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Examining the First Peer-to-Peer Mentorship Program (F1Doctors) for International Medical Students

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ABSTRACT

In this study, we report international medical students in the United States and conduct an analysis of the first, peer-to-peer, national mentorship program for international medical students and international pre-med applicants in the US (F1Doctors). We used analyzed survey data collected through F1Doctors and the Association of American Medical Colleges yearly matriculation reports. Results indicated that the average college grade point

average (GPA) and Medical College Admission Test score (MCAT) of international applicants was higher than that of all applicants. Additionally, non-US applicants reported facing numerous unique challenges such as limited access to extracurricular opportunities and difficulty finding mentors who are familiar with the application process. International applicants have the potential to increase the diversity of healthcare professionals, and F1Doctors is the first platform to support international healthcare applicants in the US.

Keywords: International applicants, medical school, health professional school, GPA, MCAT, challenges, F1Doctors

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INTRODUCTION

The United States is the most popular post-secondary education destination for international students, with well-established pathways and initiatives including the Department of State's Education USA network and 8,369 colleges and universities, certified by the Student and Exchange Visitor Program (SEVP), who were eligible to issue F1 and M1 student visas in the 2020 calendar year (Student and exchange visitor program, 2020). According to the Open Doors Report, there were 1,075,496 international students enrolled in the US in the 2019-2020 academic year. In 2020, international students made up about 5.5% of the total US student population (Institute of International Education, 2020). Within medical education alone, the Association of American Medical Colleges (AAMC) reported 1294 total enrolled non-US citizens or non-permanent residents in 2020-2021, which is a 2.34% decrease compared to 2016-2017 enrollees (1325 total) (Association of American Medical Colleges, 2020). Despite a dramatic increase in the US international student population over the last 50 years, the pathway to pursuing a medical education in the United States as a non-US permanent resident or non-citizen remains extremely challenging.

Currently, the most common path for non-US citizens to practice medicine in the United States is through pursuing their medical degree (MD, MBBS) in their home countries and entering the United States as international medical graduates (IMGs). IMGs are an extremely valuable part of the US healthcare workforce (Pinsky, 2017). In the 2022 match cycle, 4,571 IMGs matched to residency training spots in the United States (Educational Commission for Foreign Medical Graduates 2022.). An IMGs' entry into the US is organized and facilitated through the Educational Commission for Foreign Medical Graduates (ECFMG), a private non-profit organization founded in 1956 (Hallock & Kostis, 2006). Recent changes such as the United States Medical Licensing Examination (USMLE) Step 1 exam transitioning

to pass/fail grading among other immigration policies have provided potential challenges and disadvantages to the IMG community pursuing residency and fellowship opportunities in the US (Al-Akchar et al., 2021).

The alternate path for non-US citizens to practice medicine in the United States is to attend an undergraduate institution of higher learning followed by an accredited medical school in the US. However, the proportion of international students applying to residency programs from US medical institutions, is much smaller than that of IMGs pursuing residencies (Datta& Miller, 2012; Educational Commission for Foreign Medical Graduates, 2022). Medical schools are one of the least accessible educational institutions for international students, and international medical students remain a large minority in the US (Association of American Medical Colleges, 2020). International medical students also have a comparatively low medical school matriculation rate. In the 2020 application cycle, there were 1841 international applicants to US medical schools, with only 15% matriculating (276) (Association of American Medical Colleges, 2020). This is well-below the national matriculation average of 41.9% (22,239 matriculants from 53030 applicants (Association of American Medical Colleges, 2020). Additionally, out of the 155 accredited allopathic and the 37 osteopathic medical schools in the US, only 48 and 14, respectively, accept applications from international students (American Association of Colleges of Osteopathic Medicine, 2022). The majority of public US medical schools do not consider applications from international students (Aspiring Docs., n.d.)

In addition to the lower number of schools that accept applications from international students, there are numerous unique challenges faced by international medical student applicants that likely contribute to their low matriculation rates. However, these specific challenges have yet to be characterized and no organizations exist to support international students in their application journey to US medical schools.

To provide relevant mentorship and resources to international students applying to US health professional schools, and further explore the unique challenges that students might be facing, F1Doctors was created in May 2020. It is the first online, national, peer-to-peer mentorship platform for international pre-health students in the US (F-1 Doctors, 2022). F1Doctors is a completely free platform where international pre-health and health students can access one-on-one mentorship from international volunteer mentors at different stages of their health professional training (current medical students and residents). In addition, the platform has centralized resources catered to international students such as lists of programs that accept international students in the US, respective financial aid policies, loan companies that fund international students, pre-baccalaureate programs, and gap year opportunities. The resources are also shared widely over social media

platforms (Instagram, Facebook, Twitter), and anonymous surveys and feedback are collected through these platforms as well.

LITERATURE REVIEW

To date, there has been a scarcity of literature on international students pursuing medical education in the US (Datta & Miller, 2012). Additionally, many studies do not differentiate this group from IMGs even though vast differences in their educational paths exist. To our knowledge, the only article to date that has highlighted international medical students in the US is by Data and Miller (2012), which highlights the critical need for our work. Related research from other disciplines as well as studies on international students outside of the US have been drawn upon throughout our discussion to highlight potential similarities/differences and avenues for future research.

We highlight the current state of international medical students in the US, the challenges they face while applying to US medical schools, and the impact F1Doctors has had on the application process of mentees. We draw on results from the Association of American Medical Colleges' yearly reports as well as a year-in-review of F1Doctors (F-1 Doctors, 2022). Throughout this manuscript, we define international students as students on F-1 visas or students who are considered non-U.S. citizens or non-US permanent residents.

The AAMC national data has been used by numerous groups to assess diversity-related trends in the medical school applicant pool (Hill et al., 2020; Jolly et al., 2008; Lett et al., 2018; Merritt et al., 2021; Vick et al., 2018). A 2008 study using AAMC data in addition to data from the American Association of Colleges of Osteopathic Medicine and the Educational Commission for Foreign Medical Graduates emphasized a potential need to recruit more applicants given the projected increase in the capacity and number of US MD and DO schools (Jolly et al., 2008). A 2015 study by Smith et al. that used AAMC data illustrated significant differences between race distribution within US medical schools and the race distribution for overall, regional, and subregional populations (Smith et al., 2015). Paired with the considerably lower application rates from underrepresented minorities (Black/ African American, Native Hawaiian/ Pacific Islander, American Indian/ Alaskan Indian), the authors concluded that these differences may reflect societal quandaries more broadly that influence opportunity and career choice (Smith et al., 2015). None of these studies, to our knowledge, included international applicants. Our study is the first to focus on the national landscape of international medical applicants, recognizing their contributions to the diversity of medical schools.

Challenges Faced by International Students Applying to US Medical Schools

Given that the proportion of international students enrolling in US medical schools is decreasing compared to an increase in the overall international student population in the US, there is reason to believe that challenges affecting international students might be more unique to those pursuing medical education compared to other fields in the US. Additionally, international pre-medical students in the United States likely face different challenges compared to pre-medical students in other countries.

Applications to US medical schools for medical education (MD and DO programs) require an undergraduate education specifically at a US accredited institution, with some accepting a Canadian degree as well, whereas MBBS programs in most other countries can be pursued immediately after high school graduation in any country (Zavlin et al., 2017). Many countries with undergraduate medical programs commonly welcome international medical students and assess their needs on a case-by-case basis (Byrne et al., 2019; Huhn et al., 2016; Huhn & Nikendei, 2018; Yilmaz et al., 2020). In general, international students pursuing medical and other degrees outside their home countries have been reported to face several challenges that center around culture shock, feelings of isolation, socio-cultural adaptation, and assimilation, language barriers, and adapting to a new environment and health care (Belford, 2017; Newsome & Cooper, 2016; Wang et al., 2018). It is likely that international applicants to US medical schools face these as well, however most are well acclimated by the time they apply due to their time spent in the US as an undergraduate student (Datta & Miller, 2012). Instead, our data shows that the barriers these students face are limitations in extracurricular opportunities, poor healthcare advising resources on campus and a lack of mentors who truly understand the process.

First, international students that wish to enroll in extracurriculars off-campus or take a job during the summer or their gap year to attain work experience must apply for optional practical training (OPT) beforehand (Nilsson & Ripmeester, 2016). Non-STEM majors are limited to one cumulative year of OPT, and STEM majors are allowed three years across their undergraduate summers and gap years, limiting the number of US-based internships, research programs or gap year jobs they can undertake**.** OPT also limits part-time work opportunities and those not directly related to one's field of study (Nilsson & Ripmeester, 2016). This might make gaining clinical experience through work such as medical assistance or scribe positions more difficult if a student does not have what is deemed a related major. International students are also not eligible for any federally funded research or pre-medical programs to strengthen their application. Lastly, international students struggle to find mentors that can support them on their journey to medical school. While the process and requirements of applying to US

medical schools is standardized, non-US citizens require additional guidance when it comes to finding internships and research opportunities that accept non-US citizens, immigration barriers while applying, and real costs associated with attending a US medical school as a non-US citizen. Only individuals who have gone through this process can accurately speak to these topics. In the past, prior to the creation of F1Doctors, international students struggled to find mentors who could answer their specific questions leaving them to navigate the process alone. These examples highlight the disadvantages faced by international undergraduate students in the US when it comes to accessing extracurricular opportunities and finding mentors to guide them through the application process. Further research is needed to understand if this inaccessibility to opportunities resulted in differences in the resumes of international students vs all applicants at the time of medical school application.

Yet another challenge is the very limited number of schools that accept international students. Out of the 155 accredited allopathic and the 37 osteopathic medical schools in the US, only 48 and 14 respectively accept applications from international students, with most public US medical schools not considering international applicants *(*Aspiring Docs, n.d.). Almost all state-funded schools refuse international applicants (Datta & Miller, 2012). Moreover, even at schools that accept international students, their international student status might disadvantage them.

One study interviewed deans of medical school admissions from US and Canadian medical schools to learn about the admissions process, what factors are weighed in deciding who to extend interviews and offers of admission to, and how these factors have changed since an analogous study performed in 1986. Their results, based on the ratings of 120 admissions deans who responded to a survey sent to all US and Canadian medical schools, showed that in the 2008 survey, interview recommendation was the most important factor in deciding who to admit, replacing cumulative GPA from the 1986 survey (Monroe et al., 2013). In 2008, letters of recommendation were second most important followed by cumulative GPA (Monroe et al., 2013). Moreover, in 2008, the following factors were listed as "medium importance" factors: experience with underserved populations, medical/clinical research experience, state residency, GPA (cumulative nonscience/math), and US citizenship. The last two, US citizenship and cumulative nonscience/math GPA were considered to tie in importance, illustrating the high consideration citizenship status is given in evaluating international pre-medical applicants (Monroe et al., 2013).

There has been a lot of efforts aimed at increasing diversity and representation among medical school matriculants (Vick et al., 2018), and international students spanning from across the world contribute significantly to the diversity of health care providers. A 2018 report from office of

admissions at the Ohio State University College of Medicine provides eight broad tactics to increase diversity in medical school admissions that include emphasizing diversity enhancement in mission and vision statements, making committee voting anonymous and having multiple screening per application to minimize bias (Capers et al., 2018). The report also recommended adopting a holistic review to place academic scores in individual context, blinding interviewers to applicant scores, having committee members undertake the implicit association test (IAT) and reviewing overall results, hiding applicant photos, and increasing diversity on the committees (Capers et al., 2018). Unfortunately, to our knowledge, there are no efforts to blind an applicant's citizenship status. This might impact the low percentage of medical school applicants that are international. Collectively, these studies and statistics highlight systemic factors within medical education that likely impact acceptance rates of international students and their low matriculation rates into medical schools historically.

Financing medical school is another hefty obstacle faced by international medical students. International students face a lot of difficulty procuring external loans since most banks require a credit worthy US citizen or permanent resident co-signer to sanction loans to international students, and many banks charge high interest rates (Parker; Sanyal, 2*006*). In the past few years, a few new private lenders for international students that don't require co-signers have entered the market (F-1 Doctors*,* 2022; MPOWER Financing, 2020; Prodigy Finance, 2022; Stilt, 2022.), but they also charge high interest rates as well. A few schools additionally require incoming students to deposit anywhere from one to four years' worth of tuition and living expenses in an escrow account prior to the issuance of visa paperwork (Datta & Miller, 2012). Given these challenges, international students are very often dissuaded by pre-medical advisors and mentors alike from pursuing pre-medical students in the US.

Lastly, the start of medical school does not mark the end of the road, as international medical students also face limited eligibility for external grants and are limited by the number of residencies willing to sponsor their residency visas (J-1 or H-1B) (Datta et al., 2013). A US medical degree enables international medical students to pursue a year of optional practical training before transitioning to their H-1B or J-1 visa for the remainder of their residency training. In addition to matching at a visa sponsoring institution, international medical students need to make sure to complete all visa requirements prior to applying for their J-1 or H-1B visa. For example, H-1B visa applicants are required to have passed all three united states medical licensing exams (Datta et al., 2013; American Medical Association*,* 2020). Moreover, both J-1 and H-1B visas have stringent limitations: a cap on training years, visa expiration and renewal times and costs, moonlighting and visa transfer restrictions, and requirements such as the home country

requirement for the J-1 visa (Datta et al., 2013). Faced with all these challenges, it is no surprise that only less than 300 international students matriculate in US medical schools every year and even more are discouraged from even applying.

F1 Doctors Mentoring Program

F1Doctors, established in May 2020, is a free, web-based platform geared to supporting non-US citizens on their journey to health professional schools (F-1 Doctors, 2022). The platform provides mentorship through an online application process. Mentees can simply send an email to a mentor directly and schedule a time to speak with them. From that point, a mentor-mentee relationship is cultivated in an independent manner.

The organization also creates resources tailored specifically for non-US citizens applying to health professional schools such as: 1) a curated list of medical schools that accept international students along with their respective financial aid policies; 2) a list of gap year opportunities international pre-meds can apply to; 3) a list of lenders that provide loans to non-US citizens for university without the need for a US citizen cosigner.

In the year since its founding, F1Doctors has grown to include 144 mentors from over 44 countries and has received over 900 mentorship requests as of July 2021. To assess the impact of F1Doctors, an anonymous survey is sent out every year. This survey characterizes the mentor's and mentee's experience of working with F1Doctors and how it helped them in their application process. This data was utilized and analyzed in our study.

RESEARCH METHOD

To capture the individual experiences of international students at US medical schools, their personal struggles, and barriers to information access, an F1Doctors-led survey was pursued. The use of a survey is justified by the relative scarcity of published data about international students' experience in medical school. Surveys have been used in previous literature, albeit not related to international students, to grasp personal challenges and views of medical students (Duffield & Spencer, 2002; O'Connell et al., 2018). Overall, given the scarcity of published data and the goal to grasp individual student experiences, AAMC published data as well as F-1Doctors-led anonymous surveys were chosen to capture the landscape of international students at US medical schools in this article.

AAMC National Data

To assess differences in academic scores between international students versus all medical students, results from the national AAMC yearly

results were analyzed (Association of American Medical Colleges, 2020). Notably, given that the goals of the study were to understand what information is currently available, paid special reports from AAMC were not sought out. Only pre-prepared reports that were available upon request were utilized. The non-U.S Citizen and Non-Permanent Resident column from AAMC's 'Table A-18: MCAT Scores and GPAs for Applicants and Matriculants to U.S. Medical Schools by Race/Ethnicity' was utilized for international applicant and matriculants data. The 2020-2021 Column from AAMC's 'Table A-16: MCAT Scores and GPAs for Applicants and Matriculants to U.S. Medical Schools' was utilized for all applicants and matriculants data.

F1Doctors Year-in-Review Surveys

An anonymous survey geared towards understanding (1) the academic scores of and challenges faced by international applicants during the 2020-2021 cycle, as well as (2) any benefits they gained from F1Doctors was distributed through Facebook, Instagram, and email list-serves of F1Doctors. A survey was also sent to F1Doctors mentors (who are current students or graduates of US medical schools) to assess their GPAs and MCAT scores. These surveys were sent by our quality control and resources departments respectively and meant to internally assess our performance and provide resources and statistics for our mentees. According to the Yale University IRB guidelines, this research is deemed non-human subject research since it is a secondary analysis of existing data. IRB review was not required for this study because it does not fall within the regulatory definition of research involving human subjects. Moreover, this research was performed on a de-identified dataset that was not originally collected for the purposes of this study, was voluntarily reported by respondents anonymously, and was retrospectively analyzed in this study.

Statistical Analysis

A One-way ANOVA with Turkey's ad hoc analysis for multiple comparisons was used to assess differences in MCAT scores and GPA between all international applicants and F1Doctors 2020-2021 applicants and matriculants. A Two-Way ANOVA with Turkey's ad hoc multiple comparisons test was used to assess differences in MCAT and GPA scores between all medical school applicants, regardless of citizenship, and international applicants over time. An overall p-value of 0.05 was utilized. PRISM Graph Pad 9 was utilized to generate all the graphs displayed and perform statistical analysis.

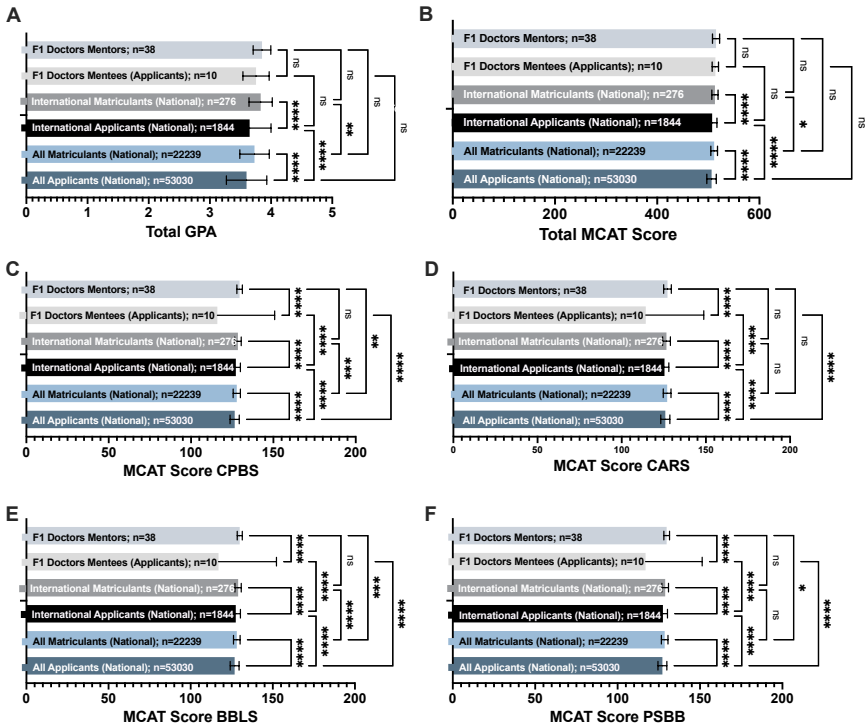
RESULTS

Average GPA and MCAT Scores for International Matriculants and Applicants Are Higher Than All Applicants.

Thirty-eight out of one hundred and ten F1 Doctors mentors responded to the F1Doctors year in review survey. The GPA and MCAT averages in 2020-2021 were compared in **Fig 1** between international applicants, international matriculants, all applicants, all matriculants, F1Doctors mentees (pre-medical students applying to medical school), and F1Doctors mentors (current international students at a US medical school).

Figure 1

Comparison of 2020-2021 applicants' and matriculants' GPA (A) and MCAT averages (B-F).

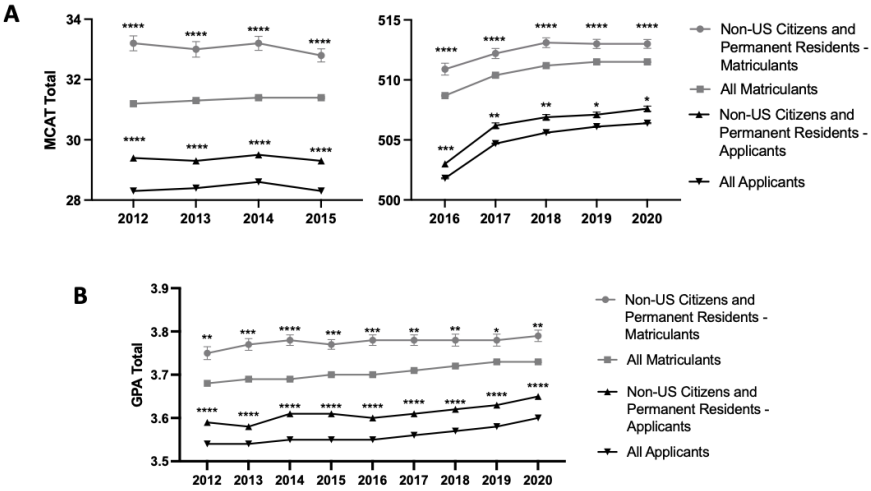


Note. Graphs show Mean ± SD. *p<0.05, **p<0.005, ***p<0.0005, ****p<0.0001 based on One-Way Anova with Turkey's ad hoc multiple comparisons test. The non-U.S Citizen and Non-Permanent Resident column from AAMC's 'Table A-18: MCAT Scores and GPAs for Applicants and Matriculants to U.S. Medical Schools by Race/Ethnicity' was utilized for international applicant and matriculants data. The 2020-2021 Column from AAMC's 'Table

A-16: MCAT Scores and GPAs for Applicants and Matriculants to U.S. Medical Schools' was utilized for all applicants and matriculants data.
*Note: The F1Doctors mentors did not matriculate in the 2020-2021 academic year. They served as mentors for the applicants applying in the 2020-2021 cycle and thus were included in the analysis to gauge the academic scores of the mentors in comparison to all and international matriculants of this year.

First, using the AAMC yearly report, results showed that the average GPA of international matriculants in 2020-2021 was higher than that of all matriculants during that same period (3.83±0.19 vs 3.73±0.24, p=0.0027), and the average GPA of international applicants was also higher than that of all applicants (3.65±0.25 vs 3.6±0.3 p< 0.0001). A similar trend was seen with MCAT total results in that the total score of international applicants was higher than that of all applicants (506.7±9.4 vs 506.4±9.2, p<0.0001) and the score of international matriculants was higher than that of all matriculants (513±6.2 vs 511.5±6.5, p=0.0419).

Figure 2
The academic scores of international medical applicants and matriculants over time



Note: Graphs Show Mean ± SEM; . *p<0.05, **p<0.005, ***p<0.0005, ****p<0.0001 based on Two-Way Anova with Turkey's ad hoc multiple comparisons test. The 'Non-US Citizen of Permanent Resident' rows from AAMC's Table's A-16 to A-19: MCAT Scores and GPAs for Applicants and Matriculants to U.S. Medical Schools by Race/Ethnicity' was utilized for MCAT and GPA scores.

Based on survey results, F1Doctors mentees had lower scores on the individual MCAT sections compared to international applicants, however there was no significant difference in total MCAT score (513.8±6.1 vs

507.6±9.4, p=0.194). Comparing the MCAT score and GPAs of all F1Doctors mentors with all international matriculants on the AAMC yearly review showed no significant difference (MCAT Score: 515.19±6.9 vs 513±6.2, p=0.672; GPAs: 3.85±0.14 vs 3.83±0.19, 0.9989).

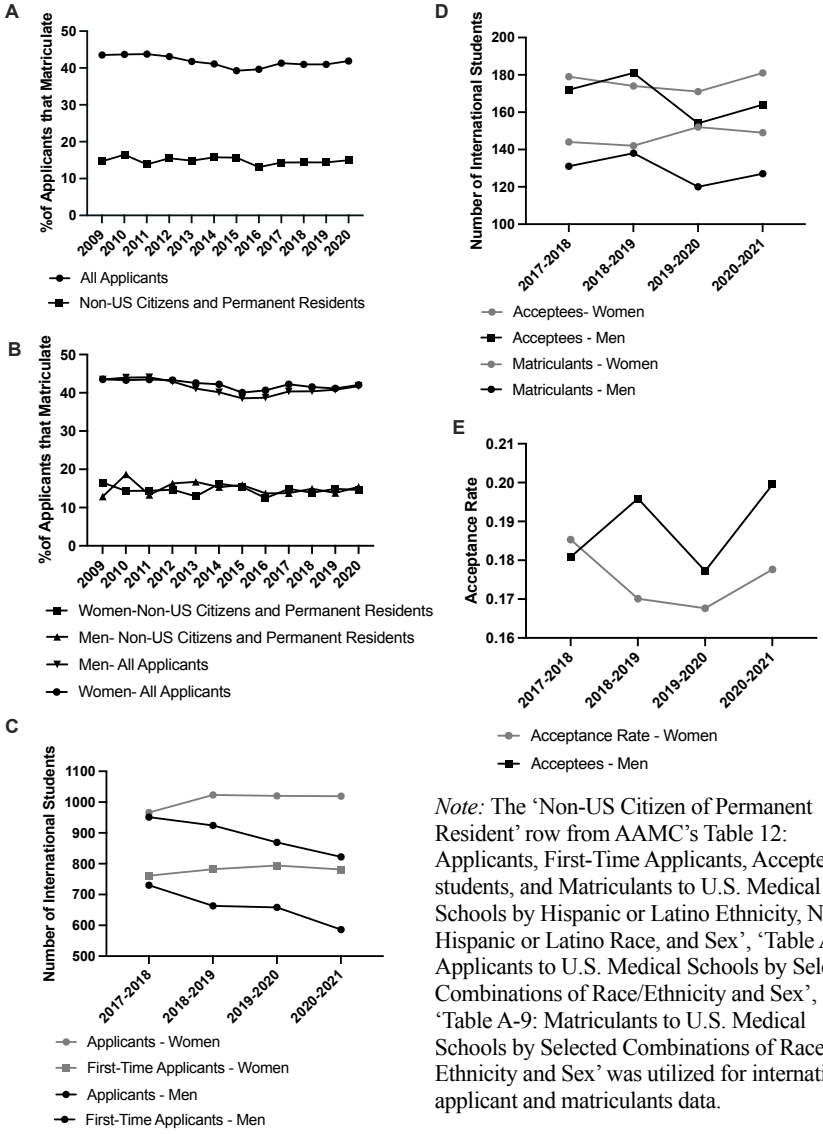
These results are further substantiated by **Fig 2** which analyzes the academic scores of international students over time. Results in **Fig 2A** show an upward trend in MCAT score for both domestic and international applicants/matriculants since the exam change in 2016. Notably, MCAT scores of international students were shown to be significantly higher than that of domestic students for the past nine years in 2012-2016 before the test change and in 2016-2020 after the MCAT change. Similar results can be seen when analyzing the GPA over time with a consistently higher GPA for international students since 2012 (**Fig 2B)**. These trends suggest that academic statistics and standards have been consistently higher for non-US citizen applicants and matriculants compared to domestic applicants and matriculants, and that F1Doctors mentors are representative of all international matriculants from an MCAT and GPA standpoint.

Matriculation Rates of International Medical Students Has Been Historically Lower Compared to All Applicants.

In the past four years, there has been a decrease in male international applicants, but their acceptance and matriculation rates remain high. Despite applying with a higher MCAT and GPA, **Fig 3A** which analyzes the landscape of international medical applicants over time shows that the percentage of international applicants that matriculate has been around 14% for non-US citizens and permanent residents compared to about 42% for domestic students since 2009, with no significant difference in the matriculation percentage between men and women in both the domestic and non-domestic groups (**Fig 3B**). Interestingly, over the past four years, there has been a greater number of female international applicants and first-time applicants compared to men (approximately 200 more females than males during 2020-2021 cycle**; Fig 3C**), however the difference in acceptances and matriculation between genders is less drastic (approximately 20 more females than males during 2020-2021 cycle; **Fig 3D**). The acceptance rate was also higher for men vs women (approximately 20% vs 17%). The reasons leading to these gender differences in these past four years are unknown, and notably, such major differences were not seen in 2009-2012 (data not shown).

Figure 3.

The landscape of international medical applicants and matriculants over time



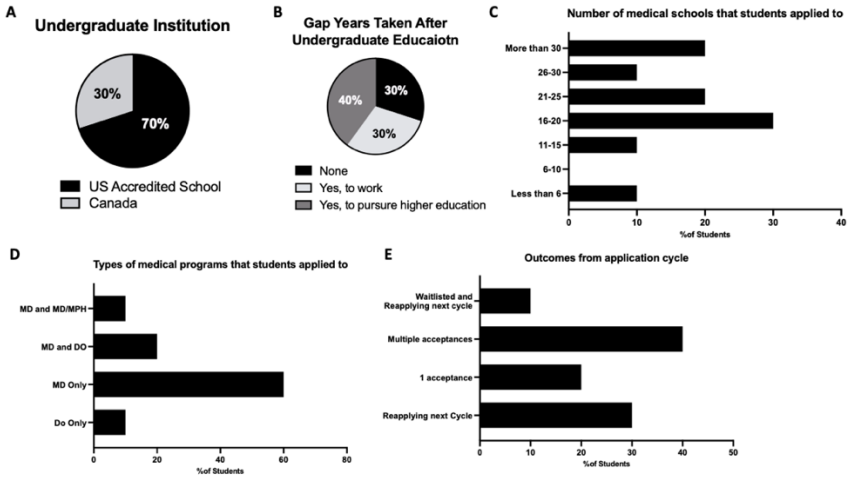
Note: The 'Non-US Citizen of Permanent Resident' row from AAMC's Table 12: Applicants, First-Time Applicants, Accepted students, and Matriculants to U.S. Medical Schools by Hispanic or Latino Ethnicity, Non-Hispanic or Latino Race, and Sex', 'Table A-8: Applicants to U.S. Medical Schools by Selected Combinations of Race/Ethnicity and Sex', 'Table A-9: Matriculants to U.S. Medical Schools by Selected Combinations of Race/ Ethnicity and Sex' was utilized for international applicant and matriculants data.

The Majority of F1Doctors Mentees Received One or More Medical School Acceptances in the 2020–2021 Cycle.

In the year since its founding, F1Doctors has grown to include 144 mentors from over 44 countries and has received over 900 mentorship requests as of July 2021. In the anonymous survey sent to mentees to assess the impact of F1Doctors on their 2020-2021 application cycle, ten mentees reported applying to medical schools during the 2020-2021 cycle. 70% of them attended a US accredited school for their undergraduate degree while 30% attended a Canadian university (**Fig 4A**). 30% of the F1Doctors mentees did not take a gap year between their undergraduate degree and medical school while 70% did take a gap year dedicated to higher education or to work (**Fig 4B**). Moreover, **Fig 4C** shows that about 50% of mentees applied to over 20 US medical schools during the 2020-2021 application cycle, with about 60% applying solely to MD programs (**Fig 4D)**. Outcomes from the 2020-2021 cycle for F1Doctors mentees show that 60% of the applicants have received one or multiple acceptances while about 40% of the mentees will be reapplying in the next cycle (**Fig 4E**).

Figure 4

Characteristics and outcomes from F1Doctors mentees that applied to medical schools in the 2020-2021 application cycle



Note: N=10 for all graphs. Figures A-E show responses to the year in review survey.

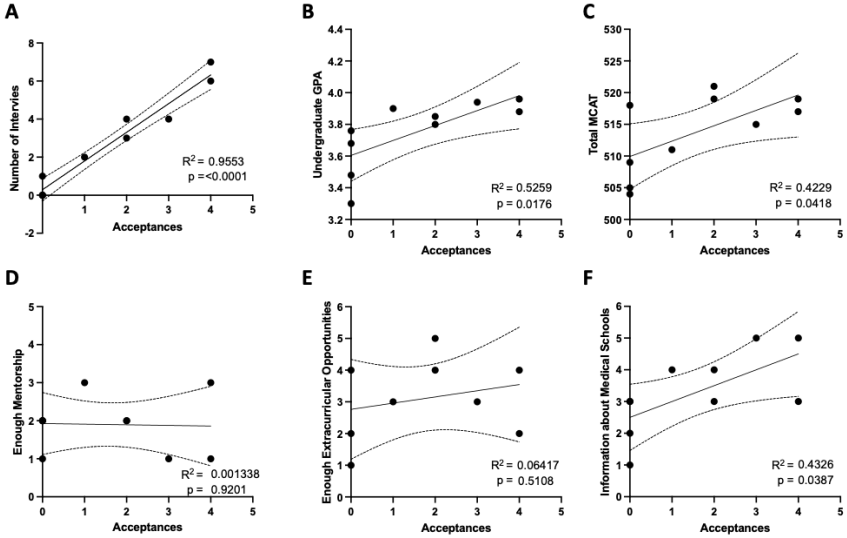
The Factors That Correlated Positively with Acceptances Include the Number of Interviews, GPA, Total MCAT Scores, and Self-Reported Sense of Receiving Enough Information About Medical Schools.

Delving into the different factors that are correlated with receiving acceptances for F1Doctors mentees, **Fig 5** suggests a positive correlation

between the number of interviews and the number of acceptances (R^2 =0.9553, p<0.0001) in that the more interviews an F1Doctors mentee received, the more acceptances the mentee was sent. A weaker but significant positive correlation was also found between the undergraduate GPA and the number of acceptances (R^2 = 0.5259, p=0.0176), and between the total MCAT and the number of acceptances (R^2 = 0.4229, p=0.0418). To assess if applicants felt they had enough mentorship, enough extracurricular opportunities, and enough information about medical schools, a likert-scale (1-5) was used. No significant correlation was found between the number of acceptances and self-reported sense of having enough extracurricular activities or sense of having enough mentorship. **Fig 5F** shows that the more mentees felt like they received enough information about US medical schools, the more likely they were to receive acceptances (R^2 = 0.4326, p=0.0387). This confirms the importance of outreach and access to information for international students which remains one of the primary missions of F1Doctors.

Figure 5

Factors that correlated with the number of acceptances that F1Doctors mentees received in the 2020-2021 application cycle.



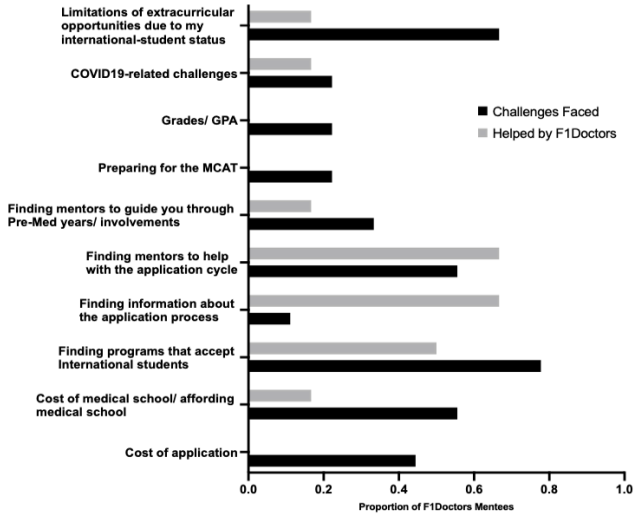
Note: Graphs show best fit lines with 95% confidence intervals. R^2 and p-values based on simple linear regression analysis.

F1Doctors Mentees Reported Facing Numerous Challenges During the 2020–2021 Application Cycle with Limitations of Extracurricular Opportunities, Finding Mentors to Help with the Application Cycle, and Finding Programs That Accept International Student Being the Most Important Challenges.

F1Doctors was founded to help mentees access relevant information related to the medical school application process. F1Doctors mentees reported numerous challenges during the 2020-2021 application cycle **(Fig 6)**. While this application cycle was the first one since the COVID-19 pandemic, only 20% of mentees reported COVID-19 related challenges as primary barriers during the application cycle. The main obstacles faced by mentees were related to their international student status including finding programs that accept international students (78%), finding mentors to help with the application cycle (56%), limitations to engage in extracurricular activities due to the non-resident status (67%), as well as cost of medical school (56%) and application (44%). F1Doctors was reported to help mentees most with finding information about the application process (67%), finding mentors to help with the application cycle (67%), and finding programs that accept international students (50%). This further confirms the crucial importance of F1Doctors mentorship to help international applicants navigate the barriers of admission to US medical schools across the country.

Figure 6

Self-reported challenges faced by F1Doctors Mentees in the 2020-2021 Application cycle and factors that F1 Doctors platform and/or its mentors were reported to have helped with.



Note: N=10 for all challenges faced, N=6 for Helped by F1Doctors.

DISCUSSION AND CONCLUSIONS

Our results show that international matriculants and applicants have a higher GPA/MCAT (513±6.2 vs 511.5±6.5, p=0.0419) compared to all matriculants and applicants at the national level. Additionally, higher MCAT score, and GPA correlated with higher number of acceptances among the 2020-2021 applicants. Higher GPA and MCAT scores for international applicants compared to the national average can be explained by the limited number of medical schools that international students can apply to. Of the 42 MD schools that accept international students, 64.2% are private (Association of American Medical Colleges, 2022.). Furthermore, of all the 42 MD programs, 38% are ranked in the top 20 MD programs by *US News*. These schools are known to have higher GPA and MCAT requirements thus skewing the admission criteria for international applicants (*U.S. News*, 2022). As a result, we speculate that international students self-select for higher GPA and MCAT scores prior to entering the competitive application cycle.

From 2019-2020 to 2020-2021, there was a 4.6% decrease in applicants who are not legal residents of the US compared to a 0.6% decrease in total applicants (Association of American Medical Colleges, 2020). However, there was a 5.6% increase in the number of the international applicants that matriculated to medical schools, compared to a 1.7% increase in total matriculants. This could potentially be due to the higher academic scores of international applicants. Other factors could also be at play such as an increase in the number of international students that schools are willing to accept, the effects of the COVID-19 pandemic, an increase in the aid being offered to enable accepted international students to matriculate, or/and changes in school policies. Further research into the factors behind the increase in the matriculation rate is required Additionally, despite an increase in matriculation over the year, the overall matriculation rates are still significantly lower (approximately 14%) than national averages (41.9%), and the factors that contribute to this are likely multi-factorial and have not been studied.

Interestingly, over the past four years, there seems to be a decrease in male international applicants and an increase in female international applicants. However, there is less of a difference in acceptance and matriculation rates between genders. Studies have examined academic performance differences between genders and do not show a clear pattern in the distribution of medical school and clerkship test scores among genders (Bibbo et al., 2015; Dixon, 2015; Violato et al., 2020). One potential explanation could be that the decrease in male applicants may stem from a self-selection bias if only male applicants with more competitive scores and resumes are applying. Since international students test scores data stratified by gender is not made available by the AAMC, there is no definitive claim

that can explain this trend. Future test score data stratified by gender for international students would be needed to further rationalize this trend.

Impact of F1Doctors Mentoring Program

The year in review for F1Doctors showed that all mentees who utilized the services of F1Doctors and connected with a mentor, graduated from US or Canadian based undergraduate institutions, and took gap years. Only a small percent reported challenges with their GPA or MCAT, in line with the national data suggesting higher academic standing among international applicants. Additionally, GPA and MCAT scores were significantly correlated with the number of acceptances, highlighting the importance of high academic standing among international medical students. Almost 60% of the mentees were accepted to at least one medical school. This is greater than the national average of approximately 20% acceptance rate for international students **(Fig 3E)**. Further empirical evaluation is needed to understand whether F1Doctors played a role. Interestingly, the F1Doctor's mentees also had a greater matriculation rate (60%) than the national average (42%), although no conclusions can be drawn from this difference given the limitations of sample size and selection bias discussed further in the text (Association of American Medical Colleges, 2022). Moreover, while mentorship and lack of extracurricular activities were considered major challenges by the mentees, these challenges did not correlate with being accepted to medical schools. Nevertheless, they are important factors that should be considered in any future studies or initiatives targeting international pre-medical students.

In addition to the limitations regarding extracurricular opportunities, mentees reported challenges related to mentorship during the application cycle, information about the application cycle, and cost of medical schools and applications. A 2017 qualitative study by Hadinger focusing on underrepresented minorities in medical school admissions identified perceived fit, prior experience, having mentors and encouragement, a drive to help others, a passion for science and the benefits of the career as the most common motivators for unrepresented minorities to apply to medical school (Hadinger, 2017). On the flip side, lack of information, guidance, adequate resources, advising, social support, and financial and academic factors were identified as the main hurdles to applying (Hadinger, 2017). Many of those barriers are shared with challenges identified in our survey, suggesting that the low representation of international medical students might play a critical role in the challenges they face. The mentees reported that F1Doctors was able to assist with mentorship and resources, further highlighting the need for platforms like F1Doctors. Numerous case studies have previously validated the effectiveness of mentorship in recruiting and retaining unrepresented minorities (Dahlberg & Byars-Winston, 2019; Louissaint et al., 2021).

As the US population continues to diversify, the diversity of healthcare professionals has yet to follow suit. International applicants have the potential to change the landscape of the healthcare in the US by providing culturally competent care in multiple different languages. Currently, numerous hurdles exist for international students applying to medical schools in the US including a lack of access to financial resources and mentorship. F1Doctors, a newly created peer-to-peer online mentorship platform, can alleviate the lack of support international students experience. Further research is necessary to truly understand why there is a decrease in international students in medical schools, why the matriculation rate into medical schools is much lower than the national average, and how F1Doctors can be leveraged to create long lasting and systemic change.

Limitations of Our Study

Our study has several limitations. With only ten medical school applicants and 38 mentors participating in our internal and non-validated surveys, and potential differences between our applicants and international applicants with regards to MCAT-sub scores, our data were not generalizable to the entire population of international medical students. Moreover, participants were recruited through social media advertising and the mentees sought out help from our mentors. These factors could contribute to self-selection bias for those who had favorable interactions with F1Doctors and those who needed additional mentorship/resources. This study is meant to serve as a proof-of-concept to illustrate the need for more international student mentorship and resources, and future research efforts through F1Doctors will aim to minimize bias through increasing our sample size, improving our data collection methodologies, and utilizing validated surveys. We suggest future studies that include the interviews with medical students, administrators, and mentors who participated in F1Doctors to understand the landscape better. As F1Doctors continues to grow and more internationals have access to admissions guidance, this could translate to increased matriculation rates of international students at US medical schools across the country.

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