currently, the resources are not fairly allocated for URiM undergraduate students. As a result, they face barriers and challenges that prevent URiM undergraduate students from matriculating into medical school. Without a more diverse medical school student population, the current physician workforce will continue to fail to reflect the general US population. This lack of physician diversity has direct impacts, especially since minorities have a higher rate of receiving care from URiM physicians. Additionally, URiM physicians have a higher rate of working in underserved areas, becoming primary care physicians, and can connect and relate to their patient population. The physician training process begins with medical school, and if medical school diversity is not increased, the rate of diverse physicians in the US will continue to be low.

This results in minority communities being underserved by physicians who can provide culturally and linguistically sensitive care to these communities. This can lead to healthcare inequality and poorer healthcare outcomes. Without physician diversity, there can be a lack of perceived trust between the general population and their healthcare providers; ultimately compromising healthcare access. Consequently, medical schools and undergraduate institutions have a responsibility to bring about a diverse and inclusive learning environment to support their students. Their failure to support URiM students with mentorship, opportunities, resources, and a diversified pedagogy, as well as an actual holistic admissions process into medical school, goes against the responsibility that these institutions have to the public, specifically the URiM students. The literature significantly indicates that when URiM students have support systems in place, they have a higher chance of thriving. Without having these support systems in place, it

highlights the ethical failures of the marginalization of minority students, which does not allow a seamless pipeline in addressing physician diversity.

Critical race theory states that racism is a part of society that shows up in any area of society, including healthcare. The ethical implications of not addressing medical school education can be detrimental. Medical school, based on literature and statistics, highlights White and Asian students benefit. In contrast, Black/African American, Hispanic/Latino, and American Indian and Alaska Native students are at a disadvantage. Structural racism is present and that it does not provide equal opportunities for all. Some ethical implications include relying on numerical metrics, mainly used for medical school admissions, without considering them in the context of systemic inequities. Without addressing such metrics, it will continue to exacerbate the challenges that URiM students face and continue to exclude them. This not only excludes the student but continues to highlight the difficulties that minority communities and populations face in access to healthcare and a diversified physician workforce.

Already in the US, minorities earn less and face challenges in career mobility. When URiM students do not gain admission into medical schools, their social and career mobility is restricted. This not only affects them, but their families and the general community. A lack of diversity and lower matriculation rates indicates the failure of the system to provide an equitable and suitable pathway for all to reach their goals and achieve mobility. Lastly, the lack of diversity in medicine affects intragenerational mobility in healthcare. Without addressing the causes and reforming, becoming a physician will continue to remain inaccessible to many, which continues the cycle of exclusion. Literature and experiences continue to demonstrate the lack of justice and the critical need to create inclusive environments.

## Policy Recommendations

35

To address and alleviate the challenges and barriers that URiM students face in medical school and the physician workforce, several policies and reforms are needed, particularly in the educational pipeline. For this paper, the focus is on the undergraduate STEM experience, as it is one of the first gateways to build a more diverse physician workforce. Without undergraduate STEM coursework, students cannot meet the course prerequisites required for admission to medical school and the start of physician training. Their ability to pursue medical school admissions and become a physician is hindered if they are unable to complete undergraduate STEM coursework and programs successfully.

Undergraduate institutions need to expand access to mentorship and provide academic support programs tailored to URiM students. Research by Chen et al. (2018) indicates that medical schools with diversity offices have higher URiM enrollment and student success. This suggests that similar models should be implemented at the undergraduate level to support pre-med students in their journey. While many undergraduate institutions already have some form of inclusion offices and programming; creating one geared more towards the STEM fields would be beneficial in fostering a culture of belonging and mentorship with a more specific focus. This focus would allow students to connect not only their racial identities but also their academic backgrounds. This can also be achieved through student organizations with departmental and institutional support, such as creating minority pre-med organizations to raise awareness and provide community space for URiM students.

Additionally, since many minority-serving institutions lack resources, it is essential to establish community partnerships with local hospitals and medical offices, as well as with community members and alumni, to provide mentorship and resources such as shadowing and clinical work, thereby bolstering a student's application to medical school. Many alumni and

community members are open to giving back to their institutions and providing support to students. Especially with alumni of minority-serving institutions, there is a possibility that students will connect with them, as a larger minority alumni base may be available and allow for relatability.

Many grassroots support structures can be built into places for institutions to support their undergraduate URiM STEM and pre-med students. Additionally, almost all undergraduate degrees require students to complete elective coursework to reach the standard 120 semester credit hours required for graduation. Some institutions have already implemented elective coursework to provide additional support and structure for pre-med students. This allows students to earn credits toward their degree while also developing their skills and knowledge and providing resources. This can be achieved in partnership with community organizations and even collaborations with medical schools. These courses could be taught not only by professors, but also by pre-health advisors and even community members. Having these courses and embedding the experiences into the course can build up the experiences and opportunities for URiM students because instead of taking a general elective that might not be geared towards their goals of attending medical school, the time already allotted for the course can be specific and gain opportunities like shadowing and experiential learning opportunities instead of taking an elective course and then having to find time outside of instructional time of the elective courses to build up their experiences to apply to medical school.

In addition to grassroots and lower-level options to assist URiM undergraduate students in becoming more competitive medical school applicants, federal and state policies should increase funding to minority serving institutions. These institutions enroll a larger percentage of minority students but often lack the resources to provide essential services and opportunities,

such as pre-med student services and enrichment programming (Uwaezuoke, 2018; Gallegos et al., 2022). Investments in minority-serving institutions can improve student persistence and reduce attrition in STEM studies. For instance, programs like TRIO and CSU STEM collaboratives have demonstrated success in supporting URiM students through structured support (Holcombe & Kezar, 2020). As noted for the undergraduate level, increasing programs that offer research, clinical exposure, and MCAT preparation for URiM students can help provide URiM students with the support they need to be more suited for medical school admissions (Castleman et al., 2017; Dumke et al., 2018).

Increasing support and opportunities at the undergraduate level can alleviate some of the challenges and barriers that URiM students face in their journey into medical school. Additionally, it is important to address and reform the medical school admissions process. While medical schools and the AAMC claim a holistic admissions process, there is still a large reliance on numerical metrics, such as GPA and MCAT scores. That places URiM students at a disadvantage (Lucey & Saguil, 2020; Harris et al., 2020). While the framework for holistic admissions has been started with the AAMC's core competencies for medical school, further work in this realm is needed. Admissions committees need to increase their awareness and training in implicit bias and critical race theory to better understand how structural factors influence applicant outcomes.

Lastly, many medical schools have undergraduate programs as part of their institution; medical schools should consider partnering with undergraduate institutions to create mentorship and advisement programs that assist undergraduate students from their first year through their medical school admissions process and ultimately, hopefully, into matriculation. This provides not only outreach and service to undergraduate institutions by the medical school but also

enables them to influence and contribute to the development of undergraduate students, molding them into the focus of their medical education. Not only does this allow students to be successful, but it also enables medical schools to recruit and matriculate students with a higher chance of success and a deeper understanding of their mission and curriculum. For instance, the success of VCU's Hispanic student initiative demonstrated how engagement and cultural programming can increase URiM rates (Diaz et al., 2019). As a result, this enables medical schools to expand their reach, provide students with opportunities, and establish connections with the broader community.

As the landscape of US society and higher education continues to rapidly evolve, some resources and allocations can increase the success of URiM students matriculating into medical school. The ethical implications and the current issue at hand are too significant to ignore. From small-scale to large-scale reforms, some policies can be implemented to support undergraduate URiM students in achieving success and successfully matriculating into medical school. Undergraduate institutions need to play a role in dismantling the barriers that prevent URiM students from qualifying and matriculating into medical school, in which the pipeline ultimately allows a transition to a more equitable and diverse physician workforce.

## Summary

This qualifying paper aimed to explore the overarching lack of diversity of the US physician workforce with focusing on the educational pipeline starting with undergraduate STEM education that serves as a steppingstone into medical school ultimately starting the physician training. Despite the general US population continuously diversifying, the physician workforce does not mirror the diversity of the general population. Roughly 9% of all physicians identify within one of the following racial categories, Black/African American, Hispanic/Latino,

American Indian or Alaska Native (Osseso-Asare et al., 2018). This disparity has shown negative implications for healthcare access for minority communities. This paper argued that systemic barriers need to be addressed to build a more diverse physician workforce.

A review of literature consistently indicated that URiM physicians have a higher rate of serving in underserved communities and provide more culturally competent care (Fenton et al., 2016; Marrast et al., 2014). However, the physician workforce is primarily White and Asian. For example, roughly 13% of the US population is Black/African American, however roughly 5% of physicians are. Similarly, these trends show in Hispanic/Latino and American Indian and Alaskan Native communities too (Castillo-Page et al., 2019; Craig et al., 2018). Medical school admissions processes are increasingly stated as to having adopted a more holistic approach but still rely on numerical metrics such as GPA and MCAT scores heavily. These metrics provide disadvantages to URiM students due to systemic inequalities in education and access to resources (Agahi et al., 2018; Lucey & Saguil, 2020).

These disparities are evident in the matriculation rates of URiM students into medical school that have not significantly changed in the last 40 years. It is evident by the number of URiM students in medical schools, while Black/African American and Hispanic/Latino saw a very small percentage increase from 1980 to 2024; American Indian and Native Alaska students saw a decrease in enrollment in medical schools since 1980 to 2024. This highlights that the systems in place currently are not supporting URiM students evidenced by the enrollment data of students.

The AAMC's core competencies are in place to broaden the admissions criteria and processes, but disparities continue to persist. In addition to the medical school admissions process, Undergraduate STEM education is a crucial component of the medical school

admissions process. However, URiM students face higher attrition rates and report more hostile learning environments that hinder academic persistence. Although at the start of a student's collegiate career, the interest in STEM is comparable across all groups of students; URiM students are less likely to graduate with STEM degrees (Ikuma et al., 2019; Williams et al., 2018). For instance, in the most current data set by the National Center for Education Statistics, in 2021-2022, only 0.5% of STEM degrees were awarded to American Indian/Alaska Native students, 10.4% to Black/African Americans, and 17% to Hispanics (Fast Facts, 2024). Traditionally, URiM students have a higher chance of being low-income and first-generation college students, which limits their ability to participate in enrichment activities like research and internships (Gallegos et al., 2022). URiM students also have higher rates of attending minority serving institutions, and these institutions can lack resources for mentorship, research opportunities and preparatory programs (Michalec et al., 2018; Uwaezuoke, 2018).

From a review of literature, the issues at hand were analyzed using four distinct theoretic frameworks of critical race theory, social capital theory, human capital theory, and ecological systems theory. These theories indicate that URiM students' challenges are not solely dependent on the student's individual attributes, but part of a larger systemic issue that students may experience in their journey of becoming a physician. In the context of the analysis, it highlights how critical race theory highlights that racism is embedded in education structures. The social capital theory highlights the lack of access to mentorship and opportunities that URiM students face which are essential for the medical school admissions process (Dumke et al., 2018; Hadinger, 2017). From the viewpoint of human capital theory, it indicates the importance of institutional involvement in cultivating and developing students through targeted support programs (Acosta et al., 2019). From the ecological systems theory, it provides a broader view

showing how URiM students' academic journeys are shaped based on society, institutional and environmental factors.

These theoretical frameworks were used to analyze the themes reoccurring in the literature review which were the lack of racial minorities in the physician workforce, barriers in the medical school admissions process, challenges of undergraduate STEM education for URiM students, and the role of institutional support and mentorship. The issues that URiM students and greater society face with the lack of diversity are not sole issues but interconnected and larger issues and that they need to be addressed wholly and not individually. Consequently, if URiM students continue to be underrepresented in medicine, there are ethical implications. With the lack of diversity in the physician workforce, minority communities will continue to face challenges and limited access to culturally competent care. This also is an issue for overall US public health.

Critical race theory emphasis that these issues are not accidental but part of a larger system failure. It is important ethically that institutions are challenged and implement reforms to overcome these barriers as they are all interconnected. Without addressing these challenges, the cycle and inequality will continue which can contribute to a public health issue, mobility, and intergenerational mobility of students and their communities. To address the issues that have persisted in the literature review, several policy recommendations were made. This includes increasing undergraduate support for URiM students, which includes expanding mentorship and academic support programs not only tailored to URiM students, but also to URiM students in STEM since their STEM studies are part of their identity. Further recommendations included looking at grassroot opportunities such as providing community and support through student organizations, building partnerships with alumni and the community, and embedding experiential

learning opportunities into elective coursework to provide not only credit-baring opportunities but the experiential learning requirements needed for medical school admissions.

Since the majority of URiM students attend minority serving institutions, a call for an increase in federal and state funding to enhance student services is crucial. The funding provides programs like TRIO and CSU STEM collaboratives on a broader and much larger scale at institutions (Holcombe & Kezar, 2020). While this paper aims for undergraduate STEM education as one of the barriers, the medical school admissions process needs to be reformed. This includes a true movement to holistic admissions processes, provide training in critical race theory and implicit bias and medical schools expand their reach and efforts to undergraduate students with opportunities to expand the student opportunities and mentorship like VCU's Hispanic student program (Diaz et al., 2019).

Addressing the lack of diversity in the US physician workforce is complex and a one size fits all solution is not available. As a result, the response has to be varied and complex. With a detailed literature review and analysis, theoretical frameworks, ethical implications and policy recommendations, this paper indicates that there is a need for investment in the educational pipeline to diversify the US physician workforce. This needs to start at the undergraduate level as it is a catalyst and determinant whether the student can attend medical school, as it is a requirement for admissions. By bringing about change and implementing new policies and initiatives and by creating environments that support and mentor URiM students, institutions can be a key contributor to the diversification of the US physician workforce that reflects the diversity of the US population and provides healthcare equity and access to all.

## References

Acosta, D. A., Poll-Hunter, N. I., & Eliason, J. (2017). Trends in racial and ethnic minority applicants and matriculants to U.S. medical schools, 1980–2016. *Analysis In Brief*, *17*(3), 1-4.

Aditya, I., & Fan, Z. J. (2017). The pre-med ambition: Is it worth it? *Canadian Medical Education Journal,* 8(3), 119-120.

Agahi, F., Speicher, M. R., & Cisek, G. (2018). Association between undergraduate performance predictors and academic and clinical performance of osteopathic medical students. *Journal of the American Osteopathic Association*, *118*(2), 106-114. https://doi.org/10.7556/jaoa.2018.025

Association of American Medical Colleges. (2015). *Altering the Course Black Males in Medicine*. AAMC. https://store.aamc.org/downloadable/download/sample/sample_id/84/

Association of American Medical Colleges. (2019). *Underrepresented in Medicine Definition*. https://www.aamc.org/initiatives/urm/

Association of American Medical Colleges. (2020). *Core Competencies for Entering Medical Students*. AAMC. https://www.aamc.org/services/admissions-lifecycle/competencies-entering-medical-students

Association of American Medical Colleges. (2025). 2026 AMCAS Applicant Guide. AAMC. https://students-residents.aamc.org/media/11616/download

Association of American Medical Colleges. (n.d.). *2024 facts: Applicants and matriculants data*. AAMC. https://www.aamc.org/data-reports/students-residents/data/facts-applicants-and-matriculants

Association of American Medical Colleges. (n.d.). *Facts glossary*. AAMC. https://www.aamc.org/data-reports/students-residents/data/facts-glossary

Association of American Medical Colleges. (n.d.). *The MCAT Exam Score Scale. AAMC Students*. https://students-residents.aamc.org/applying-medical-school/article/mcat-exam-score-scale/

Association of American Medical Colleges. (n.d.). *The Parts of Your Medical School Application*. https://students-residents.aamc.org/applying-medical-school/faq/what-parts-your-application-tell-medical-schools-2/

Association of American Medical Colleges. (n.d.). *What's on the MCAT Exam?*. AAMC. https://students-residents.aamc.org/prepare-mcat-exam/whats-mcat-exam-pdf-outline

Ballejos, P. M., Olsen, P., Price-Johnson, T., Garcia, C., Parker, T., Sapien, E. R., & Romero-Leggott, V. (2018). Recruiting American Indian/Alaska Native students to medical

school: A multi-institutional alliance in the U.S. southwest. *Academic Medicine, 93*(1), 71–75. doi:10.1097/ACM.0000000000001952

Bannerman, C., Guzman, N., Kumar, R., Nnebe, C., Setayesh, J., Venapally, A., & Sussman, J. (2020). Challenges and advice for MD/PhD applicants who are underrepresented in medicine. *Molecular Biology of the Cell*, *31*(24), 2640-2643. https://doi.org/10.1091/mbc.E20-07-0444

Bingham, J. L., Adolpho, Q. B., Jackson, A. P., & Alexitch, L. R. (2014). Indigenous women college students' perspectives on college, work, and family. *Journal of College Student Development*, *55*(6), 615-632. https://doi.org/10.1353/csd.2014.0055

Bottia, M. C., Mickelson, R. A., Jamil, C., Moniz, K., & Barry, L. (2021). Factors associated with college STEM participation of racially minoritized students: A synthesis of research. *Review of Educational Research*, 614-648. https://doi.org/10.3102/00346543211012751

Carmichael, M. C., St. Clair, C., Edwards, A. M., Barrett, P., McFerrin, H., Davenport, I., Awad, M., Kundu, A., & Ireland, S. K. (2016). Increasing URM undergraduate student success through assessment-driven interventions: A multiyear study using freshman-level general biology as a model system. *CBE-Life Sciences Education*, *15*(3), 1-14. https://doi.org/10.1187/cbe.16-01-0078

Castillo-Page, L., Conrad, S., Caulfield, M., Dill, M., Eliason, J., & Jones, K. (2019). *Diversity in medicine: Facts and figures 2019*. Association of American Medical Colleges. https://www.aamc.org/data-reports/workforce/report/diversity-medicine-facts-and-figures-2019

Castleman, L.B., Long, T. B., & Mabel, Z. (2017). Can financial aid help to address the growing need for STEM education? The effects of need-based grants on the completion of science, technology, engineering, and math courses and degrees. *Journal of Policy Analysis and Management*, *37*(1), 136–166. https://doi.org/10. 1002/pam.22039

Cestone, C., Russo, D., Berardi-Demo, L., Weber, V., White, M., Shumsky, J., Baird, D., Walker, L., & Nunez, A., (2018). Broadening diversity in medicine: Outcomes of the Drexel pathway to medical school postbaccalaureate medical science program. *The Journal of Best Practices in Health Professions Diversity*, *11*(1), 1-12. https://www.jstor. org/stable/26554287

Chelberg, K., & Bosman, L. (2020). American Indian college student mentoring: A study to measure changes in self-efficacy. *Education Sciences*, *10*(2), 1-13. https://doi.org/10.3390/educsci10020038

Chen, A. J., Rodriguez, E. J., & Campbell, M. K. (2018). Examining diversity offices in medical education. *Journal of Best Practices in Health Professions Diversity: Education, Research & Policy, 11*(1), 43-50. https://www.jstor.org/stable/26554290

Cheng, H. L., McDermott, C. R., Wong. J. Y., & McCullough, M. K. (2019). Perceived discrimination and academic distress among Latinx college students: A cross-lagged

longitudinal investigation. *Journal of Counseling Psychology*, *67*(3). 1–8. doi:10.1037/cou0000397

Craig, A. M., Rucker, M. J., & Richeson, A. J. (2018). Racial and political dynamics of an approaching "Majority-Minority" United States. *The ANNALS of the American Academy of Political and Social Science*, *677*, 204-214. https://doi.org/10.1177/0002716218766269

Cooper, M. K., Gin, E. L., & Brownell, E. S. (2019). Diagnosing differences in what introductory biology students in a fully online and an in-person biology degree program know and do regarding medical school admission. *Advances in Physiology Education, 43*(1), 221–232. https://doi.org/10.1152/advan.00028.2019

Corridon, P. (2021). Admissions to medical school during the COVID-19 era without the MCAT. *Journal of Medical Education and Curricular Development*, *8*, 1-3. https://doi.org/10.20944/preprints202102.0274.v1

Crewe, S. E. (2021). Critical race theory- Uncomfortable but necessary tool for change agents. Journal of Social Work Education, 57(3), 416-418. https://doi.org/10.1080/10437797.2021.1945396

Davis, D., Dorsey, J. K., Franks, D. R., Sackett, R. P., Searcy, A. C., & Zhao, X. (2013). Do racial and ethnic group differences in performance on the MCAT exam reflect test bias? *Academic Medicine, 88*(5), 593–602. https://doi.org/10.1097/ACM. 0b013e318286803a

DeCarvalho, H., Lindner, I., Sengupta, A., Rajput, V., & Raskin, G. (2018). Enhancing medical student diversity through a premedical program: A Caribbean school case study. *Education for Health*, *31*(1), 48-51. https://doi.org/10.4103/1357-6283.239047

Diaz, A., Corredor, M., Jackson, D., Whitehurst-Cook, M., & Strauss, F. J. (2019). Lessons learned from the VCU school of medicine Latino medical student association: A roadmap for increasing diversity in medical school. *Journal of Hispanic Higher Education, 18*(1), 98–106. https://doi.org/10.1177/1538192717729736

Dumke, E. K., Tyndall, C., Naff, D., Crowder, A., & Cauley, K. M. (2018). A qualitative exploration of pre-health students' perceptions of academic success and persistence. *NACADA Journal, 38*(2), 5–19. https://doi.org/10.12930/NACADA-16-031

Ellis, J., Fosdick, B. K., & Rasmussen, C. (2016). Women 1.5 times more likely to leave STEM pipeline after calculus compared to men: Lack of mathematical confidence a potential culprit. *PLoS One*, *11*(7), 1-14. https://doi.org/10.1371/journal.pone.0157447

Estrada, M., Burnett, M., Campbell, G.A, Campbell, B. P., Denetclaw, F.W., Gutierrez, G.C., Hurtado, S., John, H.G., Matsui, J., McGee, R., Okpodu, M.C., Robinson, J.T., Summers, F.M., Werner-Washburne, M., & Z.M. (2016). Improving underrepresented minority student persistence in STEM. *CBE-Life Sciences Education*, 15(1). 1-10. https://doi.org/10.1187/cbe.16-01-0038

Fang, D. Z., Young, C. B., Golshan, S., Fellows, I., Moutier, C., & Zisook, S. (2010). Depression in premedical undergraduates: A cross-sectional survey. *The Primary Care Companion to The Journal of Clinical Psychiatry*, *12*(6), 1-6. https://doi.org/10.4088/PCC.10m00958blu

Feng, L., Close, E.W., Luxford, J.C., Pierson, A.J., Olmstead, A., Shim, J., Koka, S.V, & Galloway, C.H. (2025). Transforming undergraduate STEM education: The learning assistant model and student retention and graduation rates. *Research in Higher Education,* 66(4), 1-26. https://doi.org/10.1007/s11162-024-09823-5

Fenton, J. J., Fiscella, K., Jerant, F. A., Sousa, F., Henderson, M, Fancher, T., & Franks, P., (2016). Reducing medical school admissions disparities in an era of legal restrictions: Adjusting for applicant socioeconomic disadvantage. *Journal of Health Care for the Poor and Underserved,* 27(1), 22-34. doi: 10.1353/hpu.2016.0013.

Flores, M.G., Banuelos, M., & Harris, R. P. (2024). "What Are You Doing Here?": Examining minoritized undergraduate student experiences in STEM at a minority serving institution. *Journal for STEM Education Research,* 7(1), 181-204. https://doi.org/10.1007/s41979-023-00103-y

Fong, C. J., Owens, S. L., Segovia, J., Hoff, M. A., & Alejandro, A. J. (2021). Indigenous cultural development and academic achievement of tribal community college students: Mediating roles of sense of belonging and support for student success. *Journal of Diversity in Higher Education*. https://doi.org/10.1037/dhe0000370

Gallegos, A., Gordon, L. K., Moreno, G., Nahm, S., Brown, K., Walker, V., Rangel, V., Clavijo, S., & Casillas, A. (2022). Visibility & support for first generation college graduates in medicine. *Medical Education Online*, *27*(1). https://doi.org/10.1080/10872981.2021.2011605

Gay, E. S., Santen, A. S., Mangrulkar, S. R., Sisson, H. T., Ross, T. P., & Bibler Zaidi, L. N. (2018). The influence of MCAT and GPA preadmission academic metrics on interview scores. *Advances in Health Science Education Theory Practice, 23*(1), 151–158. doi: 10.1007/s10459-017-9779-9

Goode, C., Talbot, C., (2016). A special master's program as pipeline to increase diversity at an osteopathic medical college. *Journal of Best Practices in Health Professions Diversity*, *9*(2), 1198-1216.

Grace, M. K. (2017). Subjective social status and premedical students' attitudes towards medical school. *Social Science & Medicine*, *184*, 84–98. doi: 10.1016/j.socscimed.2017.05.004

Green, A. M., Brand, B. R., & Glasson, G. E. (2019). Applying actor–network theory to identify factors contributing to nonpersistence of African American students in STEM majors. *Science Education, 103*(2), 241–263. https://doi.org/10.1002/sce.21487

Greenfield, B. L., Elm, J. H., & Hallgren, K. A. (2021). Understanding measures of racial discrimination and microaggressions among American Indian and Alaska Native college

students in the southwest United States. *BMC Public Health,* 21(1). https://doi.org/10.1186/s12889-021-11036-9

Gross, J. P., Mommaerts, C. D., Earl, D., & De Vries, R. G. (2008). Perspective: After a century of criticizing premedical education, are we missing the point? *Academic Medicine,* 83(5), 516-520. https://doi.org/10.1097/ACM.0b013e31816bdb58

Grumbach, K., & Mendoza, R. (2008). Disparities In human resources: Addressing the Lack of diversity in the health professions. *Health Affairs,* 27(2), 413-422. https://doi.org/10.1377/hlthaff.27.2.413

Gurin, P., Dey, E., Hurtado, S., & Gurin, G. (2002). Diversity and higher education: Theory and impact on educational outcomes. *Harvard Educational Review,* 72(3), 9-42. https://doi.org/10.17763/haer.72.3.01151786u134n051

Guy-Evans, O. (2025). Bronfenbrenner's Ecological Systems Theory. *Simply Psychology*. https://www.simplypsychology.org/bronfenbrenner.html

Hadinger, M. A. (2017). Underrepresented minorities in medical school admissions: A qualitative study. *Teaching and Learning in Medicine, 29*(1), 31–41. https://doi.org/10.1080/ 10401334.2016.1220861

Hall, A., Nishina, A., Lewis, J., (2017). Discrimination, friendship diversity, and STEM-related outcomes for incoming ethnic minority college students. *Journal of Vocational Behavior*, *103*, 76-87. https://doi.org/10.1016/j.jvb.2017.08.010

Harris, R. B., Bryant, M., Theobald, E. J., & Freeman, S. (2020). Reducing achievement gaps in undergraduate general chemistry could lift underrepresented students into a "hyperpersistent zone". *Science Advances*, *6*(24), 1-8. https://doi.org/10.1126/sciadv.aaz5687

Henderson, M. C., Kelly, C. J., Griffin, E., Hall, T. R., Jerant, A., Peterson, E. M., Rainwater, J. A., Sousa, F. J., Wofsy, D., & Franks, P. (2018). Medical school applicant characteristics associated with performance in multiple mini-interviews versus traditional interviews: A Multi-Institutional Study. *Academic Medicine*, *93*(7), 1029-1034. https://doi.org/10.1097/ACM.0000000000002041

Higgins, S.S.C.M., Hwang, T.W., Richard, C., Chapman, H.C., Laporte, A., Both, S., Thomas, R.C., & Deville, C. (2106). Underrepresentation of women and minorities in the United States IR academic physcian workforce. *J Vac Interv Radiol*, 12(1), 1837-1844. https://doi.org/10.1016/j.jvir.2016.06.011

Hilts, A., Part, R., & Bernacki, M. L. (2018). The roles of social influences on student competence, relatedness, achievement, and retention in STEM. *Science Education, 102*(4), 744–770. https://doi.org/10.1002/sce.21449

Hirshfield, L. E., Yudkowsky, R., & Park, Y. S. (2019). Pre-medical majors in the humanities and social sciences: impact on communication skills and specialty choice. *Medical Education*, *53*, 408-416. https://doi.org/10.1111/medu.13774

Holcombe, E., & Kezar, A. (2020). Ensuring success among first-generation, low-income, and underserved minority students: Developing a unified community of support. *American Behavioral Scientist*, *64*(3), 349-369. https://doi.org/10.1177/0002764219869413

Hutchins, E. B., Reitman, J. B., & Klaub, D. (1967). Minorities, manpower, and medicine. *The Journal of Medical Education*, *42*(9), 809-821.

Ikuma, L. H., Steele, A., Dann, S., Adio, O., & Waggenspack, W. (2019). Large-scale student programs increase persistence in STEM fields in a public university setting. *The Research Journal for Engineering Education*, *108*(1), 57-81. https://doi.org/10.1002/jee.20244

Jones, A. C., Nichols, A. C., McNicholas, C. M., & Stanford, F. C. (2021). Admissions is not enough: The racial achievement gap in medical education. *Academic Medicine*, *96*(2), 176-181. https://doi.org/10.1097/ACM.0000000000003837

Jordt, H., Eddy, S. L., Brazil, R., Lau, I., Mann, C., Brownell, S. E., King, K., & Freeman, S. (2017). Values affirmation intervention reduces achievement gap between underrepresented minority and white students in introductory biology classes. *CBE Life Sciences Education, 16*(3), 1-10. https://doi.org/10.1187/cbe.16-12-0351

Komaromy, M., Grumbach, K., Drake, M., Vranizan, K., Lurie, N., Keane, D., & Bindman, A. B. (1996). The role of black and Hispanic physicians in providing health care for underserved populations. *New England Journal of Medicine*, *334*(20), 1305-1310. https://doi.org/10.1056/NEJM199605163342006

Kotter, T., Wagner, J., Bruheim, L., & Voltmer, E. (2017). Perceived medical school stress of undergraduate medical students predicts academic performance: An observational study. *BMC Medical Education*, *17*(1), 1-6. https://doi.org/10.1186/s12909-017-1091-0

Lett, L. A., Murdock, H. M., Orji, W. U., Aysola, J., & Sebro, R. (2019). Trends in racial/ethnic representation among US medical students. *JAMA Network Open*, *2*(9), 1-12. https://doi.org/10.1001/jamanetworkopen.2019.10490

Lisberg, A., & Woods, B., (2018). Mentorship, mindset and learning strategies: An integrative approach to increasing underrepresented minority student retention in a STEM undergraduate program. *Journal of STEM Education*, *19*, 14-20.

Lucey, R. C., & Saguil, A. (2020). The consequences of structural racism of MCAT scores and medical school admissions: The past is prologue. *Academic Medicine, 95*(3), 351–356. https://doi.org/10.1097/ACM.0000000000002939

Lundberg, C. A. (2007). Student involvement and institutional commitment to diversity as predictors of Native American student learning. *Journal of College Student Development*, *48*(4), 405-416. https://doi.org/10.1353/csd.2007.0039

Marrast, L. M., Zallman, L., Woolhandler, S., Bor, D. H., & McCormick, D. (2014). Minority physicians' role in the care of underserved patients. *JAMA Internal Medicine*, *174*(2), 289. https://doi.org/10.1001/jamainternmed.2013.12756

Mason, H. R., Ata, A., Nguyen, M., Nakae, S., Chakraverty, D., Eggan, B., Martinez, S., & Jeffe, D. B. (2022). First-generation and continuing-generation college graduates' application, acceptance, and matriculation to U.S. medical schools: A national cohort study. *Medical Education Online*, *27*(1). https://doi.org/10.1080/10872981.2021.2010291

Mau, W., (2016). Characteristics of US students that pursued a STEM major and factors that predicted their persistence in degree completion. *University Journal of Educational Research*, *4*(6), 1495-1500. https://doi.org/10.13189/ujer.2016.040630

Mcgee, E.O., Thakore, B.K., LaBlance, S.S. (2017). The burden of being "model": Racialized experiences of Asian STEM college students. *Journal of Diversity in Higher Education*, *10*(3), 253-270. https://doi.org/10.1037/dhe0000022

Michalec, B., Cuddy, M. M., Hafferty, P., Hanson, M. D., Kanter, S. L., Littleton, D., Martimianakis, M. A., Michaels, R., & Hafferty, F. W. (2018). It's happening sooner than you think: Spotlighting the pre-medical realm. *Medical Education*, *52*, 359-361. https://doi.org/10.1111/medu.13531

Morris, D. B., Gruppuso, P. A., McGee, H. A., Murillo, A. L., Grover, A., & Adashi, E. Y. (2021). Diversity of the national medical student body — Four decades of inequities. *New England Journal of Medicine*, *384*(17), 1661-1668. https://doi.org/10.1056/nejmsr2028487

Morrison, E., & Grbic, D. (2013). The relationship between racial and ethnic diversity in a class and students' perceptions of having learned from others. *Analysis In Brief: Association of American Medical Colleges*, *13*(6), 1-2.

National Center for Education Statistics. *The NCES Fast Facts Tool.* National Center for Education Statistics (NCES) Home Page, a part of the U.S. Department of Education. (2024). https://nces.ed.gov/fastfacts/display.asp?id=72

Ogunyemi, D., & Edelstein, R. (2007). Career intentions of U.S. medical graduates and international medical graduates. *Journal of the National Medical Association*, *99*(10), 1132-1137.

Osseo-Asare, A., Balasuriya, L., Huot, S., Kenne, D., Berg, D., Nunez-Smith, M., Genao, I., Latimore, D., & Boatright, D. (2018). Minority resident physicians' view on the role of race/ethnicity in their training experiences in the workplace. *JAMA Network Open*, *1*(5), 1–11. https://doi.org/10.1001/jamanetworkopen.2018.2723

Poole, K. G., Jordan, B. L., & Bostwick, M. J. (2020). Mission drift: Are medical school admissions committees missing the mark on diversity? *Academic Medicine*, *95*(3), 357-360. https://doi.org/10.1097/ACM.0000000000003006

Puddey, I. B., Mercer, A., & Carr, S. E. (2019). Relative progress and academic performance of graduate vs undergraduate entrants to an Australian medical school. *BMC Medical Education*, *19*(1), 1-14. https://doi.org/10.1186/s12909-019-1584-0

Rainey, K., Dancy, M., Mickelson, R., Stearns, E., & Moller, S. (2018). Race and gender differences in how sense of belonging influences decisions to major in STEM. *International Journal of STEM Education*, *5*(1). https://doi.org/10.1186/s40594-018-0115-6

Rattan, A., Savani, K., Chugh, D., & Dweck, S. C., (2015). Leveraging mindsets to promote academic achievement: Policy recommendations. *Perspectives on Psychological Science*, *10*(6), 721-726. https://doi.org/10.1177/1745691615599383

Roche, R., Manzi, J., & Kruithoff, C.B. (2020). The benefits of being a "buddy": Exploring the medical student experience as mentor to minority high-school students. *Health Equity*, 5(1), 1-7. https://doi.org/10.1089/heq.2020.0060

Sherrill, W. W., Mayo, M. R., Truong, D. K., Pribonic, P. A., & Schalkoff, A. C. (2016). Assessing medical student cultural competence: What really matters. *International Journal of Medical Education, 7*, 248–254. https://doi.org/10.5116/ijme.578b.687c

Sladek, R. M., Bond, M. J., Frost, L. K., & Prior, K. N. (2016). Predicting success in medical school: a longitudinal study of common Australian student selection tools. *BMC Medical Education*, 16, 1-7. https://doi.org/10.1186/s12909-016-0692-3

Stegers-Jager, M. K. (2018). Lessons learned from 15 years of non-grades-based selection for medical school. *Medical Education, 52*(1), 86–95. https://doi.org/10.1111/medu.13462

Tachine, R. A., Cabrera, L. N., & Bird, Y. E. (2017). Home away from home: Native American students' sense of belonging during their first year in college. *The Journal of Higher Education, 88*(5), 785–807. https://doi.org/10.1080/00221546.2016.1257322

Talamantes, E., Gonzalez, K., Mangione, M. C., Ryan, G., Jimenez, A., Gonzalez, F.,.Greenwood, S. S., Hayes-Bautista, E. D., & Moreno, G. (2016). Strengthening the community college pathway to medical school: A study of Latino students in California. *Family Medicine*, *48*(9), 703-710.

Thompson-Rogers, K., Davis, D., Davis-Maye, D., Turner, C., (2018). Historically black colleges and universities' mentorship of health profession students: A content analysis exploring the North Carolina health careers access program. *IAFOR Journal of Education, 6*(2), 17-32.

Ulloa, J., Viramontes, O., Ryan, G., Wells, K., Maggard-Gibbons, M., & Moreno, G. (2018). Perceptual and structural facilitators and barriers to becoming a surgeon: A qualitative

study of African American and Latino surgeons. *Academic Medicine*, *93*(9), 1326–1334. https://doi.org/10.1097/ACM.0000000000002282

U.S. Census Bureau. (n.d.). *U.S. Census Bureau QuickFacts: United States*. Census Bureau QuickFacts. Retrieved December 20, 2020, from https://www.census.gov/quickfacts/fact/table/US/PST045219

Uwaezuoke, K. (2018). *The Case of the Leaky Pipeline: Exploring the Experiences of Underrepresented Minority Premed Students in the UC System*. [Doctoral dissertation, University of California]. https://escholarship.org/uc/item/8q1424jc

Whalen, D., & Shelley, M. (2010). Academic success for STEM and non-STEM majors. *Journal of STEM Education: Innovations and Research*, 11(1), 45-60.

Wiebe, E., Unfried, A., & Faber, M. (2018). The relationship of STEM attitudes and career interest. *EURASIA Journal of Mathematics, Science and Technology Education*, *14*(10). https://doi.org/10.29333/ejmste/92286

Williams, M.J., George-Jones, J., & Hebl, M. (2018). The face of STEM: Racial phenotypic sterotypicality predicts STEM persistence by-and ability attributions About- students of color. *Journal of Personality and Social Psychology*, *116*(3), 1-28. doi: 10.1037/pspi0000153.

Wolfe, A.B., & Riggs, M. E. (2017). Macrosystem analysis of programs and strategies to increase underrepresented populations in the geosciences. *Journal of Geoscience Education*, *65*(4), 577-593. https://doi.org/10.5408/17-256.1

Xierali, M. I., & Nivet, A. M. (2018). The racial and ethnic composition and distribution of primary care physicians. *Journal of Health Care for the Poor and Underserved, 29*(1), 556–570. doi: 10.1353/hpu.2018.0036

Zhang, L., Lee, S.E., Kenworthy, C. S., Chiang, S., Holaday, L, Spencer, J. D., Poll-Hunter, N., Sanchez, J.P. (2017). Southeast and East Asian American medical students' perceptions of careers in academic medicine. *Journal of Career Development*, *46*(3), 1-16. https://doi.org/10.1177/0894845317740225