

# **Access, Health, and Wealth: The Impact of the National Health Service Corps in Rural America, 1970-2000**

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## ABBREVIATIONS FOUND IN REPORT

AMA: American Medical Association

ARF: Area Resource File

FIPS: Federal Information Processing Standards

FP/GP: Family Physician/General Practitioner

FTE: Full Time Equivalent

HPSA: Health Professional Shortage Area

MSA: Metropolitan Statistical Area

NCHS: National Center for Health Statistics

NHIS: National Health Interview Survey

NHSC: National Health Service Corps

PCP: Primary Care Physician (family physicians/general practitioners, general pediatricians and general internists)

RDC: Research Data Center at the National Center for Health Statistics

SAM: Social Accounting Matrix

SMR: Standardized Mortality Ratio

## Introduction

Since its inception in 1970, the National Health Service Corps (NHSC) has relied heavily on family physicians to serve medically-underserved populations throughout the U.S. In 2006, over thirty years later, the NHSC is subject to reauthorization. The Robert Graham Center saw an opportunity to contribute to a review and evaluation of the NHSC using existing public datasets, a low-cost and replicable approach to program evaluation. The Robert Graham Center, the mission of which is to bring a family medicine and primary care perspective to health policy, was interested in doing this work because the NHSC is one of the main primary care access programs in the U.S. The Graham Center was also an appropriate organization to conduct this examination because the NHSC has depended more on family physicians to fulfill its mission than any other health professional group (in fact, demand for family physicians from Corps communities remains high, and there are more than 600 open family medicine positions in Community Health Centers in 2005).<sup>1</sup> The Graham Center wanted to see if, thirty years later, there is evidence that the NHSC is fulfilling its mission.

## Background

The NHSC was created when the Emergency Health Personnel Act of 1970 was enacted as Public Law 91-623, intended to address the problems of too few clinicians training in the right specialties and practicing in the right areas. Its charge was straightforward - place physicians and dentists in underserved areas. By 1980 the NHSC had a budget of \$150 million, with a field strength of 2,080 in service to the underserved. In 1990, the NHSC was reauthorized for an unprecedented 10 years, but it was a shadow of its former self. The budget cuts of the previous decade had dried up the scholarship pipeline, loan repayment had hardly begun to make up the shortfall, and the field strength fell to barely 1,000 in 1991. However, after rejuvenation in the late 1990s, the NHSC of the year 2000 had a field strength of 2,376, which was roughly 12 percent of the 20,000 primary medical, oral, and mental and behavioral health clinicians needed in Primary Care Health Professional Shortage Areas (HPSAs) nationwide. Roughly half of these clinicians were primary care physicians, and the number of mental and behavioral health professionals had grown to 148. In 2000, and throughout the history of the program, about 60 percent of NHSC clinicians served in the rural US. This report focuses on these rural clinicians and does not address NHSC placements in urban counties.

## Analyses

We used existing data sets, including data from the U.S. Census, the National Health Interview Survey, and the Health Resources and Services Administration, to examine the work of the NHSC between 1970 and 1999. All analyses can be replicated in future years without any new requirement for primary data collection since U.S. Census data are readily available through the Bureau's web site ([www.census.gov](http://www.census.gov)) and can be linked to the National Health Interview Survey using county Federal Information Processing Standards (FIPS) codes at the National Center for Health Statistics' (NCHS) Research Data Center (RDC). The Area Resource File (ARF) is prepared each year by Quality Resources Systems, Inc. under contract with the Health Resources and Services Administration and can also be linked to the National Health Interview Survey (NHIS) data using FIPS codes. Analyzing

these data, we produced a series of charts, tables and maps. We also used IMPLAN software to estimate the economic impact of NHSC placements on communities (see Appendix 1 for details on the IMPLAN analysis).

### Findings

- In its first 30 years, the NHSC placed 13,915 health professionals in 1,911 rural counties. Between 1970 and 1999, they provided 30,660 person-years of service to the residents of these counties. NHSC physicians provided 72% of the person-years of service.
- Primary care physicians were 90% of the NHSC physicians serving in rural counties, and family physicians composed nearly two-thirds (63%) of all physicians.
- As was intended by the Congress when authorizing the NHSC, clinicians were consistently placed in the most underserved and most resource-deprived counties. These counties had poorer health status, higher poverty, and higher concentrations of racial and ethnic minorities than the general population. These counties, despite this deprivation, exhibited improvement in health outcomes over ten years of NHSC presence.
- Placing NHSC physicians in underserved, rural counties has not prevented other physicians from moving into those same counties, and in fact, the placement of NHSC physicians within a county is associated with a greater increase in physician-to-population ratios than non-NHSC counties.
- Though people living in rural Health Professional Shortage Area counties reported better health status in 1996 than 1981, people living in rural Health Professional Shortage Area counties *with* NHSC physicians consistently reported better health status than in counties without NHSC physicians.
- People living in rural Health Professional Shortage Area counties had lower overall mortality in 1998 than 1981. People living in rural Health Professional Shortage Area counties consistently staffed with NHSC physicians enjoyed slightly higher reductions in mortality than counties without NHSC physicians or those with intermittent staffing.
- Under the conservative assumption of two office staff per NHSC provider, we found that in 1999, 1,244 NHSC clinicians in the 11 most rural states possibly produced at least 2,488 additional healthcare office jobs, 4,888 non-healthcare jobs, \$874.9 million in economic output and \$29.6 million in business taxes to governments.

### Conclusions

- This study reveals that, in its first 30 years, the NHSC has had measurable success in improving the health of people living in rural areas, and their communities. The benefits of the NHSC are probably derived largely through their sustained presence in the most underserved communities.
- The disparities in mortality identified for communities served by the NHSC will require solutions that deal with the causes of social deprivation—poverty, education inequalities, unemployment, and poor social cohesion. Taking steps to solve these problems, and improving mortality disparities, could also be part of the Health Resources and Services Administration (HRSA) response, perhaps as an adjunct to NHSC resources.

- Given the success of the NHSC, and the ongoing, unmet needs of rural communities, the NHSC continues to be a vital part of the solution to resolving the healthcare needs in these communities.
- Analysis of the NHSC impact can be done routinely at relatively low cost using public datasets like the National Health Interview Survey. Such datasets can also be used to measure the impact of other federal health programs, like community and rural health centers and Area Health Education Centers.

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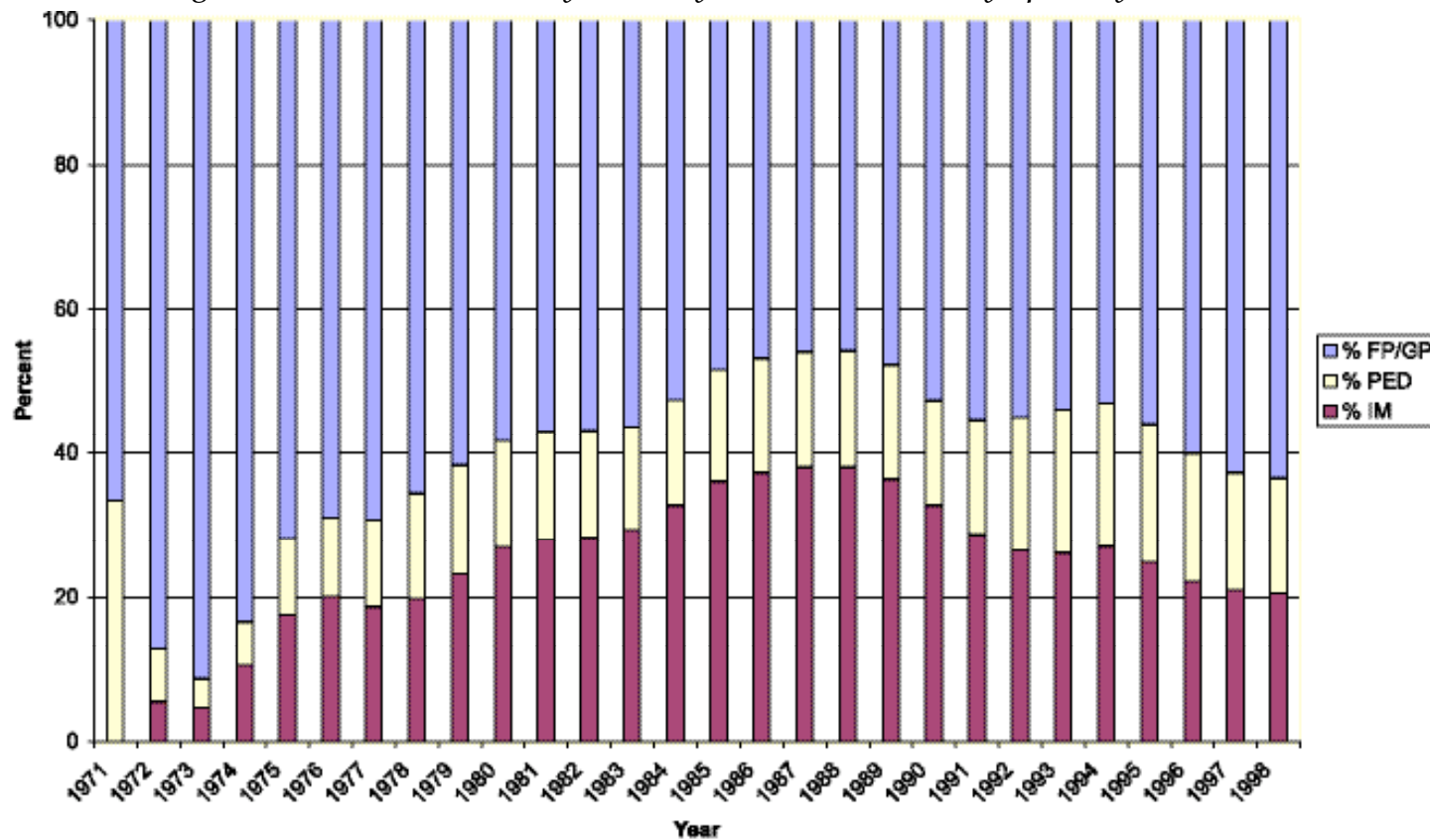
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Since its inception in 1970, the NHSC has relied heavily on family physicians to provide healthcare to medically-underserved populations throughout the U.S. Initially, the NHSC mostly deployed to small, sparsely settled, geographically remote communities in rural (non-Metropolitan Statistical Area or non-MSA) regions of the country. In the late 1970s, personnel assignments were restricted to federally-designated Health Professional Shortage Areas (HPSAs).

Figure 1. NHSC Rural Primary Care Physician Distribution by Specialty, 1971-1999



Source: Green LA, Dodoo MS, Ruddy G, Fryer GE, Phillips RL, McCann JL, et al.<sup>2</sup>

**Message: Most of the years between 1970 and 1999, family physicians and general practitioners comprised the majority of NHSC primary care physicians.**

## INTRODUCTION

In 2006, the NHSC was subject to reauthorization. The Robert Graham Center saw an opportunity to review and evaluate of the NHSC using existing public datasets, a low-cost and replicable approach to program evaluation. We wanted to see if, thirty years later, there is evidence that the NHSC is fulfilling its mission.

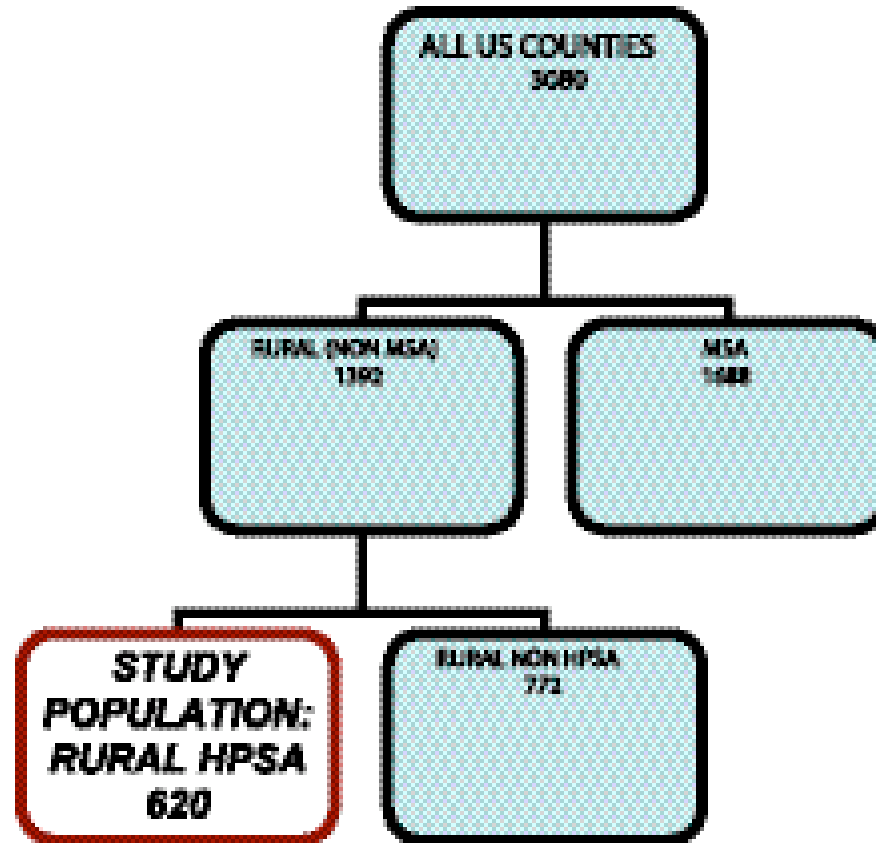
The Robert Graham Center for Policy Studies in Family Medicine and Primary Care, with its mission to bring family medicine and primary care perspectives to health policy, was interested in doing this work because the NHSC is one of the main primary care access programs in the U.S. Also, the NHSC has depended more on family physicians to fulfill its mission than any other health professional group (demand for family physicians from Corps communities remains high, and there are more than 600 open family medicine positions in Community Health Centers in 2005)<sup>1</sup> (see Figure 1). In fact, in the year 2000 family physicians served in the NHSC at a rate over four times higher than general internists and pediatricians.

Products of this research were intended (1) to help the NHSC learn from its past to become as effective as possible in the future, (2) to illustrate the benefit of public investment in the NHSC, and (3) to provide empirical evidence about the NHSC's value to rural communities. It is also important to note that the Graham Center is a private, non-governmental organization affiliated with the American Academy of Family Physicians, and undertook this research on its own initiative. The Graham Center was not working under any contract with the NHSC and was not otherwise obligated to perform this research.

This report briefly summarizes the results of a series of analyses of the impact of NHSC-obligated primary care clinicians on the rural communities they served. This study did not address the contribution of the 7965 NHSC health professionals, 36% of total from 1970-1999, who served urban (MSA) populations. **All analyses include NHSC placements in rural whole-county primary care Health Professional Shortage Areas and U.S. territories, unless otherwise noted (see Figure 2).** This report describes the contribution of NHSC personnel and the areas in which they served and depicts important associations. The contribution of NHSC clinicians was assessed using national public data sets and NHSC provider and program site records furnished by the NHSC. For more detailed information on methods, see Appendix 1.

This report begins with a history of the NHSC, followed by a general description of the geographic distribution of NHSC sites, personnel by discipline, and medical specialty for physicians. These resources are profiled for the 30-year period beginning in 1970. Later sections address other characteristics and potential impacts of the program. Evaluation focused on three distinct areas: (1) NHSC and local primary care workforces, (2) populations served and their health, including self-reported health status and age standardized mortality ratios, and (3) local economic impact.

Figure 2. Countries Included in Study



Source: 2003 Area Resource File; County designations valid as of 2002.

## FIRST 30 YEARS - A SHORT HISTORY

The NHSC was created when the Emergency Health Personnel Act of 1970 was enacted as Public Law 91-623, intended to address the problems of too few clinicians training in the right specialties and practicing in the right areas. Its charge was straightforward - place physicians and dentists in underserved areas. Within six months of its initial operation in 1972, the NHSC had placed 180 clinicians (U.S. Public Health Service Commissioned Corps Officers or civil servants) in more than 100 communities. Also in 1972 the Emergency Health Personnel Act Amendments established the NHSC Scholarship Program, which linked award of a full scholarship (tuition, fees, and stipend) to a commitment on the part of the scholar to serve in an underserved area. The NHSC continued to place volunteers in the interim years while the first scholars were chosen, completed their training, and began service in 1977.

By 1980 the NHSC had a budget of \$150 million, with a field strength of 2,080 in service to the underserved. However, during the 1980s, the NHSC's budget was cut several times. It seemed that the program was slated for dissolution, but by the mid-1980s it became clear that despite an increase in the number of physicians nationwide, the problem of lack of access was growing and becoming acute. Therefore in 1987 the NHSC was augmented by the establishment of the NHSC loan repayment programs, including the federal loan repayment plan and the joint state-federal loan repayment plan. These new programs recruited already trained and qualified primary care clinicians by offering incremental annual payments to be applied against their student loans in return for service in an underserved area. This enabled the NHSC to fill an immediate need for clinicians, as opposed to waiting for the scholarship pipeline.

In 1990, the NHSC was reauthorized for an unprecedented 10 years, but it was a shadow of its former self. The budget cuts of the previous decade had reduced or eliminated scholarships, loan repayment had hardly begun to make up the shortfall, and the field strength fell to barely 1,000 in 1991. However by 1994 the NHSC had grown by more than 80 percent to 1,867, and in response to community demand, the NHSC expanded eligibility for loan repayment to several mental and behavioral health disciplines.

The NHSC of 2000 had a field strength of 2,376, which was roughly 12 percent of the 20,000 primary medical, oral, and mental and behavioral health clinicians needed in HPSAs nationwide. Roughly half of these clinicians were primary care physicians; the remainder were nurse practitioners, physician assistants, certified nurse midwives, obstetricians/gynecologists, dentists, and mental and behavioral health professionals. That year, and throughout the history of the program, about 60 percent of NHSC clinicians served in rural America.

## DISTRIBUTION OF NHSC RESOURCES IN RURAL COUNTIES BETWEEN 1970-1999

From 1970-1999, 13,915 health professionals served the NHSC in rural areas, staffing 4,504 NHSC sites in 1,251 of the 1,392 rural counties in the U.S (excluding U.S. territories). (See Table 1). They accounted for 30,660 person-years of service during the 30-year period. Their contribution by health professional discipline is shown in Table 2. Comparable data for primary care physicians (family physicians, general practitioners, general internists, and general pediatricians) are in Table 3. For the period 1970-1999, NHSC staffing levels peaked in 1986 at 2,746 personnel and 2,025 person-years. Over the years, most rural NHSC staff were primary care physicians; 8,777 staff and 19,943 person-years, representing 90% of all rural NHSC physicians. Family physicians and general practitioners (FP/GP) have comprised the majority of the NHSC rural primary care physician workforce (70% of primary care physicians, 63% of all physicians, and 13,961 person-years), but the contributions of both general internal medicine (20% of primary care physicians and 4,031 person years) and pediatrics (10% of primary care physicians and 1,952 person years) have also been substantial (see Figure 1). The maps in Figures 5-16 reflect the national geographic distribution of NHSC sites and personnel by discipline (and specialty for physicians) throughout the history of the program.

# DISTRIBUTION OF NHSC RESOURCES IN RURAL COUNTIES BETWEEN 1970-1999

Table 1. State Distribution of Rural NHSC Resources, 1970-1999

State	Staffed Sites	FP/GP (FTE)	Primary Care Physicians* (FTE)**	All Physicians	Non-Physician Clinicians (FTE)
AK	40	203.0	256.1	325.8	169.5
AL	151	385.6	718.3	877.9	338.7
AR	100	271.3	372.3	442.8	97.7
AZ	91	697.0	1122.5	1453.5	577.2
CA	190	885.1	1650.8	1838.6	649.3
CO	110	386.0	536.6	558.2	289.6
CT	6	34.3	200.0	214.7	170.8
DC	3	23.2	95.7	120.1	87.0
DE	7	54.5	71.8	76.9	7.1
FL	164	564.1	1206.4	1431.6	605.4
GA	147	350.9	742.8	850.5	374.7
HI	5	14.7	22.2	31.5	6.1
ID	49	169.8	211.1	220.7	82.7
IA	77	245.0	316.9	347.3	146.5
IL	57	340.6	1083.3	1246.6	325.1
IN	57	160.7	270.3	294.8	94.2
KS	78	159.9	196.6	213.3	112.2
KY	118	262.6	484.6	589.3	190.7
LA	70	198.3	393.8	521.3	138.4
MA	25	135.2	562.5	644.5	297.6
MD	47	221.6	634.9	771.1	171.6
ME	88	218.0	289.1	326.5	182.7
MI	136	485.2	828.2	977.3	289.3
MN	69	212.8	285.1	315.1	158.4
MO	135	429.6	787.5	947.2	370.4
MS	124	374.1	661.3	772.5	349.8
MT	69	319.9	414.8	475.6	134.8
NC	265	695.3	1045.0	1252.3	542.0
ND	50	124.2	153.3	163.5	100.4

## DISTRIBUTION OF NHSC RESOURCES IN RURAL COUNTIES BETWEEN 1970-1999

State	Staffed Sites	FP/GP (FTE)	Primary Care Physicians* (FTE)**	All Physicians	Non-Physician Clinicians (FTE)
NE	73	147.3	184.8	221.7	144.4
NH	13	47.6	81.9	125.4	24.2
NJ	21	105.8	349.9	453.1	145.0
NM	99	505.2	726.2	927.0	583.5
NV	34	106.7	173.9	185.3	62.0
NY	131	595.7	1789.0	2087.4	760.3
OH	127	443.3	944.0	1146.3	253.4
OK	88	365.9	635.3	806.0	280.7
OR	74	221.7	262.5	312.3	236.4
PA	147	673.9	1250.5	1452.5	581.7
RI	1	24.6	100.6	113.5	34.2
SC	146	268.9	493.7	700.1	366.0
SD	74	250.4	335.8	383.2	261.5
TN	155	318.7	639.2	768.6	340.6
TX	180	576.7	1020.6	1183.5	785.4
UT	63	185.3	266.7	293.7	128.6
VA	104	362.8	617.8	696.8	186.3
VT	26	55.6	110.0	146.3	58.9
WA	93	488.7	680.2	779.7	458.4
WI	89	310.6	481.7	573.9	163.6
WV	130	451.7	690.8	841.8	324.8
WY	54	130.2	180.1	190.5	53.7
Territories	54	No Data (Territories Not Included in FTE Total)			
<b>Total U.S.</b>	<b>4504</b>	<b>15,259.8</b>	<b>27,629</b>	<b>32,689.6</b>	<b>13,293.5</b>

Source: NHSC; Analysis by the Robert Graham Center 2006.

\*Includes Family Physicians/General Practitioners, General Internists, and General Pediatricians.

\*\* FTE=Full Time Equivalent

**MESSAGE: Between 1970 and 1999, five states (NC, CA, TX, FL, and TN) staffed at least 150 sites with NHSC personnel, accounting for more than 20% of all NHSC sites. New York deployed more NHSC physicians and primary care physicians than any other state.**

## DISTRIBUTION OF NHSC RESOURCES IN RURAL COUNTIES BETWEEN 1970-1999

Table 2. Relative Contribution of Clinicians to Rural NHSC Workforce, 1970-1999

Discipline	Number of Clinicians	Percent of Primary Care Clinicians	Person Yearst	Percent of Person Years
MD	8276	60	18,646.6	61
Dentist	1527	11	3487.3	11
DO	1446	10	3311.8	11
Physician Assistant	911	7	1597.7	5
Nurse Practitioner	904	7	1779.5	6
Nurse	260	2	615.3	2
Nurse Midwife	142	1	232.5	1
Social Worker	102	1	210.3	1
*Other	347	1	778.8	3
Total	13,915	100	30,659.8	101**

Source: NHSC; Analysis by the Robert Graham Center 2006.

\*Podiatrists composed the largest number of "Other" clinicians (n=84).

\*\*Does not sum to 100% due to rounding.

†Person years are defined as the total number of months served between 1970 and 1999, divided by 12. For example, if a clinician served six months in 1995, 12 months in 1996, and six months in 1997, the clinician contributed 24 months divided by 12, or 2 person years.

**MESSAGE:** In the 30 years spanning 1970-1999, MDs and DOs comprised more than 70% of the NHSC workforce, with nurses, dentists, PAs and social workers representing most of the remainder.



# DISTRIBUTION OF NHSC RESOURCES IN RURAL COUNTIES BETWEEN 1970-1999

Table 3. Relative Contribution of Primary Care Physicians to Rural NHSC Workforce, 1970-1999

Specialty	Number of Physicians	Percent of Primary Care Physicians	Person Yearst	Percent of Person Years
Family Medicine	4,208	48	9,646.3	48
General Practice	1,946	22	4,314.3	22
Internal Medicine	1,777	20	4,030.7	20
Pediatrics	846	10	1,951.5	10
Total	8,777*	100	19,942.8	100

Source: NHSC; Analysis by the Robert Graham Center

\*Sum does not equal that of all MDs and DOs from Table 2 because of the contribution of other sub-specialty physicians, most of whom were psychiatrists or obstetricians/gynecologists.

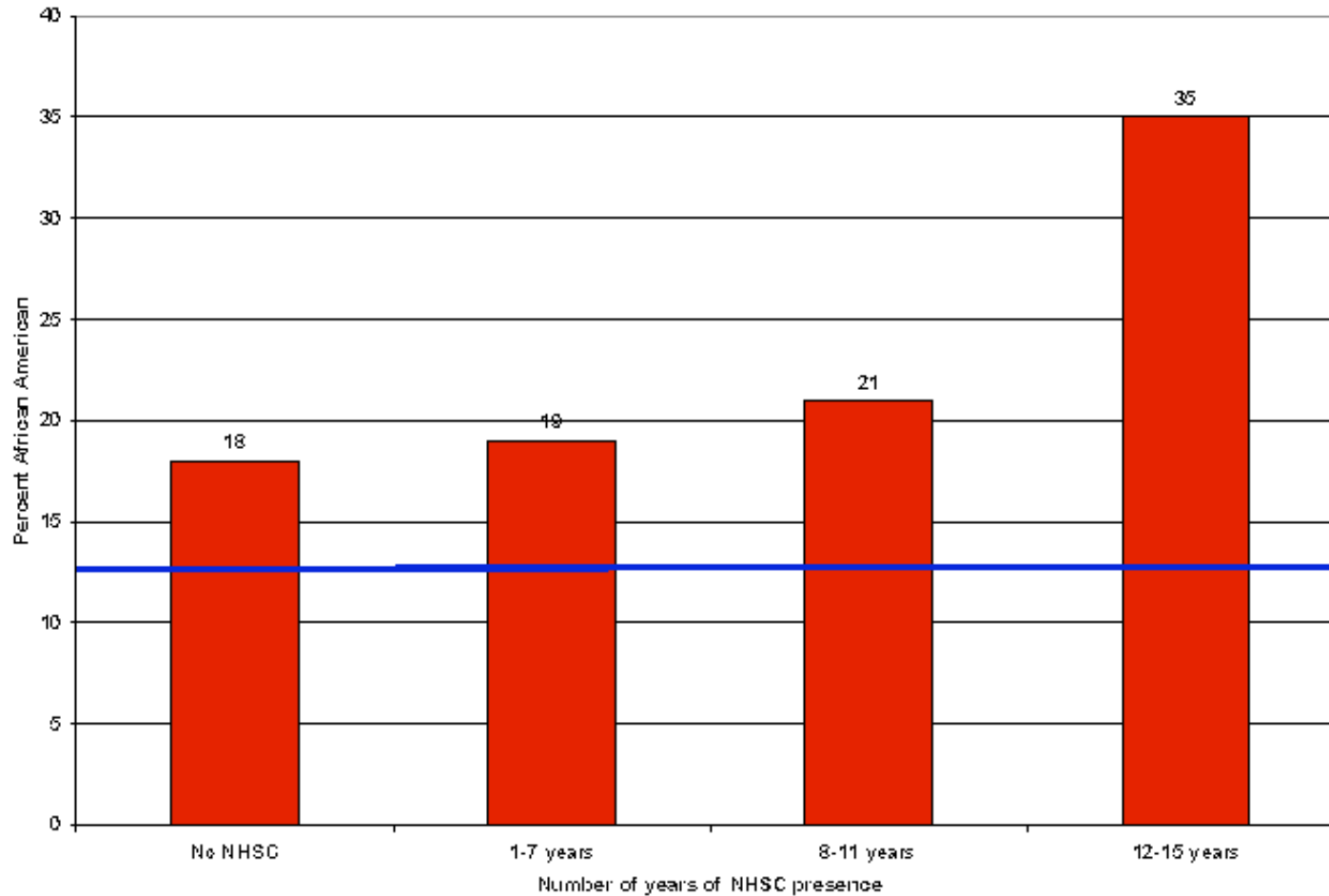
tPerson years are defined as the total number of months served between 1970 and 1999, divided by 12. For example, if a clinician served six months in 1995, 12 months in 1996, and six months in 1997, the clinician contributed 24 months divided by 12, or 2 person years.

**MESSAGE: In the 30 years spanning 1970-1999, family physicians and general practitioners comprised 70% of the NHSC primary care physician workforce, with internists and pediatricians representing 20 and 10 percent respectively.**

While these profiles of national resource allocation document the widespread geographic involvement of the NHSC, the characteristics of communities served is also important. Consistently, the NHSC has placed obligated medical personnel in areas of greatest need, poorer health status, higher poverty, and areas in which racial and ethnic minorities comprise a large proportion of the general population.<sup>3</sup> Figures 3 and 4 depict the percent of the population that are racial and/or ethnic minorities and living in poverty by the number of years of NHSC service, including physician, nurse practitioner, and physician assistant service to rural whole-county primary care HPSA counties in 1984. Though the data in Figures 3 and 4 reflect county averages, using individuals as the unit of analysis yielded similar results.

## DISTRIBUTION OF NHSC RESOURCES IN RURAL COUNTIES BETWEEN 1970-1999

Figure 3. Percent of Rural HPSA County Population That Is Racial/Ethnic Minority by NHSC Presence, 1984-1998



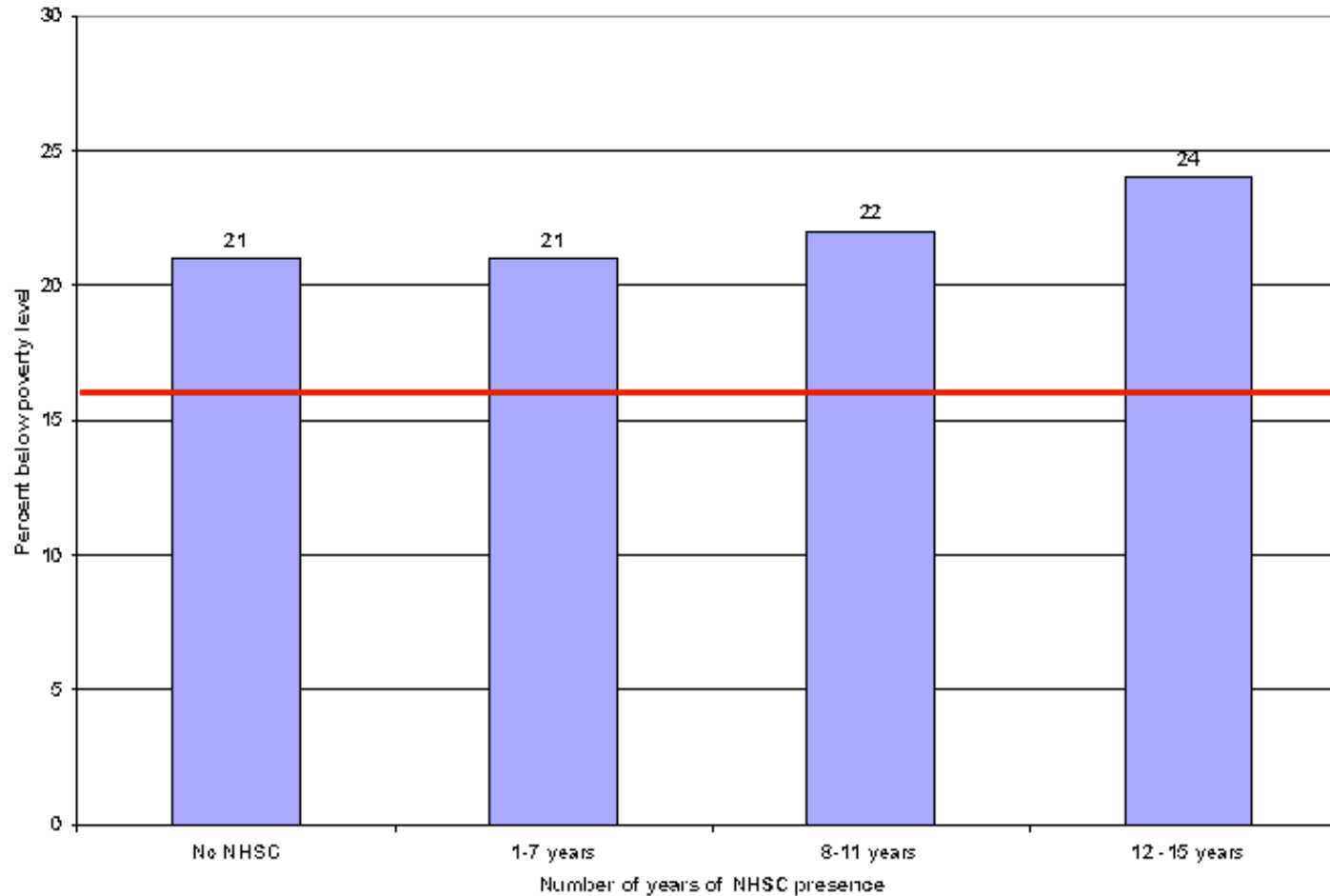
Source: NHSC, Area Resource File, U.S. Census; Analysis by the Robert Graham Center 2006.

The horizontal line shows the percent of U.S. rural non-HPSA county population that was racial/ethnic minority in 1980 (12.5%).

**MESSAGE:** The NHSC has assigned its resources preferentially and delivered its most consistent service to counties with large minority populations.

# DISTRIBUTION OF NHSC RESOURCES IN RURAL COUNTIES BETWEEN 1970-1999

Figure 4. Percent of Rural HPSA County Population That Is Below Poverty Level by NHSC Presence, 1984-1998



Source: NHSC, Area Resource File, U.S. Census; Analysis by the Robert Graham Center 2006.

The horizontal line shows the percent of U.S. rural non-HPSA county population that was below poverty level in 1980 (15.2%)

**MESSAGE:** The NHSC has assigned its resources preferentially and delivered its most consistent service to counties with large populations living in poverty.

## AFFECT OF THE NHSC STAFFING ON PHYSICIAN WORKFORCE WITHIN COMMUNITIES

Concerns have been raised about NHSC placements having a negative long-term effect on a community's long-term physician workforce by discouraging in-migration of non-NHSC physicians. We compared 141 rural whole-county primary care HPSAs with NHSC physicians in 1984 and most of the preceding five years with 142 rural whole-county primary care HPSAs without NHSC resources between 1979 and 2001.<sup>4</sup> Table 4 indicates that NHSC-served counties increased their non-NHSC primary care physician-to-population ratios at greater rates than did counties not served by the NHSC. Multivariate analyses revealed that while the NHSC effect was significant in increasing the ratio from 1981 to 1996, presence of a hospital in the county was an even stronger influence (see Appendix 1 for details on the analysis). It may not be feasible to build a hospital in every U.S. county in order to attract primary care physicians, but the NHSC may be a viable way to enhance a community's physician workforce.

*Table 4. Mean Rural County Primary Care Physician-to-Population Ratio for 1981, 1986, 1991, 1996, and 2001 by NHSC Presence Between 1979 and 1984*

NHSC Presence, 1979-1984	Mean PCP per 10,000 1981	Mean PCP per 10,000 1986	Mean PCP per 10,000 1991	Mean PCP per 10,000 1996	Mean PCP per 10,000 2001
Yes (n=141)	2.53	2.49	2.59	3.47	3.93
No (n=142)	1.76	2.03	2.07	2.31	2.34

*Source: NHSC, Area Resource File; Analysis by the Robert Graham Center 2006.*

**Message: NHSC presence does not seem to prevent immigration of non-NHSC physicians; increases can be due to some NHSC physicians remaining after their obligations or non-NHSC physicians remaining longer, as the mean physician to population ratio has increased at a greater rate in NHSC-served counties than in counties that never had NHSC placement.**

## SELF-REPORTED HEALTH STATUS IMPROVES WHEN NHSC RESOURCES ARE PRESENT

Every year since 1957, the U.S. Centers for Disease Control and Prevention’s National Center for Health Statistics has conducted the National Health Interview Survey. Information is obtained each year from a probability sample of about 111,000 people who reside in 43,000 households. We focused on self/parent-reported health status and the number of physician visits in the 12 months preceding the interview for persons in rural whole-county primary care HPSAs served vs. not served by the NHSC. Comparisons were made for the years 1986, 1991, and 1996 for which AMA Physician Masterfile data were available. Geographic links for county of NHSC primary care physician location and respondent residence were made using FIPS codes. FIPS codes represent counties and county equivalents in the 50 states and the District of Columbia. All work (see Appendix 1) was done at the NCHS Research Data Center in Hyattsville, Maryland.

Table 5 illustrates more favorable self/parent ratings of health on the traditional five-point scale for residents of NHSC-served counties than other rural whole-county primary care HPSAs. Table 6 similarly shows that more doctors’ visits were reported by the residents of NHSC counties for two of the three years examined.

*Table 5. Mean Rural County Self-Reported Health Status According to NHIS by NHSC Presence, 1986-1996*

	Mean †Health Status	
	NHSC Presence	No NHSC Presence
1986	2.50*	2.73*
<i>NHIS respondents</i>	1253	257
1991	2.35	2.41
<i>NHIS respondents</i>	1345	2635
1996	2.37	2.44
<i>NHIS respondents</i>	1200	1646

*Source: NHSC, Area Resource File, National Health Interview Survey; Analysis by the Robert Graham Center 2006.*

†Health status is measured using a 1-5 Likert Scale: 1= Excellent; 2 = Very good; 3 = Good; 4 = Fair; and 5 = Poor. The lower the health status rating, the healthier the National Health Interview Survey respondent.

\* $p < .05$

**MESSAGE: Rural whole county HPSAs with a NHSC presence show a trend toward better self-reported health status than those without NHSC presence.**

## SELF-REPORTED HEALTH STATUS IMPROVES WHEN NHSC RESOURCES ARE PRESENT

Table 6. Mean Rural County Number of Self-Reported Physician Visits According to NHIS by NHSC Presence, 1986-1996

	Mean Number of Visits in Past 12 Months	
	NHSC Presence	No NHSC Presence
1986	3.95	3.51
NHIS respondents	1252	251
1991	4.52	4.11
NHIS respondents	1345	2638
1996	4.27	4.36
NHIS respondents	1202	1649

Source: NHSC, Area Resource File, National Health Interview Survey; Analysis by the Robert Graham Center 2006.

**MESSAGE:** In 1986 and 1991, but not in 1996, residents of rural whole county HPSAs with a NHSC presence reported more physician visits than residents of rural whole county HPSAs with no NHSC presence.

## NHSC RESOURCES IMPROVE AGE-STANDARDIZED MORTALITY RATIOS

Mortality rates, adjusted for age, were compared for rural whole county HPSAs and non-HPSA counties to assess the degree to which the placement of NHSC-obligated clinicians in needy communities might reduce health disparities there (see Appendix 1 for more information on the analysis)<sup>5</sup>. The standardized mortality ratios (SMRs) that appear in Table 7 were calculated using the indirect method, i.e. the SMRs represent deaths in the respective study groups relative to the number expected based on the experience, from 1981 through 1983, of the 772 rural non-HPSAs. 1981-1983 age-specific rates for those counties were multiplied by county age group population, then summed to compute expected mortality for each county group. For example, an SMR of 1.20 would indicate 20% more deaths occurred than expected, while an SMR of .75 means 25% fewer deaths occurred than expected given the age distribution of the population and the aggregate three-year experience of the 772 counties.

Study groups were configured by rural whole-county primary care HPSA status in 1984 and level of NHSC presence from 1984-1998. Table 7 depicts improvement in age-adjusted mortality among all study groups from the period 1981-1983 to 1996-1998, though NHSC presence did not diminish disparities in mortality between rural whole-county primary care HPSAs and non-HPSA populations during that time. On balance, all groups improved substantially over the 15 years of observation. The larger SMRs in counties with the earliest NHSC placements suggest that the NHSC first placed clinicians in counties of greatest need.

Mortality ratios in Table 7 must be interpreted in the context of possible random variation associated with relatively rare events and small county populations. Thus, aggregated populations for county groups were also contrasted. Those results appearing in Table 7 were similar to the outcome of analyses using individual counties as the units of analysis.

*Table 7. Rural County Standardized Mortality Ratios (SMR) and Percent Improvement in SMR by NHSC Clinician<sup>†</sup> Presence, 1981-1998*

Years of NHSC Presence, If Any	SMR 1981-1983	SMR 1996-1998	% Improvement in SMR 1981-1998
Whole county HPSA with No NHSC Presence (n=172)	.997	.947	5
Whole county HPSA with 1-7 Years NHSC Presence (n=293)	1.027	.987	4
Whole county HPSA with 8-11 Years NHSC Presence (n=84)	1.062	1.043	2
Whole county HPSA with 12-15 Years NHSC Presence (n=71)	1.086	1.036	5
Non-HPSA with No NHSC Presence (n=772)	*.993	*.942	5

*Source: NHSC, Area Resource File, National Health Interview Survey; Analysis by the Robert Graham Center 2006*

*\*This is the reference group. This is not equal to 1.0 because this reference group is based on the summed county populations, while Table 7 data reflect group county medians.*

*†“Clinician” refers to physicians, NPs, and PAs.*

**MESSAGE:** All rural counties assessed, including whole county HPSAs with no NHSC presence, showed improvements in standardized mortality rates. Rural underserved counties with the most continuous NHSC presence showed gains similar to non-HPSA counties.

## THE IMPACT OF NHSC RESOURCES ON LOCAL ECONOMIES

The healthcare sector is a major contributor to the rural economies of many states, where as an employer it is second only to public schools.<sup>6</sup> In rural areas of many states, NHSC healthcare providers are not just providing healthcare services, but are also major contributors to economic and business life. The extent of such contributions is assessed in this section using standard economic input-output analysis methods.<sup>7</sup> See Appendix 1 for a full description of our methods.

The data presented in Table 8 show 1,244 NHSC personnel in the 11 most rural states in the US in 1999. We chose these most rural states to ensure we were using the most pure cases and the states most applicable to our report, The NHSC in Rural Counties. These included 541 primary care physicians, 97 sub-specialist physicians, 204 dentists, 218 physician assistants and 184 nurse practitioners.

*Table 8. NHSC Personnel in the 11 Most Rural States, 1999*

State	Primary Care Physicians	Sub-specialty Physicians	Dentists	Physician Assistants/ Nurse Practitioners	*Total NHSC Personnel
Total US Rural	541	97	204	402	1,244
Alabama	13	1	6	6	25
Arkansas	6	2	3	1	12
Kentucky	4	5	1	6	16
Maine	7	8	1	11	27
Mississippi	4	1	9	4	18
Montana	6	1	-	3	10
New Hampshire	3	-	-	0	3
North Dakota	1	1	-	3	5
South Dakota	4	-	-	4	8
Vermont	1	1	-	-	2
West Virginia	6	-	3	10	19
11 rural states (above)	54	19	23	48	143

*Source: NHSC personnel data: HRSA Geospatial Data Warehouse (U.S. Department of Health and Human Services); Rurality data: U.S. Census*

*\*Rounding may cause slight discrepancies in sums.*

**MESSAGE: 1,244 NHSC personnel served the most rural areas of the US in 1999. These included 541 primary care physicians, 97 sub-specialist physicians, 204 dentists, 218 physician assistants and 184 nurse practitioners.**



## Analysis assuming two support staff persons

The economic impact results are presented in Table 9. Assuming that two support staff persons (including nursing and clerical staff) are needed per provider at each NHSC site, the presence of 1,244 NHSC clinicians in rural areas would lead to an additional 2,488 direct or immediate healthcare provider office practice jobs in these areas. The analysis showed that these jobs generated \$346 million of economic output and \$2.4 million of business taxes in these 11 rural states. These were all direct impacts of having NHSC clinicians in rural areas. There are additional impacts, referred to as indirect and induced impacts.

NHSC healthcare provider office practices purchase inputs from other rural and other regional businesses including office and medical supplies. These effects may generate additional jobs. The total effects of such purchases are called the indirect economic impacts of the program. From our estimation, using IMPLAN, the indirect impacts of NHSC clinicians in these 11 rural states were \$96.8 million of economic output, \$3.9 million business taxes and 885 additional jobs.

Workers from the NHSC healthcare provider rural office practices and the complementary businesses whose jobs are supported by the presence of the rural NHSC clinicians make personal consumption expenditures at the local rural stores and restaurants. These effects may also generate additional jobs. The total effects of such expenditures are called the induced economic impacts of the program. From our estimation, using IMPLAN, the induced impacts of NHSC clinicians in these 11 rural states is \$432.4 million of economic output, \$23.3 million business taxes and 4,004 additional jobs.

The total impact on the rural economies of these 1,244 NHSC clinicians in 1999 was the sum of the direct, indirect and induced impacts. These 1,244 NHSC clinicians in rural areas produced 2,488 additional healthcare office jobs, and 4,889 non-healthcare jobs in the rural economies. They also generated a total \$874.9 million of economic output and \$29.6 million in business taxes.

Primary care clinicians, including primary care physicians, physician assistants and nurse practitioners, made up about 75 percent of all rural-sited NHSC clinicians in 1999, and they generated about 75 percent of the economic impact. We found that 943 NHSC primary care clinicians in the 11 most rural states generated 1,886 additional healthcare office jobs, and 3,705 on-healthcare jobs. They also generated a total \$663.2 million of economic output and \$22.4 million in business taxes.

## Analysis assuming four support staff persons

If we assume that in each NHSC provider's office, four support staff persons (including nursing and clerical staff) are needed per provider, the presence of 1,244 NHSC clinicians in rural areas would lead to 6,220 direct healthcare provider office practice jobs in the rural areas, generating 4,986 additional healthcare office jobs. They will also generate 8,147 non-healthcare jobs, \$1.458 billion of economic output and \$49.3 million in business taxes.

## THE IMPACT OF NHSC RESOURCES ON LOCAL ECONOMIES

Table 9. Nationwide Annual Economic Impact of NHSC Clinicians in Rural Areas, 1999

### Assuming 2 office staff per physician

	Direct Impact	Indirect Impact	Induced Impact	Total Economic Impact*
All NHSC clinicians				
Number of Jobs (FTE)	3,732	885	4,004	8,620
Value Added to Economy	\$281,271,072	\$59,107,970	\$253,522,428	\$593,901,470
Economic Income	\$278,892,459	\$55,190,599	\$230,249,725	\$564,332,783
Business Taxes	\$2,378,613	\$3,917,371	\$23,272,703	\$29,568,687
Economic Output	\$345,699,744	\$96,775,954	\$432,387,269	\$874,862,967

### Assuming 4 office staff per physician

	Direct Impact	Indirect Impact	Induced Impact	Total Economic Impact*
All NHSC clinicians				
Number of Jobs (FTE)	6,220	1,474	6,6735	14,367
Value Added to Economy	\$468,785,120	\$98,513,291	\$422,537,402	\$989,835,813
Economic Income	\$464,820,765	\$91,984,339	\$383,749,562	\$940,554,666
Business Taxes	\$3,964,355	\$6,528,952	\$38,787,840	\$49,281,147
Economic Output	\$576,166,272	\$161,293,265	\$720,645,487	\$1,458,105,024

Source: IMPLAN; Analysis by the Robert Graham Center

\*Rounding may cause slight discrepancies in sums.

**MESSAGE:** In rural areas, NHSC healthcare clinicians are major contributors to local economies, producing up to 14,367 jobs and \$1.5 billion in economic impact.

## An Alabama example

In Alabama, with the assumption that each NHSC provider needs four support staff persons, we found that all 25 NHSC clinicians generated \$16.31 million of total economic output, \$12.61 million of value added to the economy and about \$257 thousand of business taxes, as illustrated in Table 10.

*Table 10. An Example of the Annual Economic Impact of NHSC Clinicians in Rural Areas: The Case of the 25 NHSC Clinicians in Rural Alabama, 1999*

### Assuming 2 office staff per physician

	Direct Impact	Indirect Impact	Induced Impact	Total Economic Impact*
All NHSC clinicians				
Number of Jobs (FTE)	76	12	11	99
Value Added to Economy	\$6,403,767	\$639,385	\$562,061	\$7,605,213
Economic Income	\$6,349,606	\$596,844	\$504,067	\$7,450,517
Business Taxes	\$54,161	\$42,541	\$57,994	\$154,696
Economic Output	\$7,870,632	\$1,046,940	\$919,175	\$9,836,747

### Assuming 4 office staff per physician

	Direct Impact	Indirect Impact	Induced Impact	Total Economic Impact*
All NHSC clinicians				
Number of Jobs (FTE)	126	20	18	164
Value Added to Economy	\$10,616,034	\$1,060,034	\$931,838	\$12,607,906
Economic Income	\$10,526,240	\$989,506	\$835,690	\$12,351,436
Business Taxes	\$89,794	\$70,528	\$96,148	\$256,470
Economic Output	\$13,048,679	\$1,735,716	\$1,523,895	\$16,308,290

Source: IMPLAN; Analysis by the Robert Graham Center

\*Rounding may cause slight discrepancies in sums.

**MESSAGE: Using Alabama as an example, the NHSC is a strong contributor to rural economies, producing up to 164 jobs and \$16 million in economic impact in this state alone.**

# THE IMPACT OF NHSC RESOURCES ON LOCAL ECONOMIES

## A Maine example

In Maine, with the assumption that each NHSC provider needs four support staff persons, we found that all 27 NHSC clinicians generated \$25.03 million of total economic output, \$11.6 million of value added to the economy and about \$630 thousand of business taxes, as illustrated in Table 11.

Table 11. An Example of the Annual Economic Impact of NHSC Clinicians in Rural Areas: The Case of the 27 NHSC Clinicians in Rural Maine, 1999

### Assuming 2 office staff per physician

	Direct Impact	Indirect Impact	Induced Impact	Total Economic Impact*
All NHSC clinicians				
Number of Jobs (FTE)	71	33	31	135
Value Added to Economy	\$2,900,300	\$1,617,760	\$1,563,786	\$6,081,846
Economic Income	\$2,845,633	\$1,502,231	\$1,402,565	\$5,750,429
Business Taxes	\$54,161	\$115,529	\$161,221	\$331,417
Economic Output	\$7,870,632	\$2,892,465	\$2,552,176	\$13,162,824

### Assuming 4 office staff per physician

	Direct Impact	Indirect Impact	Induced Impact	Total Economic Impact*
All NHSC clinicians				
Number of Jobs (FTE)	135	63	60	257
Value Added to Economy	\$5,514,656	\$3,076,023	\$2,973,396	\$11,564,075
Economic Income	\$5,410,712	\$2,856,355	\$2,666,848	\$10,933,915
Business Taxes	\$103,944	\$219,668	\$306,548	\$630,160
Economic Output	\$14,675,418	\$5,499,759	\$4,852,729	\$25,027,906

Source: IMPLAN; Analysis by the Robert Graham Center

\*Rounding may cause slight discrepancies in sums.

**MESSAGE:** Using Maine as an example, the NHSC is a strong contributor to rural economies, producing up to 257 jobs and \$25 million in economic impact in this state alone.

## Summary of Economic Impact

Table 12 summarizes the multipliers, additional jobs and economic output created by NHSC personnel in the 11 most rural states.

With the assumption that each NHSC provider needs four support staff persons, we found that each provider generated \$1.17 million of economic output, \$796 thousand of value added to the economy and on average about \$40 thousand of business taxes.

*Table 12. Annual Economic Impact of NHSC Clinicians in 11 Most Rural States: New Rural Jobs and Additional Rural Economic Output and Income Created by NHSC Staff Presence, 1999*

### Assuming 2 office staff per physician

	Direct Economic Impact	Type SAM† Multipliers	Total Economic Impact*	Additional jobs & output created	Average annual impact per NHSC provider
Number of Jobs (FTE)	3,732	2.3	8,620	4,888	(N/A)
Value Added to Economy	\$281,271,072	2.1	\$593,901,470	\$312,630,398	\$477,413
Economic Output	\$345,699,744	2.5	\$874,862,967	\$529,163,223	\$703,266
Business Taxes	\$2,378,613	12.4	\$29,568,687	\$27,190,074	\$23,769

### Assuming 4 office staff per physician

	Direct Economic Impact	Type SAM† Multipliers	Total Economic Impact*	Additional jobs & output created	Average annual impact per NHSC provider
Number of Jobs (FTE)	6,220	2.3	14,367	8,147	(N/A)
Value Added to Economy	\$468,785,120	2.1	\$989,835,813	\$521,050,693	\$795,688
Economic Output	\$576,166,272	2.5	\$1,458,105,024	\$881,938,752	\$1,172,110
Business Taxes	\$3,964,355	12.4	\$49,281,147	\$45,316,792	\$39,615

Source: IMPLAN; Analysis by the Robert Graham Center

\*Rounding may cause slight discrepancies in sums.

†Social Accounting Matrix

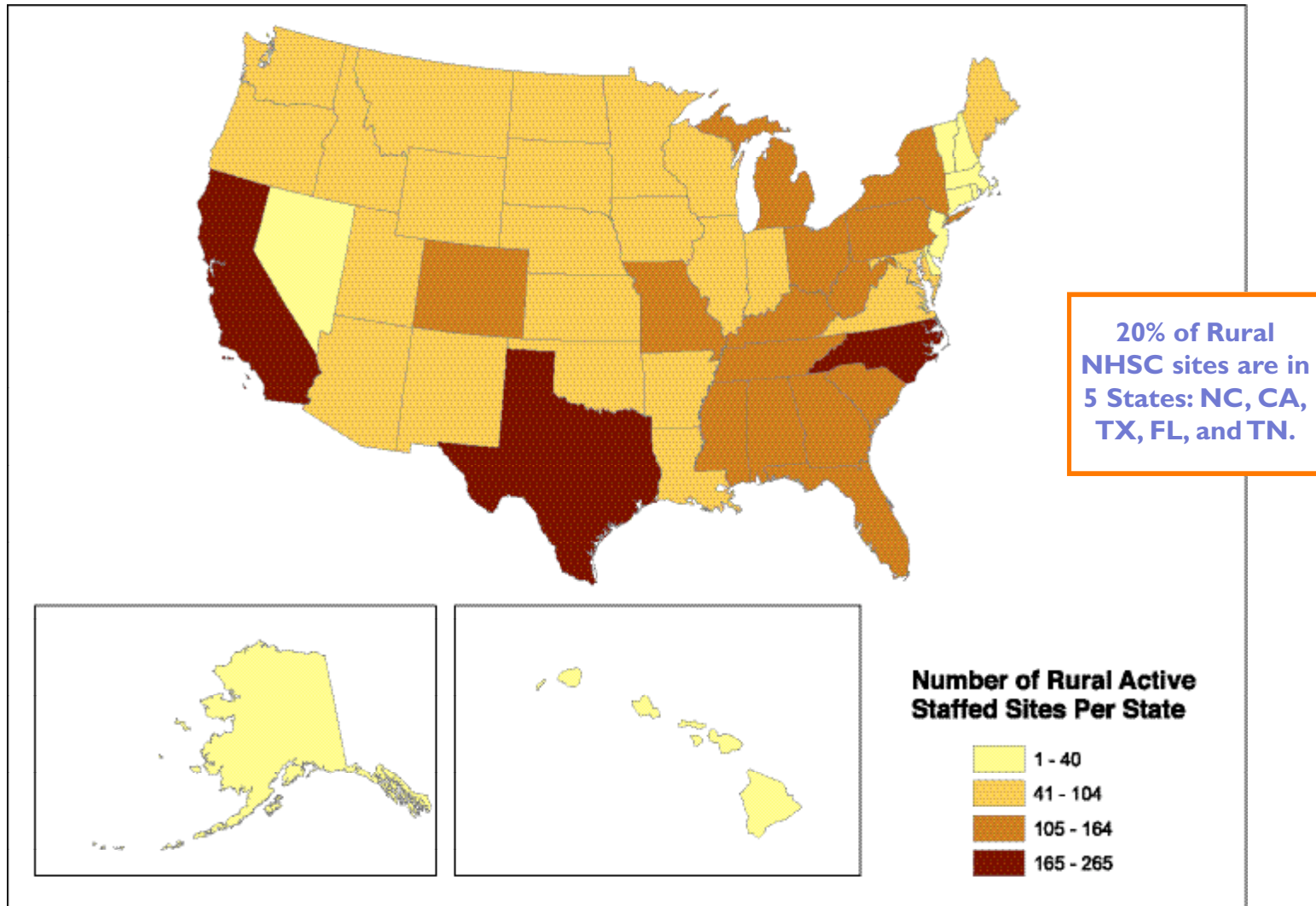
**MESSAGE: NHSC clinicians create or sustain up to 8,147 jobs in the 11 most rural states per year, and generate an estimated \$45 million in business taxes (assuming four office staff per physician).**

## FINDINGS

- In its first 30 years, the NHSC placed 13,915 health professionals in 1,251 rural counties. Between 1970 and 1999, they provided 30,660 person-years of service to the residents of these counties. NHSC physicians provided 72% of the person-years of service.
- Primary care physicians were 90% of the NHSC physicians serving in rural counties, and family physicians composed nearly two-thirds (63%) of all physicians.
- As was intended by the Congress when authorizing the NHSC, clinicians were consistently placed in the most underserved and most resource-deprived counties. These counties had poorer health status, higher poverty, and higher concentrations of racial and ethnic minorities than the general population. Nonetheless, these counties, exhibited improvement in health outcomes over ten years of NHSC presence comparable to the rest of the nation.
- Placing NHSC physicians in underserved, rural counties has not prevented other physicians from moving into those same counties, and in fact, the placement of NHSC physicians within a county is associated with a greater increase in physician-to-population ratios than non-NHSC counties.
- Though people living in rural Health Professional Shortage Area counties reported better health status in 1996 than 1981, people living in rural Health Professional Shortage Area counties with NHSC physicians consistently reported better health status than in counties without NHSC physicians.
- People living in rural Health Professional Shortage Area counties had lower overall mortality in 1998 than 1981. People living in rural Health Professional Shortage Area counties consistently staffed with NHSC physicians enjoyed slightly higher reductions in mortality than counties without NHSC physicians or those with intermittent staffing.
- Under the conservative assumption of two office staff per NHSC provider, we found that in 1999, 1,244 NHSC clinicians in the 11 most rural states possibly produced at least 2,488 additional healthcare office jobs, 4,888 non-healthcare jobs, \$874.9 million in economic output and \$29.6 million in business taxes to governments.

- This study reveals that, in its first 30 years, the NHSC has had measurable success in improving the health of people living in rural areas, and their communities. The benefits of the NHSC are derived largely through their sustained presence in the most underserved communities.
- The disparities in mortality identified for communities served by the NHSC will require solutions that deal with the causes of social deprivation—poverty, education inequalities, unemployment, and poor social cohesion. Taking steps to solve these problems, and improving mortality disparities, could also be part of the Health Resources and Services Administration (HRSA) response, perhaps as an adjunct to NHSC resources.
- Given the success of the NHSC, and the ongoing, unmet needs of rural communities, the NHSC continues to be a vital part of the solution to resolving the healthcare needs in these communities.
- Analysis of the NHSC impact can be done routinely at relatively low cost using public datasets like the National Health Interview Survey. Such datasets can also be used to measure the impact of other federal health programs, like community and rural health centers and Area Health Education Centers.

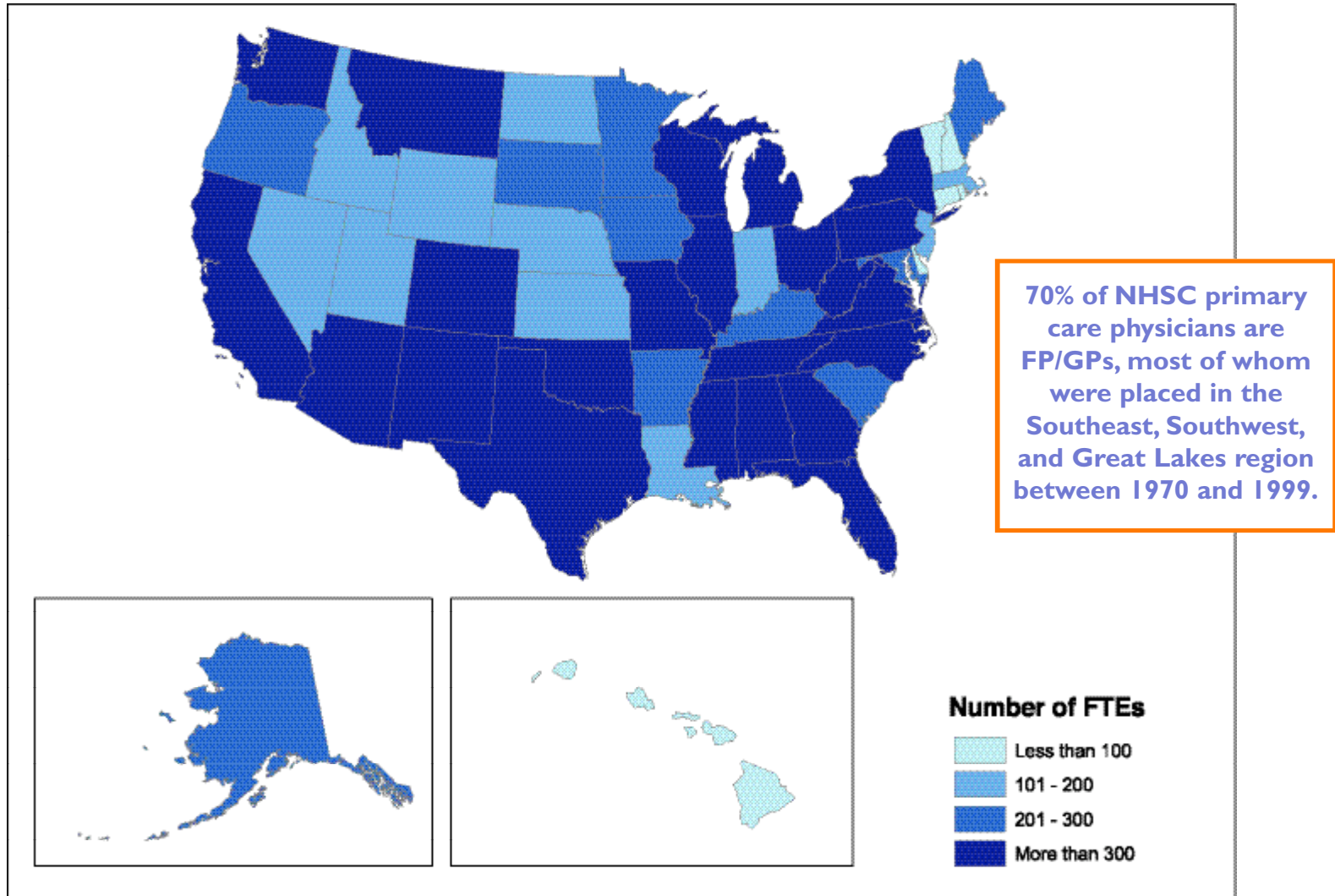
Figure 5. NHSC RURAL Sites by State, 1970-1999 (n=4504)



Data Source: National Health Service Corps  
Prepared by the Robert Graham Center: Policy Studies in Family Medicine and Primary Care

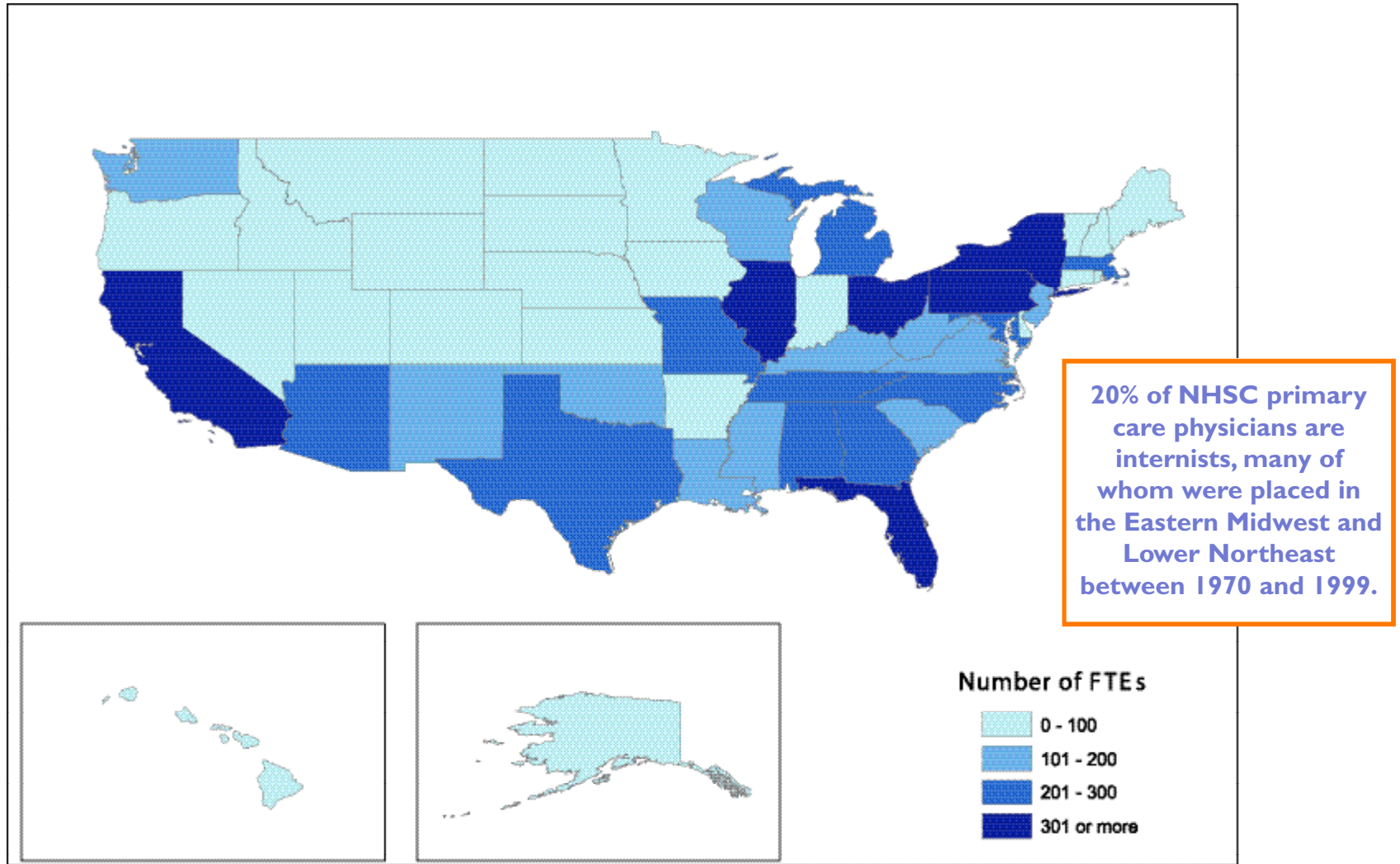


Figure 6. NHSC Family Physician/General Practitioner FTEs, 1970-1999 (n=15,264)



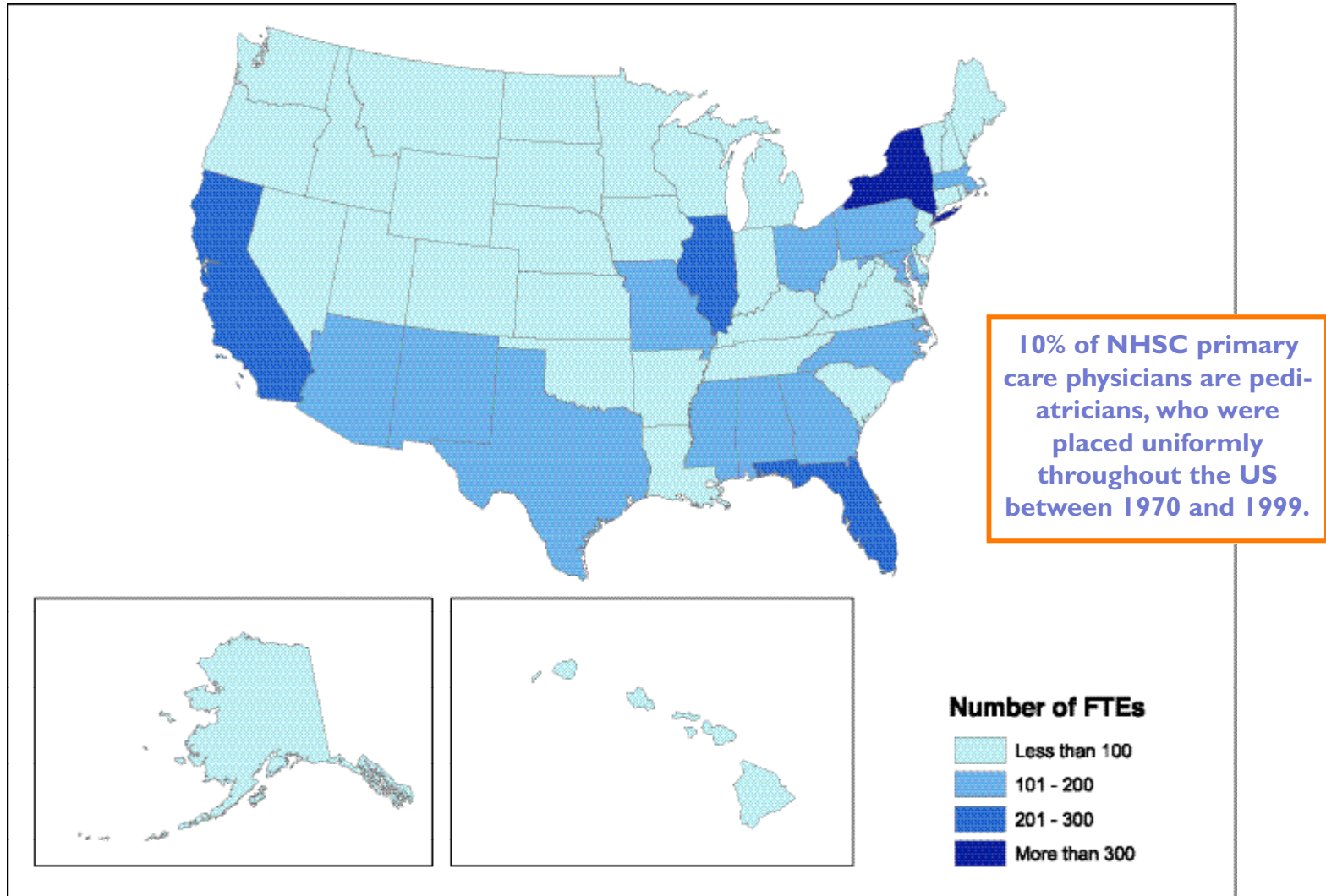
Data Source: National Health Service Corps  
 Prepared by the Robert Graham Center: Policy Studies in Family Medicine and Primary Care

Figure 7. NHSC Internist FTEs, 1970-1999 (n=8193)



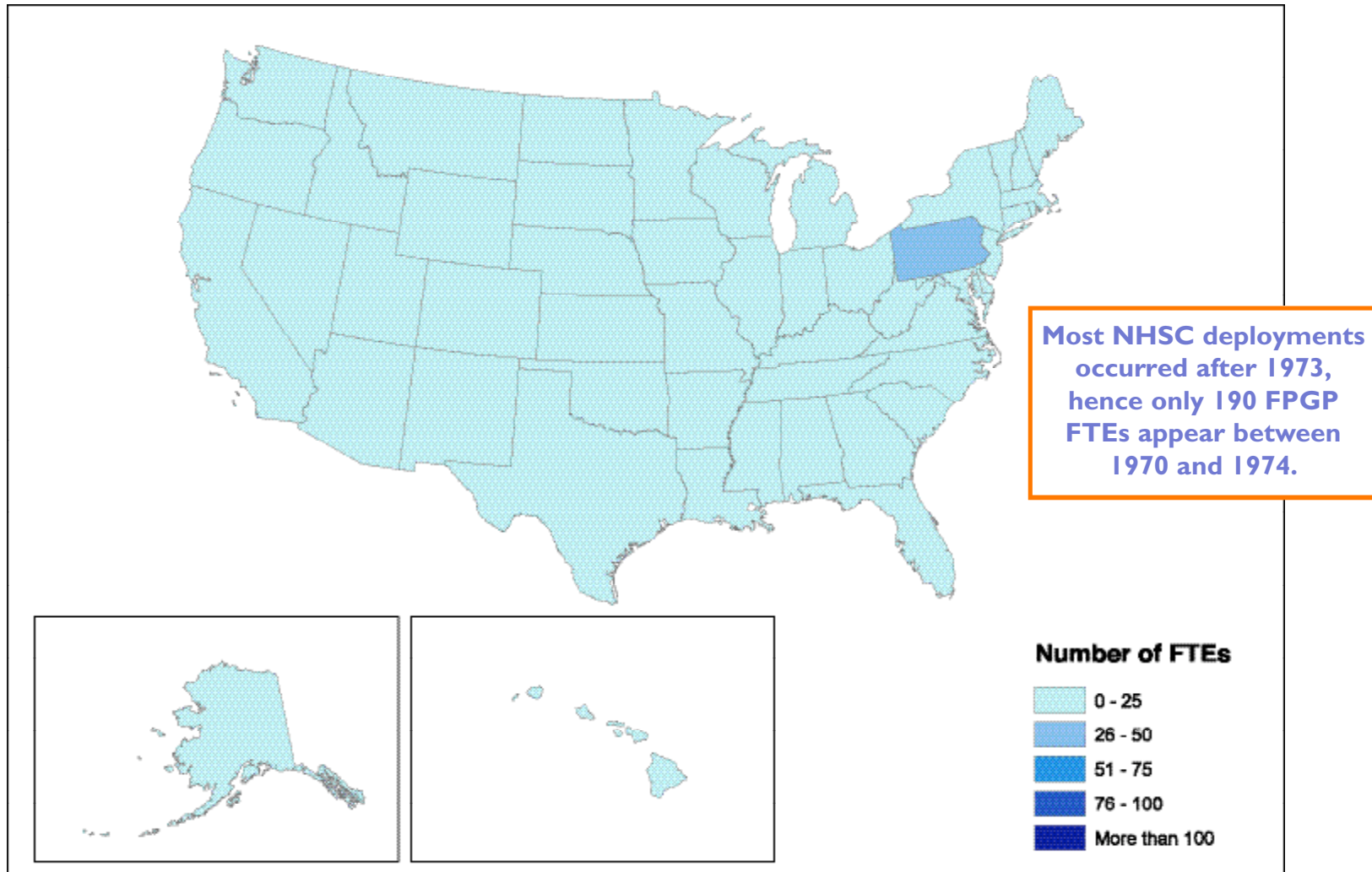
Data source: National Health Service Corps  
Prepared by the Robert Graham Center: Policy Studies in Family Medicine and Primary Care

Figure 8. NHSC Pediatrician FTEs, 1970-1999 (n=4184)



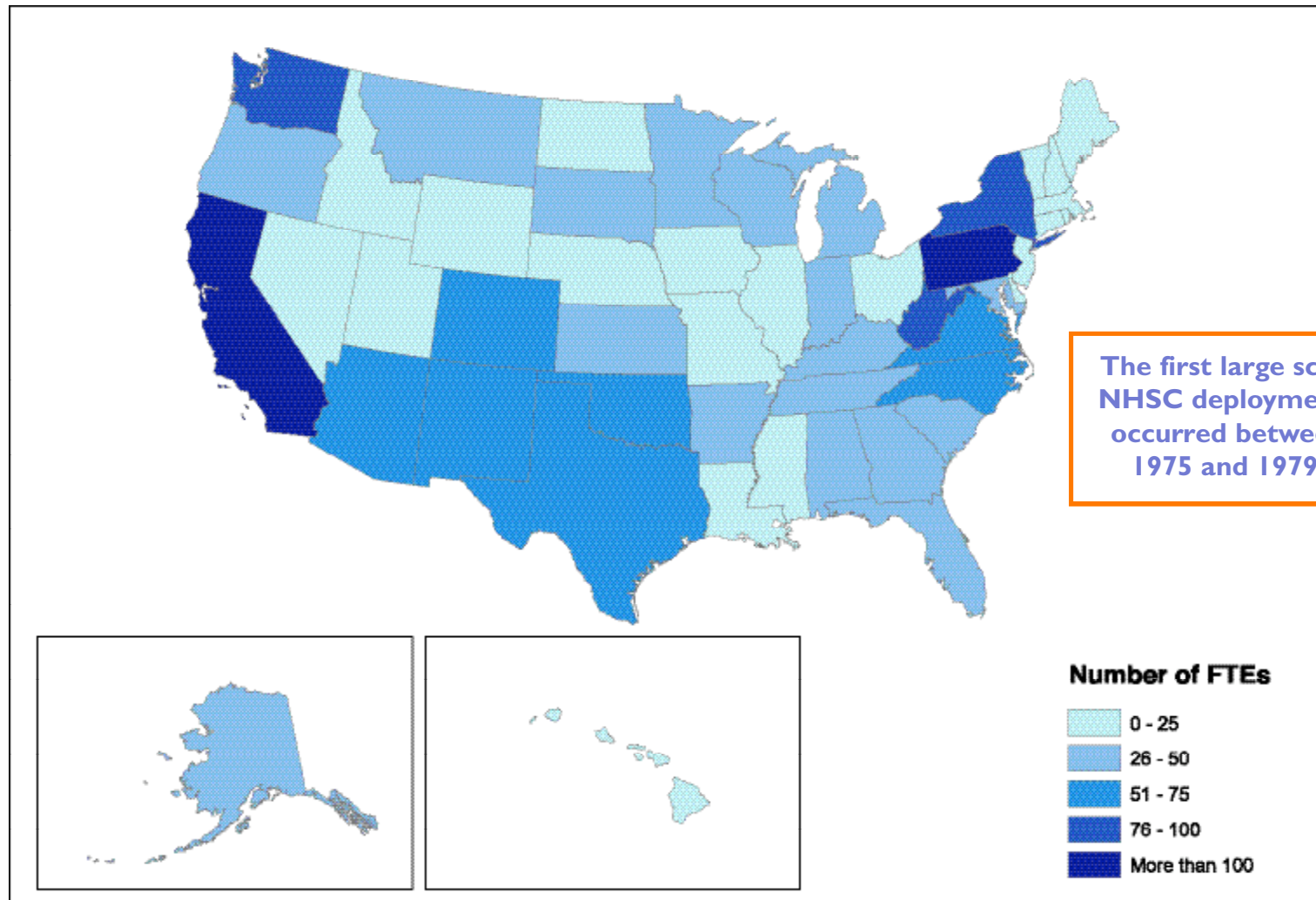
Data Source: National Health Service Corps  
 Prepared by the Robert Graham Center: Policy Studies in Family Medicine and Primary Care

Figure 9. NHSC Family Physician/General Practitioner FTEs, 1970-1974 (n=190)



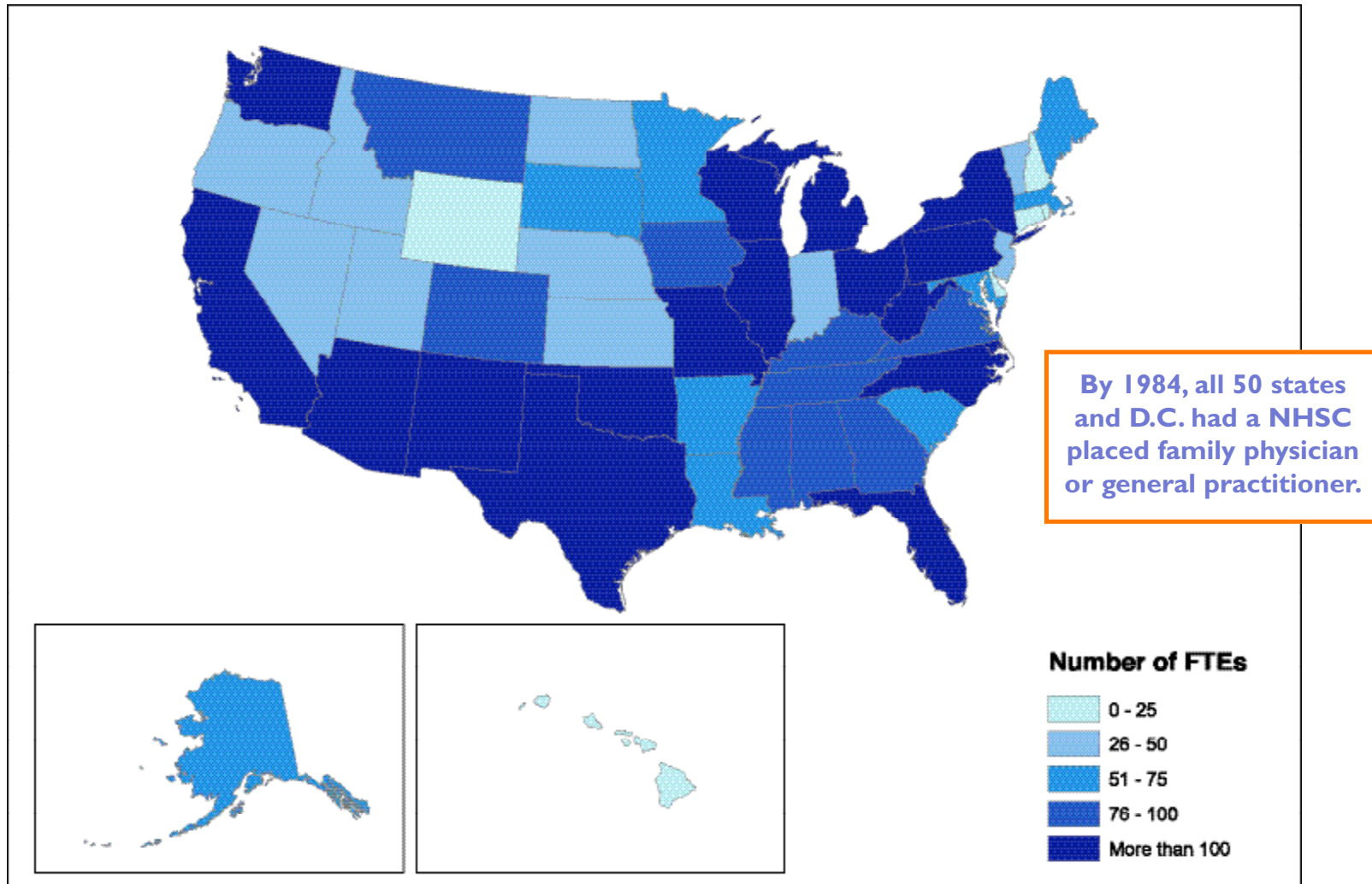
Data Source: National Health Service Corps  
Prepared by the Robert Graham Center: Policy Studies in Family Medicine and Primary Care

Figure 10. NHSC Family Physician/General Practitioner FTEs, 1975-1979 (n=1752)



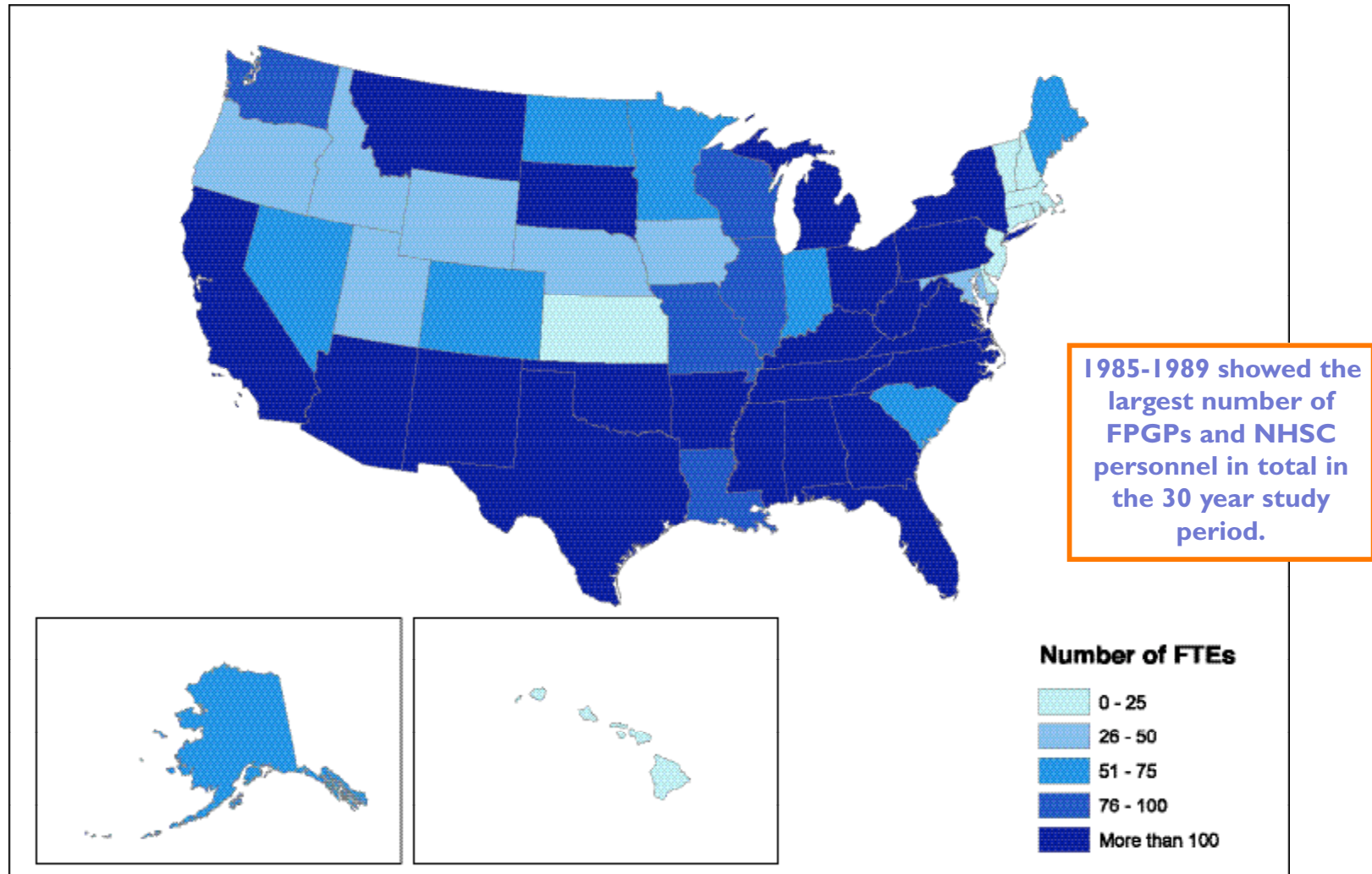
Data Source: National Health Service Corps  
 Prepared by the Robert Graham Center: Policy Studies in Family Medicine and Primary Care

Figure 11. NHSC Family Physician/General Practitioner FTEs, 1980-1984 (n=4429)



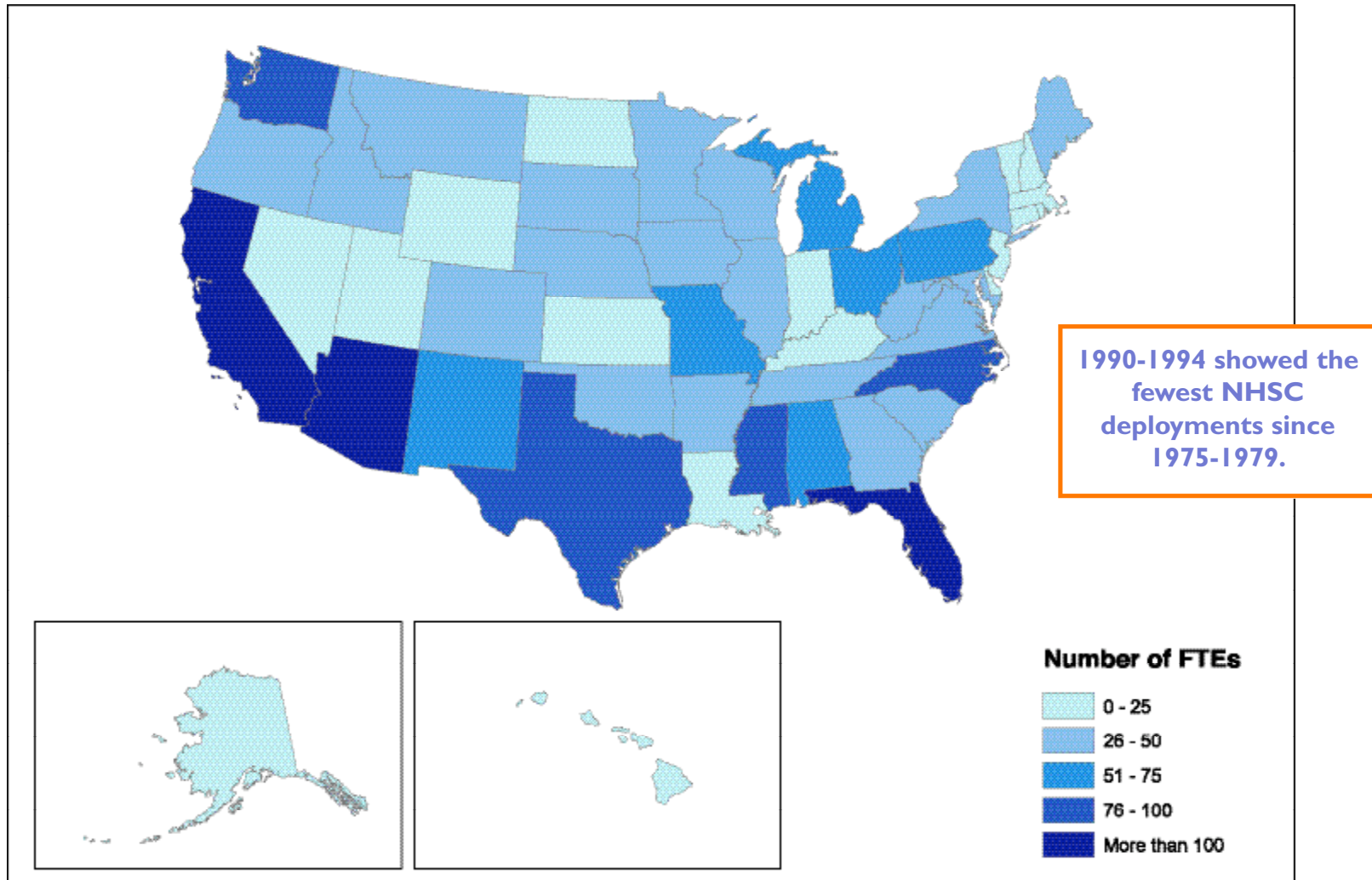
Data Source: National Health Service Corps  
Prepared by the Robert Graham Center: Policy Studies in Family Medicine and Primary Care

Figure 12. NHSC Family Physician/General Practitioner FTEs, 1985-1989 (n=4662)



Data Source: National Health Service Corps  
 Prepared by the Robert Graham Center: Policy Studies in Family Medicine and Primary Care

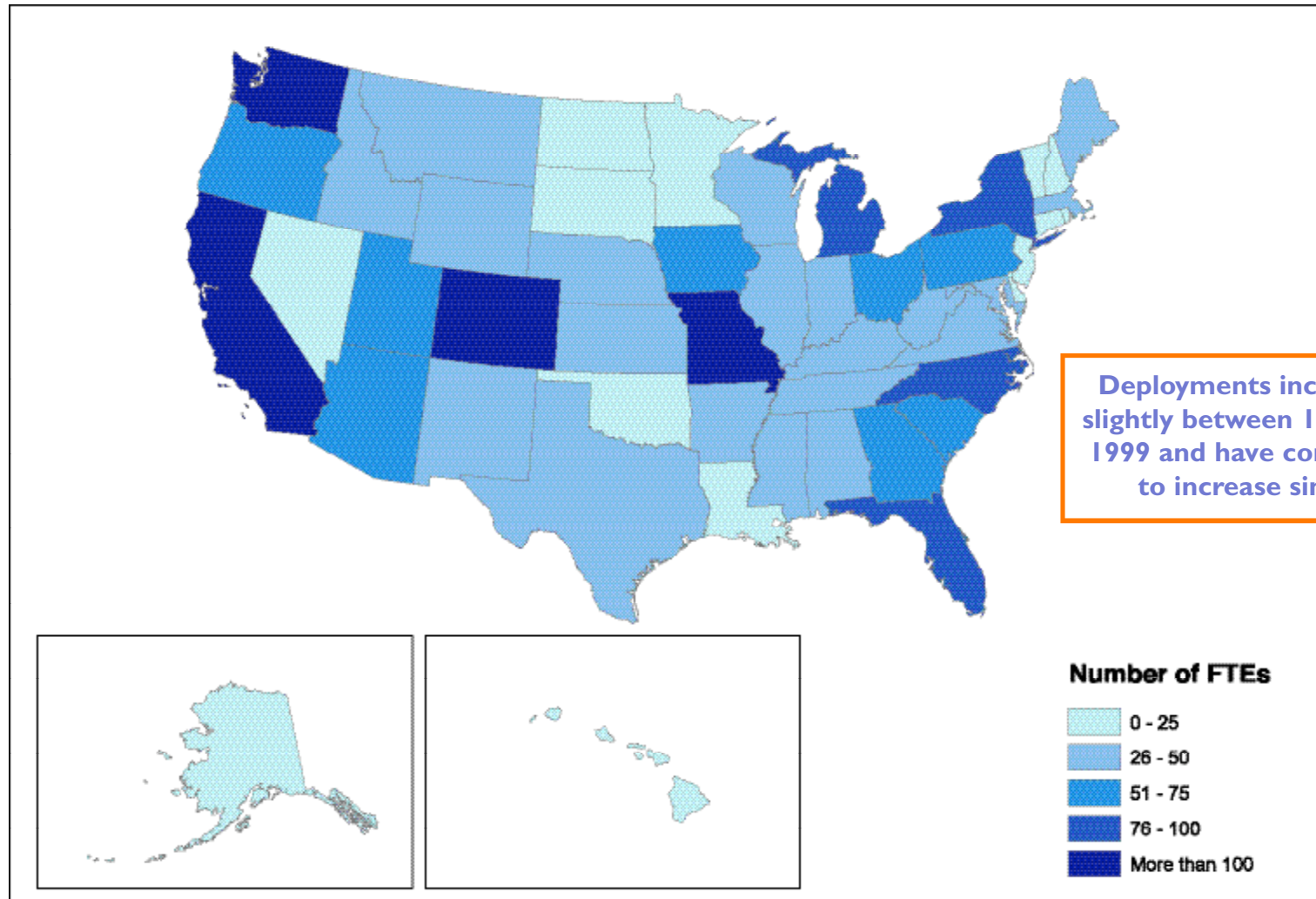
Figure 13. NHSC Family Physician/General Practitioner FTEs, 1990-1994 (n=2092)



Data Source: National Health Service Corps  
Prepared by the Robert Graham Center: Policy Studies in Family Medicine and Primary Care

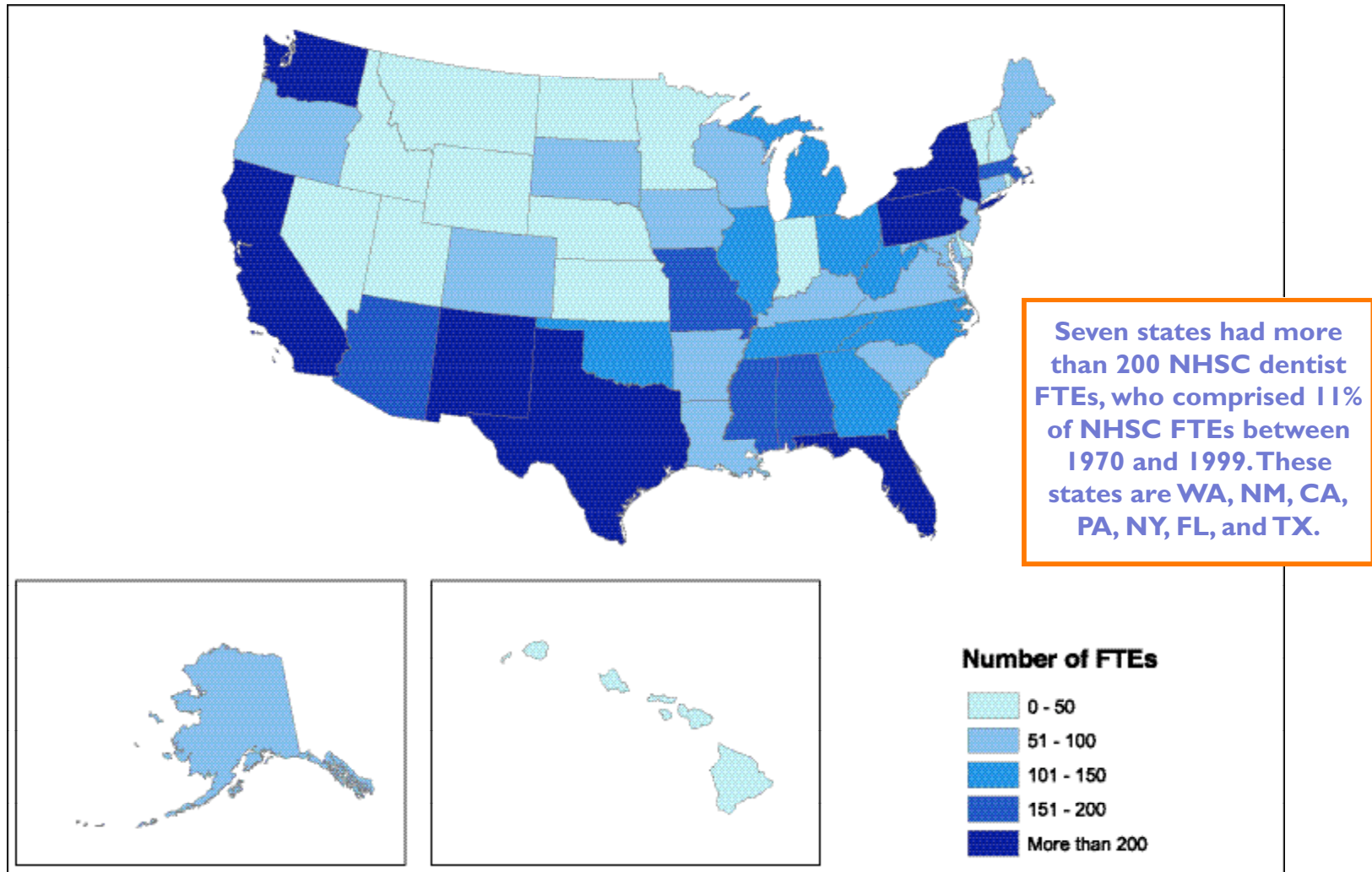


Figure 14. NHSC Family Physician/General Practitioner FTEs, 1995-1999 (n=2136)



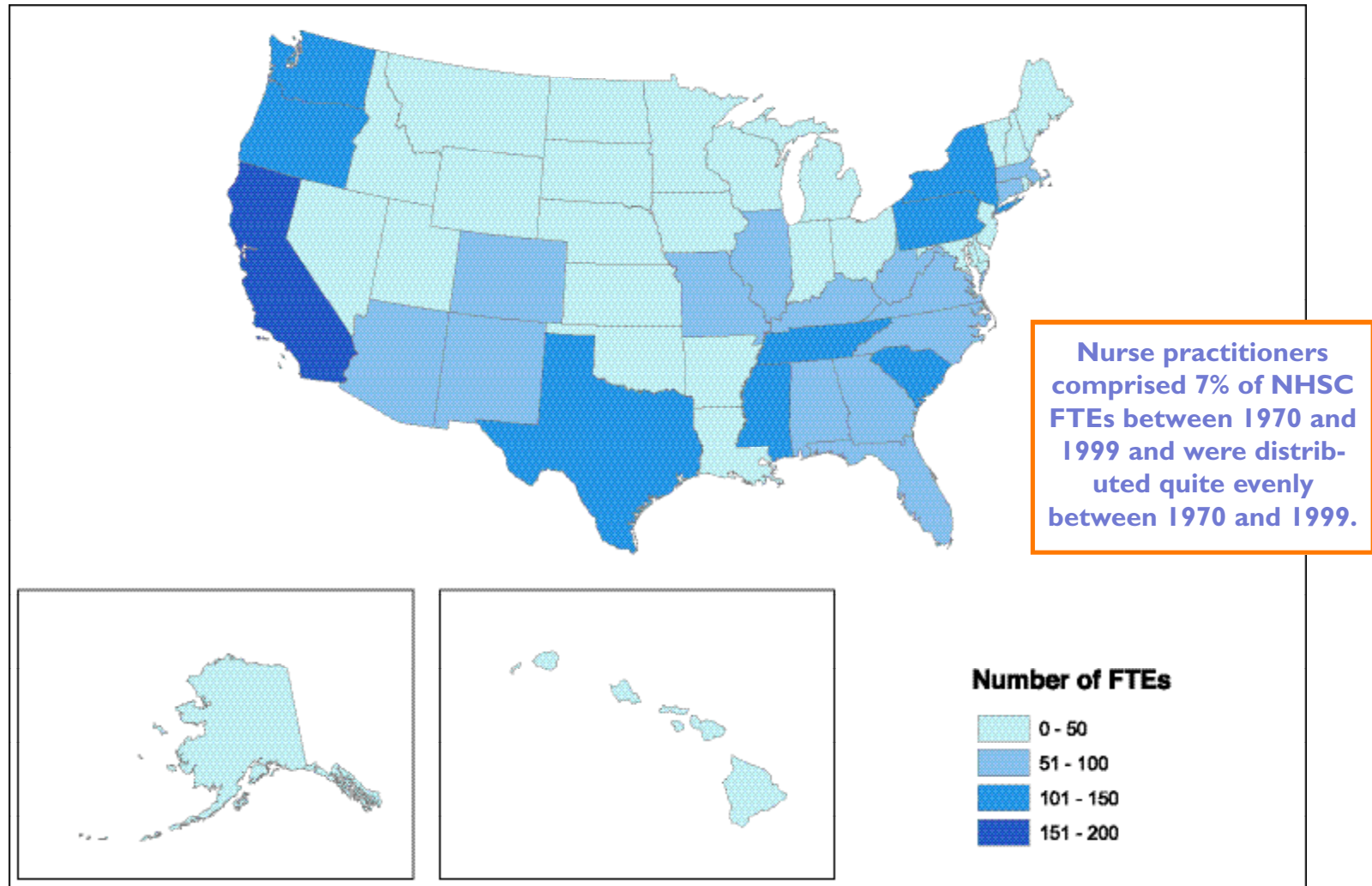
Data Source: National Health Service Corps  
 Prepared by the Robert Graham Center: Policy Studies in Family Medicine and Primary Care

Figure 15. NHSC Dentist FTEs, 1970-1999 (n=5496)



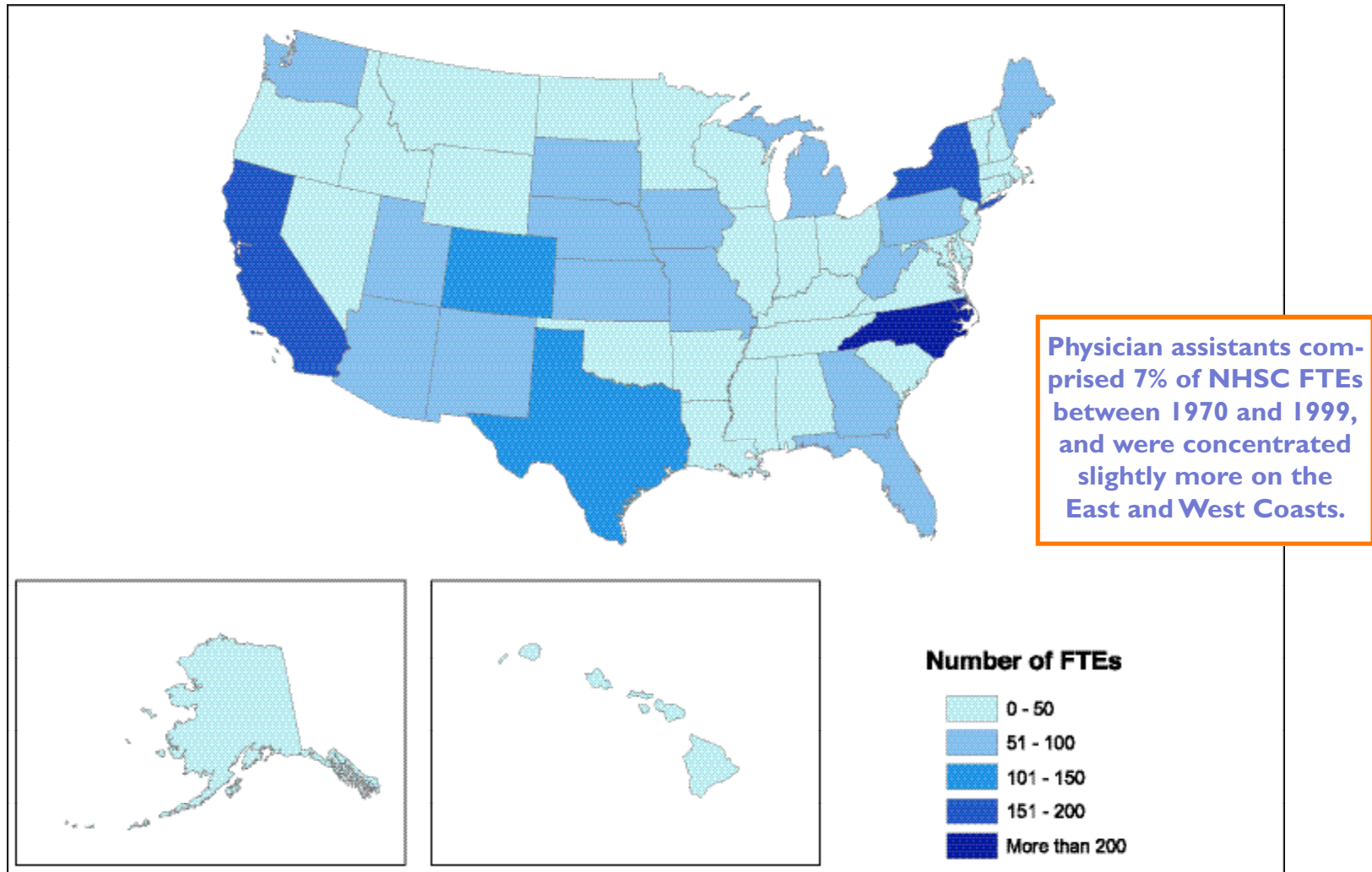
Data Source: National Health Service Corps  
 Prepared by the Robert Graham Center: Policy Studies in Family Medicine and Primary Care

Figure 16. NHSC Nurse Practitioner FTEs, 1970-1999 (n=2770)



Data Source: National Health Service Corps  
 Prepared by the Robert Graham Center: Policy Studies in Family Medicine and Primary Care

Figure 17. NHSC Physician Assistant FTEs, 1970-1999 (n=2315)



Data Source: National Health Service Corps  
Prepared by the Robert Graham Center: Policy Studies in Family Medicine and Primary Care

The Robert Graham Center convened an advisory committee to offer input on this research endeavor. The committee met twice in Washington, DC and participated in numerous conference calls and e-mail exchanges. The committee acted on an advisory basis only, and the final content in this report is the sole responsibility of the Robert Graham Center.

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## APPENDIX I: DETAILED METHODOLOGY

Analyses were not ecological – we examined people in actual counties with and without NHSC resources. To determine NHSC resource distribution between 1970 and 1999, we used NHSC historical files. These files, obtained from the NHSC, contained data on discipline, specialty, geographic location, and service duration for each NHSC clinician. We used these files to calculate person-years, which are defined as the total number of months served between 1970 and 1999, divided by 12. For example, if a clinician served six months in 1995, 12 months in 1996, and six months in 1997, the clinician contributed 24 months divided by 12, or two person years.

To determine rurality and racial, ethnic, and income characteristics of populations within counties, we used Census data reported in the publicly-available Area Resource File (ARF), sponsored by the U.S. Department of Health and Human Service's Health Resources and Services Administration (HRSA, 2003). The ARF is produced by Quality Resource Systems, Inc. (QRS) under contract to HRSA ([www.qrs-inc.com](http://www.qrs-inc.com)).

To examine primary care physician to population ratios, we used a series of the American Medical Association's archived Physician Masterfiles obtained from Medical Marketing Service, Inc. (Wood Dale, IL. <http://www.mmslists.com/main.asp>) We identified clinically-active allopathic and osteopathic primary care physicians—family physicians, general internists, general pediatricians and general practitioners—in each non-metropolitan (also known as non-MSA or rural) county nationwide as of December 31st 1981, 1986, 1991 and 1996. Counts from the NHSC historic files of NHSC primary care physicians present in each county in December of 1981, 1986, 1991 and 1996 were subtracted from the Masterfile primary care totals for those months to determine the number of non-NHSC primary care physicians in each county at these times. This selection strategy allowed approximately six months for Masterfile data to reflect the presence of newly-placed NHSC physicians and recently graduated non-NHSC physicians, both of whom typically relocate in July.<sup>3</sup> We combined the calculated non-NHSC primary care physician counts with total population estimates from the U.S. Census obtained from the publicly-available Area Resource File (ARF) (HRSA, 2003) to derive non-NHSC primary care physician-to-population ratios in nonmetropolitan counties in 1981, 1986, 1991 and 1996. Linear interpolation was used to estimate populations for these non-decennial years, assuming an even annual growth for counties from 1980 to 1990 and 1990 to 2000.

We contrasted changes in the physician workforce from 1984 through 2001 for two sub-groups of rural county HPSAs in 1984: (1) all 142 HPSA counties not served by the NHSC from 1979-2001 and (2) all 141 HPSA counties served by NHSC physicians, nurse practitioners or physician assistants in 1984 and at least 3 of the years from 1979-1983. Analyses of covariance were performed to assess the effect of NHSC service from 1979-1984 on direct patient care primary care physician to population ratios in 1981, 1986, 1991, 1996 and 2001 controlled for the following variables found in the ARF:

- (1) 1984 per capita income in dollars;
- (2) 1979 percent of persons below the poverty level;

- (3) 1980 unemployment rate for persons 16 years of age or older;
- (4) 1980 percent black population;
- (5) 1980 percent Spanish descent;
- (6) 1980 percent of persons 25 years of age or older with high school or more education;
- (7) 1994 presence of a hospital; and
- (8) 1994 presence of a rural health center.

To determine and compare health status and healthcare utilization for residents of counties with and without NHSC resources, we again used the NHSC historic data and the Area Resource File, specifically variables on the number and type of personnel serving at NHSC sites, other non-Federal healthcare resources, and Primary Care Health Professional Shortage Area (HPSA) designation. We linked to records of rural National Health Interview Survey participants for the years 1987-1996 at the National Center for Health Statistics (NCHS) Research Data Center (RDC) by county based on FIPS codes. This enabled us to compare the health status and healthcare utilization of Americans who reside in rural (non-MSA) designated Primary Care Health Personnel Shortage Area (HPSA) counties with NHSC resources with residents of such counties without NHSC resources.

To compare the mortality rates of NHSC-served and non-served counties, we used NHSC historic files to identify counties with NHSC resources. We calculated all-cause age-adjusted mortality rates for each rural HPSA and non-HPSA county using data from the Area Resource File, which includes mortality data from the National Center for Health Statistics. Three-year averaged age-adjusted mortality rates were calculated for each county during a baseline (1981-1983) and follow up period (1996-1998). Three year averages provided more stable rate estimates than single-year figures.

For additional information on these analyses see Pathman, Fryer, et. al.<sup>5</sup>

### **IMPLAN analysis**

Data on the number and discipline of NHSC personnel that were assigned to rural sites nationwide in 1999 were obtained from the HRSA Geospatial Data Warehouse (US DHHS, HRSA). Eleven states with the most rural populations were selected, using population data from the 2000 US Census. Data on the number and discipline of NHSC personnel that were assigned to rural sites in these 11 states were also obtained from the HRSA Geospatial Data Warehouse.

We used a standard input-output social accounting framework, IMPLAN software, and multipliers derived using 2002 structural matrices<sup>8</sup> to estimate the direct, indirect and induced economic impacts of the sector in which most NHSC personnel work in rural areas. The sector includes the rural sites where many NHSC physicians, dentists, physician assistants and nurse practitioners provide services.

The analysis was not repeated for the sectors including nursing home facilities, hospitals, or pharmaceuticals. The proportions of NHSC personnel with any direct economic relations with those sectors could not be estimated accurately.

We first estimated the total number of jobs due to the presence of the NHSC personnel. The literature shows that in most cases each provider needs between two and four clerical and clinical support staff persons to practice and provide clinical services.<sup>9</sup> The direct economic impacts were assessed separately in a sensitivity analysis assuming first two, and secondly four, support staff persons. Next, the number of total staff and total jobs generated was fed into the input-output model to derive the indirect and induced impacts on employment, economic output, value added and indirect business taxes in the area. As examples, economic impacts were estimated for two rural states: Alabama (45% rural) and Maine (60% rural).

For additional information on using IMPLAN to estimate economic impact, see Doeksen and Schott.<sup>7</sup>

### **Overall Limitations**

Potential incompleteness and inaccuracies in the Physician Masterfiles may have affected our findings. This study emphasized rural HPSAs, and results may vary if non-rural, or MSA, HPSAs were considered. Our data were limited to participants of the Federal NHSC program – state programs which compose about 15% of total NHSC resources are excluded. Mortality rates were not adjusted for racial composition, which has been shown to be associated with mortality. Finally, most NHSC clinicians captured in this study were Scholarship Program participants. In 2003 the NHSC shifted nearly 90% of its support to the Loan Repayment program, participants of which may distribute differently than Scholarship Program participants.



1. Rosenblatt RA, Andrilla CHA, Curtin T, Hart LG. Shortages of Medical Personnel at Community Health Centers: Implications for Planned Expansions. *JAMA*. 2006;295:1042-1049.
2. Green LA, Doodoo MS, Ruddy G, Fryer GE, Phillips RL, McCann JL, et al. The physician workforce of the United States: a family medicine perspective. Washington, D.C.: Robert Graham Center, 2004.
3. Singer JD, Davidson SM, Graham S, Davidson HS. Physician retention in community and migrant health centers. Who stays and for how long? *Med Care*. 1998;36:1198-1213.
4. Pathman DE, Fryer GE, Jr., Phillips RL, Smucny J, Miyoshi T, Green LA. NHSC staffing and the growth of the local rural non-NHSC primary care physician workforce. *J Rural Health*. 2006;22:285-293
5. Pathman DE, Fryer GE, Green LA, Phillips RL. Changes in age-adjusted mortality rates and disparities for rural physician shortage areas staffed by the NHSC: 1984-1998. *J Rural Health*. 2005 Summer;21(3):214-20.
6. Philippakos E, Hodges AW, Mulkey D. Economic Impacts of Healthcare in the Rural Health Networks of Florida. Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL.
7. Doeksen GA, Schott V. Economic importance of the health-care sector in a rural economy. *Rural Remote Health*. 2003 Jan-Jun;3(1):135.
8. Sorratini JA. Estimating Statewide Truck Trips Using Commodity Flows and Input-Output Coefficients. Transportation Research Record No. 1707, Freight Transportation Research. Transportation Research Board 2000.
9. Cost Survey: 2005 Report Based on 2004 Data. Englewood, Colo: Medical Group Management Association; 2005.