

LETTERS—CONCISE RESEARCH REPORTS

Association Between Socioeconomic Background and MD-PhD Program Matriculation



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INTRODUCTION

Recognizing that scientists from diverse backgrounds make significant contributions toward biomedical research, the National Institutes of Health expanded its diversity criteria to include first-generation college graduates in 2018.¹ Nevertheless, first-generation college graduates face multiple barriers to becoming physician-scientists. While 56% of undergraduate students are the first in their family to attend college,² less than 15% of medical school matriculants are first-generation college graduates,³ and the representation of first-generation college graduates in MD-PhD programs has not been reported. To address this knowledge gap, we examined differences between first-generation and continuing-generation college graduates' consideration of MD-PhD program training prior to medical school matriculation and their likelihood of MD-PhD program matriculation.

METHODS

We obtained de-identified data from the Association of American Medical Colleges (AAMC) for 91,987 medical school matriculants between academic years 2007–2008 and 2011–2012. Students' consideration of MD-PhD was obtained by student self-report from the Pre-Medical College Admission Test (MCAT) Questionnaire administered to registrants, and program enrollment was obtained from the AAMC Student Record System (SRS). We obtained self-reported sex, race/ethnicity, age at matriculation, parental education, MCAT scores, undergraduate institutions' Carnegie classification, self-reported premedical loans (yes/no), and prior research experiences from the AAMC Data Warehouse. Students were considered first-generation college graduates if neither parent held a 4-year college degree. We used summary statistics to describe matriculant characteristics by first-generation college graduate status. We used multivariable logistic regression models to examine the associations between first-generation college graduate status and consideration of an MD-PhD

degree, and whether students who considered MD-PhD program training matriculated into an MD-PhD program. This study was approved by the Albany Medical College Institutional Review Board, and followed the Strengthening the Reporting of Observational Studies in Epidemiology reporting guideline.⁴ Statistical analyses were performed using STATA v 16.1 (StataCorp).

RESULTS

After excluding matriculants who did not complete the PMQ or were missing data, our study sample included 61,247 students representing 66.6% of all matriculants between 2007–2008 and 2011–2012. The proportion of first-generation college graduates in excluded and included cohorts did not differ significantly (11.9% vs 12.1%, respectively, chi-squared test $p=0.56$). Compared to continuing-generation peers (Table 1), a smaller percentage of first-generation college graduates identified as White (52.2% vs 63.7%, $p<0.001$), reported prior research experience (52.5% vs 57.7%, $p<0.001$), and scored in the highest MCAT quartile (14.1% vs 27.2%). First-generation college graduates comprised 12.3% of all medical school matriculants but just 7.3% of all MD-PhD program matriculants.

In our fully adjusted model (Table 2), first-generation college graduates were as likely as their continuing-generation peers to have considered pursuing an MD-PhD (aOR: 1.00, 95% CI: 0.89–1.11). Although a greater proportion of first-generation college graduates reported premedical loans (54.5% vs 30.4%, $p<0.001$), all students with premedical loans were 22% less likely to consider an MD-PhD irrespective of first-generation status (aOR: 0.78, 95% CI: 0.72–0.84). Among students who considered an MD-PhD degree, first-generation college graduates (versus continuing-generation) were 30% less likely to matriculate in MD-PhD programs (aOR: 0.70, 95% CI: 0.50–0.99). This difference accounts for MCAT scores and prior research, which were positively associated with MD-PhD matriculation.

DISCUSSION

First-generation college graduates were significantly underrepresented in MD-PhD programs compared to their continuing-generation peers. Although first-generation college graduates were as likely as continuing-generation peers to

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Table 1 Characteristics of Medical School Matriculants from 2007–2008 to 2011–2012

	First-generation college graduates, N (%)		p value
	No	Yes	
Total	N=53,838 (87.9%)	N=7398 (12.1%)	
Seriously considered MD-PhD			0.007
No	50,344 (93.5%)	6978 (94.3%)	
Yes	3494 (6.5%)	420 (5.7%)	
Matriculation program			<0.001
MD	51,845 (96.3%)	7242 (97.9%)	
MD-PhD	1993 (3.7%)	156 (2.1%)	
Sex			0.49
Male	27,550 (51.2%)	3876 (52.4%)	
Female	26,288 (48.8%)	3522 (47.6%)	
Age at matriculation			<0.001
<23 years old	24,461 (45.4%)	2545 (34.4%)	
≥23 years old	29,377 (54.6%)	4853 (65.6%)	
Race/ethnicity			<0.001
Non-Hispanic White	34,286 (63.7%)	3862 (52.2%)	
Non-Hispanic Asian	10,231 (19.0%)	1365 (18.5%)	
Hispanic/Latinx	3839 (7.1%)	770 (10.4%)	
Non-Hispanic Black/African-American	2458 (4.6%)	632 (8.5%)	
Non-Hispanic American Indian/Alaska Native/Hawaiian Native/Other Pacific Islander	189 (0.4%)	53 (0.7%)	
NH multiracial	1470 (2.7%)	202 (2.7%)	
NH unknown/other	1365 (2.5%)	514 (6.9%)	
MCAT quartiles			<0.001
1st (lowest)	10,633 (19.7%)	2699 (36.5%)	
2nd	15,791 (29.3%)	2330 (31.5%)	
3rd	12,759 (23.7%)	1327 (17.9%)	
4th (highest)	14,655 (27.2%)	1042 (14.1%)	
Undergraduate Carnegie classification			<0.001
Research universities - very high research activity	32,521 (60.4%)	4021 (54.4%)	
Research universities - high research activity and doctoral research universities	6890 (12.8%)	1152 (15.6%)	
Master's colleges and universities	4834 (9.0%)	1110 (15.0%)	
Baccalaureate colleges - arts and sciences	6209 (11.5%)	587 (7.9%)	
Other Carnegie classifications	708 (1.3%)	187 (2.5%)	
Not specified	2676 (5.0%)	341 (4.6%)	
Premedical loan			<0.001
No	37,468 (69.6%)	3366 (45.5%)	
Yes	16,370 (30.4%)	4032 (54.5%)	
Prior research experience			<0.001
No	22,755 (42.3%)	3513 (47.5%)	
Yes	31,083 (57.7%)	3885 (52.5%)	

MCAT Medical College Admission Test

Table 2 Consideration of MD-PhD and Enrollment in MD-PhD Programs for Medical School Matriculants from 2007–2008 to 2011–2012

	Consideration of MD-PhD program, N=61,247	MD-PhD program matriculation, N=2151
First-generation college graduates	(Ref)	(Ref)
Continuing-generation college graduate	1.00 (0.89–1.11)	0.70 (0.50–0.99)
Sex		
Male	(Ref)	(Ref)
Female	0.74 (0.70–0.80)	1.06 (0.89–1.27)
Age at matriculation		
<23 years old	(Ref)	(Ref)
≥23 years old	0.87 (0.82–0.93)	0.95 (0.80–1.13)
Race/ethnicity		
Non-Hispanic White	(Ref)	(Ref)
Non-Hispanic Asian	1.06 (0.97–1.15)	0.86 (0.69–1.08)
Hispanic/Latinx	1.31 (1.17–1.48)	1.03 (0.75–1.41)
Non-Hispanic Black/African-American	1.22 (1.03–1.44)	1.93 (1.23–3.02)
Non-Hispanic American Indian/Alaska Native/Hawaiian Native/Other Pacific Islander	1.05 (0.60–1.85)	1.05 (0.22–4.97)
Non-Hispanic multiracial	1.25 (1.04–1.51)	0.82 (0.48–1.39)
Non-Hispanic unknown/other	1.22 (1.01–1.47)	1.11 (0.67–1.82)
MCAT quartiles		
1st (lowest)	(Ref)	(Ref)
2nd	1.13 (1.02–1.26)	1.68 (1.13–2.50)
3rd	1.47 (1.32–1.64)	3.15 (2.15–4.61)
4th (highest)	1.67 (1.50–1.86)	6.28 (4.34–9.1)
Undergraduate Carnegie classification		
Research universities - very high research activity	(Ref)	(Ref)
Research universities - high research activity and doctoral research universities	1.06 (0.96–1.18)	0.75 (0.56–1.01)
Master's colleges and universities	1.27 (1.13–1.42)	0.62 (0.43–0.88)
Baccalaureate colleges - arts and sciences	1.15 (1.03–1.28)	1.24 (0.96–1.61)
Other Carnegie classifications	1.71 (1.35–2.18)	0.68 (0.32–1.45)
Not specified	0.86 (0.73–1.02)	0.74 (0.47–1.17)
Premedical loan		
No	(Ref)	(Ref)
Yes	0.78 (0.72–0.84)	1.01 (0.83–1.22)
Prior research experience		
No	(Ref)	(Ref)
Yes	1.55 (1.45–1.67)	1.94 (1.58–2.39)

MCAT Medical College Admission Test

consider pursuing an MD-PhD prior to matriculation, they were 30% less likely to enroll in MD-PhD programs. This finding persisted after controlling for MCAT scores and prior research experiences, which prior research has found to be associated with MD-PhD program matriculation,⁵ suggesting that there were other barriers to matriculating into an MD-PhD program for first-generation college graduates.

Notably, we found that all students with premedical loans were less likely to consider MD-PhD training, suggesting that financial barriers may be a significant constraint on the physician-scientist pipeline. These findings could have

significant implications for the National Institutes of Health's and medical schools' investment in students pursuing MD-PhD career paths. Research in doctoral education identified specific barriers that first-generation students face, including the need to maintain paid employment during academic terms and a lack of support and social capital critical to successfully navigate an academic career.⁶ Our work highlights the necessity to identify and eliminate structural barriers, including premedical debt, limiting opportunities for first-generation college graduates to pursue a physician-scientist career.

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Author Contribution Dr. Mason and Dr. Ata had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

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Declarations:

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