

The National Health Service Corps and Medicaid Inpatient Care: Experience in a Southern State

Janice C. Probst, PHD, Michael E. Samuels, DRPH, Terry V. Shaw, MSW, Gary L. Hart, PHD, and Charles Daly

Background: Since 1970, the National Health Service Corps (NHSC) has worked to increase primary care access among underserved groups. This study examined whether NHSC alumni physicians were likely to treat a high proportion of Medicaid patients in their practices.

Methods: Using licensure files and hospital discharge data, we identified all physicians practicing in South Carolina who attended at least one discharge in 1998, excluding physicians who graduated before 1969, residents, and current NHSC-obligated physicians. The outcome studied was ranking in the highest quartile for Medicaid participation.

Results: Former NHSC participants, after adjustment for personal characteristics, education, and specialty, were nearly twice as likely to fall into the category of high Medicaid participation. NHSC physicians were more likely to practice in community health centers and to locate in areas with a health professions shortage and counties with high percentages of minorities and people living in poverty.

Conclusion: NHSC alumni make career choices leading them to serve low-income patients.

Multiple factors influence physician willingness to practice among rural and urban underserved populations. Female, minority, and internationally trained physicians are more likely to accept Medicaid patients.¹ Medically indigent

patients are more likely to report nonwhite physicians as their primary caregivers²; minority physicians report higher proportions of minority and low-income patients in their practices than do white physicians.^{3,4} In part, these differences are the result of physician choices regarding practice location. Physicians practicing in areas with high proportions of low-income persons are more likely to participate in Medicaid.⁴ Physicians tend to locate in communities where their racial groups are present in high proportions and to draw the majority of their patients from their own racial/ethnic groups.⁵

Since 1970, the National Health Service Corps (NHSC) has worked to increase access to primary care for the residents of medically underserved inner city and rural areas. Through scholarships and loan repayment programs, the NHSC has placed and supported more than 20,000 health

Key Points

- National Health Service Corps (NHSC) physicians disproportionately had characteristics associated with increased acceptance of Medicaid patients; 20% of all black physicians providing patient care in South Carolina participated in the NHSC.
- When personal characteristics were held constant, NHSC alumni were almost twice as likely to have a high proportion of Medicaid patients as were their peers.
- NHSC physicians were more likely than other physicians to practice in federally qualified community health centers and to locate their practices in counties with a health professions shortage or high populations of minorities and people living in poverty.
- Service with the NHSC was not associated with high Medicaid participation after controlling for career choices and personal characteristics.
- Service with the NHSC may have educational benefits similar to rural residency tracks, exposing physicians to practice with underserved populations and potential career choices involving such populations.

From the Arnold School of Public Health and the South Carolina Rural Health Research Center, University of South Carolina, and the Office of Research and Statistics, South Carolina Budget and Control Board, Columbia, SC; the Rural Health Research Center, University of Washington, Seattle, WA; and the Bureau of Primary Care, Health Resources and Services Administration, Washington, DC.

The research on which this article is based was supported by Contract 000-BHPC-0033 from the Office of Evaluation, Analysis and Research, Bureau of Primary Health Care, Health Resources and Services Administration, U.S. Department of Health and Human Services, Bethesda, MD.

Reprint requests to Janice C. Probst, PhD, South Carolina Rural Health Research Center, Arnold School of Public Health, University of South Carolina, 800 Sumter Avenue, Columbia, SC 29208. Email: jprobst@gwm.sc.edu

Accepted June 4, 2002.

Copyright © 2003 by The Southern Medical Association
0038-4348/03/9608-0775

care practitioners.⁶ Scholarship recipients are required to serve 1 year for each year of scholarship support they receive, with a minimum commitment of 2 years. The NHSC loan repayment program also has a 2-year minimum service obligation; loan recipients may continue service in 1-year increments until their educational loans have been completely repaid. The majority of practitioners supported (approximately 16,500) have been physicians. The major recruitment mechanism has been the NHSC Scholarship Program, with about 10,800 placements.

Several researchers have studied the effectiveness of the NHSC in alleviating physician shortages and increasing the number of physicians treating minority and low-income populations, with conflicting results. NHSC alumni physicians placed between 1979 and 1981 were less likely to remain in rural areas than were non-NHSC physicians entering similar areas. This survey did not ascertain whether NHSC physicians continued to work with underserved populations in urban locations.⁷ Examination of a broader sample of physicians with NHSC service between 1975 and 1983 found that 40% of physicians placed in rural areas as part of their NHSC obligation remained in rural areas, although not necessarily the areas of their service.⁸ Research has also explored the NHSC's ability to recruit and place minority providers. A survey of scholarship recipients found that minority physicians were less satisfied with rural placements and less likely to anticipate a career in those regions than white physicians.⁹

Some survey research has assessed whether NHSC participants continue to work with underserved populations after their service obligation. Among family physicians who received NHSC scholarships and served in rural areas, the majority continued to provide care for rural or underserved populations 6 years after the end of their obligated service.¹⁰ A 1993 national survey of physicians found race and previous NHSC participation, in that order, to be the principal determinants of physicians caring for underserved patients.³

Previous examinations of the postservice activities of NHSC alumni physicians, reported above, have primarily used the physician's location and/or self-reported patient-care patterns to measure behavior. Retention, studied principally as rural practice location, overlooks other vulnerable populations, however. In terms of numbers of medically underserved persons lacking providers willing to accept Medicaid or indigent patients, more live in urban areas than in rural counties. Physicians in an urban area practicing at a federally qualified community health center (FQCHC) or seeing a disproportionately poor and minority population meet an important need. Self-report studies attempt to address the latter situation by asking physicians to describe their patient populations. Although physician estimates can compare reasonably well with data obtained from patient surveys, these estimates tend to slightly exaggerate physician willingness to accept needy patients (as shown in Table 3 in the article by Cantor et al³).

The objective of this research was to investigate whether physicians who once served in the NHSC treat low-income persons in their current practice settings. It was hypothesized that NHSC alumni would be more likely than their peers to treat Medicaid-funded patients. If NHSC alumni physicians continue to treat vulnerable patients after meeting their service obligation, they are contributing to the NHSC mission, regardless of whether this contribution is in urban or rural settings.

Methods

Data Sources

The Office of Research and Statistics (ORS) of the South Carolina Budget and Control Board maintains the physician licensure and inpatient discharge files for the state of South Carolina. Information from ORS files was matched with NHSC files provided by the Cecil D. Sheps Health Services Research Center at the University of North Carolina at Chapel Hill to identify NHSC alumni currently practicing in South Carolina. The ORS created data sets for physician characteristics and inpatient discharges for use in this study. All unique identifiers, such as name and social security number, were removed before the data were released to the researchers. The analysis is based on calendar year 1998. The research was approved by the Institutional Review Board of the University of South Carolina and by the Data Oversight Council of the South Carolina Budget and Control Board.

Participants

Active Physicians. The population studied included all allopathic and osteopathic physicians practicing in South Carolina during 1998 who were not enrolled in residency training, had graduated from medical school in 1969 or later, and were not currently meeting an NHSC service obligation. Physicians were identified using South Carolina medical licensure files. Physicians were classified as practicing in South Carolina if, in addition to having a current license, they identified a practice location in South Carolina on their license application. Physicians in residency training were excluded because residents do not make independent decisions about their practice locations or the patients they treat. Residents and interns constituted 1,011 (12.7%) of the physicians licensed and practicing in South Carolina in 1998. Physicians who graduated from medical school before 1969 were excluded because they were unlikely to have participated in NHSC and did not represent a valid comparison group for NHSC physicians. No NHSC alumnus practicing in South Carolina graduated from medical school before 1969. Current NHSC participants were excluded because their decisions concerning practice location and patient population were not made independently. Of the 11,978 physicians licensed in 1998 in South Carolina, 3,608 met the definition of active,

independent physicians who graduated from medical school in 1969 or later, were not currently in residency training or meeting an NHSC service obligation, and attended one or more inpatient discharges during 1998.

NHSC Alumni. NHSC physicians were defined as any physicians with records of NHSC service, regardless of whether that service was in South Carolina or another state. South Carolina licensure-file information was linked to NHSC national data files in a five-step matching process: first, social security number alone; second, social security number and date of birth; third, last name, first name, and date of birth; fourth, last name and first name with a check for false matches; and finally, last name and date of birth with a check for false matches. Physicians whose NHSC and South Carolina identifiers matched on all five possible comparisons were identified as NHSC alumni. This process identified 233 physicians practicing in South Carolina who were currently meeting their obligations ($n = 18$) or had done so previously ($n = 215$). Among the latter, 135 provided inpatient care in 1998. Just over half of the NHSC physicians (74; 54.8%) had met their service obligation in state; the remainder (61; 45.2%) had served elsewhere and subsequently moved to South Carolina.

Health Services Information

Inpatient Data Files. The Uniform Billing data set encompasses every hospitalization that occurs within South Carolina. By law, each hospital must submit a uniform discharge summary for every patient discharged. Because this data set applies to the entire population of persons discharged from hospitals across the state, it is the best source for assessing the type of population cared for by physicians. The principal limitation of these data is that they do not include contributions of physicians who only work in the outpatient setting (additional analysis looking at treatment of Medicaid outpatients is currently in progress). From the inpatient data set, the following information was extracted for each discharge from a short-term, nonfederal general hospital:

- *Patient number:* A unique but anonymous identifier was created for each individual so that the number of patients and the number of discharges could be tallied.
- *Physician number:* An artificial identifier was created for each attending physician (ie, the physician with principal responsibility for the patient's care). Other physicians (eg, an emergency department physician who may have admitted the patient or physicians called in for consultation during the course of the hospital stay) were not tallied. The identifier provided a link between the inpatient file and the physician licensure file, which contained physician characteristics.
- *Patient age, race, and sex.*
- *Principal payer* (ie, Medicaid, Medicare, other insurance, self-pay/indigent, other).
- *County in which the hospitalization occurred.*

Statistical Analysis

All analyses were conducted using PC SAS software, version 6.12 (SAS Institute, Inc., Cary, NC). For bivariate analysis of categorical variables, χ^2 or Fisher's exact test was used. For continuous variables, Student's t test was used. Logistic regression was used to complete multivariate analysis.

Results

Demographic Characteristics of NHSC and Other Physicians

NHSC alumni differed from other South Carolina physicians providing inpatient care in 1998 by sex (more women), race (more nonwhites), state in which their medical schools were located (less concentration in Southern states), and the year in which they graduated from medical school (Table 1). One in five black physicians providing inpatient care in South Carolina in 1998 and nearly one in five of all other nonwhite physicians were NHSC alumni. Only one NHSC physician had graduated from a medical school outside of the United States. More than half of the NHSC physicians graduated from medical school between 1978 and 1983. Reflecting NHSC program purposes, NHSC alumni were more likely to report primary care specialties than were other physicians (65.9 versus 44.1%) (Table 1).

Just over half (74 of 135, or 54.8%) of the NHSC physicians were initially assigned to South Carolina by the NHSC for their service obligation placement, whereas the remainder had their initial NHSC placement in other states and subsequently moved to South Carolina. In-migrants did not differ significantly from other NHSC alumni by sex or race, but were significantly less likely to have attended medical school in South Carolina (6.6% among in-migrants versus 31.1% of retained physicians; $P = 0.001$). In-migrants also were significantly more likely to have graduated from medical school before 1984 (91.8%) than were NHSC alumni whose initial assignments were in South Carolina (64.9%).

Description of Patient Population

Physicians practicing in South Carolina provided care to 401,564 patients who experienced 449,886 discharges during 1998 (these numbers are smaller than those for the total number of patients and discharges presented above because some hospitalizations, principally in communities along the North Carolina and Georgia borders, involved attending physicians whose principal practices were not located in South Carolina). Physicians meeting the qualifications for inclusion in the present study cared for 346,815 patients who experienced 388,047 discharges. NHSC alumni served as attending physicians for 15,201 (3.9%) of those discharges, a proportion that closely reflects their representation in the population of physicians providing inpatient care. Physicians whose principal practice was in a county in which the largest town had

Table 1. Characteristics of physicians studied, by National Health Service Corps participation^a

	NHSC alumni physicians (n = 135) (%)	Other physicians (n = 3,473) (%)	All physicians (n = 3,608) (%)
Sex^b			
Male	76.7	83.9	83.6
Female	23.3	16.1	16.4
Race^c			
Black	20.0	3.8	4.4
Other	39.3	7.0	8.2
White	40.7	89.2	87.4
Location of medical school^c			
In South Carolina	20.0	38.8	38.1
South, not South Carolina	19.3	21.5	21.4
Other U.S.	60.0	30.8	31.9
International	0.7	8.9	8.6
Year of graduation^c			
1969–1977	20.7	26.4	26.2
1978–1983	56.3	24.6	25.8
1984–1988	14.1	22.8	22.5
1989+	8.9	26.2	25.5
Specialty^c			
Family/general	28.1	15.9	16.3
Internal medicine	16.3	12.5	12.7
Obstetrics/gynecology	10.4	8.2	8.3
Pediatrics	11.1	7.5	7.6
Other specialty	34.1	55.9	55.1

^aNHSC, National Health Service Corps. Characteristics of South Carolina physicians who graduated from medical school in 1969 or later, served as attending physician for at least one inpatient episode of care in 1998, and were not meeting an NHSC service obligation in 1998.

^b*P* < 0.05.

^c*P* ≤ 0.0001.

a population of 50,000 or more attended most discharges; however, a significantly greater proportion of NHSC discharges were attended by physicians located in rural counties (Table 2). Medicare was the most frequent payer for inpatient services, funding just over a third of all discharges, followed by private insurance and Medicaid (Table 3). NHSC physicians handled a greater proportion of Medicaid and black patient discharges than did other physicians (Table 3).

Practice Patterns of NHSC Alumni

The percentage of Medicaid patients among the total group of patients seen by each physician was used as a measure of service to vulnerable populations. Statewide, physicians averaged 16.2% of the discharges they attended funded by Medicaid (median, 7.2%). The distribution was highly skewed, with 713 physicians (19.8% of all physicians) including no Medicaid patients in their practices, whereas other physicians treated Medicaid patients almost exclusively. For analytic purposes, we divided physicians into those with high Medicaid engagement, defined as those who fell at or above

the third quartile for the percentage of Medicaid patients among their discharges (cut point, 21.95%), versus all others.

NHSC alumni were significantly more likely than other physicians to fall into the top quartile for the proportion of Medicaid-funded discharges in their practices (Table 4). Race, sex, specialty, the region in which the physician was educated, and the time frame in which he or she graduated, all of which were associated with NHSC participation, were also related to whether a physician was likely to fall into the high Medicaid engagement group, however.

We performed multiple logistic regression in three successive models to model the factors associated with physician treatment of Medicaid patients. NHSC participation was examined in each of the three models. First, we examined basic demographic characteristics that were not subject to change (sex, race, and the year in which the physician graduated from medical school). When personal characteristics were considered (Table 5, Model 1), women and nonwhite physicians were significantly more likely to fall into the group with a high number of Medicaid patient discharges than their coun-

Table 2. Distribution of hospital discharges, by physician National Health Service Corps experience and level of rurality of county of principal practice^a

	Discharges attended by NHSC alumni	Discharges attended by other physicians	All physicians
Population of largest town in county			
≥50,000	40.7%	58.5%	57.8%
25,000–49,999	24.6%	20.6%	20.7%
10,000–24,999	9.8%	10.0%	10.0%
5,000–9,999	18.7%	9.7%	10.0%
≤4,999	6.2%	1.3%	1.5%
Total	100.0%	100.1%	100.0%
Total discharges	15,201	372,846	388,047
Total physicians	135	3,473	3,608

^aNHSC, National Health Service Corps.

terparts; NHSC alumni were also significantly more likely to fall into the top group for number of Medicaid patients.

In Model 2, we added characteristics of the physician's education and specialty choice to the personal demographic characteristics considered in Model 1. NHSC alumni, all other factors being equal, were nearly twice as likely as their peers (odds ratio [OR], 1.93; 95% confidence interval [CI], 1.18–3.13) to be high-Medicaid-participation physicians. The largest single factor in Model 2 associated with whether a physician would fall into the high-Medicaid-participation group was specialty. Pediatricians (OR, 12.73; 95% CI, 9.44–17.32) and obstetrician-gynecologists (OR, 9.04; 95% CI, 6.89–11.90) were significantly more likely than other spe-

cialist physicians to be in the high-Medicaid-participation group. Family practitioners were also more likely than specialists to fall into the highest Medicaid participation group, whereas internal medicine physicians were less likely to do so (Table 5). Female sex, black or other nonwhite race, and graduation from a foreign medical school were also positively and significantly associated with high Medicaid participation.

In Model 3, we explored the influence on Medicaid participation of choices a physician makes after completing his or her education (practice type and practice location). Two dummy variables associated with high Medicaid participation were used to characterize practice type: academic practice and practice at an FQCHC. Three variables were used to

Table 3. Patient characteristics, discharges attended by National Health Service Corps alumni and other physicians^a

Patient characteristics	Discharges attended by NHSC alumni	Discharges attended by other physicians	All discharges
Sex			
Male	37.6%	39.8%	39.7%
Female	62.4%	60.2%	60.3%
Race			
Black	41.8%	30.7%	31.1%
White	55.9%	67.4%	67.0%
Other	0.8%	0.9%	0.8%
By payer			
Medicare	32.8%	36.0%	35.9%
Medicaid	28.2%	19.0%	19.4%
Private insurance	26.9%	31.7%	31.5%
Self-pay, indigent	6.0%	6.8%	6.8%
Other payer	6.0%	6.4%	6.4%
Total discharges	15,201	372,846	388,047
Total physicians	135	3,473	3,608

^aNHSC, National Health Service Corps.

Table 4. Characteristics of physicians who were highly engaged with Medicaid practice ($\geq 21.95\%$ ^a of their inpatient discharges were Medicaid funded) versus those who were not highly engaged ($< 21.95\%$ of their inpatient discharges were Medicaid funded)^a

	High Medicaid (n = 671) (%)	Low Medicaid (n = 2,345) (%)
Total, all physicians	22.2%	77.8%
Sex ^c		
Male	22.3%	77.7%
Female	37.2%	60.8%
Race ^c		
Black	37.1%	62.9%
Other	34.9%	65.8%
White	23.5%	76.5%
Specialty ^c		
Primary care	35.7%	34.3%
Other	16.4%	83.6%
Location of medical education ^b		
South Carolina	23.3%	76.7%
South, other	27.9%	75.5%
Other U.S.	25.2%	31.8%
Foreign	32.3%	67.7%
Year of graduation from medical school ^c		
1969–1977	21.8%	78.2%
1978–1983	25.6%	74.4%
1984–1988	23.0%	77.0%
1989+	29.5%	70.5%
NHSC experience ^c		
NHSC alumni	40.0%	60.0%
None	24.5%	75.5%

^aCutpoint is the upper quartile for percentage of Medicaid patients among all admissions by a physician. Fisher's exact test used for 2×2 tables, χ^2 test for other tables.

^b $P < 0.05$.

^c $P \leq 0.001$.

characterize practice location. The first was whether or not the practice was located in a whole-county health-professions shortage area (HPSA). The next two variables looked at county characteristics. The percentage of blacks within South Carolina counties varies from 7.6% to 67.6% (1996 data). This variable was set to equal 1 if the county of the physician's principal practice fell into the upper quartile for percentage of the black population. Counties were also characterized by percentage of the population falling below the poverty line, which ranged from 9.8% to 34.3% (1993 data); it was set to equal 1 if the physician's practice was located in a county in the top quartile.

When practice choices were added to the model, NHSC

alumni no longer differed from their peers (OR, 1.64; 95% CI, 0.97–2.76) (Table 5). Physicians in academic practice, who worked in FQCHCs, or whose practices were located in HPSAs or in counties with high concentrations of persons living below the poverty level were more likely than other physicians to fall into the highest quartile for the percentage of their inpatient discharges funded by Medicaid. Personal and specialty variables retained their significance. Thus, physicians who were female, black or other nonwhite race, and younger were more likely than other physicians to fall into the upper quartile for Medicaid participation. Pediatricians, obstetrician-gynecologists, and family/general practice physicians were markedly more likely than other physicians to fall into the highest quartile for Medicaid participation, whereas internal medicine physicians were less likely to do so (Table 5).

NHSC alumni physicians were more likely than other physicians to have made practice type and location choices associated with high Medicaid participation (Table 6). NHSC alumni were significantly more likely than other South Carolina physicians to be located in HPSAs or in counties with high concentrations of poor and minority populations. They were more than three times as likely to practice in a county with 52% or more black population as were other physicians. NHSC physicians were also more likely to practice in an FQCHC, regardless of location. Of 33 FQCHC physicians with inpatient discharges in 1998, 16 (48.5%) were NHSC alumni (an additional 18 NHSC physicians were working in FQCHCs that year as part of their obligated service; those physicians were not included in this study). NHSC physicians were more than twice as likely as other South Carolina physicians to practice in an HPSA, but approximately equally likely to practice in an academic setting.

Discussion

During the past 25 years, the NHSC has helped underserved communities gain access to practitioners and also has helped individuals afford the cost of medical education. In South Carolina, currently practicing physicians with past NHSC service (3.7% of the total) are disproportionately women and of minority heritage. Of all black physicians providing inpatient care in South Carolina in 1998, 19.2% were NHSC alumni, as were 15.9% of other nonwhite physicians. Consistent with NHSC recruiting, which is targeted toward primary care, most physicians with prior NHSC participation were practicing in primary care disciplines. This study analyzed whether former NHSC participants, either because of the characteristics they possessed when recruited or because of their experience in NHSC service sites, would treat relatively more Medicaid patients in their practices than their counterparts.

We found that South Carolina physicians' personal characteristics, regardless of NHSC service, were associated with

Table 5. Variables related to whether a physician was highly engaged in Medicaid inpatient practice in 1998^a

Variables	Model 1: Personal characteristics, NHSC participation (OR, 95% CI)	Model 2: Personal characteristics, medical training, NHSC participation (OR, 95% CI)	Model 3: Personal characteristics, medical training, NHSC participation, practice choices (OR, 95% CI)
Female sex	2.06 (1.70–2.51)	1.33 (1.05–1.67)	1.24 (0.98–1.57)
Black	1.53 (1.08–2.16)	1.76 (1.18–2.62)	1.65 (1.07–2.51)
Other nonwhite race	1.52 (1.16–1.97)	1.62 (1.12–2.33)	1.47 (1.01–2.16)
Period of graduation ^b	1.06 (0.98–1.13)	1.09 (1.00–1.17)	1.10 (1.01–1.19)
NHSC alumni	1.64 (1.11–2.39)	1.93 (1.18–3.13)	1.64 (0.97–2.76)
Medical education in South Carolina		0.74 (0.61–0.90)	0.79 (0.65–0.97)
Foreign medical graduate		1.44 (1.00–2.05)	1.36 (0.93–1.96)
Pediatrics		12.73 (9.44–17.32)	15.50 (11.38–21.27)
Family/general practice		1.96 (1.56–2.46)	2.05 (1.60–2.61)
Obstetrics/gynecology		9.04 (6.89–11.90)	10.84 (8.20–14.40)
Internal medicine		0.35 (0.24–0.50)	0.35 (0.23–0.50)
NHSC alumni, medical education in South Carolina ^c		0.21 (0.05–0.66)	0.20 (0.05–0.68)
Academic practice			5.36 (4.00–7.17)
Federally qualified community health center			4.28 (1.63–11.77)
County is HPSA			1.93 (1.32–2.80)
County high black population ^d			0.42 (0.14–1.14)
County high poverty population ^e			5.39 (2.02–15.79)

^aNHSC, National Health Service Corps; HPSA, health-professions shortage area; OR, odds ratio; CI, confidence interval.

^bYear of graduation is grouped into quartiles: 1 = 1969–1977, 2 = 1978–1983, 3 = 1984–1988, and 4 = 1989 or later.

^cInteraction term; set to 1 if physician graduated from a South Carolina school and participated in NHSC.

^dSet to 1 if county of practice falls into the top quartile in South Carolina for % population that is black.

^eSet to 1 if county of practice falls into the top quartile in South Carolina for % population that is below the poverty level.

Statistics for Model performance (–2 log likelihood):

Model 1, $\chi^2 = 98.098$ with 5 df (P = 0.0001).

Model 2, $\chi^2 = 717.968$ with 12 df (P = 0.0001). Difference between Models 1 and 2: $\chi^2 = 619.870$ with 7 df, P = 0.0001.

Model 3, $\chi^2 = 888.198$ with 17 df (P = 0.0001). Difference between Models 2 and 3: $\chi^2 = 170.230$ with 5 df, P = 0.0001.

their willingness to work among low-income patients in ways that would be anticipated, on the basis of previous research (Table 5). Physicians of minority race^{1–4} were more likely to be classified as high-Medicaid-participation physicians. Female physicians were also more likely to be classified as high-participation physicians, perhaps because they have a preference for salaried practice,¹¹ which is offered by FQCHC and academic practices.

In addition, specialty was related to a physician's propensity to treat relatively more Medicaid patients. Primary care physicians who served women and children were more likely to fall into the highest quartile for Medicaid participation. Pediatricians and obstetrician-gynecologists were heavily represented in the high-Medicaid-participation group. Medicaid funds about half of all births in South Carolina. Thus, obstetricians and pediatricians providing inpatient peri-

natal care would have to turn away significant portions of their practices if they declined to accept Medicaid patients for maternity services. According to 1995 census estimates, 54.8% of South Carolina children live at or below 200% of the federal definition of poverty.¹² Pediatricians and family medicine physicians both provide children's health services, and both were more likely than those in other disciplines to fall into the top Medicaid participation group. Internal medicine specialists generally limit their practices to adults and therefore see a population more likely to be insured through employer coverage or Medicare; thus, it is not surprising that internists were less likely to be among physicians with a high proportion of discharges funded by Medicaid.

NHSC physicians, as a result of recruiting combined with self-selection, were more likely than other physicians to possess many of the personal characteristics associated with in-

Table 6. Practice locations and practice types of National Health Service Corps alumni and other South Carolina physicians^a

County characteristics	NHSC alumni (%)	Other physicians (%)
Poverty quartile ^b		
<14.4%	26.7	38.6
14.4–18.4%	31.1	26.3
18.46–24.1%	28.9	31.4
>24.1%	13.3	3.7
Black population quartile ^b		
<24.7%	34.9	42.2
24.7–37.5%	28.9	28.5
37.6–51.9%	27.4	25.8
>51.9%	11.8	3.5
Practice characteristics		
In HPSA ^b	12.6	5.1
FQCHC ^b	11.9	0.5
Academic	5.2	7.0

^aNHSC, National Health Service Corps; HPSA, health professions shortage area; FQCHC, federally qualified community health center.

^bP = 0.001 as measured by χ^2 (2 × 4 tables) or Fisher's exact test (2 × 2 tables).

creased acceptance of Medicaid patients: female sex, non-white race, and primary care specialty. Multivariate analysis techniques cannot totally compensate for the lack of randomization; however, when these personal characteristics were held constant, NHSC alumni were almost twice as likely to be high-Medicaid-participation providers as were their peers (OR, 1.93; 95% CI, 1.18–3.13).

Physicians choose their patients through the selection of practice type and location. NHSC physicians in South Carolina were much more likely than others to locate in rural communities and in communities in which large portions of the population lived in poverty. They were also more likely than other physicians to practice in FQCHC environments, which accept disproportionately large numbers of low-income patients. After adjusting for practice type and setting, a physician's prior NHSC experience was no longer independently associated with whether he or she would fall into the top quartile for Medicaid participation.

This study has multiple limitations, stemming from the data on which it was based. First, the study only examined inpatient care provided within the state of South Carolina. South Carolina is demographically typical of the South, and particularly of the South's rural areas. South Carolina has a large black population, and 30 of its 46 counties are whole-county HPSAs. Conditions for physician practice in South Carolina, such as inpatient Medicaid reimbursement levels, may not be generalizable to the whole United States, however. In addition, the number of NHSC alumni physicians

was relatively small (n = 135). Second, the study population of physicians was limited to those in inpatient practice in 1998. Physicians whose practices did not include hospital care were excluded. Inpatient care is an important element of health care, but does not constitute the entire spectrum of care. Third, the NHSC physicians studied were those who practiced in South Carolina, having chosen either to remain in the state or to move to the state after NHSC service. Physicians who completed NHSC service and moved to other states or who never elected to practice in South Carolina may have had different practice patterns than the individuals studied. Fourth, the study did not examine the type of program (scholarship versus loan repayment) through which the physician was recruited for NHSC service. From a policy point of view, information on the initial recruitment mechanism would have been desirable. Finally, the study did not attempt to identify physicians who might have participated in community service at medically needy sites or communities as part of a state-based scholarship or loan repayment programs, rather than NHSC. Such state programs have grown since the mid-1980s to nearly equal the NHSC in terms of the number of providers supported.¹³ Omission of state-based program participants biases the study in a conservative direction, making it less likely that differences between NHSC alumni and other physicians would be detected.

Despite these limitations, the study has the important strength that it is based on observed behavior (patients treated) rather than on self-reported practice patterns or current geographic location. As noted earlier, physicians tend to overestimate slightly the proportion of vulnerable individuals among their patients.³ In addition, this study encompassed the entire physician and hospital-patient population within a single state for a year. It was thus able to capture physician behaviors in urban and rural settings.

The dual role of the NHSC has been described as assisting medically needy communities to obtain service and selecting practitioners who will remain in those communities.¹⁴ Although NHSC alumni may not remain in the sites to which they were originally assigned, they choose to work in practice settings that provide services to poor and medically underserved persons. NHSC physicians were more likely to practice in whole-county rural HPSAs, in counties with significant minority populations, and in counties with relatively poor populations. NHSC alumni make significant contributions to care in rural areas, but this study indicates the extent to which their practices also contribute to access to care for low-income patients in general, by their willingness to care for Medicaid patients.

FQCHC administrators and others recruiting for practices serving rural or urban low-income populations should consider targeting recruiting toward NHSC participants and alumni. A previous study found that NHSC physicians completing service obligations were more likely than other physicians to leave the FQCHC at which they were employed.¹⁵

Physicians were described as leaving, however, if they left a specific center; the authors did not determine whether physicians who left subsequently entered a different center. Our study indicates that NHSC alumni were more likely than others to be in FQCHC practice.

The South Carolina physicians studied had been out of medical school for as long as 30 years, and presumably most were many years past their NHSC service. Former NHSC physicians differed from others in their willingness to work with the Medicaid population, principally by choosing to practice in settings where such patients are encountered. At least three alternative explanations can be offered for this behavior. First, the NHSC procedures for recruiting physicians may have identified persons with a desire to work in primary care settings with all kinds of patients across their career. Alternatively, a physician's willingness to accept an NHSC obligation, thus committing to several years of working with needy populations, may be linked to personality traits associated with continuing in such practice. Finally, the experience gained in NHSC settings may demonstrate that care for low-income populations is not financially crippling. It is likely that all three of these factors—background, willingness, and experience—shape present practice patterns.

Conclusions

In a population of practicing physicians, none of whom was currently obligated to NHSC service, a history of such service was linked to subsequent acceptance of Medicaid patients. Whether NHSC service selected for, reinforced, or failed to discourage physicians who are willing to treat Medicaid patients, or was simply irrelevant to postservice practice, can never be definitively demonstrated. Absence of randomization limits our ability to draw firm conclusions. Nonetheless, it is our perception that NHSC loans and service obligations are beneficial. NHSC service facilitates medical education for individuals who might otherwise lack the financial means to achieve it. It is noteworthy that 20% of the nonwhite physicians in South Carolina were educated using this mechanism. In the short term, NHSC service places practitioners in needy communities across the nation. We believe that such service

may have educational benefits similar to those offered by rural residency tracks, exposing physicians to practice with underserved populations early in their careers.

References

1. Perloff JD, Kletke PR, Fossett JW, et al. Medicaid participation among urban primary care physicians. *Med Care* 1997;35:142–157.
2. Moy E, Bartman BA. Physician race and care of minority and medically indigent patients. *JAMA* 1995;273:1515–1520.
3. Cantor JC, Miles EL, Baker LC, et al. Physician service to the underserved: Implications for affirmative action in medical education. *Inquiry* 1996;33:167–180.
4. Xu G, Fields SK, Laine C, et al. The relationship between the race/ethnicity of generalist physicians and their care for underserved populations. *Am J Public Health* 1997;87:817–822.
5. 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.
6. Marwick C. National Health Service Corps faces reauthorization during a risky time. *JAMA* 2000;283:2641–2642.
7. Pathman DE, Konrad TR, Ricketts TC III. The comparative retention of National Health Service Corps and other rural physicians: Results of a 9-year follow-up study. *JAMA* 1992;268:1552–1558.
8. Cullen TJ, Hart LG, Whitcomb ME, et al. The National Health Service Corps: Rural physician service and retention. *J Am Board Fam Pract* 1997;10:272–279.
9. Pathman DE, Konrad TR. Minority physicians serving in rural National Health Service Corps sites. *Med Care* 1996;34:439–454.
10. Rosenblatt RA, Saunders G, Shreffler J, et al. Beyond retention: National Health Service Corps participation and subsequent practice locations of a cohort of rural family physicians. *J Am Board Fam Pract* 1996;9:23–30.
11. Ness RB, Ukoli F, Hunt S, et al. Salary equity among male and female internists in Pennsylvania. *Ann Intern Med* 2000;133:104–110.
12. U.S. Census Bureau, U.S. Department of Commerce. Number and Percent of Children Under 19 Years of Age, at or below 200 Percent of Poverty, by State: Three-Year Averages for 1993, 1994, and 1995 (Revised). Available at: <http://www.census.gov/hhes/hlthins/lowinckid.html>. Accessed April 28, 2003.
13. Pathman DE, Taylor DH Jr, Konrad TR, et al. State scholarship, loan forgiveness, and related programs: The unheralded safety net. *JAMA* 2000;284:2084–2092.
14. Politzer RM, Tribble LQ, Robinson TD, et al. The National Health Service Corps for the 21st century. *J Ambul Care Manage* 2000;23:70–85.
15. Singer JD, Davidson SM, Graham S, et al. Physician retention in community and migrant health centers: Who stays and for how long? *Med Care* 1998;36:1198–1213.