



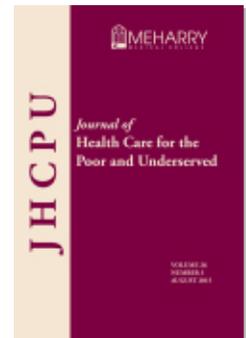
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A National Long-term Outcomes Evaluation of U.S. Premedical Postbaccalaureate Programs Designed to Promote Health care Access and Workforce Diversity

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Abstract: The National Postbaccalaureate Collaborative (NPBC) is a partnership of Postbaccalaureate Programs (PBPs) dedicated to helping promising college graduates from disadvantaged and underrepresented backgrounds get into and succeed in medical school. This study aims to determine long-term program outcomes by looking at PBP graduates, who are now practicing physicians, in terms of health care service to the poor and underserved and contribution to health care workforce diversity. **Methods.** We surveyed the PBP graduates and a randomly drawn sample of non-PBP graduates from the affiliated 10 medical schools stratified by the year of medical school graduation (1996–2002). **Results.** The PBP graduates were more likely to be providing care in federally designated underserved areas and practicing in institutional settings that enable access to care for vulnerable populations. **Conclusion.** The NPBC graduates serve a critical role in providing access to care for underserved populations and serve as a source for health care workforce diversity.

Key words: Education, medical; evaluation research; education, premedical; health services, needs and demand; medically underserved area; physician shortage area; physician's practice patterns; workforce; minority groups; underrepresented; cultural diversity.

Underserved communities are unlikely to experience the full benefits of the Patient Protection and Affordable Care Act unless medical schools produce more graduates

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who are willing and available to provide quality care to underserved rural and urban communities within the United States.¹⁻⁷ According to estimates by the Association of American Medical Colleges (AAMC), the United States is confronting a shortage of over 130,000 physicians by the year 2025.⁸ The predicted shortage has prompted an unprecedented expansion of medical school student capacity.⁹ However, medical schools have little control over their graduates' selection of specialties and practices. Simply increasing physician numbers does not guarantee that underserved communities will share equally in medical service resources. If there were practical and reliable prognostic information available about an individual's desire to serve poor and underserved populations during the medical school application process, we might be able to find future physicians that would contribute to promoting access to care for the underserved.

In 2000, Rabinowitz, et al. identified four robust predictors of the generalist physicians' care for underserved populations. These predictors included membership in an underserved ethnic or minority group, participation in the National Health Services Corps (NHSC), expression of strong interest in practicing in an underserved area prior to medical school, and personal experience of growing up in an underserved area.¹⁰

One strategy to address the national priority of producing more physicians includes the development and support of premedical postbaccalaureate programs (PBPs). Pre-medical postbaccalaureate programs enhance the academic preparedness of undergraduate college graduates in order to improve their chances for successful matriculation and graduation from medical school.¹¹

While there are 203 PBPs in the U.S. with varied missions and purposes, some have specific missions to prepare those college graduates who come from either disadvantaged backgrounds or from groups underrepresented in medicine for medical school success.¹²

The United States (U.S.) physician population in 2013 included 11.5% individuals from groups who are underrepresented in medicine including: African Americans (5.3%), American Indians/Alaska Natives (0.2%), people of Hispanic/Latino descent (6%), and Native Hawaiians/Other Pacific Islanders (0.03%).¹³ Furthermore, only 11.1% of the most recent graduating class (2014) from U.S. medical schools contained individuals from these underrepresented groups: African Americans (5.82%), American Indians/Alaska Natives (0.15%), people of Hispanic/Latino descent (5.13%), and Native Hawaiians/Other Pacific Islanders (0.02%).¹⁴ Yet, these groups underrepresented in medicine constitute 31.7% of overall U.S. population (U.S. Census Estimate 2013).

Multiple descriptive studies have reported the short-term and intermediate outcomes of PBPs such as characteristics of successful students and their impact on medical student diversity.¹⁵⁻²¹ However, few control group studies of practicing physicians have evaluated long-term outcomes of PBPs such as what patient populations are served by PBP physician alumni.²²⁻²³

Two studies of longer-term outcomes of PBPs evaluated whether the programs: 1) fulfilled their mission of preparing underrepresented and disadvantaged students to navigate their medical education successfully, and 2) resulted in graduating physicians who chose primary care specialties and /or selected practices that provided care to underserved and medically indigent patient populations.²²⁻²³ The first study by McDougle, et al. found that physicians who were graduates of Ohio State University's (OSU's) PBP were more likely than their control group counterparts to be practicing

medicine in federally designated medically underserved areas (29.4% versus 5.1%, $p \leq .01$) or to be providing services where 40% or more of the patients were medically indigent or poor (67.6% versus 33.3%, $p \leq .01$).²² The second study by Lupton, et al., found that alumni from five premedical postbaccalaureate programs across the University of California system (UCPB) were more likely than their control group counterparts to enter primary care (53.1% versus 40.1%, $p \leq .001$), and work in high-poverty communities (16.2% versus 8.7%, $p \leq .05$), high-Latino communities (18.3% versus 8.7%, $p \leq .01$), or high-African American communities (29.8% versus 19.8%, $p \leq .02$).²³

Our interest and the purpose of this study was to identify PBP's whose missions were to prepare students who fit the Rabinowitz profile for medical school and to evaluate the long-term outcomes of these PB programs to include their contribution to health care workforce diversity, and on a larger scale, to determine if these PBP graduates were contributing service to the well-being of poor and underserved patient populations.

Methods

The study described here involved the collaboration of 10 premedical postbaccalaureate programs across the United States, selected on the basis of their specific missions to prepare disadvantaged and underrepresented students for medical school. We compared PBP graduates to a matched sample of non-PBP graduates with regard to their service to underserved communities (as defined by the U.S. federal government) and medically indigent populations, defined as communities in which 40% or more of the population are medically indigent or poor. (Here, *medical indigence* refers to a state of impaired access to medical care due to financial barriers, including lack of access to affordable health care insurance; families with incomes within 200% of the poverty level, or who were medically indigent, were considered *poor*).⁴ We also asked participants about their participation in the National Health Service Corps (NHSC).

Participating programs. The following 10 medical schools and corresponding PBP's collaborated to conduct this multi-institutional study: Georgetown University School of Medicine, Michigan State University College of Human Medicine, Ohio State University College of Medicine, Southern Illinois University School of Medicine, University of California Davis School of Medicine, University of California Irvine School of Medicine, University of California San Diego School of Medicine, University of Hawaii School of Medicine, Wake Forest School of Medicine, and Wayne State University School of Medicine.

We specifically chose programs for this study on the basis of two criteria: 1) whether the program was a member of the National Postbaccalaureate Collaborative, "a partnership of PBP's dedicated to helping promising students from disadvantaged and underrepresented backgrounds get into and succeed in medical school,"²⁴ [p. 1] and 2) whether the program has an explicit mission to prepare disadvantaged and underrepresented individuals for medical school. Institutional Review Board approval or exemption was obtained for all 10 participating institutions.

Study participants. All PBP participants who graduated from the medical schools affiliated with the 10 PBP's from 1996 through 2002 were included in the study. For the control group, each institution also generated a roster of students who graduated

from medical school within the same years, 1996–2002. These initial rosters contained the graduate's first, middle and last name, any previous name associated with them (e.g., maiden name), the name of their medical school and the year of medical school graduation. From these lists, the Ohio State University College of Medicine (OSU COM) principal investigators were able to create rosters of PBP graduates and a control group for each of the participating institutions. The control groups were created through stratified random sampling so that the roster of non-postbaccalaureate (Non-PBP) program participants (controls) contained the same number of graduates by year and medical school as the PBP participants. The random number generator utility in SPSS for Windows was used to select the Non-PBP control group (IBM-SPSS Statistics for Windows, Version 19.0, 2010).

To facilitate the search for the current contact information for our study participants, the medical schools affiliated with these PBPs were asked to provide more detailed physician information concerning Post Graduate Year–one (PGY-1) and Post Graduate Year–two (PGY-2) residency program match, medical specialty if known, and current practice address from alumni records. We used all available demographic information to facilitate a search of the National Provider Identifier (NPI) registry for confirmation of current practice address. When NPI data was found to be out-of-date, other physician search engines were used to find the most up-to-date practice address information for our PBP and Non-PBP control group physicians (e.g., Healthgrades, Vitals, Doximity, and the AMA DoctorFinder).

Procedure. The instrument used was the *Survey of Service for Physicians*, a 27-item questionnaire we modeled after a published survey by Rabinowitz.¹⁰ The Rabinowitz survey identified four independent predictors of a physician's intention to provide care for underserved populations. These include: 1) being a member of an underserved racial/ethnic group, 2) participating in the National Health Services Corps, 3) having a strong interest in practicing in an underserved area before attending medical school, and 4) growing up in an underserved area. Most (86%) of the generalist physicians in the Rabinowitz study who had confirmed all four predictor characteristics, were found later to be providing substantial care to underserved communities.¹⁰

The remaining questionnaire items were designed to profile: 1) the type of practice population the physician serves; 2) the career path of the physician, including status as an academic physician or faculty member of academic health center; 3) additional personal demographics related to the physician's family socio-economic status during their upbringing (i.e., family income while growing up, the occupations, education level and immigrant status of parents, and whether or not the physician is a first-generation college graduate); and 4) the personal demographics of the physician including race, ethnicity, gender identity, sexual orientation, and disability status. Some questionnaire items, such as PBP and medical school attended were designed to validate that we had contacted the correct PBP or Non-PBP control group graduate.

The Dillman Total Design Method (TDM) for postal surveys was used to guide this national study.²⁵ A cover letter and survey were mailed to our subjects through the United States Postal Service (USPS), and followed up one week later with a post card reminder to non-responders. Approximately three weeks after the original mailing, a reminder letter and replacement survey was mailed to non-responders, and about six

weeks after the original mailing, a reminder letter and replacement survey was sent via certified mail with a return receipt request.²⁵

Each physician was assigned a unique identification (ID) number for this study, and that number was recorded on the survey before it was mailed. Physicians returned the surveys to the central data collector (OSU COM). If the survey letter was returned undeliverable, the address was again checked for accuracy against the NPI registry search website. If the address was the same as listed in the NPI registry search website, an internet search was used to determine a new practice address and a replacement survey was mailed. Only responses from the specific physician surveyed were accepted, for example, if we received a note stating that an associate or family member completed the survey, that data were not included. In addition, we verified demographic information originally received from the medical school against demographic information received from the survey. Surveys received with mismatching demographics were also dropped from the study.

Statistical analysis. We used chi-square or Fishers Exact Tests, Student's t-tests, and the Mann-Whitney U Test to compare PBP participants to Non-PBP physician groups. We also used descriptive statistics to profile the demographics of each group. All statistical analyses were conducted with IBM-SPSS for Windows, Version 19.0.

Results

Seventy-four (5.5%) of the initial group of 1,337 physicians were excluded for one of the following reasons: deceased (n=4), not practicing medicine nor had not yet started practice (n=29), found in data twice from two PBPs or from one PBP and drawn as a control for another PBP (n=9), requested withdrawal from the study (n=1), and unable to determine practice address (n=31). An additional 179 (13.4%) of physicians were dropped from the study after attempts to locate them went unsuccessful, including the certified letter confirming their address. The resulting number of physicians who were successfully contacted by mail was 1,084. A total of 477 surveys were returned for a response rate of 477/1084 (44.0%), however 17 of the surveys were not included in results due to incongruence between the demographic information on file and the answers on the survey. This resulted in a final adjusted return rate of 460/1067 (43.1%). The response rates were comparable between the PBP and Non-PBP control groups (see Table 1).

Socio-economic differences (pre-medical family characteristics). Premedical postbaccalaureate program graduates were significantly more likely to grow up in a lower socioeconomic household (annual family income < \$40,000, 43.5% versus 14.3%, $p \leq .001$). Additionally, the number of PBP physicians who were first generation college graduates was more than twice the number of Non-PBP physicians (52.4% versus 20.1%, $p \leq .001$, see Table 2). Parents of PBP physicians had significantly lower levels of education than their Non-PBP control group counterparts (Mann Whitney U Test of Rank Distributions: $p \leq .001$), and were less likely to have parents who were health care professionals (23.0% versus 35.5%, $p \leq .01$).

Rabinowitz predictor characteristics. Summary Rabinowitz predictor scores for care of the underserved were calculated by counting the number of Rabinowitz pre-

Table 1.**FREQUENCIES AND PERCENTAGES FOR RESPONDENTS AND VALID NON-RESPONDENTS LISTED BY POSTBACCALAUREATE AND CONTROL GROUP SEPARATELY AND BY INSTITUTION**

Institution	Post Bacc Group		Control Group		TOTAL	
	Count	Pct	Count	Pct	Count	Pct
Georgetown University	30/65	46.2%	29/75	38.7%	59/140	42.1%
University of Hawaii	15/28	53.6%	22/34	64.7%	37/62	59.7%
Michigan State University	21/35	60.0%	19/46	41.3%	40/81	49.4%
Ohio State University	19/44	43.2%	23/51	45.1%	42/95	44.2%
Southern Illinois University	45/122	36.9%	65/146	44.5%	110/268	41.0%
UC Davis	21/45	46.7%	21/51	41.2%	42/96	43.8%
UC Irvine	16/51	31.4%	17/52	32.7%	33/103	32.0%
UC San Diego	14/40	35.0%	19/45	42.2%	33/85	38.8%
Wake Forest University	14/23	60.9%	13/26	50.0%	27/49	55.1%
Wayne State University	14/40	35.0%	23/48	47.9%	37/88	42.0%
TOTAL	209/493	42.4%	251/574	43.7%	460/1067	43.1%

dictors present for each respondent (see Table 3). The comparison between groups showed that Rabinowitz predictor scores were significantly higher for PBP physicians ($t=16.33$, $df=458$, $p\leq.001$, mean [standard deviation]: PBP = 2.3 of 4[0.931], control = 0.90 of 4[0.909]), suggesting that the PBP physicians were predicted to be more likely to contribute to care of underserved or medically indigent populations. To summarize, the PBP physicians were significantly more likely to have been a member of an underserved racial/ethnic group (74.2% versus 9.6%, $p\leq.001$), grown up in an inner-city or rural area (63.8% versus 38.6%, $p\leq.001$), served in the National Health Service Corps (11.5% versus 3.6%, $p\leq.01$), and expressed a strong interest in underserved practice prior to medical school (74.6% versus 38.6%, $p\leq.001$, see Table 4).

Characteristics of physicians and physician practices. Demographic profiles of the two physician groups revealed differences that were expected given the populations of interest. The PBP physicians were more likely to be female (54.9%), and Black/African/African American (53.1%), Mexican American, or Hispanic/Latino (13.9%) compared with the Non-PBP physicians who were more often male (51.8%) and Non-Hispanic White (70.5%) or Asian (17.9%, see Table 5). The PBP physicians were also slightly, but significantly older in age than the Non-PBP physicians ($t=6.08$, $df=449$, $p\leq.001$, mean [standard deviation]: PBP = 42.5 [3.9], control = 40.4 [3.6]).

Due to documented disparities in health care for LGBT and disability communities,²⁶⁻²⁸ we expanded our demographic questions to include items about the physician respondent's sexual orientation and disability status. However, the number of physicians who self-reported as having a disability or identified themselves as lesbian, gay,

Table 2.

DEMOGRAPHIC CHARACTERISTICS OF 460 PRACTICING PHYSICIANS 209 PREMEDICAL POSTBACCALAUREATE PROGRAM (PBP) PARTICIPANTS AND A STRATIFIED CONTROL GROUP OF 251 NON-PBP PARTICIPANTS

Demographic characteristic	PBP Participants No. (% of 209)	Non-PBP Participants No. (% of 251)
Gender		
Female	114 (54.5)	121 (48.2)
Male	95 (45.5)	130 (51.8)
Transgender	0 (0)	0 (0)
Race/ethnicity ^a		
Asian	19 (9.1)	45 (17.9)
American Indian/Alaskan Native	4 (1.9)	0 (0.0)
Black/African/African American	111 (53.1)	11 (4.4)
Hawaiian Native or other Pacific Islander	6 (2.9)	7 (2.8)
Non-Hispanic white	13 (6.2)	177 (70.5)
Mexican American	29 (13.9)	6 (2.4)
Puerto Rican	7 (3.3)	1 (0.4)
Other Hispanic/Latino	15 (7.2)	1 (0.4)
Other or Unidentified	5 (2.4)	3 (1.2)
1st generation college graduate	109 (52.4)	50 (20.1)
Annual family income while growing up		
<\$15,000	22 (10.5)	3 (1.2)
\$15,000–\$39,999	69 (33.0)	33 (13.1)
\$40,000–\$69,999	55 (26.3)	57 (22.7)
\$70,000–\$99,999	19 (9.1)	44 (17.5)
>\$100,000	24 (11.5)	76 (30.3)
Did not know (or missing)	20 (9.6)	38 (15.1)
Highest level of parent education		
Less than 9th grade	21 (10.0)	5 (2.0)
9th–11th grade	13 (6.2)	0 (0.0)
High school graduate or GED	23 (11.0)	19 (7.6)
Some college or vocational training	51 (24.4)	27 (10.8)
College graduate	41 (19.6)	55 (21.9)
Master’s degree	34 (16.3)	52 (20.7)
Doctoral or professional degree	26 (12.4)	91 (36.3)
Did not know (or missing)	0 (0.0)	2 (0.8)
Grew up in inner-city or rural area—Yes ^a	132 (63.8)	97 (39.0)
Parent is a health professional—Yes	48 (23.0)	89 (35.5)
Disability—Yes	3 (1.4)	2 (0.8)

(Continued on p. 638)

Table 2. (continued)

Demographic characteristic	PBP Participants No. (% of 209)	Non-PBP Participants No. (% of 251)
Sexual Orientation		
Heterosexual	198 (94.7)	237 (94.4)
Lesbian	1 (0.5)	1 (0.4)
Gay	6 (2.9)	5 (2.0)
Bisexual	1 (0.5)	3 (1.2)
TOTAL	206 (98.6)	246 (98.0)
Missing	3 (1.4)	5 (2.0)

Note:
*Rabinowitz predictor items

Table 3.

RABINOWITZ PREDICTORS FOR 460 PRACTICING PHYSICIANS: PREMEDICAL POSTBACCALAUREATE PROGRAM (PBP) PARTICIPANTS COMPARED WITH A STRATIFIED CONTROL GROUP OF NON-PBP PARTICIPANTS

Number of Rabinowitz predictors	PBP participants No. (% of 209)	Non-PBP participants No. (% of 251)
0	7 (3.3)	101 (40.2)
1	42 (20.1)	90 (35.9)
2	66 (31.6)	44 (17.5)
3	83 (39.7)	16 (6.4)
4	11 (5.3)	0 (0.0)
	209 (100)	251 (100)

bisexual, or transgender (LGBT) were small and similar between groups [PBP: 3 (1.4%) versus Non-PBP: 2 (0.8%); and PBP: 8 (3.8%) versus Non-PBP: 9 (3.6%)], respectively.

The Non-PBP physicians were more likely to have identified themselves as full-time medical school faculty, but the difference was not statistically significant (18.7% Non-PBP versus 12.6% PBP: $X^2=2.85$, $df=1$, $p=.099$).

We asked respondents to tell us how many years that they had practiced medicine, beyond residency or fellowship. Both groups averaged close to eight years in practice ($t=1.17$, $df=452$, $p=.242$, mean [standard deviation]: PBP = 8.2 [2.6], Non-PBP = 7.9 [2.8]). The practice specialties of the two groups were also quite similar, however consistent with prior studies, PBP graduates were slightly but significantly more likely

Table 4.

COMPARISON OF PREMEDICAL POSTBACCALAUREATE PROGRAM (PBP) PARTICIPANTS AND NON-PBP PARTICIPANTS ACROSS RABINOWITZ PREDICTORS

Number of Rabinowitz predictors	PBP participants No. (% of 209)	Non-PBP participants No. (% of 251)	P value
Are you a member of an underserved ethnic or minority group ^a			≤.001
Yes	155 (74.2)	24 (9.6)	
No	54 (25.8)	227 (90.4)	
TOTAL	209 (100)	251 (100)	
Did you grow up in an inner-city or rural area?			≤.001
Yes	132 (63.8)	97 (38.6)	
No	75 (36.2)	152 (60.6)	
Did not answer	0 (0.0)	2 (0.8)	
TOTAL	209 (100)	251 (100)	
Did you participate in the National Health Service Corps?			≤.01
Yes	24 (11.5)	9 (3.6)	
No	185 (88.5)	240 (96.4)	
Did not answer	0 (0)	2 (0.8)	
TOTAL	209 (100)	251 (100)	
Did you have a strong interest in underserved practice prior to medical school?			≤.001
Yes	156 (74.6)	96 (38.6)	
No	53 (25.4)	153 (61.4)	
Did not answer	0 (0)	2 (0.8)	
TOTAL	209 (100)	251 (100)	

Note:

^aBlack/African American, American Indian/Alaskan Native, Hispanic/Latino or combination of these races/ethnicities.

than Non-PBP graduates to enter primary care specialties such as family medicine, general internal medicine, medicine-pediatrics, or general pediatrics (48.8% versus 39.0%, $p \leq .05$).^{22-23,29} The most frequent PBP practice specialties were family medicine, obstetrics and gynecology, general internal medicine, and pediatrics. The most frequent Non-PBP practice specialties were similar except that they were more often in internal medicine sub-specialties instead of general internal medicine (see Table 5).

Service to poor and underserved populations. Compared with Non-PBP graduates, practicing physicians who were PBP graduates were significantly more likely to

Table 5.**FREQUENCIES AND PERCENTAGES OF THE PRACTICE SPECIALTIES OF 209 PBP PHYSICIANS AND 251 NON-PBP PHYSICIANS**

Specialty	PBP participants No. (% of 209)	Non-PBP participants No. (% of 251)
Anesthesiology	5 (2.4)	4 (1.6)
Dermatology	2 (1.0)	4 (1.6)
Emergency Medicine	11 (5.3)	11 (4.4)
Family Medicine ^a	60 (28.7)	42 (16.7)
Internal Medicine- General ^a	21 (10.0)	20 (8.0)
Internal Medicine-Subspecialty	13 (6.2)	27 (10.8)
Med-Peds ^a	2 (1.0)	10 (4.0)
Neurology	1 (0.5)	4 (1.6)
OB/Gyn	29 (13.9)	21 (8.4)
Ophthalmology	1 (0.5)	3 (1.2)
Orthopaedic Surgery	1 (0.5)	15 (6.0)
Otolaryngology	0 (0)	3 (1.2)
Pathology	2 (1.0)	4 (1.6)
Pediatrics ^a	19 (9.1)	26 (10.4)
Pediatric Subspecialty	7 (3.4)	13 (5.2)
Physical Medicine & Rehabilitation	3 (1.4)	4 (1.6)
Psychiatry	6 (2.9)	5 (2.0)
Radiation Oncology	0 (0)	1 (0.4)
Radiology-Diagnostic	3 (1.4)	10 (4.0)
Surgery-General	13 (6.2)	7 (2.8)
Surgery Subspecialty	6 (2.9)	14 (5.6)
Urology	3 (1.4)	2 (0.8)
Other Subspecialty	1 (0.5)	1 (0.4)
TOTAL	209 (100)	251 (100)

^aPrimary care specialties included Family Medicine, General Internal Medicine, Medicine-Pediatrics, and Pediatrics.

be providing care in settings that enable access to health care services for underserved and vulnerable populations; these include community or federally qualified health centers, rural health centers or clinics, Indian health services medical centers, and prisons (40.7% versus 27.9%, $p \leq .01$). Regardless of whether their clinical practice was primary or specialty care, PBP graduates were more likely than Non-PBP graduates to be practicing medicine in federally designated underserved areas (Primary care: 45.1% versus 27.6%, $p \leq .01$; Non-primary care: 25.2% versus 9.8%, $p \leq .001$).

Physicians who had graduated from PBPs reported that their medical practices

included substantial numbers (40% or more) of medically indigent or poor patients to a small but significantly greater extent than Non-PBP physicians did (52.7% vs. 41.0%, $p \leq .05$; see Table 6). When asked if they currently volunteer medical services to the poor or uninsured outside of their current practice, 45 physicians from each group said that they did (PBP: 21.5% versus Non-PBP: 17.9%, $p = .347$). When we included those who said they “eventually plan to volunteer these types of services,” the percentage of affirmative responses almost doubled for both groups and the statistical difference became significant (PBP: 54.1% versus Non-PBP: 40.6%, $p \leq .01$). The Non-PBP group reported a slightly, but not significantly higher average number of volunteer hours than the PBP group ($t = 1.02$, $df = 74$, $p = .242$, mean [standard deviation]: PBP = 6.4 [4.5]; control = 7.9 [7.9]).

Table 6.

COMPARISON OF PREMEDICAL POSTBACCALAUREATE PROGRAM (PBP) PARTICIPANTS AND NON-PBP PARTICIPANTS ACROSS ADDITIONAL SERVICES AND CHARACTERISTICS

	Postbacc No. (% of 209)	Non-Postbacc No. (% of 251)	P-value
Do you currently practice in any of the following locations: community health center, federally qualified health center, rural health clinic/center, Indian health services medical clinic/center, charity hospital, prison?	85 (40.7)	70 (27.9)	$\leq .01$
Do you have a practice in which 40% or more of patients are medically indigent (e.g. Medicaid, uninsured) or have similar proportion of patients who are poor?	109 (52.7)	102 (41.0)	$\leq .05$
Do you now, or do you plan to volunteer your medical services outside of your practice to treat uninsured or indigent patients?	113 (54.1)	102 (40.6)	$\leq .01$
Primary care physician	102 (48.8)	98 (39.0)	$\leq .05$
Full-time medical school faculty	27 (12.6)	47 (18.7)	.099
Specialty Board certification	179 (85.6)	246 (98.0)	$\leq .001$
Primary care physicians practicing in federally designated underserved area	48 of 102 (45.1)	27 of 98 (27.6)	$\leq .01$
Non-primary care physicians practicing in federally designated underserved area	27 of 107 (25.2)	15 of 153 (9.8)	$\leq .001$

Discussion

Through profiling characteristics of physicians who provide services to medically underserved communities, Rabinowitz and colleagues set out to define a future physician prototype. Since the PBP programs selected for this study have missions to produce physicians that are consistent with the Rabinowitz prototype, we hypothesized that graduates of PBP programs would be more likely to be providing services to the medically underserved and impoverished patients when compared with a control group of their peers.

This is likely the first national multi-institutional control group survey of practicing physicians designed to evaluate the long-term outcomes of PBPs. Results are consistent with prior single-institution and single-state PBP studies and demonstrate that practicing physicians who were PBP graduates contribute to alleviating shortages of health care providers for underserved and vulnerable populations.^{22,23} This study expands on the previous work of Rabinowitz and colleagues by examining the scope of physician specialties beyond that of generalist practice.¹⁰ As a whole, whether they were primary care physicians or not, the PBP physicians were significantly more likely to be providing care for underserved patients by practicing in federally designated underserved areas, serving in practices where 40% or more of the patients are medically indigent or uninsured, or practicing in institutional settings that enable access to health care services for underserved and vulnerable populations.

Physician graduates of PBPs also contribute to the academic medicine pipeline, serving as an important resource for diversifying medical school faculty. The number of full-time faculty detected in our sample is consistent with the results of Andriole, et al. in their broader study of medical school graduates from about the same period (1997–2002).³⁰ Although we observed a slightly higher percentage of full-time faculty among our Non-PBP physicians, the difference was not statistically significant.

The significantly lower board certification rates we observed between PBP physicians (85.6%) and their Non-PBP counterparts (98.0%) was a matter of some concern, since this is such an important long-term outcome. However, when compared with the certification rate of 87.3% from a comparable national sample of 42,440 physicians from about the same graduation cohort (1997–2000), the American Board of Medical Specialties certification rate of PBP graduates is nearly equal to the national mean.³¹ This is a salient result, especially when taking into consideration that these PBP physician graduates participated in these programs specifically designed to academically prepare disadvantaged and underrepresented students who might not otherwise have become physicians.

Limitations. There were two limitations that we believe must be addressed. First, tracking down and obtaining valid contact information for the population of interest, PBP graduates and a random selection of control graduates from the same medical schools, involved tedious detective work. We believe, however, that our methods to identify, contact, and confirm properly the intended subjects of our research worked well. We were also fortunate to have the support from Ohio State University College of Medicine, very capable research assistants, and resources such as the National Phy-

sician Index Registry and other commercial physician search engines to locate our research subjects.

Second, just as in any self-report questionnaire, we relied on the interest of our subjects in the content of the survey and their earnest responses to our questions. While most of the survey items were innocuous, we thought it important to include a few questions that may have been sensitive for some respondents such as family income when growing up, immigrant status of parents, sexual orientation, and disability status. We recognize that the sensitive nature of these questions may have cost responses, but we believe that including these questions in return for a more modest 43.1% return rate was a worthy trade-off.

Implications for medical education. This national, control study of practicing physicians explored the long-term outcomes of premedical postbaccalaureate programs. These programs have common missions to prepare students from disadvantaged backgrounds or under-represented racial/ethnic groups for medical school. Rabinowitz identified the same personal characteristics as predictors of eventual service to underserved populations. Consistent with the findings of Rabinowitz and other PBP studies, our findings suggest that the PBP physician graduates contribute substantially to medical care for underserved and medically indigent populations.^{11,22-23,29}

The participating 10 PBPs have produced students who help medical schools achieve a critical mass of underrepresented students, which in turn helps these schools meet accreditation standards for diversity and inclusion. Further research is needed to evaluate the need for and effectiveness of educational support programs for PBP students from disadvantaged backgrounds after matriculation to medical school. In addition, further research is needed to determine how best to provide outreach to inner city and rural communities to identify and recruit students who may be a good fit for PBPs focused on underrepresented and disadvantaged backgrounds. Finally, results of this study provide additional evidence for continued Title VII grant funding of the Health Resources and Services Administration (HRSA), Health Career Opportunity Program (HCOP) in support of similarly focused PBPs.

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