Specialty Choice and Practice Location of Physician Alumni of University of California Premedical Postbaccalaureate Programs

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Abstract

Purpose
To investigate the longer-term career outcomes, such as specialty choice and practice location, of underrepresented minority and disadvantaged students who finished a University of California postbaccalaureate (UCPB) premedical program.

Method
The authors compared 303 UCPB alumni from the 1986–1987 to 2001–2002 cohorts who matriculated into medical school and could be matched to the 2008 American Medical Association Physician Masterfile with 586 randomly selected control physicians who graduated from the same medical schools in the same years as the UCPB alumni. Outcome variables included specialty, practice in a Health Professional Shortage Area (HPSA) or Medically Underserved Area (MUA), and practice in a California community with high concentrations of African American, Latino, or low-income residents.

Results
A greater percentage of UCPB alumni (161/303 [53.1%]) than control physicians (235/586 [40.1%]) were in primary care ($P < .001$). Although there were no differences between the two groups in the percentages of physicians working in HPSAs or MUAs, a greater percentage of UCPB alumni than control physicians working in California practiced in high-poverty communities (31/191 [16.2%] versus 22/252 [8.7%], $P < .016$), high-Latino communities (35/191 [18.3%] versus 22/252 [8.7%], $P < .01$), and high-African American communities (57/191 [29.8%] versus 50/252 [19.8%], $P < .02$).

Conclusions
UCPB programs have enhanced the number of physicians entering primary care and working in disadvantaged California communities. However, many UCPB alumni practice in disadvantaged communities in California that are not federally designated as HPSAs or MUAs.

One strategy to reduce health and health care disparities between ethnic and socioeconomic groups in the United States is recruitment to the health professions of more individuals from racial and ethnic groups traditionally underrepresented in medicine (UIM).[1–3] Physicians from UIM backgrounds play a key role in providing care to minority and underserved populations.[2–5] In addition, medical students of all races and ethnicities who are exposed to colleagues from diverse backgrounds during training are more likely to endorse the principle of equitable access to care and to express greater confidence in their ability to care for diverse patient populations.[6] The U.S. physician workforce does not reflect the diversity of the U.S. population—in 2000, African Americans, Latinos, and Native Americans/Alaska Natives made up over 25% of the U.S. population but less than 7% of U.S. physicians in 2005.[2] In California, these differences are even more striking—in 2007, African Americans, Latinos, and Native Americans made up 40% of the state's general population but only 9% of its physicians.[7]

Health career educational pipeline programs consist of interventions designed to grow the pool of well-qualified candidates from underrepresented backgrounds who can successfully matriculate into health professions schools.[8] Among these pipeline programs are postbaccalaureate premedical programs that target college graduates from UIM and disadvantaged backgrounds who are seeking admission to medical school. A recent study showed that alumni of Ohio State University's postbaccalaureate program who graduate from medical school are more likely than their medical school classmates who did not participate in a postbaccalaureate program to provide care to low-income and medically indigent patients, providing evidence that pipeline programs targeted to UIM students benefit underserved populations.[9] In addition, a national study found that participation in these types of "academic enhancer" postbaccalaureate programs was a significant predictor of medical students' intent at graduation to practice in underserved areas.[10]

The University of California (UC) system offers premedical postbaccalaureate (UCPB) programs at six campuses (five of which had operational programs during our study period from 1986 to 2002). The mission of these programs is

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"to increase the number of physicians who practice in shortage areas of California, by assisting capable and dedicated students from disadvantaged backgrounds in gaining admission to medical school."[11] Participants take upper-level science courses, receive career guidance and mentorship, participate in MCAT preparation programs, and receive assistance with the medical school application process. Most of the UCPB students come from UIM and financially disadvantaged backgrounds, and over two-thirds of the graduates of these programs matriculate into medical school.[12] Although a previous study[12] documented the success of UCPB programs in achieving medical school admission for participating UIM candidates, it did not examine longitudinal outcomes to determine whether UCPB alumni differed from peer physicians in career outcomes, such as specialty choice and practice location.

We therefore conducted this study to determine whether UCPB alumni who became physicians were more likely than comparable physicians to practice in California after completing their residency training, to choose primary care specialties, and to practice in underserved and disadvantaged communities.

Method

Data sources and sample selection

After obtaining institutional review board approval from the UC San Francisco Committee on Human Research, in 2008, we obtained a database from the UC Office of the President (UCOP) listing all 985 alumni of UCPB programs, beginning with the inception cohort of 1986–1987 and ending with the 2007–2008 cohort. Because medical school and residency training extend at least seven years after medical school matriculation, we eliminated UCPB alumni who finished the program after 2002 to focus on outcomes post medical training; therefore, 626 alumni from the 1986–1987 through 2001–2002 cohorts were eligible for inclusion in the study.

Using the UCOP database, which includes demographic and medical school matriculation information on each alumnus, we identified 522 UCPB alumni from the eligible cohort who matriculated into medical school by 2008. We then attempted to identify these 522 alumni in the 2008 American Medical Association (AMA) Physician Masterfile using a matching algorithm incorporating name, date of birth, and medical school attended. The AMA Physician Masterfile includes virtually all active U.S. physicians with MD degrees (including those who attended international medical schools but completed a residency or practiced in the United States) and many physicians with DO degrees. We were able to successfully identify 460 of 522 (88%) eligible alumni in the AMA Physician Masterfile. Those whom we could not match included predominantly alumni who attended osteopathic or international medical schools (and did not complete a residency or practice in the United States) or matriculated to medical schools after 2003 and may not have graduated by 2008.

We randomly selected control physicians from the pool of physicians who graduated from the same medical schools in the same years as the corresponding UCPB alumni, using a two-to-one match of control physicians to UCPB alumni. We were not able to identify control physicians for one UCPB alumnus who graduated from an international medical school, and this individual was removed, resulting in a sample of 459 UCPB alumni and 918 control physicians.

To best capture physicians who completed their training, we further limited our sample population by excluding all UCPB alumni and control physicians who were categorized in the AMA Physician Masterfile as still in residency or fellowship. This left a final sample of 889 physicians—303 of 459 (66%) eligible UCPB alumni and 586 of 918 (64%) control physicians.

Certain demographic variables, such as race/ethnicity and state of residence at the time of application to medical school, were not consistently available from the UCOP database or the AMA Physician Masterfile. To obtain this demographic information, we matched our UCPB alumni and control physicians to the American Medical College Application Service (AMCAS) database maintained by the Association of American Medical Colleges. We were able to identify 663 (230 UCPB alumni and 433 control physicians) or 75% of the 889 physicians in our study population in the AMCAS database. When available from the AMCAS database, variables on race/ethnicity and state of residence at the time of medical school application are included in our analyses.

Outcome variables

From the AMA Physician Masterfile, we obtained information on each UCPB and control physician's current practice address, mailing address, self-designated primary medical specialty, and self-designated primary professional activity. We categorized a physician as being in primary care if his or her self-designated primary specialty area was general internal medicine, general pediatrics, family medicine, general practice, geriatrics, adolescent medicine, or medicine/pediatrics. To identify a physician's practice location, we used an algorithm based on his or her current practice zip code, which defaulted to mailing zip code for the approximately 15% of physicians for whom practice zip code was not available. We geocoded each zip code to a database maintained by the Robert Graham Center that identifies federally designated primary care Health Professional Shortage Areas (HPSAs) and Medically Underserved Areas (MUAs).

For physicians practicing in California, we also geocoded each physician's zip code to a California Medical Service Study Area (MSSA), using methods previously described by Komaromy et al[4] and Grumbach et al.[5] We obtained data on the racial/ethnic composition and mean household income of the population residing in each MSSA from the 2000 U.S. Census. We identified a physician as working in a high-African American or high-Latino MSSA if the MSSA fell within the top quintile of MSSAs in the state for the percentage of the population of that race or ethnicity. Similarly, we identified a physician as working in a high-poverty MSSA if the MSSA fell in the top quintile of MSSAs in the state for the percentage of the population with a household income below 200% of the federal poverty level. One of the 192 UCPB alumni and 3 of the 255 control physicians with addresses in California reported zip codes that we could not match to the MSSA zip code

file, so we excluded them from the MSSA analysis.

We performed a sensitivity analysis to determine whether the results would change if a source of information on practice location other than the AMA Physician Masterfile was used. We manually looked up physicians whom we identified as practicing in California by name in the California Medical Board online directory, which provides the license numbers for all physicians with MD degrees licensed to practice in that state. We then used these license numbers to match physicians to entries in a relicensure survey database maintained by the California Medical Board that includes information on physicians' practice zip codes.[7]

Data analysis

We used chi-square tests to compare gender, age, race/ethnicity (UIM versus not UIM), state of residence at the time of application to medical school, physician specialty (primary care versus nonprimary care), practice location (California versus non-California), and work in underserved areas (HPSA and MUA) for UCPB alumni and control physicians. We then examined only the subset of physicians practicing in California and compared the proportions of UCPB alumni and control physicians working in HPSAs, MUAs, high-African American areas, high-Latino areas, and high-poverty MSSAs.

We used logistic regression models to examine the independent association between UCPB participation and outcome variables for those outcomes for which UCPB status was a significant predictor on bivariate analyses. We used parsimonious regression models that included as covariates only predictor variables that demonstrated a $P < .10$ on bivariate testing for the outcome in question. We confirmed goodness of fit for all regression models using the method of Hosmer et al.[13] Analyses were performed with Stata 11 (StataCorp LP, College Station, Texas). We considered all P values $<.05$ to be significant.

Results

Physician characteristics

A greater proportion of UCPB alumni than control physicians were female (171/303 [56.4%] versus 256/586 [43.8%]) and over the age of 46 (64/303 [21.1%] versus 63/586 [10.8%]) (Table 1). Significantly more UCPB graduates were from UIM racial/ethnic groups (African American, Latino, Native American/Alaska Native) compared with control physicians (192/303 [63.4%] versus 78/586 [13.3%]; $P <$ .001). Most UCPB alumni were California residents (214/303 [70.6%]) at the time of application to medical school compared with about one-third of control physicians (211/586 [36%]). Because of the matching procedure we used to randomly select control physicians, the distribution of medical schools was equal among UCPB alumni and control physicians, with almost half of the physicians in each group graduating from allopathic medical schools in California (UCPB alumni: 137/303 [45.2%] versus control physicians: 268/586 [45.7%]).

Table 1

Characteristics of Physicians Who Completed the University of California Postbaccalaureate (UCPB) Programs During 1986–2002 and of Control Physicians Matched by Medical School Attended and Year of Graduation

Physician characteristic	UCPB alumni: No. (% of 303)	Control physicians: No. (% of 586)	*P* value
Gender			<.001
Male	132 (43.6)	329 (56.1)	
Female	171 (56.4)	256 (43.7)	
Unknown	0 (0)	1 (0.002)	
Age			<.001
<35 years	43 (14.2)	135 (23.0)	
36–45 years	195 (64.4)	386 (65.9)	
>46 years	64 (21.1)	63 (10.8)	
Unknown	1 (0.3)	2 (0.3)	
Race/ethnicity			<.001
Underrepresented in medicine*	192 (63.4)	78 (13.3)	
Not underrepresented in medicine	38 (12.5)	355 (60.6)	
Unknown	73 (24.1)	153 (26.1)	
State of residence at time of application to medical school			<.001
California	214 (70.6)	211 (36.0)	
State other than California	16 (5.3)	223 (38.1)	
Unknown	73 (24.1)	152 (25.9)	
Medical degree			.99
California allopathic school	137 (45.2)	268 (45.7)	
Non-California U.S. allopathic school	128 (42.2)	245 (41.8)	
U.S. osteopathic school	32 (10.6)	60 (10.2)	
International medical school	6 (2.0)	13 (2.2)	

* Race/ethnicities underrepresented in medicine included African American, Latino, and Native American/Alaska Native.

Specialty and practice location

A greater percentage of UCPB graduates than control physicians (161/303 [53.2%] versus 235/586 [40.1%]; $P <$ .001) worked in a primary care specialty (Table 2). We attributed this gap to the difference in the number of physicians in each group practicing family medicine (UCPB alumni: 98/303 [32.3%] versus control physicians: 101/586 [17.2%]; $P <$ .001; data not shown). The characteristic that was the strongest predictor of a physician's entering a primary care specialty was gender—a significantly greater proportion of female physicians than male physicians worked in primary care ($P <$ .001). When we adjusted for gender in our regression analysis, including both gender and UCPB status as predictors, UCPB alumni remained significantly more likely than control

Table 2

Practice Characteristics of Physicians Who Completed the University of California Postbaccalaureate (UCPB) Programs During 1986–2002 and of Control Physicians Matched by Medical School Attended and Year of Graduation

Practice characteristic	UCPB alumni: No. (% of 303)	Control physicians: No. (% of 586)	*P* value
Specialty			<.001
Primary care*	161 (53.1)	235 (40.1)	
Nonprimary care	131 (43.2)	326 (55.6)	
Unknown	11 (3.6)	25 (4.3)	
State of practice			<.001
California	192 (63.4)	255 (43.5)	
Non-California	111 (36.6)	331 (56.5)	
Practice in underserved area			
Practicing in a Health Professional Shortage Area (HPSA)	43 (14.2)	97 (16.6)	.360
Not practicing in an HPSA	260 (85.8)	489 (83.4)	
Practicing in a Medically Underserved Area (MUA)	63 (20.8)	113 (19.3)	.593
Not practicing in an MUA	240 (79.2)	473 (80.7)	

* Primary care specialties included a self-designated primary specialty of family medicine, general internal medicine, general pediatrics, general practice, geriatrics, adolescent medicine, or medicine/pediatrics.

physicians to work in primary care specialties (odds ratio 1.6; 95% confidence interval 1.2–2.2).

A significantly greater proportion of UCPB alumni compared with control physicians practiced medicine in California (192/303 [63.4%] versus 255/586 [43.5%]; $P < .001$). We attributed this difference to the fact that state of residence at the time of application was the only significant characteristic in a regression model that included state of residence at the time of application and postbaccalaureate status as predictors of practicing in California.

We found no significant difference between the two groups in the proportion of physicians working in federally designated shortage areas (HPSA–UCPB alumni: 43/303 [14.2%] versus control physicians: 97/586 [16.6%]; $P = .36$; MUA–UCPB alumni: 63/303 [20.8%] versus control physicians: 113/586 [19.3%]; $P = .593$).

California-specific practice outcomes

When we examined practice location among the 191 UCPB alumni and 252 control physicians working in California for whom a zip code could be matched to the MSSA file, we again did not find significant differences between the proportions of UCPB alumni and control physicians working in HPSAs (21/191 [11%] versus 22/252 [8.7%]) and MUAs (32/191 [16.8%] versus 36/252 [14.3%]) (Table 3). However, the demographics of the communities in which UCPB alumni and control physicians worked did differ significantly. A significantly greater percentage of UCPB alumni than control physicians working in California worked in high-poverty MSSAs (31/191 [16.2%] versus 22/252 [8.7%]; $P = .016$), high-Latino MSSAs (35/191 [18.3%] versus 22/252 [8.7%]; $P < .005$), and high-African American MSSAs (57/191 [29.8%] versus 50/252 [19.8%]; $P = .015$).

In our regression models controlling for physician demographic characteristics predictive of working in any of the three types of disadvantaged areas (high-African American, high-Latino, or high-poverty MSSAs), the statistical significance of the association between UCPB alumni status and practice in a disadvantaged area was diminished, although the trend remained positive (Table 4).

For the sensitivity analysis of practice locations in California, we found 297 of the study physicians (132 UCPB alumni and 165 control physicians) in the California Medical Board online

Table 3

Practice in Underserved California Communities Among Physicians Who Completed the University of California Postbaccalaureate (UCPB) Programs During 1986–2002 and Among Control Physicians Matched by Medical School Attended and Year of Graduation

Underserved community type	UCPB alumni: No. (% of 191)*	Control physicians: No. (% of 252)*	*P* value
Health Professional Shortage Area (HPSA)			.425
HPSA	21 (11.0)	22 (8.7)	
Non-HPSA	170 (89.0)	230 (91.3)	
Medically Underserved Area (MUA)			.475
MUA	32 (16.8)	36 (14.3)	
Non-MUA	159 (83.2)	216 (85.7)	
High-Latino area			<.005
High-Latino area	35 (18.3)	22 (8.7)	
Non-high-Latino area	156 (81.7)	230 (91.3)	
High-African American area			.015
High-African American area	57 (29.8)	50 (19.8)	
Non–high-African American area	134 (70.2)	202 (80.2)	
High-poverty area			.016
High-poverty area	31 (16.2)	22 (8.7)	
Non-high-poverty area	160 (83.8)	230 (91.3)	

* One of 192 UCPB alumni and 3 of 255 control physicians working in California reported zip codes that could not be matched to California Medical Service Study Areas, resulting in the final sample of 191 and 252 physicians, respectively, for the analyses in this table.

Table 4

Adjusted Odds Ratios (ORs) for Working in a Disadvantaged Area in California Among Physicians Who Completed the University of California Postbaccalaureate (UCPB) Programs During 1986–2002 and Among Control Physicians Matched by Medical School Attended and Year of Graduation*

Physician characteristic	Practice in a high-African American area: OR (95% CI)	Practice in a high-Latino area: OR (95% CI)	Practice in a high-poverty area: OR (95% CI)
UCPB alumni	1.58 (0.81–3.06)	2.16 (0.87–5.36)	2.52 (0.99–6.40)
Underrepresented minority	1.59 (0.81–3.09)	1.30 (0.52–3.23)	1.51 (0.59–3.85)
Over age 46	0.41 (0.25–0.68)	—	—
Female	—	1.53 (0.77–3.07)	—

* Adjusted ORs are from regression models. The referent for UCPB alumni is not completing a UCPB program; for underrepresented minority, it is nonunderrepresented minority; and, for female, it is male gender. Predictor variables were only included in the regression model if they predicted the outcome variable on bivariate testing with $P < .10$; a dash indicates that the predictor variable did not meet this condition to be included in the regression model for that particular outcome variable. The total number of physicians included in the regression models was 334 (151 UCPB alumni and 183 control physicians). CI indicates confidence interval.

directory and determined their practice zip codes from the medical board relicensure survey. Although the statistical power was limited by the small sample size, the general patterns of practice locations on crude analysis for the study physicians were similar to those found using the AMA Physician Masterfile zip codes (data not shown).

Discussion

UCPB programs have a twofold mission. The first goal is "assisting capable and dedicated students from disadvantaged backgrounds in gaining admission to medical school."[11] Prior research has demonstrated the success of these programs in achieving this aim.[12] The programs also seek "to increase the number of physicians who practice in shortage areas of California."[11] This study suggests that UCPB programs are achieving this second aim as measured by some, but not all, metrics for assessing practice in disadvantaged communities.

Compared with their control physician counterparts, a larger proportion of UCPB alumni enter primary care specialties—particularly family medicine, which is a specialty currently perceived to be in shortage in the United States and critical to meeting the nation's need for expanded access to care under health care reform. Among physicians working in California, UCPB alumni were significantly more likely than their control physician counterparts to practice in communities that have population demographics that are indicators of social disadvantage and health disparities (e.g., relatively high concentrations of minority and low-income residents). However, similar proportions of UCPB alumni and control physicians worked in communities formally designated as HPSAs or MUAs, both in California and nationally.

What might explain this seeming paradox that a greater proportion of UCPB physicians were working in high-minority and high-poverty communities in California but not in HPSAs and MUAs? One explanation may be that obtaining formal designation as an HPSA or MUA requires the active engagement of the community to prepare and submit an application to the federal government to request designation status. Communities that are especially disadvantaged by factors such as poverty, limited English proficiency, and lack of community health centers may be unable to prepare formal applications. The types of population characteristics used in this study—that is, minority and poverty status—may be relatively objective measures for identifying vulnerable communities. Recognizing these challenges, the Health Resources and Services Administration (HRSA) recently convened a committee to review and make policy recommendations on methods for federal designations. Further, many HPSAs are located in rural regions. Because many UCPB alumni are from UIM backgrounds, they may be more likely to work in inner-city neighborhoods with high concentrations of racial and ethnic minority groups than in rural communities.

The results of our regression analyses suggest that some of the differences in practice outcomes between UCPB alumni and control physicians may be mediated by these individuals' underlying characteristics. The UCPB programs recruit students from California, so it is not surprising that a greater proportion of UCPB alumni than control physicians who graduated from the same medical schools ultimately practiced in California. The greater percentage of UCPB alumni in California working in disadvantaged communities also seems, at least in part, to be explained by UCPB alumni's being more likely to be underrepresented minorities. However, it is important to distinguish between mediating factors and confounding variables when interpreting regression analyses. The UCPB programs intentionally select individuals who possess characteristics that make them more likely to work in disadvantaged areas (e.g., being from UIM groups). These characteristics, therefore, may be rightly considered to mediate rather than confound the relationship between UCPB participation and practice in a disadvantaged community. From a policy perspective, the question is not so much whether a one-year postbaccalaureate program can shape the specialty choice or practice location of future physicians but, instead, whether such programs can assist individuals who possess characteristics that predispose them to careers of service to vulnerable communities in their goal of entering the physician workforce.

Our study has several limitations. Not every eligible UCPB alumni could be matched to the AMA Physician Masterfile, but the match rate was high (88%), which would limit any potential effects of bias from the unmatched sample. The accuracy of the AMA Physician Masterfile data on practice address has been questioned.[14] However, this limitation should apply equally to UCPB alumni and control physicians and should not introduce a systematic bias in our results. Our sensitivity analysis for practice location outcomes using the California Medical Board data did not suggest a systematic bias in the findings using the AMA data. Also, we were unable to find data on race/ethnicity for

25% of the study physicians, limiting the statistical power of the regression models that included race/ethnicity as a covariate. It is important to interpret the results of the regression models shown in Table 4 in light of this limitation; the odds ratios for UCPB participation were in a positive direction in all the models, but the reduction in sample size due to missing data on race/ethnicity resulted in fairly wide confidence intervals.

Conclusions

This study adds to research on the contribution of premedical postbaccalaureate programs focused on minority and disadvantaged individuals to achieving national physician workforce goals. Yet, these types of pipeline programs often struggle to attain consistent medical school institutional support and ownership.[15] The UCPB programs have long contended with an insecure financial model that has depended on a combination of student fees, state general funds for higher education, and grant support from private foundations and federal agencies. Postbaccalaureate programs are particularly vulnerable to loss of funding support in the face of the large state budget deficits, such as those that are compromising state general funding for UC, and the growing federal deficits that temper congressional enthusiasm for appropriating funds for nonentitlement programs, such as the HRSA Health Careers Opportunity Program. Our findings provide support for the establishment of stable funding and for other recent recommendations for strengthening institutionalization of postbaccalaureate programs.[15] Our study also demonstrates the importance of systematic methods for ongoing evaluation and tracking of outcomes of the alumni from these types of pipeline programs, including more routine use of large databases (e.g., AMA Physician Masterfile, AMCAS file). Our study findings also highlight the importance of ongoing efforts to reassess methods for federal designation of shortage and underserved areas.

In conclusion, our study provides evidence that UCPB programs have succeeded in enhancing the number of physicians entering primary care fields, practicing in California, and working in disadvantaged California communities.

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