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Community College Pathways

Permalink

<https://escholarship.org/uc/item/489819wq>

Journal

Academic Medicine, 89(12)

ISSN

1040-2446

Authors

Talamantes, Efrain

Mangione, Carol M

Gonzalez, Karla

et al.

Publication Date

2014-12-01

DOI

10.1097/acm.0000000000000438

Peer reviewed

Published in final edited form as:

Acad Med. 2014 December ; 89(12): 1649–1656. doi:10.1097/ACM.0000000000000438.

Community College Pathways: Improving the U.S. Physician Workforce Pipeline

Efrain Talamantes, MD, MBA,

Robert Wood Johnson Foundation Clinical Scholars Program Fellow, Department of Veteran Affairs, University of California, Los Angeles, Los Angeles, California

Carol M. Mangione, MD, MSPH,

Professor, David Geffen School of Medicine at UCLA, Department of Medicine, Division of General Internal Medicine and Health Services Research, UCLA Fielding School of Public Health, Department of Health Policy and Management, Los Angeles, California

Karla Gonzalez, BS,

Fourth-year medical student, David Geffen School of Medicine at UCLA, Los Angeles, California

Alejandro Jimenez, MD,

Fourth-year medical student at David Geffen School of Medicine at UCLA, Los Angeles, California, at the time of the study. He is now a first-year resident, Department of Internal Medicine, University of California, San Francisco, San Francisco, California

Fabio Gonzalez, MA, and

Community college counselor, San Jose City College, San Jose, California

Gerardo Moreno, MD, MSHS

Assistant Professor, David Geffen School of Medicine at UCLA, Department of Family Medicine, Los Angeles, California

Abstract

Purpose—To examine the association between participation in a community college (CC) pathway, medical school admission, and intentions to practice in underserved communities or work with minority populations.

Method—The authors performed cross-sectional analyses of the 2012 Association of American Medical Colleges matriculant and applicant files, and the Matriculating School Questionnaire to assess associations between student characteristics and participation in a CC pathway. They used

Correspondence should be addressed to Dr. Talamantes, 10940 Wilshire Blvd, Suite 710 Los Angeles, CA 90025; phone: (310) 794-2257; etalamantes@mednet.ucla.edu.

Disclosures: None reported.

Ethical Approval: This study was approved by the University of California, Los Angeles Institutional Review Board.

Disclaimers: This material is based upon data provided by the AAMC. The views expressed herein are those of the authors and do not necessarily reflect the position or policy of the AAMC.

Previous presentations: This work was presented at the Robert Wood Johnson Clinical Scholars National Conference on November 13th, 2013, in Atlanta, Georgia.

logistic regression to estimate the association between CC pathway and acceptance to medical school, intention to practice in underserved areas, or work with minority populations.

Results—There were 40,491 applicants and 17,518 matriculants to U.S. MD-granting schools; about one-third used a CC. A higher proportion of underrepresented minority (URM) matriculants used the CC pathways compared to Whites. Applicants who attended a CC after high school and before a 4-year university (First-CC) had lower odds of acceptance into medical school (adjusted odds ratio [AOR] = 0.68, 95% CI 0.61 to 0.75, $P < .05$). Compared to medical students who never attended a CC, First-CC matriculants were more likely to have parents without a college education (304/895 [34%] versus 1,683/12,598 [13%], $P < .001$) and higher odds of intentions to practice in underserved communities (AOR = 1.26, 95% CI 1.04 to 1.53, $P < .05$), after adjusting for covariates.

Conclusions—There is a high representation of URM students and higher prevalence of intention to work with underserved communities among CC-pathway participants. These findings may be of interest to those seeking to enhance diversity in the physician workforce.

Diversity in the physician workforce increases health care access for underserved populations, improves culturally and linguistically appropriate care, and better positions the workforce to serve the needs of a diverse population.^{1–9} How to achieve that diversity, however, is not well understood. To our knowledge, no prior research has clarified how or if the undergraduate pathway contributes to a diverse physician workforce that is interested in serving underserved communities. Furthermore, we are not aware of any studies that have explored the community college (CC) as a pathway to medical school. Since CCs (2-year post-secondary educational institutions) serve as a principal higher education attainment pathway for many low-income and underrepresented minority (URM) students¹⁰, we chose to investigate the CC pathways to medical school in this study.

In 2010, approximately 8 million or 44% of all the undergraduate students in the United States were enrolled at one of the 1,600 CCs throughout the country.¹¹ The percentage of Latinos attending CC's has nearly doubled since 1992,¹² and the majority of CC students come from low-income families.¹³ CC enrollment in 2010 was as follows: 57% women, 52% White, 17% Latino, 15% Black, 5% Asian, and 11% other race or not reported.¹¹ These data indicate that CC students potentially represent the type of student being targeted by national efforts to encourage URM students to pursue careers in medicine. However, achieving diversity in our future physician workforce is challenged by rising tuition costs that have outpaced family income growth. Although numerous factors influence URM interest in medicine, financial barriers can considerably widen the privilege gap, resulting in a socially stratified higher education system.¹⁴

In the United States, the majority of medical students have parents with graduate levels of education and incomes in the top quintile of all American families.^{15,16} The median student-reported parental income among matriculating medical students in 2012 was \$115,000.¹⁷ Although cost is a strong deterrent for potential applicants with lower parental income, other determinants, such as disparities in educational attainment and academic preparedness, may explain some of the demographic trends among medical school applicants.¹⁸ From 1977 to 2012, the racial-ethnic composition of medical school applicants has changed as follows:

Asians increased from 2.6% to 23%, Latinos increased from 2.6% to 8.7%, Blacks increased from 6.4% to 8.1%, American Indians and Alaska Natives decreased from 0.33% to 0.25%, and Whites decreased from 88% to 60%.¹⁹ Today, Blacks and Latinos make up 13% and 17% of the U.S. population, and comprise 6% and 5.5% of the physician workforce, respectively.^{20,21}

We describe the characteristics of pre-medical students who use CC pathways and the association of those characteristics with acceptance to medical school, intentions to serve underserved communities, and intentions to work primarily with minority populations. Given the diversity in the CC student body and prior studies identifying factors that support students' intent to practice in underserved and minority communities^{2,5,22–24}, we hypothesized that CC pathways are used differently by medical school applicants and matriculants with different characteristics, and that students who use CC pathways may be more likely to practice in underserved communities than those who did not use a CC pathway.

Method

Data sources

With approval from the University of California, Los Angeles Institutional Review Board, we analyzed a de-identified subset of data from 45,266 medical school applicants from the 2012 Association of American Medical College (AAMC) applicant file. Further analysis was performed on the 19,517 applicants who matriculated. A total of 1,824 applicant files were excluded because they only applied to non-American Medical College Application Service (AMCAS) participating schools. For example, medical schools in Texas are non-AMCAS. Our final study sample, after also excluding those with missing data (see “Other measures” section below), consisted of 40,491 applicants and 17,518 matriculants. Matriculant files were linked to responses to the 2012 Matriculating School Questionnaire (MSQ),¹⁷ which is voluntary and administered annually to all first-year medical students in the United States. The MSQ collects information on student characteristics, pre-medical experiences, medical school selection processes, future career interests, educational debts and financing. The MSQ response rate in 2012 was 72%.

College pathways

Using the Carnegie Classification of Institutions of Higher Education²⁵, we determined the educational pathways students used prior to applying to or matriculating into medical school. From among 13 different Carnegie classifications of undergraduate degree-granting institutions, we created four categories: HS-CC (attended CC during high school), First-CC (attended a CC prior to a 4-year university), Post-CC (attended a CC after graduating from 4-year university), and Non-CC (never attended a CC). This four-category pathway variable was our primary predictor. Our rationale for using three fundamentally different categories for students who attended a CC is grounded in previous work exploring the various pathways students use to gain acceptance to medical school.²⁶ HS-CC students concurrently enroll in a CC during high school because they are in an accelerated academic track that will help them gain acceptance to a 4-year university. The First-CC group is composed of

traditional CC students who obtain an associate's degree then transfer to a 4-year university. Post-CC students enrolled in a CC while or after completing a 4-year university degree to complete additional pre-medical coursework. There were no significant differences between students who attended a CC while or after completing a 4-year university degree, and therefore we collapsed them into the Post-CC category. HS-CC and Post-CC students took a minimum of 1 course at the CC to qualify for these categories.

There were 1,329 applicants and 459 matriculants who used more than one CC pathway. We assigned students who used more than one CC pathway to a single category based on where they spent more time completing pre-medical coursework using the following algorithm: students who attended CC during high school and then again after graduating from high school but prior to a 4-year university were categorized as First-CC instead of HS-CC; students who transferred to a 4-year university and returned to a CC to complete coursework were categorized as First-CC instead of Post-CC; and students who completed coursework at a CC during high school and again after graduating from a 4-year university were categorized as Post-CC instead of HS-CC.

Outcome measures

The primary outcome measure was acceptance to a U.S. MD-granting school or Medical Scientist Training Program (MSTP). Additional outcome measures were (1) plans to practice in an underserved community and (2) plans to work primarily with minority populations as reported on the MSQ.

Other measures

Students self-reported their sex (female or male), age, race-ethnicity, and parental education. We categorized race-ethnicity as White, Asian, Black, Latino, and Multiple/other on their application file. Parental education was categorized based on AAMC classification: less than college, college, master's degree, 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 2,951 individuals who had missing data were excluded. Measures with missing data were college pathway (n=552), gender (n=5), parental education (n=1,715), GPA (n=71), and MCAT scores (n=608).

Analysis

Stata version 13.0 (Stata Corporation LP 2013, 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 2-tailed t-test of differences in means and χ^2 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 (acceptance to medical school, acceptance to an MSTP,

plans to practice in an underserved community, and plans to work primarily with minority populations) using 3 different models comparing each CC pathway to the Non-CC pathway. We used a staged approach²⁷ to isolate the effects of student personal characteristics from academic characteristics. 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.^{1,5,28} Model 1 regressions included our primary predictor without adjusting for covariates. Model 2 regressions included Model 1 variables plus personal characteristics: age, gender, race-ethnicity, and parental education. Model 3 regressions adjusted for Model 1 and 2 variables plus academic characteristics: GPA, MCAT scores, and number of years in college after graduating from high school. A statistical significance level was set at $P < .05$ for all analyses.

We performed sensitivity analyses to determine whether there was a statistically significant interaction between race-ethnicity and CC pathway. The interaction variable was included in the final adjusted models for each outcome. Five separate multivariate logistic regression models, one for each race-ethnicity group, were conducted to further test the interactions.

Results

Characteristics of matriculants and applicants are shown in Table 1 and Supplemental Digital Table 1. A total of 17,518 applicants matriculated into medical school in 2012, and 4,920 (28%) of them used one of the CC pathways; 1,920 (11%) used the HS-CC pathway, 895 (5%) used the First-CC pathway, and 2,105 (12%) used the Post-CC pathway (Table 1). The mean age of matriculants was 22 years (± 2.7), and 8,082 (46%) were women, with the First-CC pathway contributing the least amount of women overall at 361 (4%).

Among Latinos, 538/1,566 (34%) used CC pathways, making Latinos the racial-ethnic group with the largest proportion of matriculants who used CC pathways. By comparison, 311/1,109 (28%) black matriculants, 2,715/9,905 (27%) white matriculants, and 963/3,628 (27%) Asian matriculants used CC pathways. Blacks made up the smallest percentage of matriculants who used the HS-CC pathway (76/1,109 [7%]), compared to Whites (1082/9,905 [11%]), Asians (416/3,628 [12%]), and Latinos (175/1,566 [11%]). One hundred thirty-one of 1,566 (8%) Latinos used the First-CC pathway, compared to 449/9,905 (4.5%) Whites. Latino and Black matriculants made up the largest percentage of students who used the Post-CC pathway compared to other racial-ethnic groups.

Among matriculants on the First-CC pathway, 304/895 (34%) had parents with less than a college education compared to 1,683/12,598 (13%) of those on the Non-CC pathway. The average matriculant GPA and MCAT score varied slightly between pathways. A higher percentage of matriculants whose parents had less than a college education used the CC pathways across all race-ethnicity categories, compared to those who used the Non-CC (see Figure 1).

Table 2 shows the unadjusted percentages for matriculants' acceptance rates to medical schools and MSTPs, matriculants' intentions to practice in an underserved community, and

matriculants' intentions to work primarily with minority populations. A total of 17,537/40,491 (43%) and 806/1,744 (46%) applicants were accepted to medical school and an MSTP program, respectively. Acceptance rates to medical school varied by pathway: 12,574/26,074 (48%) for Non-CC; 1,923/4,168 (46%) for HS-CC; 897/2,884 (31%) for First-CC; and 2,143/5,621 (38%) for Post-CC (Table 2). Among matriculants who reported on the MSQ that they intended to locate their practice in an underserved community, 202/551 (37%) used the First-CC pathway ($P < .001$) as compared to 2,103/7,467 (28%) in the Non-CC pathway. Among matriculants, 2,058/10,441 (20%) reported on the MSQ that they intended to work primarily with minority populations, and this did not vary significantly by pathway ($P < .05$).

Figure 2 illustrates unadjusted differences in outcomes by race-ethnicity and CC pathway. Students who went to a 4-year university after graduating from high school and never attended a CC made up the largest proportion of students accepted to medical school and MSTP programs across all race-ethnicity groups. Irrespective of race-ethnicity, applicants who used the First-CC pathway were less likely to be accepted to medical school or an MSTP, compared to those who used other college pathways. A higher percentage of medical students who used the First-CC pathway, except for the Multiple/other race group, indicated an intention to practice in an underserved area compared to those who used the Non-CC pathway. Among all pathways, a higher percentage of Black and Latino matriculants indicated intentions to practice in underserved areas and to work primarily with minority populations compared to other race-ethnicity groups.

Table 3 includes the results of the logistic regression analyses for each outcome. In the unadjusted model (Model 1), First-CC pathway students had lower odds of being accepted into medical school (OR [odds ratio] = 0.49, 95% CI = 0.45 to 0.53, $P < .05$). After adjusting for student personal and academic characteristics (Model 3), the effect was slightly attenuated but statistically significant (AOR [adjusted odds ratio] = 0.68, 95% CI = 0.61 to 0.75, $P < .05$). In the unadjusted model (Model 1), First-CC pathway students had higher odds (OR = 1.48, 95% CI = 1.24 to 1.77, $P < .05$) of having intentions to practice in underserved communities. After adjusting for student personal and academic characteristics (Model 3), this relationship was slightly attenuated but statistically significant (AOR = 1.26, 95% CI = 1.05 to 1.53, $P < .05$). In Model 1, First-CC students were more likely to plan to work primarily with minority populations compared to Non-CC students. This effect was no longer statistically significant after adjusting for student characteristics.

The race-ethnicity interaction with CC pathway was largely insignificant for all outcomes. However, the Latino*HS-CC and Latino*First-CC interactions were both significant ($P < .05$) for acceptance to medical school. The White*HS-CC interaction was also significant ($P < .05$) for intentions to practice in an underserved community. Supplemental Digital Table 2 shows significantly lower odds of acceptance to medical school for all race-ethnicity groups who used the First-CC pathway, except for Black applicants, compared to those on the Non-CC pathway ($P < .05$).

Discussion

To our knowledge, this is the first study to describe the contributions of the CC as a pathway to U.S. MD-granting schools. Approximately one-third of applicants in 2012 used a CC pathway to medical school. Thirty-four percent of the Latino matriculants in 2012 used one of the CC pathways, and given the population projections, there is a huge need to increase the pool of qualified Latino medical school applicants to ensure adequate representation within the physician workforce. Without the CC pathways, Latinos would have only made up 1,028/17,518 (6%) of 2012 matriculants, returning the percentage to 1980's levels.²⁹

Medical students who used the First-CC pathway were more likely to have intentions to practice in an underserved community compared to all other pathways. First-CC students likely grew up in underserved communities, and their exposure to a more resource-limited environment may have reinforced their future practice intentions. CC student practice intentions may persist, and our findings are consistent with prior studies showing that personal characteristics influence physician practice patterns.^{5,8,28} We also found that the First-CC pathway was independently associated with not getting accepted to medical school compared to other pathways. It may be more difficult for students who attend a CC to get into medical school or into an MSTP because of the limited pre-medical opportunities at non-research institutions, other socioeconomic status (SES)-related challenges, or a perception, whether it is accurate or not, that they are not as academically well prepared as students who only attend 4-year colleges or universities.

We found variation in matriculation rates among the different CC-pathway groups despite relatively small differences in GPA and MCAT scores. Holistic review processes equally value capacity for growth and emotional resilience (reflected in the distance one has traveled to be ready for medical school),³⁰ and our results suggest that these issues still need additional attention in the medical school admission process. Incorporating holistic review into the standard medical school admission process may be one way to ensure that qualified candidates for admission in spite of the non-traditional pathways they take to medical school.

The CC system represents a potential source of student diversity for medical schools; however, there are significant challenges to enhancing the pipeline from CC to medical school. First, while many First-CC students aspire to transfer to a 4-year university, only approximately 37% of students who graduate from high school and begin at the community college level eventually do.³¹ There is also a disparity in terms of who actually successfully transfers. Studies have concluded that students who transfer from community colleges to 4-year colleges are of higher SES, have more academic preparation, are less likely to be URM, and are less likely to be women.^{32,33} In keeping with these earlier findings, our results show that the medical students who used a First-CC pathway were more likely to be URM and the first in their families to attend college. Further, we found that 361/8,082 (4%) of women matriculants and 1,250/18,655 (7%) of women applicants used the First-CC pathway, yet women represent almost 60% of the entire U.S. CC student population.¹¹ Finally, the financial costs of pursuing a medical education may be prohibitive for most CC students. Financial aid programs, scholarships, and well-funded pre-medical counseling

programs to support students earlier in their educational pathways at the CC level are needed.

A limitation of this study is the cross-sectional design and our inability to include other personal or academic factors in our analyses. The admissions process includes evaluating a wide variety of applicant data related to academic preparation, personal attributes, and extracurricular experiences to assess applicants' strengths and to determine their likelihood of success in medical school, so the exclusion of some of these data could have affected our results. Further, our dataset did not include students who also applied to or matriculated in DO-granting medical schools and excluded students who applied to or matriculated to non-AMCAS medical schools. Finally, the responses from the MSQ are self-reported and are subject to bias. We included intention to practice in underserved areas or work with minority populations, but we do not know if students who expressed these interests will ultimately work in these communities.

Over the past three decades, growth in the U.S. public higher education system has occurred almost exclusively in the CC sector.³⁴ CCs will remain a relatively affordable and accessible option for millions of Americans, and enrollment will likely continue to increase. Although many medical school recruitment and outreach efforts are strictly targeted at 4-year universities, ample opportunities may exist to support CC students pursuing careers in medicine. More research is needed to understand how medical schools can better support CCs and their students who have a desire to pursue a medical education and serve the underserved. Expanding this pathway and developing interventions to help CC students gain admission to medical schools in greater numbers may be an important way to diversify the medical student body and train the physicians needed to help address health disparities.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

The authors would like to thank Dr. Douglas Grbic from the Association of American Medical Colleges (AAMC) for partnering with them on this study, Dr. Robert Brook from the Robert Wood Johnson Foundation Clinical Scholars Program for reviewing the manuscript and providing advice on the content, and Dr. David Hayes-Bautista from the Center for the study of Latino Health and Culture at the University of California, Los Angeles (UCLA), and the Médicos Para El Pueblo community college students for inspiring this work.

Funding/Support: Dr. Talamantes was supported by the Veterans Affairs (VA) Office of Academic Affiliations through the VA/Robert Wood Johnson Foundation Clinical Scholars Program, UCLA. Dr. Moreno received support from a National Institute on Aging (NIA) (K23 AG042961-01) Paul B. Beeson Career Development Award, the American Federation for Aging Research. Dr. Mangione received support from the Robert Wood Johnson Foundation Clinical Scholars Program, the UCLA Resource Centers for Minority Aging Research, Center for Health Improvement of Minority Elderly (RCMAR/CHIME) under National Institutes of Health (NIH)/NIA Grant P30-AG021684, and from the NIH/National Center for Advancing Translational Sciences UCLA Clinical and Translational Science Institute Grant Number UL1TR000124. Dr. Mangione holds the Barbara A. Levey and Gerald S. Levey Endowed Chair in Medicine, which partially supported this work.

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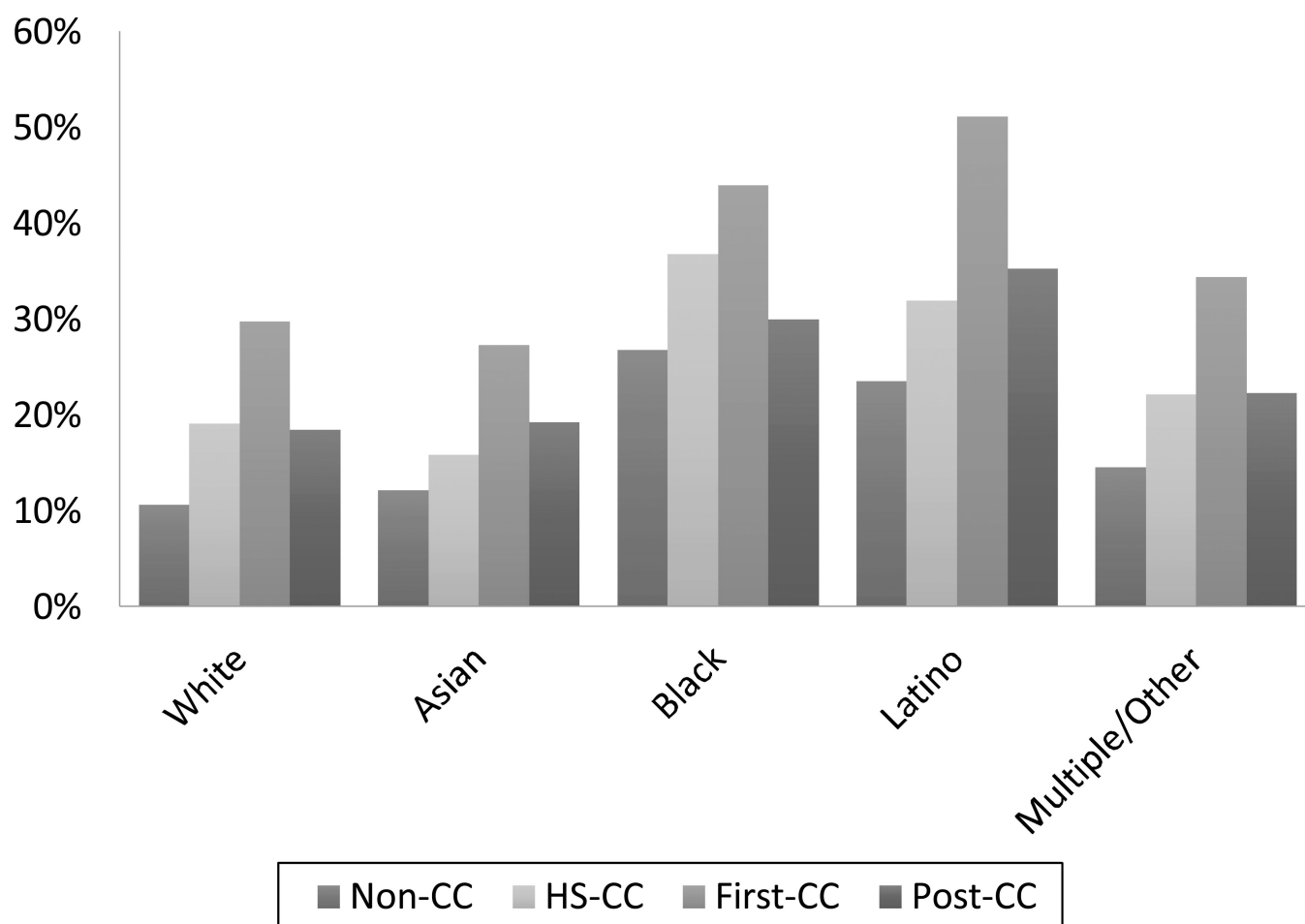
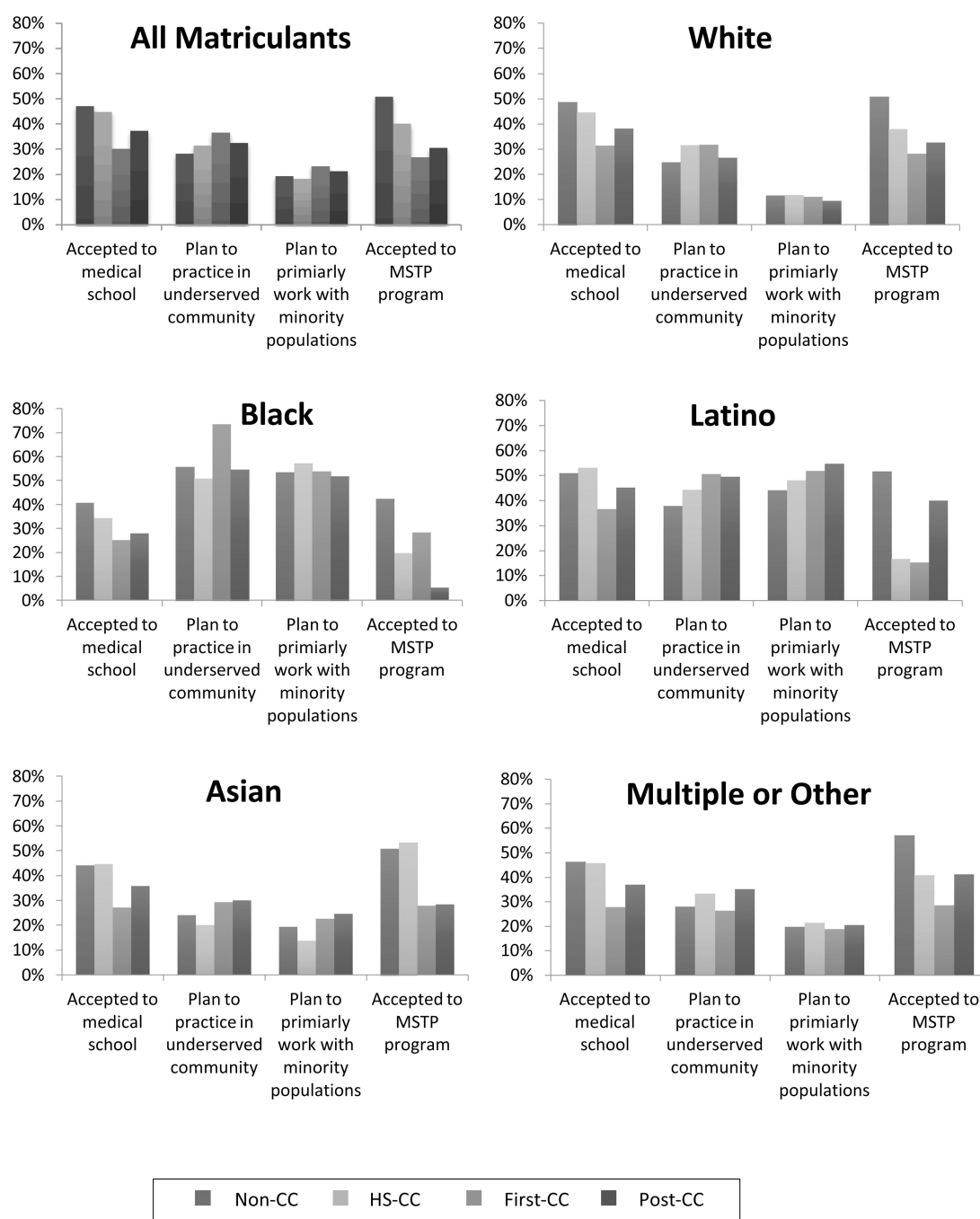


Figure 1.

Percentage of 2012 U.S. MD-granting medical school matriculants whose parents had less than a college education by race-ethnicity and pre-medical college pathway. Non-CC = applicants who never used any of the community college pathways; HS-CC = applicants who attended a community college while in high school and prior to graduating from high school; First-CC = applicants who attended a community college after graduating from high school and prior to transferring to a four-year university; Post-CC = applicants who attended a community college during or after graduating from a four-year university.

**Figure 2.**

Unadjusted primary outcomes for 2012 U.S. MD-granting medical school matriculants by race-ethnicity and community college pathway. Non-CC = applicants who never used any of the community college pathways; HS-CC = applicants who attended a community college while in high school and prior to graduating from high school; First-CC = applicants who attended a community college after graduating from high school and prior to transferring to

a four-year university; Post-CC = applicants who attended a community college during or after graduating from a four-year university.

Characteristics by Pre-Medical College Pathway for Matriculants to U.S. Medical Schools Included in the American Medical College Application Service, 2012

Table 1

| Characteristics | Non-CC | HS-CC | First- CC | Post- CC | Totals | P value ^a |
|--|---------------|--------------|-------------|---------------|--------------|----------------------|
| All matriculants,^b no. (%) | 12,598 (71.9) | 1,920 (11.0) | 895 (5.1) | 2,105 (12.02) | 17,518 (100) | |
| MD only,^c no. (%) | 11,984 (71.5) | 1,845 (11.0) | 867 (5.2) | 2,055 (12.3) | 16,751 (100) | < .001 |
| MSTP, no. (%) | 614 (80.1) | 75 (9.8) | 28 (3.7) | 50 (6.5) | 767 (100) | < .001 |
| Mean age in years (SD) | 21.8 (2.5) | 21.9 (2.4) | 23.2 (3.4) | 23.2 (3.6) | 22.0 (2.72) | < .001 |
| Female, no. (%) | 5,845 (72.3) | 901 (11.2) | 361 (4.5) | 975 (12.1) | 8,082 (100) | .32 |
| Race-ethnicity | | | | | | < .001 |
| White, no. (%) | 7,190 (72.6) | 1,082 (10.9) | 449 (4.5) | 1,184 (11.9) | 9,905 (100) | |
| Asian, no. (%) | 2,665 (73.5) | 416 (11.5) | 179 (4.9) | 368 (10.1) | 3,628 (100) | |
| Black, no. (%) | 798 (71.9) | 76 (6.9) | 75 (6.8) | 160 (14.4) | 1,109 (100) | |
| Latino, no. (%) | 1,028 (65.6) | 175 (11.2) | 131 (8.4) | 232 (14.8) | 1,566 (100) | |
| Multiple/other race, no. (%) | 917 (70) | 171 (13.1) | 61 (4.7) | 161 (12.3) | 1,310 (100) | |
| Parental education | | | | | | < .001 |
| Less than college, no. (%) | 1,683 (59.3) | 395 (13.9) | 304 (10.7) | 456 (16.1) | 2,838 (100) | |
| College, no. (%) | 2,935 (68.9) | 529 (12.4) | 226 (5.3) | 569 (13.4) | 4,259 (100) | |
| Masters, no. (%) | 3,151 (72.7) | 485 (11.2) | 178 (4.1) | 518 (11.9) | 4,332 (100) | |
| PhD or professional degree, no. (%) | 4,829 (79.3) | 511 (8.4) | 187 (3.1) | 562 (9.2) | 6,089 (100) | |
| Mean GPA (SD) | 3.68 (0.25) | 3.71 (0.24) | 3.69 (0.26) | 3.64 (0.28) | 3.68 (0.26) | < .001 |
| Mean MCAT score (SD) | 31.5 (3.99) | 31.1 (3.90) | 29.9 (3.99) | 30.3 (3.93) | 31.3 (4.00) | .61 |
| Mean no. (SD) of MCAT exams taken | 1.47 (0.74) | 1.50 (0.75) | 1.59 (0.80) | 1.63 (0.88) | 1.50 (0.77) | < .001 |
| Mean no. (SD) of applications submitted | 16.2 (10.9) | 16.7 (12.6) | 17.3 (12.7) | 15.6 (11.7) | 16.2 (11.3) | < .001 |
| No. (SD) of years in college before application to medical school | 4.6 (1.8) | 6.4 (3.0) | 6.8 (3.9) | 6.2 (3.7) | 5.1 (2.5) | < .001 |

Abbreviations: Non-CC = applicants who never used any of the community college pathways; HS-CC = applicants who attended a community college while in high school and prior to graduating from high school; First-CC = applicants who attended a community college after graduating from high school and prior to transferring to a four-year university; Post-CC = applicants who attended a community college during or after graduating from a four-year university; MSTP = Medical Scientist Training Program or MD-PhD dual-degree program; GPA = grade point average; MCAT = Medical College Admission Test; SD = standard deviation.

^aRepresents significance based on χ^2 test for proportional distribution.

^b 16,751 out of the 17,537 applicants accepted matriculated in medical school in 2012. 186 out of the 1744 applicants to a MSTP matriculated in an MD only program in 2012.

^c 767 out of the 806 accepted applicants to an MSTP program matriculated in an MSTP program in 2012.

Table 2

Unadjusted Acceptance Rates for U.S. MD-Granting and MSTP Programs, and Percentages of Matriculants with Intentions to Practice in an Underserved Community and Intentions to Work Primarily with Minority Populations as Reported on the Matriculating Student Questionnaire, 2012

| Pathway/outcome | Accepted to MD-granting school | Accepted to MSTP | Intentions to practice in an underserved community | Intentions to primarily work with minority population |
|-----------------------------|--------------------------------|------------------|--|---|
| Non-CC, no. (%) | 12,574/26,074 (48) | 649/1,275 (51) | 2,103/7,467 (28) | 1,456/7,496 (19) |
| HS-CC, no. (%) | 1,923/4,168 (46) | 75/187 (40) | 353/1,123 (31) | 207/1,131 (18) |
| First-CC, no. (%) | 897/2,884 (31) | 30/112 (27) | 202/551 (37) | 122/524 (23) |
| Post-CC, no. (%) | 2,143/5,621 (38) | 52/170 (31) | 421/1,294 (33) | 273/1,290 (21) |
| Totals, no. (%) | 17,537/38,747 (45) | 806/1,744 (46) | 3,079/10,435 (30) | 2,058/10,441 (20) |
| <i>P</i> value ^a | < .001 | < .001 | < .001 | .051 |

Abbreviations: MSTP = Medical Scientist Training Program or MD-PhD dual-degree program; Non-CC = applicants who never used any of the community college pathways; HS-CC = applicants who attended a community college while in high school and prior to graduating from high school; First-CC = applicants who attended a community college after graduating from high school and prior to transferring to a four-year university; Post-CC = applicants who attended a community college during or after graduating from a four-year university.

^aRepresents significance based on χ^2 test for proportional distribution.

Table 3

Predictors of Acceptance to MD-Granting and MSTP Programs, and Practice Intentions Among U.S. Medical School Matriculants, 2012

| | Accepted to MD-granting school, OR (95% CI) | Accepted to MSTP, OR (95% CI) | Plan to practice in an underserved community, OR (95% CI) | Plan to work primarily with minority populations, OR (95% CI) |
|----------------------------|---|-------------------------------|---|---|
| Model 1^a | | | | |
| Non-CC | Ref | Ref | Ref | Ref |
| HS-CC | 0.91 (0.86–0.98) ^d | 0.65 (0.47–0.88) ^d | 1.17 (1.02–1.34) ^d | 0.93 (0.79–1.09) |
| First-CC | 0.49 (0.45–0.53) ^d | 0.35 (0.23–0.54) ^d | 1.48 (1.24–1.77) ^d | 1.26 (1.02–1.55) ^d |
| Post-CC | 0.67 (0.63–0.71) ^d | 0.43 (0.30–0.60) ^d | 1.23 (1.08–1.40) ^d | 1.11 (0.96–1.29) |
| Model 2^b | | | | |
| Non-CC | Ref | Ref | Ref | Ref |
| HS-CC | 0.96 (0.90–1.02) | 0.70 (0.51–0.97) ^d | 1.17 (1.01–1.34) ^d | 0.93 (0.78–1.10) |
| First-CC | 0.59 (0.55–0.65) ^d | 0.45 (0.28–0.71) ^d | 1.27 (1.05–1.53) ^d | 0.98 (0.77–1.23) |
| Post-CC | 0.77 (0.73–0.82) ^d | 0.58 (0.40–0.83) ^d | 1.04 (0.91–1.19) | 0.93 (0.79–1.09) |
| Model 3^c | | | | |
| Non-CC | Ref | Ref | Ref | Ref |
| HS-CC | 0.97 (0.90–1.06) | 0.78 (0.52–1.17) | 1.17 (1.01–1.36) ^d | 0.92 (0.78–1.10) |
| First-CC | 0.68 (0.61–0.75) ^d | 0.43 (.25–0.74) ^d | 1.26 (1.04–1.53) ^d | 0.97 (0.76–1.22) |
| Post-CC | 0.95 (0.88–1.02) | 0.68 (0.44–1.04) | 1.02 (0.89–1.17) | 0.89 (0.76–1.05) |

Abbreviations: OR = odds ratio; MSTP = Medical Scientist Training Program or MD-PhD dual-degree program; Non-CC = applicants who never used any of the community college pathways; HS-CC = applicants who attended a community college while in high school and prior to graduating from high school; First-CC = applicants who attended a community college after graduating from high school and prior to transferring to a four-year university; Post-CC = applicants who attended a community college during or after graduating from a four-year university; AOR = adjusted odds ratio; GPA = grade point average; MCAT = Medical College Admission Test; SD = standard deviation, Ref = reference.

^aUnadjusted.

^bAdjusted for age, gender, race-ethnicity, parental education.

^cAdjusted for age, gender, race-ethnicity, parental education, Medical College Admission Test score, grade point average, number of years in college before application to medical school.

^d $P < .05$, using Non-CC as reference group.