Mini-medical school programs decrease perceived barriers of pursuing medical careers among underrepresented minority high school students

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Abstract

Context: The percent of underrepresented minority (URM) students who apply to medical school has changed minimally in the past 40 years. Due to the lack of URM applicants, the consequent matriculation of URMs is grossly disproportionate from their percent representation of the US population. Increasing diversity among medical students and physicians has previously been identified as essential to decreasing healthcare disparities among US minorities.

Objectives: The objective of our study was to recognize the barriers of applying to medical school among URMs in high school.

Methods: To identify and assess the prevalence of barriers, surveys were distributed to participants of Med-Achieve, a mini-medical school program of diverse high school students in New York City during the 2019–2020 academic year.

Results: Among students who will be first in their immediate family to attend college, 80.0% perceived a barrier to pursuing medical school. Specified barriers indicated include the cost of medical school (77%), a lack of guidance/role models (53.9%), and the predicted inability to do well in medical school classes (53.9%). At the end of the program, a statistically significant reduction in the barrier of lack of guidance/role models was seen.

Conclusions: This study highlights the benefit of mini-medical school programs, especially programs with a mentoring component, to decrease the perceived barriers of applying to medical school among URMs. It also suggests the potential role of similar programs to increase diversity in medicine and to decrease healthcare disparities among minorities in the United States.

Keywords: diversity; mentoring; mini-medical school; underrepresented in medicine.

Matriculation of underrepresented minorities (URM) into medical school has largely remained stagnant over the past four decades [1]. As defined by the Association of American Medical Colleges (AAMC), underrepresented minorities in medicine (URiM) are “racial and ethnic populations that...
are underrepresented in the medical profession relative to their numbers in the general population.” [2] For instance, among medical students, Hispanics are underrepresented by 70% relative to the age-adjusted US population, black males by 60%, and black females by 40% [3]. One of the major obstacles in increasing matriculation of URMIs is the lack of URMs applying to medical school. In the past two decades, multiple efforts have been developed to increase URM applicants to medical school. In 1991, a project titled “3000 by 2000” sought to increase the number of URM applicants to 3,000 by the year 2000 [4]. Additionally, the Liaison Committee on Medical Education (LCME), the accrediting body for allopathic medical schools, introduced new standards mandating the establishment of pipeline and academic enrichment programs to increase diversity among matriculants [5]. Despite these endeavors, URMs only comprise about 15% of total medical student applicants and 8.5–13.4% of matriculants [1, 6]. The lack of URM applicants to medical school suggests a gap in URMs’ perceived ability to pursue medicine. Although many studies have highlighted this gap, few studies have identified specific barriers of pursuing medicine among URMs.

Mini-medical school programs are designed to provide early exposure and facilitate interest in medicine [7]. These programs, primarily sponsored by medical schools, are executed in numerous ways. Some schools have a one-day event, whereas other programs have multi-year programs with weekly sessions [8, 9]. Studies from these programs have unanimously shown an increased interest in medicine before and after the program [8, 9]. A pitfall, however, is that few of these programs track students over several years, and even fewer have URMs as a majority of their participants.

At Touro College of Osteopathic Medicine in New York, the mini-medical school program titled “Med-Achieve” is a two-year program designed to encourage local high school students to pursue medicine and healthcare careers. The majority of participants identify as URMs. The purpose of this study was to identify the perceived barriers, if any, of attending medical school among URM high school students and if a two-year mini-medical school program could serve to decrease these barriers.

Methods

Study population

This study was approved by the Touro College Health Sciences Institutional Review Board (#1921E). Funding was provided in part through an ExamSoft grant, an International Association of Medical Science Educators (IAMSE) educational research grant, and the American Osteopathic Foundation. Recruitment for the Med-Achieve program focused on New York City high school students of all high school years (ages 14–18). Twelve target schools were selected based on their location and primarily consist of high schools from the Harlem neighborhood of Manhattan and from the Bronx borough. While there was no selection of target schools based on community income, the student population from these target high schools are primarily from low-income communities and URM (Figure 1A and B) [10]. Med-Achieve program directors coordinated with high school teachers, guidance counselors, and administrators to recruit students who expressed interest in science, technology, engineering, and mathematics (STEM)-related careers. The study includes participants enrolled in the Med-Achieve academic year 2019–2020. A total of 51 students (31 first-year and 20 second-year students) enrolled and successfully completed the Med-Achieve program. From the 51 total study population, 49 students responded to the pre-program demographic data, 39 to the pre-program survey, 43 to the mid-program survey, and 35 to the post-program survey (Figure 2). Students in the program were allowed a total of four absences throughout the program. The variation in response rates pre-, mid-, and post-program are reflective of the attendance at each session. Prior to beginning the program, written informed consent was obtained from the parents to participate in the study and have the results published.

Program and setting

Med-Achieve is a two-year after-school medical science enrichment and mentorship program sponsored by Touro College of Osteopathic Medicine in the Harlem neighborhood of New York City. The program pairs high school students with mentors, who are first- and second-year medical school students. The Med-Achieve curriculum is composed of two parts, MedStart in the first year and MedExcel in the second year. In the first year, “MedStart” students are introduced to basic medical science concepts. Second-year “MedExcel” students apply basic medical science concepts to clinical diseases organized by organ system. A total of 16 two-hour sessions are conducted per year on a weekly basis. In the first hour, a didactic lecture prepared by medical students is delivered to high school participants to lay foundational knowledge; this is followed by active learning in the second hour through small group activities or laboratories. High school students are encouraged to problem-solve with their peers, in addition to asking their medical student mentor to provide help to understand concepts.

Program and survey

Students were asked to complete a questionnaire prior to beginning the program, at the halfway point, and at the end of the program (Figure 3). The time to complete each survey was less than 10 min. Select items related to demographics and perceived barriers to becoming a physician were utilized for statistical analysis. Participants completed the pre- and mid-program surveys in person. Physical copies of the survey were distributed, in which participants were able to indicate the presence of a barrier (indicating yes or no) and selecting as many of the four predefined barriers, with the ability to write in additional barriers not listed. Perceived barriers were generated based on literature-reported challenges URM faced in applying to medical school, physician assistant school, pharmacy school, and graduate science program [11–14]. These barriers include academic, guidance/mentorship, and financial barriers [11–13]. To better delineate specific academic barriers from general intelligence, we separated perceived academic barriers into difficulty in science classes and perceived ability to succeed in medicine.
Due to the COVID-19 global health pandemic, the post-program survey was completed remotely via Google Forms.

**Data analysis**

Survey data were generated into an electronic spreadsheet utilizing a licensed version of Microsoft Excel, version 2016 (Microsoft Corporation, Redmond, WA, USA). Data grouping and chi-square analysis were also performed on Microsoft Excel. Multiple $2 \times 2$ contingency chi-square tables with variables (1) pre-, mid-, or post-program and (2) reported barrier(s) (academic, performance in science classes, guidance/mentorship, and financial) were generated to determine the associations, if any, between categorical variables and to assess significance in reducing the mean reported perceived barriers of becoming a physician. A value of $p<0.05$ was considered statistically significant.

**Results**

**Demographics**

Participants in Med-Achieve voluntarily self-identified their ethnicity prior to the first session of the program. Among the 49 students who responded to the pre-program demographic survey, 16 (32.7%) identified as Asian, 16
(32.7%) identified as Hispanic or Latino, 15 (30.6%) identified as Black or African American, and 2 (4.1%) identified as white (Table 1). The program consisted of 38 (77.6%) female participants, 9 (18.4%) male participants, and two participants who did not specify their gender (Table 1). Thirty-one (88.6%) students reported attending a New York City public high school (Figure 1C).

Family education impacts perceived barriers of becoming a physician

Overall, 26 (66.7%) of the students who completed the pre-program survey reported a perceived barrier. Students of various levels of family education reported a difference in the perceived barriers to becoming a physician. Students who would be first in their family to attend a 4-year university were 17.9% more likely (8/10 first generation [80.0%] compared to 18/29 non-first generation [62.1%]) to report a perceived barrier to pursuing a medical career. Additionally, students who would be the first in their family to attend medical school were 16% more likely (20/28 first generation [71.4%] compared to 6/11 non-first generation [54.5%]) to report a perceived barrier to pursuing a medical career.

Med-Achieve decreases perceived barriers of becoming a physician

At time points of pre-, mid-, and post-program, students were asked if they perceived any barriers to becoming a physician via survey (Figure 4). Initially, 26 (66.7%) of
The students felt there were barriers to pursuing medical school. The greatest reason for these perceived barriers included the cost of medical school (20 students, 76.9%), followed by a lack of proper guidance, role models, or support system (14 students, 53.9%), not being smart enough (14 students, 53.9%), and difficulty of science classes (6 students, 23.1%). Halfway through the program, an overall perceived barrier was reported by 22 students (51.2%) and by 22 students (62.9%) at the end of the program (Figure 4). A chi-square test analysis of pre-, mid-, and post-program response revealed a significant change in the self-reported barriers related to medical school. The greatest decline in perceived barriers was the perception of guidance, role models, and support system (53.9% pre and 18.2% post; p=0.01). This was followed by a significant reduction in the perceived barrier of the cost of medical school (76.9% pre and 45.5% mid, p=0.02, Figure 5). The perceived barriers of science class difficulty and perceived barriers related to not being smart enough to do well in medical school did not significantly change throughout the program.

Second-year students perceive more barriers to becoming a physician

Student responses at the end of the year were grouped into year 1 (MedStart) or year 2 (MedExcel). Of the 10 students in the second year of the program who responded to the survey, eight students felt that there were barriers. In comparison, 14/22 (63.6%) students in their first year reported barriers.

Discussion

Increasing diversity among medical students and physicians is an essential step in decreasing healthcare disparities among US minorities. In a study by the National Bureau of Economic Research, black men were reportedly more likely to select preventative health services when offered by a black doctor [15]. This represents one aspect of the need to increase URiM because it can help decrease the black-white health care gap [15]. Our study explored the perceived barriers of pursuing medical school among URiM students and how a mini-medical school program can help to decrease these perceived barriers. Previous studies have shown a gap between URiM and white medical school applications; however, few studies have identified the potential barriers that may be causing this gap [1,6]. In this
study, we identified that the greatest perceived barriers by high school students to pursuing medical school included being the first generation in his or her family to attend college or medical school, the cost of medical school, the lack of guidance and/or role models, and the perceived inability to do well academically in medical school. Conversely, the difficulty of science classes was not identified as a significant barrier. Identifying these barriers can help shape programs to increase the number of URiM students applying to medical school.

Students who were the first generation to attend college and the first generation to attend medical school reported a higher perceived barrier to pursuing medicine. This trend suggests that prior family education may influence a student's perception of the barriers related to becoming a physician. Previous studies have shown that students whose parents did not go to college are 12% less likely to attend college within 10 years after high school [16]. When these students do pursue college, they are often faced with added challenges that impact their success [17]. Therefore, mini-medical school programs should identify and support first-generation college students who may be interested in health sciences.

The primary aim of most mini-medical school programs is to allow students to experience medicine and interact with medical students and faculty. Med-Achieve at Touro College of Osteopathic Medicine in New York was specifically designed to increase the resources for URiM high school students interested in medicine. A core component of the Med-Achieve program is direct mentorship from first- or second-year medical students. Each high school student is paired with a medical student for the entirety of the program. The medical student's role as a mentor ensures that the high school students are able to navigate and apply the medical knowledge taught during the weekly lessons. The mentorship relationship extends

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**Figure 4:** Student-perceived barriers of becoming a physician remained relatively unchanged (SD=0.08) through the program.

**Figure 5:** Participants' responses at various time points assessing potential barriers of becoming a physician. Chi-square tests indicate a significant change in the mean of self-reported barriers related to medical school, including guidance and mentorship pre- and post-program (p=0.01). Pairings of pre- and mid-program indicate a significant mean change specific to financial barriers (p=0.03).
Beyond medicine, as many mentors provide guidance to the college application process, social support, and general encouragement for their mentee’s goals. Through this one-on-one mentoring, we were able to significantly reduce the barriers related to a lack of guidance/mentorship. By demystifying the perception of medical school, the program may have provided to the high school students a means of support and may have empowered them to recognize their own potential. Additionally, the Med-Achieve program provides 2 years of mentorship to high school students. One-day mini-medical school programs may be missing an opportunity to provide long-term mentorship and guidance. We suggest that mini-medical school programs throughout the country implement long-term one-on-one student mentorship.

Financial barriers were reported to be the highest barrier of applying to medical school, with a significant decline observed mid-program and an increase at the end of the program. Our target population of high school students for the Med-Achieve program were from public schools located in low-income neighborhoods (Figure 2). Given the target population and rising cost of tuition across medical schools, it is not surprising that barriers related to finances are the highest across all barrier domains. The cost of medical school is not a factor that can be changed via mini-medical school programs. However, our study showed a significant decrease in cost as a perceived barrier. This decline is likely related to education provided on scholarships, resources, and loan forgiveness available to URiM students. In the last Med-Achieve session of the 2019–2020 academic year, the program provided resources and answered questions regarding college and medical school finances, which high school students reported was very helpful; the authors suggest the implementation of financial counseling in other mini-medical school programs.

Interestingly, 80.0% (8 of 10) of students in the second year of Med-Achieve reported barriers to medical school at the end of the program. This percentage was unexpected, as it was higher than reported at the beginning of the program. Further analysis suggests that this percentage may be skewed due to a number of factors. First, very few students completed this survey. This survey was offered remotely at the end of the program; out of 20 students in their second year, only 10 responded (50.0% response rate). It is possible that if more students responded, then the percent who felt there were barriers would be decreased. The reason for the survey being conducted remotely is tied with the second reason that the data may be skewed. This survey was collected in May 2020 during the height of the COVID-19 pandemic in New York City. The extenuating circumstances of a pandemic may have led students to feel anxious about the ability to attend college and medical school safely. Lastly, the second-year Med-Achieve students, at the time of the survey, may have been experiencing barriers related to applying to colleges, because the majority of respondents identified as high school seniors. The only barrier that increased greater than 5.0% was the barrier related to cost. The high school seniors were likely going through the process of applying for student loans and financial aid, which may have impacted their perceptions of financial barriers.

The results of this study have been taken into consideration in adjusting the subsequent Med-Achieve program year. In an effort to reduce barriers related to finances, directors of the program will continue to include information related to scholarships and pathways that may reduce the financial burden of attending medical school. To reduce barriers related to perceived academic success in medical school, mentors will be encouraged to share their experiences and the challenges they faced when applying to medical school. By sharing diverse experiences, it is the intention of Med-Achieve to build confidence in the high school students’ abilities to succeed in medical school.

This study has some limitations. First, the number of study participants is small and only represents a subset of URiM students in New York City. A larger survey of URiM high school students may reveal additional barriers. Secondly, the Med-Achieve program seeks out students who already have an interest in health sciences. Although students who are unsure about their future career interests are welcome to join the program, program recruitment focuses on high school science classes. This may lead to selection bias of our study participants. The authors believe that these limitations do not significantly impact the study results because URiM students with a preconceived interest in health sciences still experience barriers to medical school, similar to all high school students. In future studies, the authors plan to distinguish various groups within URiM to better understand if certain racial groups report similar or different perceived barriers.

Conclusions

In summary, this study identified barriers to pursuing a medical career among URiM high school students. Among these barriers, cost, family education, and guidance/role models were the highest reported. Med-Achieve, a two-year
mini-medical school program, was able to reduce the barriers of cost and guidance/role models. Future studies are needed to track these students as they attend college and to determine if they are more likely to apply and matriculate into medical school. Additionally, studies are needed to measure if perceived barriers among URiM students change throughout high school and college.

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Competing interests: None reported.

Informed consent: All participants in this study provided written informed consent prior to participation.

Ethical approval: All data collected was approved by the Touro College Institutional Review Board (IRB #1921E).

References