A National Longitudinal Survey of Medical Students' Intentions to Practice Among the Underserved

Thomas F. O'Connell, MD, Sandra A. Ham, MS, Theodore G. Hart, MD, Farr A. Curlin, MD, and John D. Yoon, MD

Abstract

Purpose
To explore students' intentions to practice in medically underserved areas.

Method
In January 2011, 960 third-year medical students from 24 MD-granting U.S. medical schools were invited to participate in a survey on their intention to practice in a medically underserved area. A follow-up survey was sent to participants in September 2011. Covariates included student demographics, medical school characteristics, environmental exposures, work experiences, sense of calling, and religious characteristics.

Results
Adjusted response rates were 564/919 (61.4%, first survey) and 474/564 (84.0%, follow-up survey). Among fourth-year medical students, an estimated 34.3% had an intention to practice among the underserved. In multivariate logistic regression modeling, predictors for intentions to practice among the underserved included growing up in an underserved setting (odds ratio [OR] range: 2.96–4.81), very strong sense of calling (OR range: 1.86–3.89), and high medical school social mission score (in fourth year: OR = 2.34 [95% confidence interval (CI), 1.31–4.21]). International experience was associated with favorable change of mind in the fourth year (OR = 2.86 [95% CI, 1.13–7.24]). High intrinsic religiosity was associated with intentions to practice primary care in underserved settings (in fourth year: OR = 2.29 [95% CI = 1.13–4.64]).

Conclusions
Growing up in medically underserved settings, work experience in religiously affiliated organizations, very strong sense of calling, and high medical school social mission score were associated with intentions to practice in underserved areas. Lack of formative educational experiences may dissuade students from considering underserved practice.

The Association of American Medical Colleges reports that over the past 35 years, there has been a growing physician shortage in the United States as the population has grown larger and older while the number of students acquiring MD degrees has remained largely unchanged.[1] The Health Resources & Services Administration estimates that more than 64 million Americans live in health professional shortage areas, which are defined as areas where the population-to-primary-care-physician ratio is greater than 3,500:1 or greater than 3,000:1 in areas with unusually high demand for primary care physicians.[2,3] Studies have found that physicians who work with the underserved are more likely to be from an underrepresented minority population, grow up in an underserved area, report interest in underserved practice prior to medical school, speak another language, belong to a family that emphasizes service to the poor, or report a sense of calling to such work.[4–7]

At the same time, there is a growing recognition that experiences during medical school play an influential role in future career decision making. Medical schools, therefore, can have substantial influence on professional identity formation through a combination of curricular experiences that expose students to underserved populations.[7–11] Some medical schools have also recruited students more likely to work in primary care and underserved areas through affirmative action, or have created focused programs for students interested in underserved rural and urban medicine.[6,12,13] Boscardin et al[14] recently demonstrated how educational experiences during medical school can reaffirm or positively change students' decisions to practice in underserved areas. Lastly, though religion and spirituality may be an important factor in shaping intentions to practice among the underserved,[15] very few studies have examined the associations between religion and work experience in religiously affiliated organizations, and medical students' intentions to practice among the underserved.

The present study uses data from a nationally representative longitudinal survey of third- and fourth-year medical students to track changes in their intentions to practice in medically underserved areas as they move through their final two years of medical school. We explored intention to practice in any medically underserved setting and intention to practice primary care in such a setting. We considered student demographic and medical school characteristics and examined students' environmental exposures and work experiences. Lastly, we examined the association of intentions to practice among the underserved with other factors that have been relatively unexamined in the literature: sense of calling, religiosity, and spirituality.

Method

The study process we describe here is also known as the Project on the Good

Please see the end of this article for information about the authors.

Correspondence should be addressed to John D. Yoon, 5841 S. Maryland Ave., MC 5000, Chicago, IL 60637; telephone: (773) 702-5197; e-mail: jdyoon@uchicago.edu.

Acad Med. XXXX;XX:00–00.
First published online
doi: 10.1097/ACM.0000000000001816

Supplemental digital content for this article is available at http://links.lww.com/ACADMED/A462.

Physician. This study was approved by the University of Chicago Social Sciences Institutional Review Board in January 2011.

Data source

In January 2011, we drew our sample of medical students from the 2010 American Medical Association Physician Masterfile—a database that includes nearly all medical students pursuing MD and DO degrees in the United States and its territories. Using a systematic sampling plan with probability proportional to size and implicit stratification, we selected 24 U.S. MD-granting medical schools and then randomly selected 40 students from each school to achieve a nationally representative sample. We mailed a confidential, self-administered, 12-page questionnaire to the stratified random sample of 960 third-year U.S. medical students in January 2011. In September 2011, when the third-year students were due to become fourth-year students, we mailed a follow-up survey (see Supplemental Digital Appendix 1 at http://links.lww.com/ACADMED/A462 for population comparisons).

We had previously developed and pretested the questionnaire topics through cognitive interviews with a small group of U.S. medical students from a medical school local to the Chicago area in October 2010.

For the first survey, the randomly selected participants received an explanatory letter in advance, followed one week later by a mailed envelope containing a paper survey instrument with an up-front incentive of a $5 bill. At that time, they were also invited to visit a secure, password-protected Web page to complete an online version of the mailed questionnaire. Nonrespondents received up to two additional mailings; for the second additional mailing, we offered nonrespondents an additional $5 gift card incentive.

Using procedures similar to those above and coded identifiers to link the two surveys, the follow-up survey was sent to those who had completed the first survey. The follow-up survey contained an up-front incentive of a $10 bill.

We constructed case weights to reflect the probability of selection from the national sample, accounting for sources of variance associated with the sample design, and to adjust for potential nonresponse bias as described in detail elsewhere.[16,17]

Outcomes

Our primary outcome was students' intention to practice among the underserved. To assess this, we asked students, "Do you plan to locate your practice in a medically underserved area?" Possible replies to this question were yes, no, or undecided. Our secondary outcome was students' intentions to practice among the underserved in a primary care specialty. We asked students to indicate which 1 of 16 clinical specialties they were most likely to choose for residency training.[18] If students indicated family medicine, internal medicine, or pediatrics, we asked them, "How likely are you to go into primary care?" Intention to practice primary care was defined as a student's indication of very or somewhat likely versus not very or not at all likely on this question. We asked these questions on both surveys. We then used data from the follow-up survey to create a variable for students who had indicated intention *both* to care for the underserved and to practice primary care versus all other combinations of these two factors.

Covariates

To assess experience working in an underserved setting, we asked students, "Have you ever *worked* in a medically underserved setting?" If they responded yes, we asked them to "Please check all of the following descriptors that apply to the underserved setting(s) in which you have worked: 1) In the United States, 2) Outside the United States, 3) Global health program through your school, 4) Service learning experiences in the community, 5) Religiously-affiliated organizations, and 6) Other."

The demographic variables we assessed included gender, underrepresented minority (defined as black/African American or Hispanic/Latino) status, and having grown up in a medically underserved setting (possible answers for this were no; yes—rural; yes—inner city; and yes—other). We also collected data on the region (Northeast, South, Midwest, and West), social mission score[10] rank (classified into quartiles), and religious affiliation (yes, no) of students' medical schools.

In addition, we assessed students' sense of calling to a particular kind of work[19] and their religious characteristics,[20,21] including religious affiliation, intrinsic religiosity, and spirituality. A sense of calling was assessed using two items from the Brief Calling Scale.[19] These items were answered on a five-point Likert-type scale ranging from 1 = not at all true of me to 5 = totally true of me. Scores on the two items were added for a total presence of calling score. The items were highly correlated ($\rho = 0.82$, $P < .0001$; Cronbach $\alpha = 0.90$). Since our sample scores were not normally distributed (mean = 7.79, standard error = 1.73), we classified the scores roughly into tertiles of calling: very strong = 9 or 10, strong = 8, and none to moderate = 2 to 7. Intrinsic religiosity is a construct that represents the extent to which an individual embraces his/her religion as the "master motive" that guides and gives meaning to his/her life. To assess this, we asked respondents to indicate their agreement or disagreement with two statements: "I try hard to carry my religious beliefs over into all my other dealings in life," and "My whole approach to life is based on my religion." We categorized intrinsic religiosity as low if the student agreed with neither statement, moderate if he/she agreed with one but not the other, and high if he/she agreed with both statements. Using a measure from previous studies,[20] we measured spirituality by asking, "To what extent do you consider yourself a spiritual person?" Because there is still disagreement as to what spirituality means, we allowed students to respond to this question using their own concept of spirituality. We categorized spirituality as high for those who indicated very spiritual, moderate for those who indicated moderately spiritual, and low for those who indicated slightly or not at all spiritual.[20]

We asked the work-experience- and demographics-related questions in the first survey and the religiosity- and calling-related questions in the follow-up survey.

Statistical analysis

We used descriptive statistics (see Table 1) to summarize student demographics and medical school characteristics in the respondent sample. We computed weighted national estimates of percentages of students planning and not planning

to locate in an underserved area by student demographics, medical school characteristics, and types of exposure (environmental [growing up in a medically underserved setting or going to a medical school with a high social mission score] and work experiences) to medically underserved populations. For bivariate analyses, we used chi-square tests to identify significant associations; we considered $P < .05$. We used multivariate logistic regression models to examine factors related to students' future plans. We assessed change over time with respect to student choices and conducted repeated regression models, with environmental exposures, work experiences, sense of calling, and intrinsic religiosity included as predictor factors, controlling for demographics, other religious characteristics, and intention to practice primary care. To make nationally representative estimates, we employed case weights to reflect sources of variance associated with the sample design and to adjust for potential nonresponse bias.[22] We performed analyses using survey analysis procedures in SAS 9.4 (SAS Institute Inc., Cary, North Carolina).

Results

Of the 960 potential respondents, 41 (4.3%) were declared out of scope because the surveys were returned unanswered even after attempts were made to contact the students at two different addresses or because information was received that the student had dropped out of school or was inaccurately identified as a third-year student in the American Medical Association Physician Masterfile. Among eligible students, our response rate was 564/919 (61.4%) for the first survey and 474/564 (84.0%) for the second survey.

Of the 474 students who responded to both surveys, 214 (45.1%) were women, 61 (12.9%) were underrepresented minorities, and 115 (24.3%) grew up in a medically underserved setting (Table 1). In addition, 142 (30.0%) reported a very strong sense of calling. For the religious characteristics, 91 (19.2%) had no religious affiliation, 277 (58.4%) were Christian (Roman Catholic/Eastern Orthodox, Evangelical Protestant, and non-Evangelical Protestant), and 98 (20.6%) were of other religions (Hindu, Jewish, Muslim, and other religion); 124 (26.2%) had high intrinsic religiosity; and 96 (20.3%) had high spirituality.

Table 1

Characteristics of the Medical Students Who Responded to Both the Third- and Fourth-Year Survey (n = 474), Project on the Good Physician, January–September 2011

Characteristic	No. (%)
Student demographics	
Gender	
Men	260 (54.9)
Women	214 (45.1)
Underrepresented minority	61 (12.9)
Grew up in a medically underserved setting	115 (24.3)
Medical school characteristics	
Region	
Northeast	113 (23.8)
South	171 (36.1)
Midwest	128 (27.0)
West	62 (13.1)
Social mission score	
Q1 (rank 1–30)	114 (24.1)
Q2 (rank 31–64)	120 (25.3)
Q3 (rank 65–110)	128 (27.0)
Q4 (rank 111–140)	112 (23.6)
Religiously affiliated	
Yes	79 (16.7)
No	395 (83.3)
Student calling and religious characteristics	
Sense of calling[a]	
None to moderate	147 (31.0)
Strong	185 (39.0)
Very strong	142 (30.0)
Religious affiliation	
None	91 (19.2)
Hindu	28 (5.9)
Jewish	30 (6.3)
Muslim	10 (2.1)
Roman Catholic/Eastern Orthodox	115 (24.3)
Evangelical Protestant	43 (9.1)
Non-Evangelical Protestant	119 (25.1)
Other religion	30 (6.3)
Intrinsic religiosity[a,b]	
Low	252 (53.2)
Moderate	90 (19.0)
High	124 (26.2)
Spirituality[a]	
Low	191 (40.3)
Moderate	181 (38.2)
High	96 (20.3)

Abbreviations: Q1 indicates first quartile; Q2, second quartile; Q3, third quartile; Q4, fourth quartile.
[a]See main text for an explanation of how answers for this characteristic were categorized.
[b]Intrinsic religiosity is a construct that represents the extent to which an individual embraces his/her religion as the "master motive" that guides and gives meaning to his/her life.

Based on survey responses, our nationally representative estimate was that 32.0% of third-year medical students in the United States had an intention to locate to a medically underserved area (Table 2). Although we estimate that 34.3% of

students had such plans in their fourth year, approximately one-third (10.8%) of these students did not have that intention in their third year. Since we were interested in also assessing factors related to plans to practice primary care in underserved areas, we estimated that 18.0% of fourth-year medical students had these intentions. We were also interested in a subgroup analysis assessing factors related to returning to rural areas to practice; however, only 69/474 (14.6%) respondents indicated that they had grown up in a medically underserved rural area, which was too few for subgroup analysis.

Our weighted national estimate of percentage of fourth-year medical students in the United States who planned to locate in a medically underserved area varied significantly by gender, underrepresented minority status, having grown up in a medically underserved setting, medical school region, and medical school social mission score rank (Table 3). Table 4 shows the weighted national estimates of percentages of fourth-year students who planned to practice in an underserved area by different kinds of exposures (in the third year) to medically underserved populations. Although 9.4% of students had worked in religiously affiliated organizations, approximately one out of four students reported having service learning (25.2%) or international (28.5%) work experience. Except for those reporting exposure to other domestic work, students with each type of exposure, including attending a school in the highest social mission score quartile, were significantly more likely to report planning to practice in an underserved area than those who did not have an exposure to underserved populations in the third year. Overall, 84.4% of third-year students reported at least one type of exposure to medically underserved populations (data not shown), and 45.4% had at least one environmental exposure *and* one work experience. This latter group was almost evenly divided in their plans to locate in a medically underserved area.

We explored the associations between calling and religiosity, other factors related to upbringing, and intentions. Those with stronger callings and stronger intrinsic religiosity and spirituality were significantly more likely to report plans to locate in a medically underserved area, but they were also more likely to belong to an underrepresented minority and to have grown up in an underserved area ($P < .0001$ for all; data not shown). Thus, in the adjusted models, independent effects of these factors would be particularly salient given the tendency of factors related to disadvantaged upbringings co-occurring.

Table 2

Nationally Representative Estimated Percentage of U.S. Medical Students Who Planned to Locate in a Medically Underserved Setting, Based on Project on the Good Physician Survey Responses (n = 474), January–September 2011[a]

Plan to locate in an underserved area (third year)	Plan to locate in an underserved area (fourth year)					
	Yes		No		Total	
	No.	% (95% CI)	No.	% (95% CI)	No.	% (95% CI)
Yes	109	23.5 (17.8–29.2)	37	8.5 (5.4–11.6)	*146*	*32.0 (24.6–39.4)*
No	*52*	*10.8 (7.5–14.1)*	276	57.2 (49.3–65.2)	328	68.0 (60.6–75.4)
Total	*161*	*34.3 (27.8–40.8)*	313	65.7 (59.2–72.2)	474	100
… and practice primary care[b]	*85*	*18.0 (13.6–23.1)*				

Abbreviation: CI indicates confidence interval.
[a]Cells with italic values were used for subsequent modeling of characteristics that predicted membership in each of these groups (Table 5).
[b]Only the fourth-year answer to this question was used here.

Table 3

Weighted National Estimate of Percentage of U.S. Fourth-Year Medical School Students Who Plan to Locate in a Medically Underserved Setting, Based on Project on the Good Physician Survey Responses (n = 474), September 2011

Characteristic	Planning to practice in an underserved area, % (95% CI)	Not planning to practice in an underserved area, % (95% CI)	*P* value
Total	34.3 (27.8–40.8)	65.7 (59.2–72.2)	N/A
Student demographics			
Gender			< .0001
Men	23.6 (16.9–30.2)	76.4 (69.8–83.1)	
Women	46.3 (37.8–54.8)	53.7 (45.2–62.2)	
Underrepresented minority	59.4 (50.0–68.8)	40.6 (31.2–50.0)	< .0001
Grew up in a medically underserved setting	61.7 (51.9–71.5)	38.3 (28.5–48.1)	< .0001
Medical school characteristics			
Region			< .0001
Northeast	22.4 (17.1–27.6)	77.6 (72.4–82.9)	
South	37.2 (25.0–49.5)	62.8 (50.5–75.0)	
Midwest	38.3 (31.2–45.5)	61.7 (54.5–68.8)	
West	42.5 (28.3–56.7)	57.5 (43.3–71.7)	
Social mission score			< .0001
Q1 (rank 1–30)	52.7 (45.4–59.9)	47.3 (40.1–54.6)	
Q2 (rank 31–64)	35.4 (26.5–44.3)	64.6 (55.7–73.5)	
Q3 (rank 65–110)	25.7 (19.0–32.5)	74.3 (67.5–81.0)	
Q4 (rank 111–140)	22.7 (17.5–28.0)	77.3 (72.0–82.5)	
Religiously affiliated			.22
Yes	28.8 (20.3–37.3)	71.2 (62.7–79.7)	
No	35.4 (28.0–42.7)	64.6 (57.3–72.0)	

Abbreviations: CI indicates confidence interval; N/A, not applicable; Q1, first quartile; Q2, second quartile; Q3, third quartile; Q4, fourth quartile.

Table 4

Percentage of U.S. Third-Year Medical Students (January 2011) Who Had Routes of Exposure to Underserved Populations (n = 474) and Weighted National Estimates of Percentages Planning and Not Planning to Practice in a Medically Underserved Setting in Fourth Year (September 2011), Project on the Good Physician

Exposure to medically underserved populations in third year by characteristic	Overall (third year), % (95% CI)	Subsequent intentions (fourth year)		
		Planning to practice in an underserved area, % (95% CI)	Not planning to practice in an underserved area, % (95% CI)	*P* value[a]
Total	100	34.3 (27.8–40.8)	65.7 (59.2–72.2)	N/A
Environmental exposure				
Grew up in a medically underserved setting	25.7 (18.8–32.7)	61.7 (51.9–71.5)	38.3 (28.5–48.1)	< .0001
Medical school in highest social mission score quartile	25.9 (6.0–45.8)	52.7 (45.4–59.9)	47.3 (40.1–54.6)	< .0001
Work experience location				
Inside of the United States	63.0 (55.6–70.5)	43.0 (36.5–49.6)	57.0 (50.4–63.5)	< .0001
Outside of the United States	27.1 (19.3–34.8)	44.5 (33.4–55.6)	55.5 (44.4–66.6)	.02
Type of work experience				
Service learning	25.2 (20.2–30.1)	44.3 (33.5–55.1)	55.7 (44.9–66.5)	.008
Religiously affiliated organizations	9.4 (6.7–12.2)	57.3 (38.3–76.2)	42.7 (23.8–61.7)	.01
International[b]	28.5 (20.3–36.7)	43.3 (32.4–54.2)	56.7 (45.8–67.6)	.03
Other domestic work[c]	28.6 (21.5–35.7)	38.1 (28.6–47.7)	61.9 (52.3–71.4)	.26
And no environmental exposure	12.3 (7.4–17.3)	19.7 (12.3–27.2)	80.3 (72.8–87.7)	.0008
Total with at least one environmental exposure and one work experience	45.4 (30.4–60.4)	50.3 (42.6–58.0)	49.7 (42.0–57.4)	< .0001

Abbreviations: CI indicates confidence interval; N/A, not applicable.
[a]*P* value for chi-square test of differences in subgroup plans to locate/not locate in an underserved area compared with those who did not have the exposure in third year.
[b]Experience in a global health program and work outside of the United States were combined into a single indicator of international work experience.
[c]Includes those who indicated that their work experience was in the United States and selected either "Other" or did not select international, service learning, or religiously affiliated organization.

We performed multivariate logistic regression modeling for four of the outcomes from Table 2: planning to locate in a medically underserved area in the third and fourth years, change of mind from not planning to planning to locate in an underserved area in the fourth year as compared with the third year, and planning to locate in an underserved area and practice primary care in the fourth year (Table 5). The models tested the effects of environmental exposure, work experience, sense of calling, and intrinsic religiosity, controlling for gender and other factors known to influence these decisions, including attending a religiously affiliated medical school. (Since the intrinsic religiosity and spirituality measures exhibited multicollinearity, only intrinsic religiosity was included in the models.)

As expected, growing up in a medically underserved setting was highly significant in all models (odds ratio [OR] range: 2.96–4.81) and is shown for comparison with other factors. Medical school social mission score was not influential in year three but became influential in year four (OR = 2.34 [95% confidence interval (CI), 1.31–4.21]); this environmental exposure was the most influential factor for those who changed their minds in year four. The effects of type of work experience changed over time; service learning was important in year three (OR = 2.73 [95% CI, 1.68–4.44]), as was other domestic work experience (OR = 2.34 [95% CI, 1.17–4.70]). International experience was important only for those who changed their minds in favor of locating in underserved areas in the fourth year (OR = 2.86 [95% CI, 1.13–7.24]). Working in a religiously affiliated organization was influential only in the fourth year (OR = 2.55 [95% CI, 1.23–5.30]). Having a very strong calling was influential (OR range: 1.86–3.89), and high intrinsic religiosity was important only for intentions to practice primary care in an underserved area in the fourth year (OR = 2.29 [95% CI, 1.13–4.64]).

Discussion

As the United States deals with a growing physician shortage, the need for physicians in medically underserved areas continues to grow.[1,23] We used a longitudinal study of a nationally representative sample of third- and fourth-year medical students to assess the changing effects of student demographics, medical school characteristics, environmental exposures, work experiences, sense of calling, and religious characteristics on plans to locate in medically underserved areas. We found that aspirations to practice among the underserved, based on a few types of past work experiences, growing up in a medically underserved area, and a very strong sense of calling, were associated with such decision making in third-year students. In the fourth year, intentions were instead related to growing up in a medically underserved setting, high medical school social mission score, work experience in religiously affiliated organizations, and a very strong sense of calling.

Table 5

Effects of Environmental Exposure, Work Experiences, Sense of Calling, and Intrinsic Religiosity on Decisions to Locate in a Medically Underserved Setting and Practice Primary Care, U.S. Medical School Students in Third Year (January 2011) and Fourth Year (September 2011) of Training, Project on the Good Physician[a]

Characteristic	Plan to locate in an underserved area (third year, n = 474), OR (95% CI)[b]	Change of mind in favor of locating in an underserved area (fourth year, n = 328), OR (95% CI)[c]	Plan to locate in an underserved area (fourth year, n = 474), OR (95% CI)[b]	Plan to locate in an underserved area and practice primary care (fourth year, n = 474), OR (95% CI)[d]
Environmental exposure				
Grew up in medically underserved setting				
No	Ref	Ref	Ref	Ref
Yes	**4.76 (3.23–7.02)**	**2.96 (1.51–5.79)**	**3.59 (2.05–6.30)**	**4.81 (2.61–8.88)**
Medical school social mission score				
Q1 (rank 1–30)	1.59 (0.66–3.84)	**5.13 (2.00–13.19)**	**2.34 (1.31–4.21)**	2.49 (0.98–6.33)
Q2 (rank 31–64)	0.77 (0.44–1.36)	**3.65 (1.54–8.62)**	1.57 (0.80–3.08)	1.69 (0.85–3.33)
Q3 (rank 65–110)	0.71 (0.44–1.13)	2.29 (0.96–5.45)	1.18 (0.60–2.33)	1.14 (0.49–2.68)
Q4 (rank 111–140)	Ref	Ref	Ref	Ref
Type of work experience				
Service learning				
No	Ref	Ref	Ref	Ref
Yes	**2.73 (1.68–4.44)**	1.68 (0.76–3.74)	1.70 (0.95–3.05)	1.72 (0.69–4.31)
Religiously affiliated organization				
No	Ref	Ref	Ref	Ref
Yes	1.75 (0.74–4.13)	1.41 (0.50–3.93)	**2.55 (1.23–5.30)**	2.46 (0.89–6.79)
International				
No	Ref	Ref	Ref	Ref
Yes	1.43 (0.58–3.54)	**2.86 (1.13–7.24)**	1.71 (0.84–3.46)	1.02 (0.41–2.54)
Other domestic work				
No	Ref	Ref	Ref	Ref
Yes	**2.34 (1.17–4.70)**	1.98 (0.81–4.83)	1.82 (0.90–3.69)	1.23 (0.43–3.55)
Calling and religiosity				
Sense of calling[e]				
None to moderate	Ref	Ref	Ref	Ref
Strong	1.27 (0.74–2.20)	1.60 (0.67–3.81)	1.58 (0.85–2.95)	1.20 (0.67–2.14)
Very strong	**2.24 (1.08–4.67)**	**2.83 (1.04–7.67)**	**3.89 (1.81–8.34)**	1.86 (0.89–3.91)
Intrinsic religiosity[e,f]				
Low	Ref	Ref	Ref	Ref
Moderate	0.95 (0.32–2.80)	1.33 (0.51–3.49)	0.95 (0.35–2.56)	1.32 (0.52–3.33)
High	1.36 (0.73–2.52)	1.34 (0.46–3.89)	0.97 (0.46–2.05)	**2.29 (1.13–4.64)**
LR χ^2; *df*; *P* value	7,411; 26; < .0001	2,098; 19; < .0001	7,198; 26; < .0001	4,549; 25; < .0001

Abbreviations: OR indicates odds ratio; CI, confidence interval; Q1, first quartile; Q2, second quartile; Q3, third quartile; Q4, fourth quartile; LR χ^2, likelihood ratio chi-square statistic; *df*, degrees of freedom.

[a]Bold indicates those values that are statistically significant (i.e., $P > .05$).

[b]Adjusted for gender, underrepresented minority status, medical school region, religious affiliation, attending a religiously affiliated medical school, and intention to practice primary care.

[c]Among those who did not have intentions to locate in a medically underserved area in third year; adjusted for gender, underrepresented minority status, medical school region, attending a religiously affiliated medical school, and intention to practice primary care.

[d]Adjusted for gender, underrepresented minority status, medical school region, religious affiliation, and attending a religiously affiliated medical school.

[e]See main text for an explanation of how answers for this characteristic were categorized.

[f]Intrinsic religiosity is a construct that represents the extent to which an individual embraces his/her religion as the "master motive" that guides and gives meaning to his/her life.

Our study adds to a growing literature that highlights how educational experiences in medical school can positively impact intention to practice among the underserved.[11,14,24] A recent study showed that students who worked with underserved populations in free clinics were more likely to commit and remain committed to practice in underserved areas.[24] Boscardin et al[14] demonstrated that students with field experiences in community health or who learned another language to improve patient communication during medical school were more likely to reaffirm intentions to practice among the underserved, initially reported at matriculation, at graduation. The same study showed that students who expressed uncertainty or disinterest in underserved practice at matriculation were more likely to change their practice intention at graduation if they reported increased awareness of perspectives of individuals from different backgrounds, having a cultural competence/awareness experience, having field experiences in community health, or learning another language to improve patient communication. Those students who positively changed their intention to practice in an underserved area required more of these types of educational experiences than students who reaffirmed such intentions.[14]

Only about 25% of students surveyed in our national study had worked with the underserved through service learning. Service learning integrates the community into the curriculum by allowing students to hone their skills while serving the community.[24,25] Though currently underused, an increasing integration of service learning into the formal curricula of medical schools could increase medical students' exposure with the underserved. For example, in a study commissioned by the Association of American Medical Colleges Workforce Studies, researchers found that although students' individual characteristics continue to play a role in specialty choice decisions, the predominant primary care culture at a school played a significant role in students' likelihood of practicing primary care.[26] Notably, this study also found that students who attended schools with high reported levels of "badmouthing" primary care were less likely to practice primary care, suggesting that school culture may serve as part of a "hidden curriculum" that shapes students' professional identities over the course of their medical education.[27] Another study demonstrated that students from one school were more likely to enter primary care residencies when they had participated in an extracurricular longitudinal MD-granting medical school program that explicitly supported students' vocational interest in caring for the underserved.[28] Overall, these studies, as well as similar insights from the social sciences,[29] suggest that institutional cultures that incorporate curricular experiences among the underserved may play a substantial role in shaping and sustaining such vocational intentions among medical students.

Alternatively, schools with these types of cultures may be preferentially attracting students who already possess a strong sense of vocation to work among the underserved. For example, previous studies have found that underrepresented minority students and those who grew up in medically underserved settings are more likely to practice in underserved areas.[5,30] Although intensive targeted programs can increase the likelihood that graduates will continue to aspire to work among underserved populations,[31] efforts at increasing underserved practice are often directed at a highly selected minority of MD medical school graduates, such as those who completed a postbaccalaureate program.[32]

As with Staiger et al,[33] our study's findings raise the question of whether students' intentions during medical school eventually lead to long-term careers in caring for underserved populations, particularly as students begin to take into account other considerations, such as financial and familial commitments.[33] Since financial obligations have been found to impact specialty choice,[5] there has been a gradual trend among today's U.S. MD medical students to increasingly prefer "controllable lifestyle" specialties over primary care.[18] Insofar as careers that work for the underserved do not necessarily promise a controllable lifestyle or higher salary, as compared with other medical careers, physicians-in-training who choose such work may have other intrinsic motivations that overcome these disincentives.[34] One such motivation can be a strong sense of vocational identity or "calling" toward such work.[4,15]

In our study, only approximately 9% of medical students had experience working with the underserved in religiously affiliated organizations. While very few medical students have worked with the underserved in religiously affiliated organizations, some medical schools are increasingly integrating religion and spirituality into educational curricula that generate and sustain vocational aspirations to care for the underserved.[35,36] Further, some religious physicians cite religious calling to perform ministry as a reason for serving in religiously affiliated health centers in underserved areas.[15]

This study has important limitations. Though we achieved a good response rate, nonrespondents may differ from respondents in ways that bias our results. The two outcome variables and several predictor variables are self-reported, and respondents were allowed to respond using their own concepts of medically underserved and primary care. Moreover, the intentions of graduating medical students in some cases will not lead to actual practice for a variety of reasons not examined in this study. Therefore, the use of a single definition of medically underserved or the measurement of students' ultimate practice locations would have provided more specificity to the interpretation of our findings. In our study, we did not ask students when their reported work experiences took place, nor did we ask them to quantify the number or duration of experiences, or to specify whether such experiences were in urban or rural settings. Finally, medical students not intending to practice among the underserved or those who were undecided may have changed their minds during the remainder of their graduate medical education.

Conclusion

In this national longitudinal study of U.S. third- and fourth-year medical students, we found that growing up in a medically underserved setting, work experience in religiously affiliated organizations, very strong sense of calling, and high medical school social mission score were associated with fourth-year students' intentions to practice among the underserved. International work experience was associated with change of mind in favor of locating in a medically underserved area in the fourth year. Other than growing up in a medically underserved area, high

intrinsic religiosity was the strongest factor associated with intentions to practice primary care in underserved areas. In the midst of a looming physician shortage disproportionately affecting the underserved, the reality is that a majority of medical students have no intentions of practicing among the underserved despite the various experiences that have exposed them to underserved populations, and a lack of formative educational experiences among the underserved may further dissuade many medical students from considering underserved practice.

Acknowledgments: The authors would like to thank Ms. Annikea Miller and Dr. Kenneth Rasinski for their capable and generous contributions to the project.

Funding/Support: This project was supported by the Arete Initiative at the University of Chicago through a grant from the John Templeton Foundation. This project was also supported by pilot grants from the Center for Health Administration Studies and the Bucksbaum Institute for Clinical Excellence at the University of Chicago.

Other disclosures: None reported.

Ethical approval: This study was approved by the University of Chicago Social Sciences Institutional Review Board.

T.F. O'Connell is a second-year internal medicine resident, Stritch School of Medicine, Loyola University Chicago, Maywood, Illinois.

S.A. Ham is senior statistician, Center for Health and the Social Sciences, University of Chicago, Chicago, Illinois.

T.G. Hart is a third-year general surgery resident, Pritzker School of Medicine, University of Chicago, Chicago, Illinois.

F.A. Curlin is Josiah C. Trent Professor of Medical Humanities, Trent Center for Bioethics, Humanities & History of Medicine, School of Medicine, Duke University, Durham, North Carolina.

J.D. Yoon is assistant professor of medicine, MacLean Center for Clinical Medical Ethics, Department of Medicine, University of Chicago, Chicago, Illinois.

References

1 Association of American Medical Colleges. Help wanted: More U.S. doctors: Projections indicate America will face shortage on M.D.s by 2020. https://www.aamc.org/download/82874/data/helpwanted.pdf. [No longer available.] Accessed December 15, 2015.
2 U.S. Department of Health & Human Services. Strategic plan: Fiscal years 2010–2015. https://www.hhs.gov/sites/default/files/secretary/about/priorities/strategicplan2010-2015.pdf. Accessed April 17, 2017.
3 Health Resources & Services Administration. Health Professional Shortage Area (HPSA) application and scoring process. https://bhw.hrsa.gov/shortage-designation/hpsa-process. Accessed April 17, 2017.
4 Curlin FA, Dugdale LS, Lantos JD, Chin MH. Do religious physicians disproportionately care for the underserved? Ann Fam Med. 2007;5:353–360.
5 Rabinowitz HK, Diamond JJ, Veloski JJ, Gayle JA. The impact of multiple predictors on generalist physicians' care of underserved populations. Am J Public Health. 2000;90:1225–1228.
6 Komaromy M, Grumbach K, Drake M, et al. The role of black and Hispanic physicians in providing health care for underserved populations. N Engl J Med. 1996;334:1305–1310.
7 Goodfellow A, Ulloa JG, Dowling PT, et al. Predictors of primary care physician practice location in underserved urban or rural areas in the United States: A systematic literature review. Acad Med. 2016;91:1313–1321.
8 Chen C, Petterson S, Phillips RL, Mullan F, Bazemore A, O'Donnell SD. Toward graduate medical education (GME) accountability: Measuring the outcomes of GME institutions. Acad Med. 2013;88:1267–1280.
9 Chen C, Chen F, Mullan F. Teaching health centers: A new paradigm in graduate medical education. Acad Med. 2012;87:1752–1756.
10 Mullan F, Chen C, Petterson S, Kolsky G, Spagnola M. The social mission of medical education: Ranking the schools. Ann Intern Med. 2010;152:804–811.
11 Grbic D, Slapar F. Changes in medical students' intentions to serve the underserved: Matriculation to graduation. AAMC Analysis in Brief. 2010;9(8):1–2.
12 Ko M, Heslin KC, Edelstein RA, Grumbach K. The role of medical education in reducing health care disparities: The first ten years of the UCLA/Drew Medical Education Program. J Gen Intern Med. 2007;22:625–631.
13 Rabinowitz HK, Diamond JJ, Markham FW, Paynter NP. Critical factors for designing programs to increase the supply and retention of rural primary care physicians. JAMA. 2001;286:1041–1048.
14 Boscardin CK, Grbic D, Grumbach K, O'Sullivan P. Educational and individual factors associated with positive change in and reaffirmation of medical students' intention to practice in underserved areas. Acad Med. 2014;89:1490–1496.
15 Curlin FA, Serrano KD, Baker MG, Carricaburu SL, Smucker DR, Chin MH. Following the call: How providers make sense of their decisions to work in faith-based and secular urban community health centers. J Health Care Poor Underserved. 2006;17:944–957.
16 Cook AF, Arora VM, Rasinski KA, Curlin FA, Yoon JD. The prevalence of medical student mistreatment and its association with burnout. Acad Med. 2014;89:749–754.
17 Program on Medicine and Religion, University of Chicago. Project on the good physician. https://pmr.uchicago.edu/projects/research/good-physician. Accessed April 17, 2017.
18 Dorsey ER, Jarjoura D, Rutecki GW. Influence of controllable lifestyle on recent trends in specialty choice by US medical students. JAMA. 2003;290:1173–1178.
19 Dik BJ, Eldridge BM, Steger MF, Duffy RD. Development and validation of the Calling and Vocation Questionnaire (CVQ) and Brief Calling Scale (BCS). J Career Assess. 2012;20:242–263.
20 Yoon JD, Shin JH, Nian AL, Curlin FA. Religion, sense of calling, and the practice of medicine: Findings from a national survey of primary care physicians and psychiatrists. South Med J. 2015;108:189–195.
21 Hoge DR. Validated intrinsic religious motivation scale. J Sci Stud Relig. 1972;11:369–376.
22 Groves R. Survey Methodology. Hoboken, NJ: Wiley; 2004.
23 Association of American Medical Colleges. Physician supply and demand through 2025: Key findings. https://www.aamc.org/download/153160/data/physician_shortages_to_worsen_without_increases_in_residency_tr.pdf. Accessed April 17, 2017.
24 Xierali I, Fair M, Johnson S, Maeshiro R, Jeney A. Do free clinic experiences enhance medical student commitment to underserved areas? AAMC Analysis in Brief. 2016;16(2):1–2.
25 Stewart T, Wubbena Z. An overview of infusing service–learning in medical education. Int J Med Educ. 2014;5:147–156.
26 Erikson CE, Danish S, Jones KC, Sandberg SF, Carle AC. The role of medical school culture in primary care career choice. Acad Med. 2013;88:1919–1926.
27 Coulehan J. Viewpoint: Today's professionalism: Engaging the mind but not the heart. Acad Med. 2005;80:892–898.
28 Kost A, Benedict J, Andrilla CH, Osborn J, Dobie SA. Primary care residency choice and participation in an extracurricular longitudinal medical school program to promote practice with medically underserved populations. Acad Med. 2014;89:162–168.
29 Krumboltz JD. The happenstance learning theory. J Career Assess. 2009;17:135–154.
30 Xu G, Veloski J, Hojat M, Politzer RM, Rabinowitz HK, Rattner SL. Factors influencing primary care physicians' choice to practice in medically underserved areas. Acad Med. 1997;72(10 suppl 1):S109–S111.
31 Ko M, Edelstein RA, Heslin KC, et al. Impact of the University of California, Los Angeles/Charles R. Drew University Medical Education Program on medical students' intentions to practice in underserved areas. Acad Med. 2005;80:803–808.
32 Thomson WA, Ferry P, King J, Wedig CM, Villarreal GB. A baccalaureate-MD program for students from medically underserved communities: 15-year outcomes. Acad Med. 2010;85:668–674.
33 Staiger DO, Marshall SM, Goodman DC, Auerbach DI, Buerhaus PI. Association between having a highly educated spouse and physician practice in rural underserved Areas. JAMA. 2016;315:939–941.
34 Ratanawongsa N, Howell EE, Wright SM. What motivates physicians throughout their careers in medicine? Compr Ther. 2006;32:210–217.
35 Wasson K, Bading E, Hardt J, et al. Physician, know thyself: The role of reflection in bioethics and professionalism education. Narrat Inq Bioeth. 2015;5:77–86.
36 Marian University. Faith: Francis and Clare Physician Vocation Program. https://www.marian.edu/osteopathic-medical-school/campus-life/faith. Accessed April 24, 2017.