

The Impact of Multiple Predictors on Generalist Physicians' Care of Underserved Populations

ABSTRACT

Objectives. This study examined the relative and incremental importance of multiple predictors of generalist physicians' care of underserved populations.

Methods. Survey results from a 1993 national random sample of 2955 allopathic and osteopathic generalist physicians who graduated from medical school in 1983 or 1984 were analyzed.

Results. Four independent predictors of providing care to underserved populations were (1) being a member of an underserved ethnic/minority group, (2) having participated in the National Health Service Corps, (3) having a strong interest in practicing in an underserved area prior to attending medical school, and (4) growing up in an underserved area. Eighty-six percent of physicians with all 4 predictors were providing substantial care to underserved populations, compared with 65% with 3 predictors, 49% with 2 predictors, 34% with 1 predictor, and 22% with no predictors. Sex, family income when growing up, and curricular exposure to underserved populations during medical school were not independently related to caring for the underserved.

Conclusions. A small number of factors appear to be highly predictive of generalist physicians' care for the underserved, and most of these predictive factors can be identified at the time of admission to medical school. (*Am J Public Health.* 2000;90:1225-1228)

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The shortage of physicians providing primary care to underserved populations has been one of the most intractable US health policy problems of the past century, with a major impact on access to health care for large segments of society.¹⁻³ Despite a number of initiatives to address this problem, underserved populations continue to lack generalist physicians. Furthermore, market forces are likely to exacerbate this problem in the future, especially if caring for these populations remains unattractive to managed care organizations.⁴ Considering the oversupply and maldistribution of physicians nationally, any change that results in an increase in the number providing care to the underserved will have a substantial and disproportionate impact on access to medical care, and it will also likely have a positive impact on the overall cost and quality of health care.

Historically, many of the proposals designed to increase physicians' care for the underserved have focused on eliminating the large number of barriers that inhibit providing health care to these populations.⁵ However, while eliminating these barriers is critically important, most are either not modifiable, extremely difficult to alter politically, or extraordinarily expensive to change. At the same time, there has been little attention focused on those physicians who, despite the current unsupportive environment, already provide substantial care to the underserved. If predictors could be found to identify physicians who will provide care to the underserved, policies to increase the number of these physicians would likely result in increased access to care for the underserved.

Prior studies have identified a number of individual factors related to physicians' care for the underserved (e.g., background, education, economic factors).⁶⁻¹² Although each of these factors is important, many are interrelated, few data are available regarding their relative importance and interdependence, and no information is available regarding the impact of multiple factors. For example, while studies have shown that minority physicians are much

more likely than their nonminority peers to practice in underserved areas (12% vs 6%),⁶ these absolute differences are relatively small, and little is known of the relative importance of providing minority students vs other students with educational experiences in underserved areas or with financial support. Similarly, while the National Health Service Corps (NHSC) has been highly successful in providing care to the underserved,^{5,13} little is known about its incremental impact on physicians with prior plans to practice in shortage areas compared with those without such intentions. Identification of those factors that predict underserved practice and, more importantly, the combination of those prognostic factors that yield the greatest likelihood of physicians' care to the underserved can provide educators and policymakers with important information. This report addresses these issues and assesses the impact of multiple predictors on caring for underserved populations.

Methods

As part of a large national study to learn about medical school and student characteristics influencing generalist career choice and care of the underserved, a questionnaire was sent to a stratified random sample of 2600 allopathic physicians and 355 osteopathic physicians who graduated from a US medical school

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in 1983 or 1984 and whose self-reported specialty from the American Medical Association Physician Masterfile or the American Osteopathic Association Masterfile was family practice, general practice, general internal medicine, or general pediatrics without subspecialization. Physicians who were in the military were excluded. The population was stratified by the 4 primary care groups and by the quartile ranking of primary care specialty outcomes of the physician's school of graduation. A more detailed description of the sample stratification and selection process has previously been reported.¹⁴ Questionnaires were mailed in January 1993, with follow-up mail and telephone reminders to maximize the response rate.

In the current analysis, the outcome variable of providing substantial care to underserved populations was defined as self-reports of either (1) having a medical practice in a federally designated underserved area (e.g., a Health Professions Shortage Area or Medically Underserved Area), (2) having a practice in which 40% or more of the patients are medically indigent (e.g., on Medicaid, uninsured), or (3) having a similar proportion of patients who are poor.

On the basis of prior studies,⁶⁻¹¹ 7 variables from the questionnaire were considered as independent, or predictor, variables regarding caring for the underserved: gender, being a member of a racial/ethnic minority group that was medically underserved (Black, Hispanic, or Native American/Alaska Native), family income level when growing up (by quintile), growing up in either an inner-city or a rural area, having a strong interest before medical school in practicing in a rural area or an urban low-income neighborhood, NHSC participation, and having required or elective clinical experiences with underserved patients or in underserved areas during medical school.

Multivariate logistic regression analysis was performed to observe the relationships between the 7 independent variables and the outcome. Variables that were independently related to the outcome ($P < .05$) were identified, and a predictive score for each physician was defined as the number of these variables present. The proportion of physicians with various predictive scores who were providing substantial care to underserved populations was then analyzed.

Results

Responses were received from 2199 (74%) of the 2955 physicians. A total of 310 responding physicians were considered ineligible because they either had left generalist practice or were employed by the military. An additional 185 were excluded because they

TABLE 1—Percentage of Practicing Generalist Physicians With Predictor Variables and Practice Outcome (n = 1704)

Predictor variable	%
Sex	
Male	67
Female	33
Racial/ethnic group	
Medically underserved (Black, Hispanic, or Native American/Alaska Native)	8
Other	92
Family income when growing up	
High	4
Upper middle	26
Middle	39
Lower middle	25
Low	7
Grew up in inner-city or rural area	
Yes	39
No	62
National Health Service Corps participation	
Yes	13
No	87
Strong interest in underserved practice prior to medical school	
Yes	37
No	63
Clinical experience with the underserved during medical school	
Yes	72
No	28
Practice outcome	
Provides substantial care to underserved populations ^a	
Yes	35
No	65

Note. Because of rounding, percentages may not total 100.

^aSelf-reported practice in a federally designated underserved area, having a practice in which 40% or more of the patients are medically indigent (e.g., on Medicaid, uninsured), or having a practice in which a similar proportion of the patients are poor.

failed to provide information regarding the practice outcome (n = 54), 1 or more of the 7 predictor variables (n = 83), or both (n = 48).

There were thus 1704 physicians in the analysis. The proportions of physicians with each of the 7 predictor variables and the practice outcome are shown in Table 1. The 595 physicians (35%) who reported providing substantial care to the underserved included 264 who practiced in a federally designated underserved area (195 of whom also cared for patients who were either medically indigent or poor) and another 331 whose practice was not located in an underserved area but who cared for a substantial proportion of patients who were medically indigent or poor.

By multivariate logistic analysis (Table 2), 4 of the 7 predictor variables were found to be independently predictive ($P < .001$) of providing substantial care to underserved populations: whether the physician (1) was a member of an underserved minority, (2) had participated in the NHSC, (3) had a strong interest in practicing in an underserved area before medical school, and (4) grew up in an underserved area. Neither sex, family income when growing up, nor curricular exposure to under-

served populations during medical school was related independently to providing care to the underserved.

Eighty-six percent (18 of 21) of the physicians with all 4 predictors (95% confidence interval [CI] = 71%, 95%) were providing substantial care to underserved populations, compared with 65% (75 of 115) of those with 3 predictors (95% CI = 56%, 74%), 49% (174 of 356) of those with 2 predictors (95% CI = 44%, 55%), 34% (175 of 508) of those with 1 predictor (95% CI = 30%, 38%), and 22% (153 of 704) of those with no predictors (95% CI = 19%, 25%) (Figure 1). Compared with the reference group of physicians with no predictors, the relative risk of providing care to the underserved was 3.9 (95% CI = 3.2, 4.9) for physicians with 4 predictors, 3.0 (95% CI = 2.5, 3.6) for those with 3 predictors, 2.2 (95% CI = 1.9, 2.7) for those with 2 predictors, and 1.6 (95% CI = 1.3, 1.9) for those with 1 predictor. When the data were analyzed separately for allopathic and osteopathic physicians, the pattern of these results was similar. In order to determine whether these patterns might be useful in making predictions for future physicians, a logistic model was developed. The predicted outcomes

TABLE 2—Multivariate Analysis of Predictor Variables Related to Providing Substantial Care to the Underserved

	Odds Ratio (95% CI)	P
Sex (male vs female)	0.9 (0.7, 1.1)	.271
Racial/ethnic group (medically underserved vs not)	2.9 (1.9, 4.4)	<.001
Family income when growing up (per quintile)	1.0 (0.9, 1.2)	.583
Grew up in inner-city/rural area (yes vs no)	1.6 (1.3, 2.0)	<.001
National Health Service Corps participation (yes vs no)	2.2 (1.6, 3.0)	<.001
Strong interest in underserved practice prior to medical school (yes vs no)	1.7 (1.4, 2.1)	<.001
Clinical experience with the underserved during medical school (yes vs no)	1.1 (0.8, 1.4)	.570

Note. CI = confidence interval.

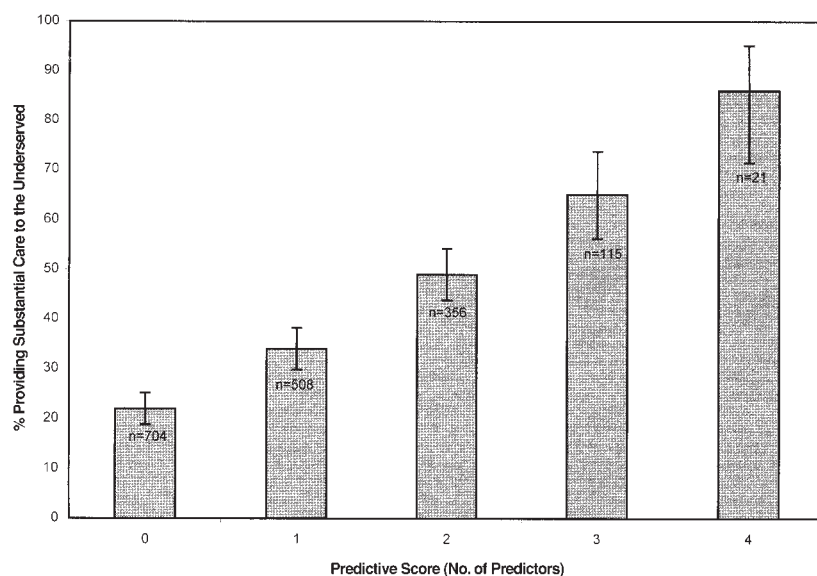


FIGURE 1—Percentage of physicians with various predictive scores who are providing substantial care to the underserved.

were highly correlated with the observed outcomes ($r=0.83$), indicating that the model was highly predictive. For physicians with each of the various combinations of predictors, Table 3 shows the proportion that provides substantial care to the underserved.

Discussion

Although providing health care to underserved populations represents a complex problem involving a large number of factors,¹⁵ having an adequate supply of generalist physicians remains critical. The results of this study identified a small number of factors that were powerful predictors of generalist physicians' providing care to the underserved. The more of these predictors that were present, the greater

was the likelihood of caring for the underserved. The proportion of physicians caring for the underserved was almost 4 times higher among those with all 4 predictors than among those with none of the predictors. Furthermore, the absolute degree to which these 4 factors predicted providing care to the underserved was remarkably high, representing a level of magnitude similar to that of risk factors for many medical problems, such as the 4 combined cardiac risk factors for coronary heart disease of hypertension, hypercholesterolemia, diabetes, and smoking.^{16,17}

Of the 4 independently predictive factors identified, 3 (whether the physician was a member of an underserved minority, grew up in an underserved area, and had a strong interest in practicing in an underserved area before medical school) can be identified at the time of ad-

mission to medical school, which suggests that using this information to select medical school applicants could substantially increase the proportion of physicians caring for underserved populations. Participation in the NHSC was the only experiential factor related to caring for the underserved, while curricular exposure to underserved populations during medical school was not an independent predictor. This finding is consistent with prior data, some of which suggest that the medical school curriculum may not have a major impact on care for the underserved.^{9,18} The lack of significance of a physician's family income when growing up in predicting care to the underserved suggests that affirmative action programs replacing minority background with economic indices are unlikely to achieve similar outcomes, which is also consistent with prior research.¹⁰ Although sex was not an independent predictor of caring for the underserved in this study, there is evidence that men are more likely than women to practice in rural underserved areas.² The present study did not address the role of residency training, which might also have had an impact on caring for the underserved.^{2,19}

This study extends previous work that identified individual factors related to location of a physician's practice in a federally designated underserved area.^{11,12} However, these studies did not look at the impact of multiple factors on physicians' care of the underserved; neither did they take into account the large number of underserved patients who actually obtain medical care at sites that are not themselves located in underserved geographic areas, a common occurrence especially in urban areas. Therefore, the present study represents the first to examine the impact of multiple factors on generalist physicians' care of the underserved, and it broadens the outcome of caring for the underserved to include practice in an underserved area as well as provision of substantial care to the medically indigent and poor.

Despite the important results of this study, there are a number of significant limitations. First, although this analysis was designed to investigate the factors related to generalist physicians' care for the underserved, it was part of a much larger study whose primary goal was to identify characteristics that influence generalist specialty career choice.¹⁴ Consequently, only a limited number of questionnaire items relating to care for the underserved were available for this analysis, although other important factors may exist. Second, all of the predictor and outcome variables were self-reported, and some may need external validation. Third, while our outcome definition included physicians whose practice consisted of 40% or more patients who were medically indigent or poor, this variable is actually a continuum, and future studies need to take this into consideration.

TABLE 3—Proportion of Physicians With Various Combinations of Predictors Who Are Providing Substantial Care to the Underserved

Predictive Score	Predictors	No. of Physicians	Proportion of Physicians (95% CI) ^a Caring for Underserved
4	Grew up, ^b Interest, ^c NHSC, ^d Minority ^e	21	0.86 (0.71, 0.95)
3	Interest, NHSC, Minority	7	0.71 (0.43, 0.86)
	Grew up, NHSC, Minority	16	0.69 (0.44, 0.81)
	Grew up, Interest, Minority	30	0.67 (0.50, 0.84)
	Grew up, Interest, NHSC	62	0.63 (0.51, 0.75)
2	NHSC, Minority	10	0.60 (0.30, 0.80)
	Interest, Minority	7	0.57 (0.14, 0.71)
	Grew up, Minority	17	0.59 (0.36, 0.82)
	Interest, NHSC	40	0.53 (0.38, 0.68)
	Grew up, NHSC	31	0.52 (0.34, 0.70)
	Grew up, Interest	251	0.47 (0.41, 0.53)
1	Minority	21	0.62 (0.41, 0.83)
	NHSC	41	0.46 (0.31, 0.61)
	Interest	218	0.33 (0.27, 0.39)
	Grew up	228	0.32 (0.26, 0.38)
0	None	704	0.22 (0.19, 0.25)

^aConfidence interval (CI) based on binomial distribution or the normal approximation.

^bGrew up in either an inner-city or a rural area.

^cHaving a strong interest prior to medical school in practicing in an underserved area.

^dNational Health Service Corps participation.

^eBeing a member of a racial/ethnic minority group that is medically underserved.

Fourth, this study failed to differentiate between physicians who grew up or practice in rural areas and those in the inner city. Because the factors related to practice in these areas are likely to differ in many ways, it is important to collect and analyze these data independently. Finally, this study included physicians from only 2 classes who graduated from medical school 15 to 16 years ago, and its findings may not apply to more recent graduates. Therefore, future studies should include a larger number of potential predictors, separately collect and analyze data on background and practice in rural areas and in the inner city, and determine whether a broader and more recent group of graduates have similar patterns of predictability. Finally, information regarding physicians' length of service and plans for the future is important, as is their level of satisfaction with caring for the underserved.

Despite these limitations, the results of this study are striking. Only 4 factors were found to be highly predictive of generalist physicians' care of the underserved. The resultant model indicated that increasing the number of physicians with multiple predictors may have a major impact on access to care for those who live in medically underserved areas, are medically indigent, or are poor. This information is particularly important, because the number of medically uninsured is predicted to increase over the next decade. These data are also likely to be increasingly used, as academic health centers and others find themselves being held to greater accountability to address broader public policy issues in order to justify continued

public support.²⁰ Finally, although this study is limited to predicting care for the underserved by generalist physicians, it provides an important methodology and model that could also be used for the equally critical problems posed by the shortage of other health professionals who provide medical care to the underserved. □

Contributors

H.K. Rabinowitz conceptualized and supervised the study. J.J. Diamond supervised the data analysis. J.J. Veloski supervised the design and implementation of the original questionnaire. J.A. Gayle analyzed the data. All 4 authors helped plan the study, interpret the data, and write the paper.

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