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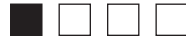
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Interest in Family Medicine Among US Medical Students and Its Association With a Community College Academic Pathway

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BACKGROUND AND OBJECTIVES: One-third of all medical students attend a community college (CC) on their path to medical school. The objective of this study was to examine the association between CC participation and initial specialty of interest among US allopathic medical students.

METHODS: We performed a national cross-sectional study of allopathic medical students who completed the 2012 Association of American Medical Colleges' Matriculating Student Questionnaire. Bivariate and logistic regression analyses were conducted.

RESULTS: A total of 9,885 medical student respondents were included in the study sample, consisting of 7,035 (71%) non-CC pathway, and 2,850 (29%) CC pathway participants. CC pathway participants were more likely to express intent to specialize in family medicine (272/2,850 [10%] vs 463/7,035 [7%], $P<0.001$), compared to those on the non-CC path. CC pathway participants had higher odds of intent to specialize in family medicine (adjusted odds ratio [AOR]=1.32; 95% CI 1.13-1.56, $P<0.001$), compared to those on the non-CC path. Women, independent of college pathway, were nearly two times more likely to express an intention to specialize in family medicine, and three times more likely to express an intention to specialize in pediatrics than men.

CONCLUSIONS: Medical students who used a CC pathway are more likely to have intentions to specialize in family medicine, compared to those on the non-CC path.

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Medical Colleges (AAMC) physician shortage estimate of up to 31,000 PCPs by 2025.¹⁰ Thus, it is important to attract, retain and develop a more sustainable PCP workforce.

Individual-level characteristics positively associated with selecting a primary care specialty include female gender, older age, broad undergraduate background, greater altruistic beliefs and attribution of greater importance to social responsibility such as serving the underserved and minority populations.^{9,11,12} Interest in family medicine and participation in family medicine department-sponsored enrichment programs have also been associated with selecting a family medicine specialty.¹³⁻¹⁶ Additionally, participating in Title VII, Section 747 of the Public Health Service Act-funded programs was associated with primary care specialty choice, practice

A high concentration of primary care physicians (PCPs) is associated with better health outcomes, including management of chronic care, self-rated health, and cancer.¹⁻⁶ However, national trends demonstrate that since 2002 there has been a continuous decline in the percentage of US medical graduates

going into primary care.^{7,8} A longitudinal national study from 1997 to 2006 demonstrated a dramatic change in family medicine residency selection from 17.6% to 6.9%, in internal medicine from 15.7% to 6.7%, and in pediatrics from 10.2% to 6.7%.⁹ These trends are consistent with the Association of American

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in underserved regions, and service to underserved populations.¹¹ However, the impact of the community college (CC) undergraduate education pathway to medical school and its association with specialty choice has not been explored.

A recent national study found that one-third of US medical students attend a CC, and the CC pathway is positively associated with intentions to serve vulnerable and minority communities.¹⁷ CCs enroll approximately 7.3 million, or half of the entire US undergraduate population, where the average age of a CC student is 28 years, 36% are the first in their families to attend college, and 49% are white, 22% Hispanic, 14% black, 6% Asian and 1% Native American.¹⁸ The majority of CC students are women and 44% of all students come from low-income backgrounds when they graduate from high school.^{18,19} Therefore, the CC pathway to medical school may further inform national efforts to increase diversity of the family medicine workforce.²⁰⁻²³

This study examines the relationship between attending a CC, and intentions to specialize in family medicine and other primary care specialties among a national cohort of matriculating US allopathic medical students.

Methods

Data Sources

We analyzed deidentified data of 19,517 matriculants from the 2012 Association of American Medical College (AAMC) matriculant file that was linked to the voluntary Matriculating School Questionnaire (MSQ). The MSQ is administered annually to all first-year medical students in the United States, and collects information on student characteristics, premedical experiences, medical school selection processes, future career interests, and educational debt and financing. The MSQ response rate in 2012 was 72%. Our final analytic study sample consisted of 9,855 matriculants after excluding those with missing data. This study was

reviewed and approved by the University of California, Los Angeles Institutional Review Board.

College Pathways

Our primary predictor was having attended a community college. Using the Carnegie Classification of Institutions of Higher Education, we determined the educational pathways students used prior to applying or matriculating into medical school. From among 13 different Carnegie classifications of undergraduate degree-granting institutions, we created two categories: (1) CC—attended CC during high school, attended a CC prior to a 4-year university, or attended a CC after graduating from four year university; and (2) non-CC—never attended a CC. Our rationale for using three fundamentally different CC categories is described in a prior study.¹⁷

Measures

The primary outcome measure was (1) plans to practice in family medicine, internal medicine, pediatrics or other specialty as measured by the MSQ. Other measures included self-reported gender (female or male), age, race-ethnicity, and parental education. We categorized race-ethnicity as non-Hispanic white, Asian, black, Latino, and multiple/other. Parental education was categorized based on AAMC classification: less than college, some college, masters and professional, or PhD degree. Academic variables were grade point average (GPA), most recent Medical College Admissions Test (MCAT) score, number of MCAT exams completed, number of applications, and years of premedical education. A total of 4,197 individuals who had missing data were excluded from the analysis.

Analysis

Stata version 14.0 (Stata Corporation LP 2016, College Station, TX) was used to conduct analyses. Descriptive statistics were used to describe the variable frequencies, means, and percentages. Cross tabulations were

conducted to determine unadjusted proportions of student characteristics for each outcome. In bivariate analyses, tests for the statistical significance of unadjusted differences across groups were performed using a two-tailed *t*-test of differences in means and chi-square tests of differences in proportions when both variables were categorical.

We performed logistic regression to calculate the unadjusted odds ratio (OR) and adjusted odds ratios (AORs) of each outcome (plans to specialize in family, internal medicine, pediatrics, or other specialty) using two different models comparing each CC pathway to the non-CC pathway. Inclusion of covariates was based on the literature on factors that influence admission to medical school and practice intentions, even if the variables had no statistically-significant association with matriculation in the bivariate analyses.²⁴⁻²⁶ Model 1 regressions included our primary predictor without adjusting for covariates. Model 2 regressions included personal characteristics: age, gender, race-ethnicity, parental education, and GPA and MCAT scores. A statistical significance level was set at $P < 0.05$ for all analyses.

Results

A total of 9,885 US medical school students responded to the 2012 AAMC MSQ. The 2,850 students that participated in the CC pathway to medical school were on average older (mean=22.8 years; SD=3.3 years) as compared to non-CC pathway students (mean=21.9 years; SD=2.5 years). A lower proportion of women participated in the CC pathway compared to the non-CC pathway (28% vs 72%). Latinos had the largest proportion of students participating in the CC pathway (37%), and the lowest proportion participating in the non-CC pathway (63%). Among medical students identifying their parents as having completed less than college education, 40% utilized a CC pathway. Mean academic GPAs between the college pathways were similar, with slightly higher

MCAT scores among non-CC pathway matriculants (Table 1).

Table 2 compares the unadjusted percentages of intended specialty practice reported on the MSQ by academic pathway. A higher proportion of CC pathway participants identified family medicine (10%) as compared to non-CC pathway (7%) participants, and a lower proportion identified pediatrics (12% CC pathway vs 15% non-CC pathway) as their intended specialty.

Table 3 lists unadjusted predictors of specialty intent by academic pathway, and adjusted predictors of specialty intent by academic pathway, controlling for age, gender, race/

ethnicity, parental education, academic GPA and MCAT score. On unadjusted analysis, we observed a significant association between college pathway and intended specialty for family medicine and pediatrics. Medical students who participated in a CC pathway had significantly higher unadjusted odds of intent to pursue family medicine (odds ratio [OR]=1.50; 95% confidence interval [CI] 1.28-1.75), and significantly lower unadjusted odds of intent to pursue pediatrics (OR=0.77; 95% CI 0.68-0.88). We did not observe a significant association between college pathway and intent to pursue internal medicine or other specialties.

The AOR of intent to pursue family medicine (AOR=1.33; 95% CI 1.13-1.56) remained significantly high for medical students who participated in a CC pathway compared to non-CC pathway, and significantly low for intent to pursue pediatrics (AOR=0.78; 95% CI 0.68-0.90). For each 1-year increase in age among medical students who used a CC-pathway, the adjusted odds of intending to pursue family medicine increased by 7%. On multivariate analysis, women were more likely to report family medicine (AOR=1.77; 95% CI 1.51-2.08) and pediatrics (AOR=3.17; 95% CI 2.78-3.61) as their intended practice, independent of college pathway.

Table 1: Characteristics by Premedical College Pathway for Matriculants to US Medical Schools Included in the American Medical College Application Service, 2012

Characteristics	Non-Community College	Community College	Total
Matriculants, n (%)	7,035 (71.2)	2,850 (28.8)	9,885 (100)
Mean age, years (SD)	21.9 (2.5)	22.8 (3.3)	22.1 (2.8)
Females, n (%)	3,555 (72)	1,383 (28)	4,938 (100)
Race-Ethnicity, n (%)			
Non-Hispanic white	4,257 (72)	1,674 (28)	5,931 (100)
Asian	1,333 (73)	482 (27)	1,815 (100)
Black	452 (73)	168 (27)	620 (100)
Latino	515 (63)	308 (37)	823 (100)
Multiple/Other	478 (69)	218 (31)	696 (100)
Parental education, n (%)			
Less than college	978 (60)	651 (40)	1,629 (100)
College	1,677 (67)	808 (33)	2,485 (100)
Masters	1,752 (72)	678 (28)	2,430 (100)
PhD or professional degree	2,628 (79)	713 (21)	3,341 (100)
Mean GPA (SD)	3.68 (0.25)	3.68 (0.26)	3.68 (0.25)
Mean MCAT (SD)	31.5 (3.97)	30.6 (3.90)	31.3 (3.98)

Abbreviations: n (number); SD (Standard Deviation); GPA (Grade Point Average); MCAT (Medical College Admission Test).

Table 2: Unadjusted Percentages of Matriculants With Intent to Enter Primary Care Specialties as Reported on the Matriculating Student Questionnaire, 2012, n (%)

Specialty/Pathway	Non-Community College	Community College	Total
Family medicine	463 (7)	272 (10)	735 (7)
Internal medicine	1,218 (17)	472 (17)	1,690 (17)
Pediatrics	1,047 (15)	338 (12)	1,385 (14)
Other	4,307 (61)	1,768 (62)	6,075 (62)
Total	7,035 (100)	2,850 (100)	9,885 (100)

Table 3: Predictors of Intent to Pursue Primary Care Specialties Among US Allopathic Medical School Matriculants, 2012. Reported as: Odds Ratio (95% Confidence Interval)

Predictor	Family Medicine	Internal Medicine	Pediatrics	Other
Unadjusted models				
Non-CC pathway	Ref	Ref	Ref	Ref
CC pathway	1.50 (1.28-1.75)*	0.95 (0.84 – 1.07)	0.77 (0.68-0.88)*	1.03 (0.95-1.13)
Adjusted models				
Non-CC pathway	Ref	Ref	Ref	
CC pathway	1.33 (1.13-1.56)*	0.93 (0.83-1.05)	0.78 (0.68-0.90)*	1.07 (0.98-1.18)
Age	1.07 (1.04-1.10)*	1.06 (1.04-1.08)*	0.95 (0.93-0.98)*	0.95 (0.94-0.97)*
Gender				
Male	Ref	Ref	Ref	Ref
Female	1.77 (1.51-2.08)*	0.80 (0.72-0.90)*	3.17 (2.78-3.61)*	0.55 (0.51-0.61)*
Race-Ethnicity				
Non-Hispanic white	Ref	Ref	Ref	Ref
Asian	0.50 (0.39-0.64)*	1.58 (1.39-1.81)*	0.88 (0.75-1.03)	0.93 (0.83-1.03)
Black	0.54 (0.38-0.77)*	1.10 (0.86-1.41)	1.01 (0.79 – 1.28)	1.10 (0.92-1.32)
Latino	0.65 (0.49-0.88)*	1.36 (1.12-1.66)*	0.74 (0.58-0.93)*	1.08 (0.92-1.26)
Multiple/Other	0.74 (0.54-1.01)	0.98 (0.79-1.22)	0.86 (0.68-1.09)	1.19 (1.01-1.41)*
Parental education				
Less than college	Ref	Ref	Ref	Ref
College	0.91 (0.71-1.14)	1.02 (0.85-1.21)	0.89 (0.74-1.08)	1.07 (0.94-1.22)
Masters	1.01 (0.80-1.27)	1.00 (0.84-1.19)	0.97 (0.80-1.17)	1.01 (0.88-1.15)
PhD or professional degree	0.81 (0.64-1.02)	1.15 (0.98-1.36)	0.79 (0.66-0.95)*	1.08 (0.95-1.23)
GPA	1.53 (1.09-2.15)*	1.19 (0.94 – 1.50)	1.09 (0.83-1.44)	0.73 (0.61-0.88)*
MCAT	0.93 (0.91-0.96)*	1.03 (1.02-1.05)*	0.98 (0.97-1.00)*	1.01 (0.99-1.02)

Abbreviations: Ref (reference); CC (community college); GPA (grade point average); MCAT (Medical College Admission Test)

* $P < .05$

All racial/ethnic categories were associated with significantly lower adjusted odds of reporting intent to practice in family medicine as compared to non-Hispanic white medical students, except for medical students that reported multiple racial/ethnic categories. When considering intent to pursue internal medicine, Asian (AOR=1.58; 95% CI 1.39-1.81), and Latino (AOR=1.36; 95% CI 1.12-1.66) medical students were associated with the highest adjusted odds of choosing internal medicine as compared to non-Hispanic white. Parental education was generally not associated with specialty intent on multivariate analysis, except for pediatrics (AOR=0.79; 95% CI 0.66-0.95) among medical students whose

parents completed a professional degree as compared to medical students whose parents completed less than college. The multivariate association between GPA and MCAT with intended specialty is summarized in Table 3.

Discussion

In this study, we demonstrate an independent, statistically-significant association between college pathway to medical school and intentions to specialize in primary care specialties. We found that after adjusting for confounding variables, medical students who attended a CC were more likely to report intentions to specialize in family medicine, compared to those who never attended

a CC. Our findings are relevant given the projected shortage of primary care physicians, and the increasing need to identify and nurture early interest in family medicine and other primary care specialties.¹⁵ Medical students who attended a CC represent an important pool of future physicians and may help, as part of a multipronged strategy, to alleviate the US primary care shortage.

This is the first study to consider and support the CC pathway as a predictor of intentions to specialize in family medicine. This finding is consistent with prior research that demonstrates individual-level characteristics such as non-health care professional parents, older students, lower socioeconomic class, parental

income less than \$100,000 per year, Latino background, rural background, and marriage are positively associated with selecting a family medicine specialty.^{14,27} Prior research has shown that the CC pathway is an important pathway to prepare students for science, technology, engineering, and math (STEM) fields like medicine.²⁸ Thus, CCs have the potential pipeline infrastructure to enhance and diversify the primary care physician workforce. A primary care physician workforce that is more representative of the populations it serves may be more prepared to help reduce health disparities by addressing language and cultural barriers to the receipt of high quality health care.^{29,30} Realizing the benefits of the CC pathway to medical school will require strategic and sustainable partnerships between our medical education, university, CC system, and primary care training programs and associations. For example, the University of California, Davis School of Medicine has partnered with Kaiser Permanente to develop Prep Medico (https://www.ucdmc.ucdavis.edu/diversity-inclusion/prep_medico/prep-medico.html), a 4-year premedical enrichment program to actively support CC and other historically unrepresented minority undergraduate students, and nurture their interest in primary care specialties like family medicine.

Medical students that used the CC pathway were less likely to report intentions to specialize in pediatrics compared to non-CC pathway students. Our study also found that women are more likely than men to have intentions to specialize in family medicine and pediatrics regardless of college pathway. This finding is consistent with prior literature that concludes that women are more likely than men to choose family medicine or a primary care specialty.^{11,12,31,32-35}

Limitations

This study is limited by its retrospective cross-sectional design, and

limited information on personal financial factors (eg, salary) or academic factors as they may relate to specialty intent. The matriculant data file did not include students who also applied to or matriculated in osteopathic or non-American Medical College Application Service medical schools. It is possible that we did not include personal or academic factors that may impact matriculating student intentions to specialize. The responses from the MSQ are self-reported, and subject to bias. Additionally, the measure for current parental income had missing data and was excluded from our statistical models, which may have biased our results. Moreover, we do not know how medical school culture and the process of medical acculturation may influence intent to specialize in family medicine, or if medical students ultimately enter the specialty they report.³⁶⁻³⁸ Indeed, medical school culture that disparages primary care plays an important role in medical students' intentions to specialize in family medicine.³⁹

Conclusion

Our results identify an important academic pathway—community colleges—as a new independent predictor of intentions to specialize in family medicine. Our results also validate and re-emphasize the gender gap in early intentions, where women are more likely to identify family and pediatric medicine as a future specialty. In summary, we found that the community college pathway may be an important predictor that may help alleviate the current primary care physician workforce shortage and maldistribution.

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