

HEALTH CARE AND HUMAN SERVICES POLICY, RESEARCH, AND CONSULTING—WITH REAL-WORLD PERSPECTIVE.

National Health Service Corps – An Extended Analysis

Final Report

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Executive Summary

In this study we continue our analysis of the National Health Service Corps (NHSC) with the purpose of gaining new insights into the program's performance regarding the distribution of providers in high-need areas. The objective of this study is threefold. First, we focus on the recent retention trends of NHSC program alumni in Health Professional Shortage Areas (HPSAs). Second, we analyze the retention patterns of those NHSC participants who serve in Indian Health Service (IHS) sites and compare them with that of all NHSC participants, and third, we examine the recruiting and retention effects of the program.

In a previous project (Lewin, 2014), we examined short- and long-term retention in HPSAs of providers who participated in NHSC LRP and SP and compared their retention with the retention of non-participants working in those areas, using data from the period 2000-2013. In the current study we increase the timeframe by adding two more years of NHSC administrative data (2014 and 2015) to determine whether the retention patterns changed over the more recent years, given the important recent program growth and changes. We update and expand the data infrastructure we constructed for the previous project, and as before, we rely on data on NHSC program participants, Provider360 data, Medicare data and data on HPSA designations. Our current NHSC data covers the period between 2000 and 2015, the Provider360 data is recorded as of January 2015, and the Medicare data spans the period between 2005 and 2014. The Provider360 and the Medicare data allow us to observe NHSC participants and their location after their separation from service. Combining their post-service location with information on whether that location is a HPSA or not, we construct HPSA retention statistics for all the program participants that we identified in Provider360 or Medicare data.

To analyze retention patterns, similar to Lewin (2014), we construct four variables:

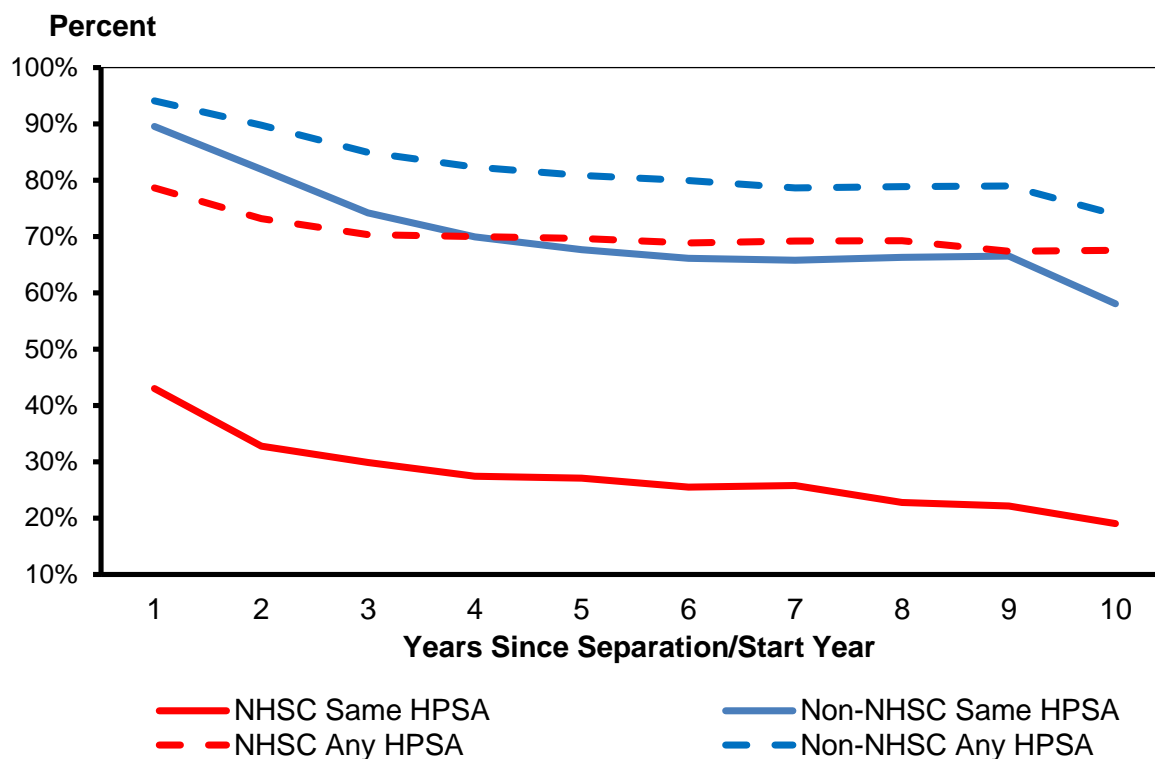
- ▶ Serving in the same HPSA and in the same county. This variable takes the value of 1 if the NHSC provider remains in the same county as the one where he or she served in NHSC, and 0 otherwise.
- ▶ Serving in a HPSA in another county. This variable takes the value of 1 if the NHSC provider remains in a HPSA that is located in a different county than the one in which he or she served while in NHSC service, and 0 otherwise.
- ▶ Serving in a non-HPSA from the same county. This variable takes the value of 1 if the NHSC provider moves to a non-HPSA area from the county where he or she served while in NHSC, and 0 otherwise.
- ▶ Serving in a non-HPSA in another county. This variable takes the value of 1 if the NHSC provider moves to a non-HPSA area from another county than the county he or she served while in NHSC, and 0 otherwise.

We create these measures for non-participants as well, but the reference point is not the year when they left service, but the first year ("start year") they appear in the Medicare data. Using the above variables, we construct retention rates as the ratios between the number of providers in the same (or any) HPSA and the total number of providers leaving service in a given year. These rates are calculated one year after separation from NHSC, two years after separation from NHSC and so on. In the case of non-participants (that are available to us from the Medicare data and Provider360 data), the annual retention rates are calculated one year since the start year, two years since the start year and so on for each cohort.

Post-Service HPSA Retention Analysis

In Figure ES.1 we show that about 79% of the NHSC participants serve in primary care HPSAs one year after completion of their NHSC service. Less than half of participants who are still in primary care HPSAs one year after separation are actually in the same county as the one in which they served while in service (i.e., 43% of participants). There is a fairly steep decline in the retention rate in years 2 and 3 after separation (by about 10 and 3 percentage points, respectively), followed by a lower decline thereafter.

Figure ES.1: Retention Rates of NHSC Participants and Non-Participants—Primary Care



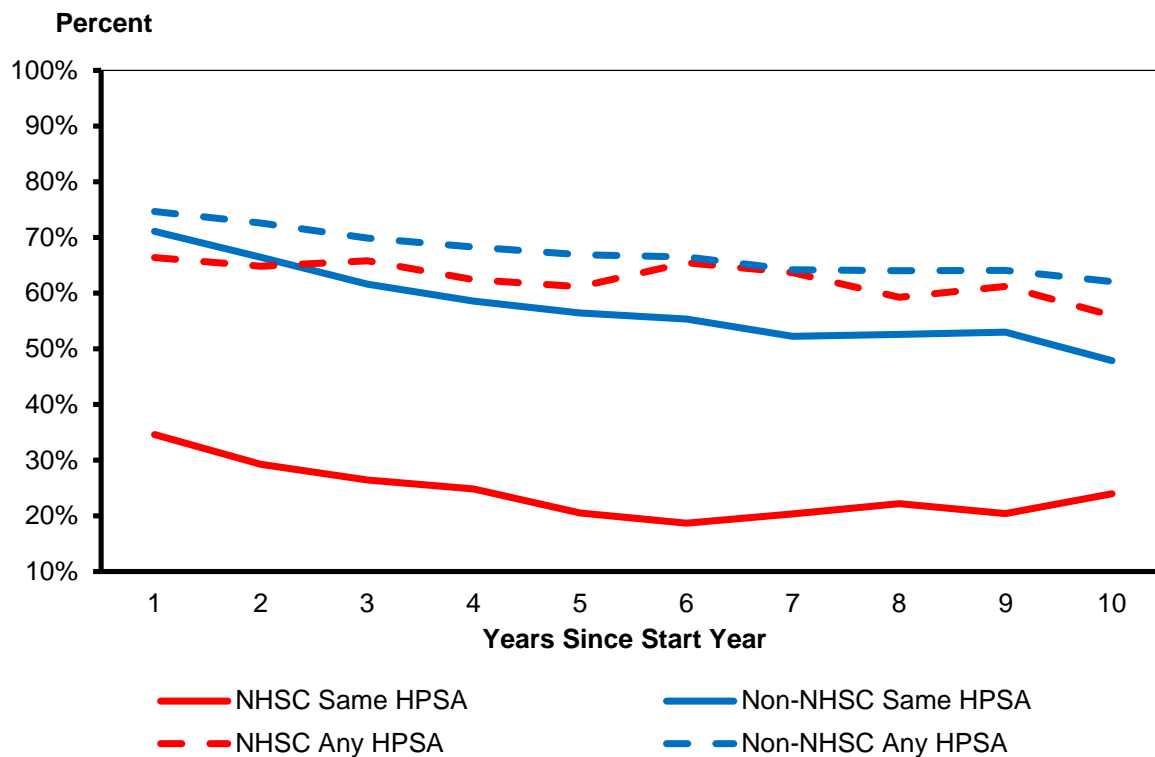
Focusing on non-participants, we note that their retention rates in primary care HPSAs are always higher than the retention rates of participants, both in terms of retention in the same HPSA as well as in terms of retention in a different HPSA. Their retention also drops after we first observe them in the data (their 'start' year). One year after we first observe non-participants in HPSAs, 94% of them are still in HPSAs. Moreover, a very large fraction of them (89% of all non-participants) remain in the same HPSAs where they were first observed. The retention rates in any HPSAs decline by about 3-4 percentage points every year thereafter, while the retention rates in the same HPSA decline at a slightly faster rate (about 6-7 percentage points per year). These rates indicate that once non-participant providers serve in a HPSA, they tend to remain in those areas, and to some extent even when they move, they migrate from one HPSA to another.

In Figure ES.2 we present the retention rates in mental health HPSAs. The retention rates of participants are lower in mental health HPSAs than in the case of primary care HPSAs. The fraction of participants serving in the same HPSA as during the program drops from 35% in the first year to 29% in the second year, and to 27% in the third year since separation. From then on

it hovers between 19% and 24%. The retention rate of participants in any mental health HPSA is relatively constant over the years, ranging between 56% and 67%.

Similar to primary care HPSAs, non-participants in mental health HPSAs are more likely to stay in the same HPSA than participants. Their retention rate declines by 3-4 percentage points each year since the start year, while the retention rate in any HPSA declines at a lower rate, about 2-3 percentage points. It is important to note that the retention rate in any mental health HPSA is similar across participants and non-participants, especially in the further out years.

Figure ES.2: Retention Rates of NHSC Participants and Non-Participants—Mental Health



It is important to note that we dropped from the retention analyses in Figures ES.1 and ES.2 the NHSC participants who left service in 2015, which is the last year of our timeframe.

A Comparison with Previous Retention Results

In the case of primary care providers, the “same HPSA” retention rates in the first years after separation from service are lower than in Lewin (2014). Specifically, the retention rates from this study are between 6 to 10 percentage points lower than in Lewin (2014) for the first years since separation, with the difference being larger in the further-out years. This suggests that the primary care providers who left NHSC in the more recent years leave the HPSA where they served at higher rates than before.

However, when comparing the “any HPSA” retention rates, it turns out that although the retention rates from this study are smaller than the ones reported in Lewin (2014), the differences are much smaller than in the case of “same HPSA” retention (about 2-3 percentage points). This suggests that NHSC alumni still remain in HPSAs at elevated rates (just as

documented in Lewin 2014), but the moves from the “same HPSA” to “any HPSA” locations are more frequent in the more recent years than in the past.

Similarly, in the case of mental health providers, the “same HPSA” retention is smaller than in Lewin (2014), by values between 2 and 12 percentage points. The differences in “any HPSA” retention are much smaller (between 1 and 2 percentage points, with one exception). As in the case of primary care providers, this points to: (i) an increase in the frequency with which providers move out of the HPSAs where they served while in NHSC; and (ii) a large fraction of these moves out of “same HPSA” have as a destination another HPSA, such that the “any HPSA” retention is overall very close to the “any HPSA” retention from the previous study.

We develop a theoretical framework in which a zero difference between the retention rates of participants and non-participants is equivalent to a zero recruiting effect. We define the recruiting effect as the program’s success in attracting providers who would not serve in HPSAs without the incentive. Since the average HPSA preference for the newly attracted providers is lower than the average preference of the rest of the providers, it follows that the post-obligation retention rate of participants is lower than that of non-participants. Importantly, the retention differential becomes larger when the recruiting effect is larger.

In Lewin (2104), the average retention differential between non-participants and participants over the first six years since separation/start year is 11.7 percentage points for primary care providers, and 3.3 percentage points for mental health providers. It turns out that in our study the average retention differential over the first six years since separation/start year is 13.6 and 5.4 percentage points for primary care and mental health providers, respectively. This increase in the retention differential is consistent with an increase in the program recruiting effect. It is in fact possible that the increase in the program generosity and program outreach that were the result of the ACA and ARRA changes in the 2009-2011 period resulted in more and more providers who would not have served in HPSAs in the absence of the NHSC award. If that were the case, then these new program participants had a smaller retention rate, potentially indicating that the program’s recruiting effect over the last few years may have increased.

As we show in Chapter IV, these differences do not seem to be driven by other provider-level or local-level characteristics, such as age, gender, provider type, local area income, or percent of the population under poverty rate.

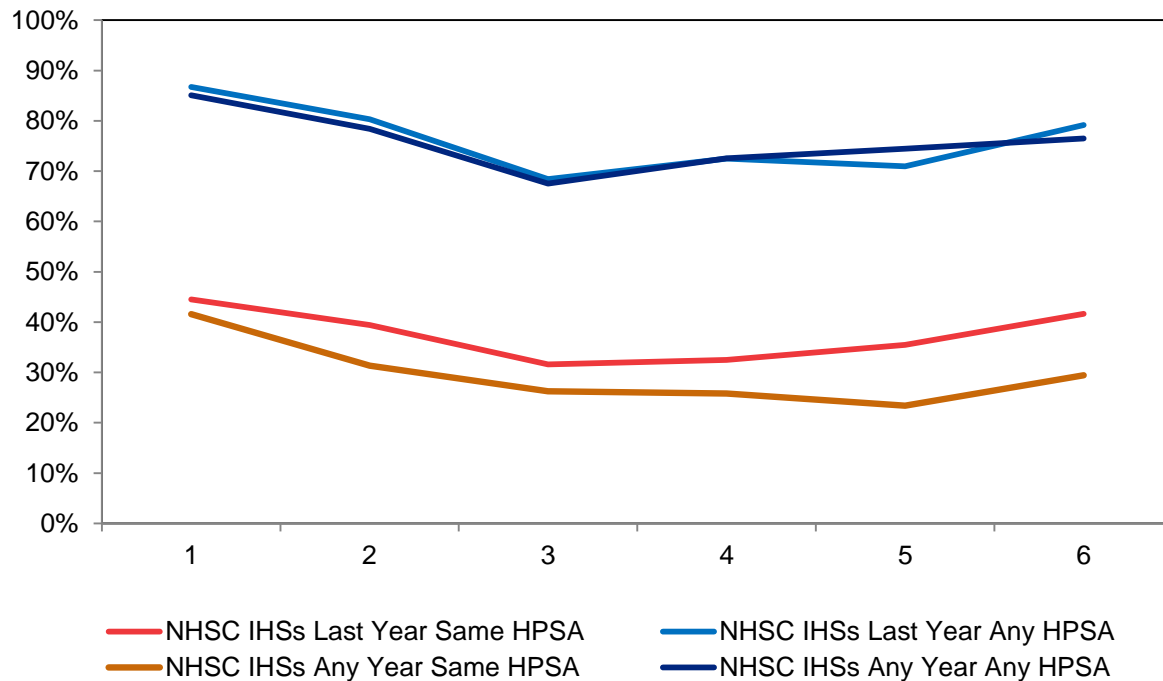
A Comparison with NHSC Participants Who Served in Indian Health Service Sites

In Figure ES.3 we present the retention profiles in the same HPSA as well as in any HPSA using the same methods described above for NHSC participants who served in IHS sites. Given that IHS sites change their destination somewhat frequently over our timeframe, we construct the “same HPSA” and the “any HPSA” retention rates by whether the provider was ever working in an IHS site, and whether the provider was last observed in service in an IHS site. The “same HPSA” retention rates are similar to the “same HPSA” retention rates from Figure ES.1 for all NHSC providers. The retention rate based on whether the provider was ever in an IHS site is lower than the retention rate of providers who leave NHSC service from IHS sites.

Despite the fact that the “same HPSA” retention of the NHSC-IHS providers who were ever in an IHS site is lower than that of the NHSC-IHS providers who left service from an IHS site (especially for the further out years), the “any HPSA” retention rates of these categories are virtually indistinguishable from each other. Nonetheless, the NHSC-IHS “any HPSA” retention rates are larger than the “any HPSA” retention rates of all NHSC participants. There a number of limitations that preclude us from making direct comparisons with the “any HPSA” retention rates of all NHSC providers, but this higher retention rate of NHSC-IHS alumni may point to a

higher preference for serving IHS site populations, and thus a higher preference for serving in NHSC in general.

Figure ES.3: Retention Rates of NHSC Participants in Indian Health Sites – Primary Care



Recruiting and Retention Effects

In order to be effective, NHSC must be able to induce some providers to locate in HPSAs given that they would not have otherwise chosen those locations. A large number of providers do practice in HPSAs and do not need an incentive to do so. However, those who would have located in HPSAs without the incentive may apply for and receive the incentive if they are eligible. Hence, the payment of the incentive to these providers does not increase the supply of providers in HPSAs. Conversely, some providers who would not have chosen to practice in HPSAs may be induced to do so by the program. If so, they increase the supply of providers in the area. This is what we call the *recruiting effect* of the NHSC program. A larger recruiting effect translates into a greater success of the program, given that the supply of providers in HPSAs is larger than what it would be in the absence of the program.

Also, the NHSC program generates a *retention effect* to the extent that NHSC providers serve in HPSAs longer than what they would if there were no program. Ultimately, this effect is defined following the same logic as for the recruiting effect, of whether the program directly increases the supply of medical services in HPSAs, relative to a case when the program does not exist.

Estimation of the recruiting effect is based on an empirical specification in which the total number of providers currently serving in a HPSA is modeled as a function of the number of NHSC participating providers serving in that area. A one-to-one increase in the number of providers as a result of NHSC participation is interpreted as evidence that the program attracts only providers who would not serve there without the incentive, whereas a zero effect of

program participation on providers is interpreted as consistent with the notion that the program does not attract any new providers in the area—all would have practiced in the HPSA regardless of the incentive. These are extreme cases, and the reality lies between the two bounds, but an estimated effect that is closer to 1 indicates a larger recruiting effect, whereas an effect that is closer to 0 indicates a smaller recruiting effect. In this model we control for past levels of providers in the area, as well as for a number of relevant local level characteristics that typically influence the location choices of providers.

Regarding the retention effect, we make use of a novel dataset, that of providers who were deemed eligible for NHSC funding in the application process, but ended up not receiving funding, mainly because of funding limits. A comparison between the time served in HPSAs by NHSC participants and the time served in HPSAs by non-participating providers may not yield a true retention effect of the program, as the two provider populations may be inherently different in terms of characteristics we cannot measure in the current data. The differential retention patterns between participants and non-participants may be a combination of the true program retention effect and the effect of other, non-program related factors. Given that, arguably, the unfunded providers represent a provider population that is similar to that of actually funded providers, a comparison between these two categories will mitigate the influence of other factors, and help us better isolate the actual retention effect of the program.

Our estimates of recruiting and retention effects indicate substantial increases in the number of FTE-years generated by NHSC in HPSAs. We estimate that over the entire period considered, NHSC increased the number of primary care physician FTE-years in HPSAs by about 12,500, the number of NP/PAs FTE-years by about 35,000 and the number of mental health provider FTE-years by 28,000.

In this study we face a number of important data limitations in the estimation of the recruiting and retention effects. Hence, our estimates should be viewed with caution. However, regardless of the exact value of the total effect on the number of provider-years in HPSAs, our estimates presented in Chapter VI point to potential important program effects of the NHSC program in increasing the number of providers in high-need areas—providers that would not be there with the NHSC incentive. This study advances current knowledge on the NHSC program effect, and offers a pathway for further causal effect analyses, once more data on participants and eligible unfunded providers becomes available in the future.

Introduction

In this study we continue our analysis of the National Health Service Corps (NHSC) with the purpose of gaining new insights into the program's performance regarding the distribution of providers in high-need areas. The objective of this study is threefold. First, we focus on the recent retention trends of NHSC program alumni in Health Professional Shortage Areas (HPSAs). Second, we analyze the retention patterns of those NHSC participants who serve in Indian Health Service (IHS) sites and compare them with that of all NHSC participants, and third, we examine the recruiting and retention effects of the program.

The NHSC is administered by the Bureau of Health Workforce (BHW) in the Health Resources and Services Administration (HRSA). Its stated goal is to improve the geographic distribution of the health care workforce in HPSAs by providing financial support to eligible providers who serve in those areas. The NHSC funds a Loan Repayment Program (LRP) and a Scholarship Program (SP). Since 2009, the LRP's generosity has increased significantly. In FY 2014, providers participating in LRP received up to \$30,000 per year for a 2-year commitment (relative to typically \$25,000 per year in previous years) in a HPSA with scores between 0 and 13, and up to \$50,000 for a 2-year commitment in a HPSA with scores of 14 or higher. The statute allows for up to \$35,000 per year (or \$70,000 over two years). Upon the conclusion of an initial service obligation period, NHSC providers may apply for additional loan repayment funding in return for further service. The Scholarship Program offers funding for up to four years of medical school in exchange for an obligation to serve in a HPSA for a time that is equal to the time the provider received the scholarship.

The NHSC deployed 9,700 health care professionals to thousands of sites across the country in 2015 (HRSA Congressional Justification for 2017).¹ In the FY 2017 Department of Health and Human Services (DHHS) budget, President Obama proposes boosting the National Health Services Corps to 15,000 a year over 2018-2020 (HRSA Congressional Justification for 2017). These clinicians include primary care physicians, primary care nurse practitioners, certified nurse-midwives, primary care physician assistants, dentists, registered dental hygienists, health service psychologists, licensed clinical social workers, psychiatric nurse specialists, marriage and family therapists, and licensed professional counselors. These professionals deliver critical medical, dental, and mental health services in geographic areas, facilities, and populations that have limited access to health care services (Health Resources and Services Administration, 2016).

In a previous project (Lewin, 2014), we examined short- and long-term retention in HPSAs of providers who participated in NHSC LRP and SP and compared their retention with the retention of non-participants working in those areas, using data from the period 2000-2013. In the current study we increase the timeframe by adding two more years of NHSC administrative data (2014 and 2015) to determine whether the retention patterns changed over the more recent years, given the important recent program growth and changes. We update and expand the data infrastructure we constructed for the previous project, and as before, we rely on data on NHSC program participants, Provider360 data, Medicare data and data on HPSA designations. Our current NHSC data covers the period between 2000 and 2015, the Provider360 data is recorded as of January 2015, and the Medicare data spans the period between 2005 and 2014.² The Provider360 and the Medicare data allow us to observe NHSC participants and their location after their separation from service. Combining their post-service

¹ These numbers do not include participants in state loan repayment programs.

² In Lewin (2014), the NHSC data spanned the 2000-2013 period, Provider360 was recorded as of December 2013, and the Medicare data covered the 2005-2011 period.

location with information on whether that location is a HPSA or not, we construct HPSA retention statistics for all the program participants that we identified in Provider360 or Medicare data.

Like in the previous study (Lewin, 2014), we construct two individual-level analytic datasets. In the first analytic dataset we combine annual, individual-level administrative data on NHSC participants with annual, individual-level data from the Medicare file. The main advantage of this dataset is that it is longitudinal, thus allowing us to track the location of providers in every year of their NHSC obligation, as well as in every year (up to 2014) after separation from service. The second analytic dataset combines administrative NHSC data with individual-level data on NHSC alumni as of January 2015. With this dataset, we are able to analyze the retention patterns of NHSC providers by using two points in time: at the time of their service separation, and January 2015.

With these two datasets, we construct descriptive statistics of retention, by calculating the retention rates as the fraction of NHSC alumni who still serve in the same HPSA where they served while in NHSC, relative to the total number of NHSC providers who left service in that HPSA in a given year. This is what we call “same HPSA” retention, and we calculate it at various points in time after separation from NHSC. We also construct “any HPSA” retention rates by counting in the numerator – along with the “same HPSA” providers - all NHSC alumni who serve in HPSAs other than the HPSA where they served under the NHSC obligation. These rates are calculated by provider type, and provider discipline. We also calculate these rates for the NHSC alumni who served in IHS sites.

An important contribution of this study is that we provide new insights into the recruiting and retention effects of the program. We define the recruiting effect as the success of the program in attracting to HPSAs providers who would not have served in those areas without the NHSC incentive. It is important to note that this measure is *smaller* than the number of actual NHSC participants, because in reality some NHSC participants would serve in HPSAs even if there were no program. Our definition of the recruiting effect excludes the latter category, and therefore focuses only on the providers who offer services beyond what would be offered in HPSAs without the NHSC program. In a similar fashion, we define the retention effect of the program as the increase in the number of providers who serve in HPSAs longer than they would have in the absence of the program.

Estimation of the recruiting effect is based on an empirical specification in which the total number of providers currently serving in a HPSA is modeled as a function of the number of NHSC participating providers serving in that area. A one-to-one increase in the number of providers as a result of NHSC participation is interpreted as evidence that the program attracts only providers who would not serve there without the incentive, whereas a zero effect of program participation on providers is interpreted as consistent with the notion that the program does not attract any new providers in the area. These are extreme cases, and the reality lies between the two bounds, but an estimated effect that is closer to 1 indicates a larger recruiting effect, whereas an effect that is closer to 0 indicates a smaller recruiting effect. In this model we control for past levels of providers in the area, as well as for a number of relevant local level characteristics that typically influence the location choices of providers.

Regarding the retention effect, we make use of a novel dataset, that of providers who were deemed eligible for NHSC funding in the application process, but ended up not receiving funding, mainly because of funding limits. A comparison between the time served in HPSAs by NHSC participants and the time served in HPSAs by non-participating providers may not yield a true retention effect of the program, as the two provider populations may be inherently different in terms of characteristics we cannot account for in the current data. The differential retention

patterns between participants and non-participants may be a combination of the true program retention effect and the effect of other, non-program related factors. Given that, arguably, the unfunded providers represent a provider population that is similar to that of actually funded providers, a comparison between these two categories will mitigate the influence of other factors, and help us better isolate the actual retention effect of the program.

The main body of the report is organized as follows: in Chapter II we discuss our data sources and the construction of the analytical datasets, along with the main measures. In Chapter III we present descriptive statistics of the population of NHSC participants and non-participants, while in Chapter IV we present the retention rates of NHSC participants, followed by a regression analysis in which we attempt to determine how much of the retention differential between NHSC alumni and non-participants is explained by program participation, by controlling for a host of observable factors, including the provider's medical discipline, age and gender as well as other factors such as local area median income and percentage of the population in poverty. In Chapter V we focus on the retention of NHSC alumni who serve in IHS sites, while in Chapter VI we present the results from our analysis of the recruiting and retention effects. Chapter VII concludes the report, along with a discussion on the key limitations of this study and potential future extensions.

Data Sources and Analytic Datasets

We follow the strategy from Lewin (2014) to construct two analytic datasets for our empirical analyses. These datasets are constructed by linking administrative information on NHSC participants with proprietary and public data on providers that allow us to track NHSC alumni in the years after obligation completion. A detailed description of the data sources, along with a discussion on the strategy we used to construct the two analytical datasets is available in Lewin (2014). In what follows we review the main features of the various datasets and then focus on the new data elements that allow us to update and expand the previous analysis.

NHSC Administrative Files and Provider Datasets

The NHSC administrative files provided to us by HRSA include all providers who entered the NHSC programs over the period 2000-2015. These files include annually updated, individual information on where each participant was located while serving under the NHSC obligation. Of the total number of 28,388 providers, 11,868 are physicians, 8,718 are nurse practitioners (NP) or physician assistants (PA) and the remaining 7,802 individuals represent other providers, such as dental or behavioral health providers. Other important individual demographic and award/service characteristics, include: age, gender, race/ethnicity, award year, entry year, type of award, length of initial service obligation, funds received, practice type, provider type, location, and separation year.

Table II.1 provides relevant statistics about the composition of the NHSC participants in each year of the 2000-2015 timeframe. Perhaps the most important feature is the marked increase in the number of participants, especially in the more recent years, from a total of 7,080 providers participating in the program in 2010, to 10,513 in 2015. This is not surprising, since these are the years when ACA and ARRA stipulations on the number of awards and generosity of awards came into effect. These changes made NHSC very attractive for an increasing number of providers.

More than half of this increase of 3,433 providers is due to an increase in the number of “Other” providers participating in the program, about a third due to an increase in nurse practitioners and physician assistants (NP/PA), and about a sixth due to increases in the number of participating physicians. The fraction of physicians in the total field strength decreased from 50% in 2010 to 39% in 2015, while the fraction of “Other” providers increased from 21% to 31% over the same period. In terms of NHSC program type, virtually all the increase in field strength in the second half of the period is attributable to LRP. Also, female providers represented 74% of all participants in 2015 (up from 69% in 2010, and 64% in 2005), while the fraction of White providers increased from 54% in 2010 to 68% in 2015. In Appendix Table A.1 we present the distribution of the NHSC workforce by provider discipline. It is clear that there was a substantial increase in the number of mental health providers in the last few years.

In Table II.2 we present the characteristics of the new providers who join service in every year between 2000 and 2015. Focusing on new entrants, one can notice that the number of providers starting service in 2010 is almost double the number of new entrants in 2009. Also, the new entrants that started service after 2010 were more likely to be White, female, non-physicians and joining the program through LRP. These recent flows into the NHSC workforce ended up changing the distribution of the NHSC workforce as we show in Table II.1.

Table II.1: Select Socio-Demographic Characteristics of NHSC Participants by Entry Year

Entry Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total	919	1,063	1,464	2,396	3,009	3,421	3,386	3,239	3,180	4,239	7,080	9,768	9,585	8,489	10,392	10,513
Type																
<i>MDs</i>	592	685	874	1,364	1,684	1,998	2,025	1,979	1,977	2,435	3,515	4,395	4,295	3,849	4,400	4,088
<i>NP/PAs</i>	227	254	391	635	807	865	799	767	731	1,081	2,095	3,015	2,879	2,474	3,116	3,179
<i>Other</i>	100	124	199	397	518	558	562	493	472	723	1,470	2,358	2,411	2,166	2,876	3,246
Gender																
<i>Males</i>	398	443	552	891	1,129	1,247	1,208	1,136	1,091	1,368	2,057	2,708	2,597	2,280	2,762	2,699
<i>Females</i>	520	619	911	1,504	1,879	2,173	2,177	2,102	2,088	2,869	4,878	6,904	6,831	6,049	7,479	7,734
Program																
<i>LRP</i>	806	880	1,186	2,057	2,622	2,960	2,855	2,658	2,596	3,624	6,498	9,205	9,011	7,911	9,768	9,971
<i>SP</i>	113	183	278	339	387	461	531	581	584	615	582	563	574	578	624	542
Age	36.4	36.2	36.5	36.6	36.5	36.2	36.2	35.9	35.8	35.8	36.3	36.6	36.4	36.2	36.3	36.6
Race/ Ethnicity																
<i>White</i>	89	250	475	918	1,246	1,408	1,378	1,341	1,345	1,829	3,846	5,920	6,051	5,457	6,947	7,199
<i>Black</i>	18	35	57	99	129	185	188	181	189	244	596	986	1,051	998	1,223	1,252
<i>Hispanic</i>	802	760	882	1,284	1,494	1,663	1,675	1,566	1,470	1,872	1,771	1,632	1,299	945	833	558
<i>Other</i>	10	18	50	95	140	165	145	151	176	294	867	1,230	1,184	1,089	1,389	1,504

Table II.2: Select Socio-Demographic Characteristics of NHSC New Entrants by Entry Year

Entry Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total	919	438	714	1,236	1,152	1,341	1,072	1,033	988	1,958	3,627	3,761	2,402	2,157	2,731	2,859
Type																
<i>MDs</i>	592	240	373	653	588	730	576	532	556	923	1,499	1,346	858	701	897	804
<i>NP/PAs</i>	227	124	227	337	337	350	281	304	240	602	1,213	1,241	735	669	901	930
<i>Other</i>	100	74	114	246	227	261	215	197	192	433	915	1,174	809	787	933	1,125
Gender																
<i>Males</i>	398	167	243	460	416	464	350	331	317	568	964	970	607	538	673	643
<i>Females</i>	520	271	471	776	736	877	722	702	671	1,389	2,520	2,780	1,794	1,616	2,054	2,214
Program																
<i>LRP</i>	806	347	573	1,086	970	1,141	858	822	812	1,766	3,482	3,616	2,214	2,004	2,569	2,762
<i>SP</i>	113	91	141	150	182	200	214	211	176	192	145	145	188	153	162	97
Age	36.4	36.6	36.7	36.7	36.5	36.4	36.2	35.7	36.1	35.8	36.9	37.0	36.5	36.8	37.2	37.1
Race/ Ethnicity																
<i>White</i>	89	168	261	521	506	546	463	462	452	891	2,342	2,577	1,616	1,532	1,965	2,018
<i>Black</i>	18	19	28	52	52	86	57	65	58	112	367	439	312	274	329	334
<i>Hispanic</i>	802	242	391	615	530	643	513	447	411	803	306	312	209	63	57	43
<i>Other</i>	10	9	34	48	64	66	39	59	67	152	612	433	265	288	380	464

The NHSC administrative files do not contain information on the location of providers after program completion. Also, they do not contain the participant's National Provider Identification (NPI) number, or other unique identifiers which would enable us to track their location after program completion. We therefore rely on our additional data sources to identify the participants' NPI and then subsequently determine where they were located after program completion. These data sources, which are also used to identify non-participant providers, are: the Medicare Providers File developed from Medicare claims data over the period 2005-2014; and the Provider 360 File, a proprietary file containing comprehensive information on most medical providers in the United States.

Finally, we employ data from HRSA with information on HPSA designations, types, disciplines, sites and scores. We use the most recent file of these data, which was compiled in December 31, 2013. The reader is referred to a detailed discussion of these datasets in Lewin (2014).

The Medicare provider file contains a total number of providers between 639,197 and 940,690 in each year of the 2005-2014 period.³ Table II.3 shows the number of providers by type in each year. The data from the 2005-2011 period is the same data as in Lewin (2014), whereas data for the years 2012-2014 come from CMS's website.⁴

Table II.2: Number of Providers by Type in Each Year (Medicare Provider Data)

Year	MDs	NP/PAs	Other	Total
2005	421,574	23,774	170,048	639,197
2006	449,349	27,751	182,496	686,709
2007	495,998	35,959	224,794	791,004
2008	515,583	42,235	237,500	834,113
2009	529,978	46,946	245,442	864,565
2010	544,509	52,447	254,317	896,932
2011	559,338	59,465	264,718	933,575
2012	524,557	52,329	264,226	883,213
2013	532,167	59,551	273,855	912,153
2014	536,482	67,605	285,973	940,690

HPSA Designations and HPSA Scores

HRSA also provided Lewin with a detailed file containing information on all HPSA sites as of December 2013. As of December 2013, there were 5,976 primary care HPSAs, 4,758 dental care HPSAs and 3,876 mental health HPSAs. This file includes information on each HPSA: ID, name, status, type, discipline, HPSA score and detailed geographic identifiers. In Table II.4 below we present the number of HPSA sites by HPSA disciplines (i.e., primary care, dental health and mental health) and by the main HPSA types (facility HPSAs, single county HPSAs, Census tract HPSAs and minor civil division HPSAs).⁵

³ These providers include both primary care practitioners and non-primary care practitioners.

⁴ Available at: <https://www.cms.gov/research-statistics-data-and-systems/statistics-trends-and-reports/medicare-provider-charge-data/physician-and-other-supplier.html>.

⁵ A minor civil division is a term used by the Census to designate the primary [governmental](#) or [administrative divisions](#) of a [county](#), such as a [civil township](#), [precinct](#), or [magisterial district](#).

Table II.3: Distribution of HPSA Sites by Disciplines and Types

Discipline	Facility	Single County	Census Tract	Minor Civil Division	Total
Primary Care					
Count	3,270	1,746	9,981	3,384	18,381
Percent	17.79	9.50	54.30	18.41	100
Dental Health					
Count	2,676	1,695	7,334	1,083	12,788
Percent	20.93	13.25	57.35	8.47	100
Mental Health					
Count	2,715	2,408	4,401	394	9,918
Percent	27.37	24.28	44.37	3.97	100

As most of our empirical analysis was at the zip code level, the next step was to determine whether the zip code associated with each provider's location was part of a HPSA or not. We used the dataset we received from HRSA containing information on all HPSAs and constructed an algorithm to determine whether a provider's zip code was part of a single-county HPSA, Census tract HPSA, Census division HPSA, or a facility HPSA. More details are available in Lewin (2014).

Next, we mapped the detailed health care occupation (available in P360) of each non-NHSC participant into the corresponding NHSC discipline. The list of NHSC disciplines is presented in Table II.5 along with the distribution of providers by these disciplines in the overall population of NHSC participants and in the sample of participants we identified in the first analytic dataset. Table II.5 also provides the average age of providers (at entry in NHSC service) and the distribution by gender and HPSA type.

Analytic Datasets

Of the total of 28,388 individual NHSC participants we identified a number of 12,903 NHSC alumni in the first analytic dataset and a number of 24,173 providers in the second analytic dataset. In the first analytic dataset, 9,435 providers served in Primary Care HPSAs, 2,631 served in Mental Care HPSAs, and not surprisingly, only 27 served in Dental Care HPSAs. This is because a very small number of dentists and dental workers bill Medicare, and thus are not captured in the Medicare data. The same limitation applies to OB-GYN physicians and Pediatricians and other smaller categories of primary care physicians, since they rarely bill Medicare. As shown in Table II.5, with the exception of Dental Care providers, the sample of NHSC alumni we identify in the first analytic dataset appears to resemble the overall population of participants in terms of provider discipline, age at entry and gender.

Table II.4: Comparison between NHSC Providers in the Overall Population and in the First Analytic Dataset

Discipline	All NHSC Providers	NHSC in First Data Set
Allopathic Physician	5,199	3,644
Osteopathic Physician	1,592	1,238
Chiropractor	13	10
Certified Nurse Midwife	698	262
Dentist	3,049	19
Health Service Psychologist	2,028	751
Licensed Clinical Social Worker	2,987	934
Licensed Prof Counselor	2,867	49
Marriage and Family Therapist	450	14
Nurse Practitioner	5,010	2,888
Pharmacist	26	
Physician Assistant	3,708	1,238
Psychiatric Nurse Specialist	89	57
Registered Dental Hygienist	672	8
TOTAL	28,388	12,093
Age (at Entry)	36.7	37.4
Gender		
<i>Males</i>	8,109	4,034
<i>Females</i>	20,113	8,059
HPSA Type		
<i>Primary Care</i>	15,080	9,435
<i>Mental Health</i>	9,587	2,631
<i>Dental</i>	3,721	27
TOTAL	28,388	12,093

We complete the construction of the first analytic dataset by eliminating the following groups of non-NHSC participant providers: (i) those who did not fall under any one of the NHSC discipline types; (ii) those who did not serve in HPSAs; (iii) those who served in HPSAs where no NHSC participant served over the 2005-2014 period; and (iv) specialists (cardiologists, dermatologists etc.). The purpose of these data restrictions was to ensure a degree of comparability between NHSC participants and non-NHSC participants who served in HPSAs. We ended up with a total of 289,675 non-participant providers serving in primary care HPSAs and a total of 25,324 non-participants serving in mental health HPSAs. The main characteristics of non-participants are presented in Table II.6.

Table II.5: Non-NHSC Providers Serving in Primary Care and Mental Health HPSAs in the First Analytic Dataset

Characteristics	Primary Care HPSA		Mental Health HPSA	
	Non-NHSC Providers	Percent	Non-NHSC Providers	Percent
Physician	215,731	74.5	11,379	44.9
Certified Nurse Midwife	870	0.3		
Health Service Psychologist		--	5,814	23.0
Licensed Clinical Social Worker		--	6,192	24.5
Licensed Professional Counselor		--	367	1.4
Marriage and Family Therapist		--	6	0.0
Nurse Practitioner	53,590	18.5	1,566	6.2
Physician Assistant	19,484	6.7		
TOTAL	289,675	100.0	25,324	100.0
Age (at Entry) ⁶	43.7	--	51.7	--
Gender				
<i>Males</i>	168,917	58.3	11,895	48.8
<i>Females</i>	120,758	41.7	13,429	51.2
TOTAL	289,675	100.0	25,324	100.0

The main advantage of the first analytic dataset stems from the fact that it allows us to track the location of providers after they complete their NHSC service. However, the number of NHSC providers is potentially limited. We therefore constructed a second analytic dataset relying only on NHSC data, P360 data and HPSA data. The main feature of this dataset is that it provides information on the NHSC providers' location in two points in time: the year of program termination and January 2015 (i.e., the time when P360 information is recorded).

The number of NHSC participants in this second dataset increases to about 24,173. As expected, the distribution of NHSC providers by discipline resembles the distribution from the overall NHSC population more closely (Table II.7). Also, the other characteristics of participants from the second dataset are more similar to the characteristics from overall population of participants.

⁶ This is the average age of non-participant providers when they first appear in the Medicare data.

Table II.6: Comparison between NHSC Providers in the Overall Population and in the Second Analytic Dataset

Discipline	All NHSC Providers	NHSC in Second Data Set
Allopathic Physician	5,199	4,875
Osteopathic Physician	1,592	1,507
Chiropractor	13	11
Certified Nurse Midwife	698	622
Dentist	3,049	2,606
Health Service Psychologist	2,028	1,642
Licensed Clinical Social Worker	2,987	2,358
Licensed Professional Counselor	2,867	2,135
Marriage and Family Therapist	450	362
Nurse Practitioner	5,010	4,473
Pharmacist	26	12
Physician Assistant	3,708	3,262
Psychiatric Nurse Specialist	89	77
Registered Dental Hygienist	672	231
TOTAL	28,388	24,173
Age (at Entry)	36.7	36.7
Gender		
<i>Males</i>	8,109	7,274
<i>Females</i>	20,113	16,899
HPSA Type		
<i>Primary Care</i>	15,080	13,714
<i>Mental Health</i>	9,587	7,622
<i>Dental</i>	3,721	2,837
TOTAL	28,388	24,173

NOTE: The total number of matched NHSC providers presented in the above table is limited to providers with a valid NPI.

NHSC-eligible Unfunded Providers

A new dataset that was made available for this study by HRSA includes those providers who were considered eligible to participate in the program, but ultimately did not receive funding from NHSC, largely due to funding limitations. This category of providers is important, as it potentially represents a more adequate comparison group than the non-participating providers who serve in HPSAs. Non-participating providers are likely to be different from NHSC participants across characteristics we cannot account for in the data. However, if one can assume that program participation is in essence randomly distributed across pool of actual participants and eligible unfunded providers, then the latter category can serve as a proper comparison group and thus offer the possibility to shed more light into the estimation of direct program effect on the retention of providers in HPSAs.

There are 1,318 eligible unfunded providers who submitted an NHSC application between 2013 and 2015. We exclude from the analysis the 503 providers who applied in 2015, as we are not able to track their location in our provider datasets. In Provider360, we identified 166 and 158 primary care providers who applied in 2013 and 2014, respectively, and 76 and 38 mental health providers who applied in 2013 and 2014, respectively. We track the location of these providers for one or two years in Provider360.

Retention Measures

To analyze retention patterns, as in Lewin (2014), we construct four variables:

- ▶ Serving in the same HPSA and in the same county. This variable takes the value of 1 if the NHSC provider remains in the same county as the one where he or she served in NHSC, and 0 otherwise.
- ▶ Serving in a HPSA in another county. This variable takes the value of 1 if the NHSC provider remains in a HPSA that is located in a different county than the one in which he or she served while in NHSC service, and 0 otherwise.
- ▶ Serving in a non-HPSA from the same county. This variable takes the value of 1 if the NHSC provider moves to a non-HPSA area from the county where he or she served while in NHSC, and 0 otherwise.
- ▶ Serving in a non-HPSA in another county. This variable takes the value of 1 if the NHSC provider moves to a non-HPSA area from another county than the county he or she served while in NHSC, and 0 otherwise.

We create these measures for non-participants as well, but the reference point is not the year when they left service, but the first year (“start year”) they appear in the Medicare data. Using the above variables, we construct retention rates as the ratios between the number of providers in the same (or any) HPSA and the total number of providers leaving service in a given year. These rates are calculated one year after separation from NHSC, two years after separation from NHSC and so on. In the case of non-participants the annual retention rates are calculated one year since the start year, two years since the start year and so on for each cohort.

In past literature, retention was approached in multiple ways, with a focus on the length of retention in high need areas, the interval at which retention is measured, or defined by the location’s level of need. Previous retention studies that used retention measures defined by these criteria include Konrad et al. (2000), Holmes (2004), Holmes (2005), Pathman et al., 2012(a), Pathman et al., 2012(b), or Pathman and Konrad (2012).

Retention of NHSC Participants in HPSAs

Before we analyze the retention patterns of NHSC participants, it is important to articulate a conceptual framework to guide the interpretation of the empirical results. In Lewin (2014) we constructed a theoretical model of location decisions made by providers. In this chapter we reiterate the main structure and predictions of the model, and then present the retention analysis as viewed from the perspective of this model.

Conceptual Framework

In our previous study (Lewin, 2014), we specified a theoretical model of geographic location choices made by various groups of providers. In this model, the individual provider is assumed to periodically make choices of where to live and practice, guided by which location is offering the highest utility. This utility is a function of: pecuniary factors (compensation package), non-pecuniary factors (such as preferences for a location type, such as a HPSA); and random shocks. In the simple case of two locations, one being a HPSA, and another one being a non-HPSA location, the model predicts that the probability of choosing to locate in a HPSA increases with the wage differential between the HPSA and non-HPSA locations, as well as with the preference differential between the two locations.

When NHSC is available and all else is constant the probability of an eligible provider to choose to locate in a HPSA increases. More importantly, the NHSC award can attract to HPSAs providers with a strong distaste (or negative preferences) for HPSAs, to the extent that the NHSC award may be large enough to compensate for that negative preference. Assuming that is the case, the direct implication is that the number of providers who serve in HPSAs is most likely greater than the number of providers who would serve there had there been no program. These additional providers who are directly induced by the program to locate in HPSAs reflect a *recruiting effect* of the program.

If the program generates a recruiting effect as we define it above, it must follow that the average preference for a HPSA location in the population of NHSC participants is lower than in the population of non-participants who serve in HPSAs. This is driven by the additional providers who serve in HPSAs despite the fact that they dislike those locations, and do so only as a result of the program award. Also, those providers who serve in HPSAs without being NHSC participants must have sufficiently high preferences for HPSA locations since they do not need any additional incentive to serve there.⁷

The difference in the average preference for HPSAs between the participants and non-participants has a direct impact on the HPSA retention rate. As participants have a lower average preference, they are less likely to remain in HPSAs after they complete their NHSC obligation. In contrast, non-participating providers are more likely to remain in HPSAs over time, since they serve there in the first place, without the added incentive of the program. Therefore, the post-obligation retention rates of participants will be *lower* than those of non-participants.

In the case when the HPSA retention of the two provider groups is exactly the same, it must be because there is no difference between the participants' average HPSA preference the non-participants' average HPSA preference. This in turn, would reflect that the program was not successful in attracting additional providers, i.e., providers who would not locate in HPSAs without the incentive. In other words, the recruiting effect of the program would be zero, and all participants are simply providers who would have served in HPSAs without the program. In this

⁷ Of course, an implicit assumption is that the wages of participants and non-participants serving in HPSAs are the same.

case, the program award is a payment that does not change the behavior of participants in a desired way. On the contrary, when a large difference in the HPSA retention rates is reflected, in light of our conceptual framework, it is consistent with a large recruiting effect of the program, and thus points to the program's success in attracting new providers to serve in HPSAs.

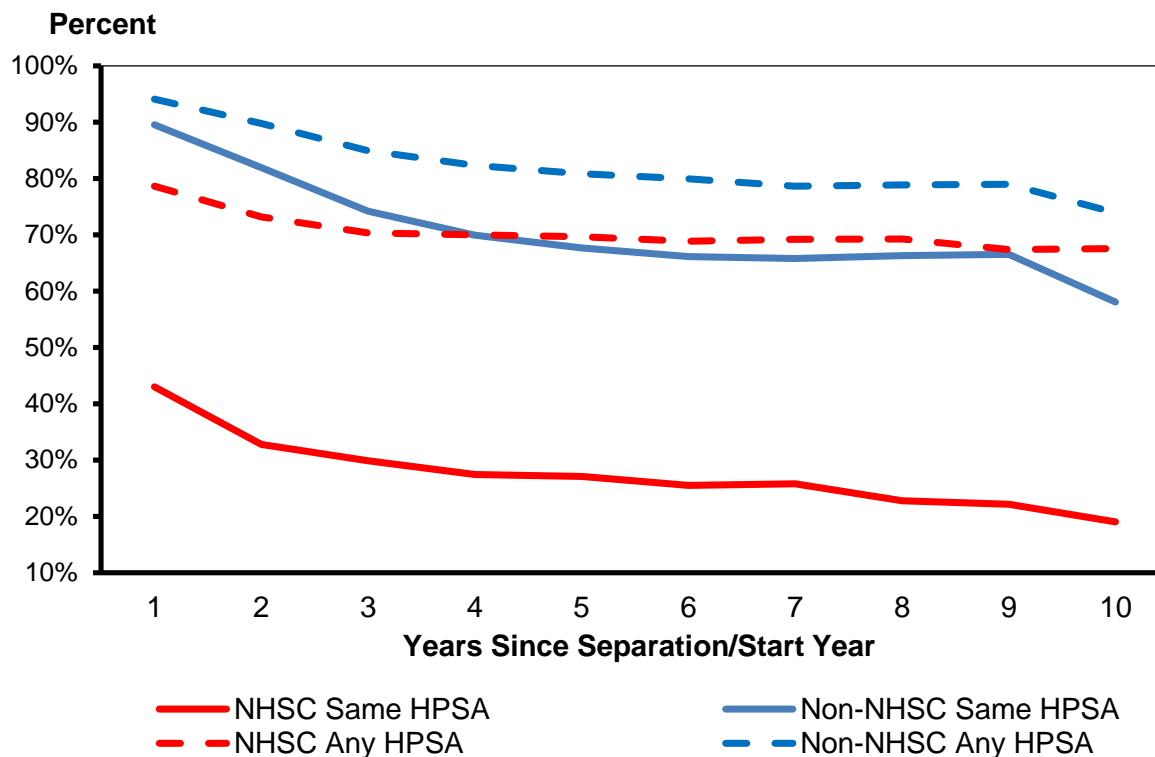
We also define a program *retention effect* as the increase in time served in HPSAs by providers beyond what would be supplied in the absence of the program. In other words, the program has a retention effect if the average time spent in HPSAs by providers is larger than what they would have spent had there been no program.

Retention Measures Using Longitudinal Data (First Analytic Dataset)

In Figure III.1 we start with retention rates in primary care HPSAs by years elapsed since separation from service (for participants) and by years since start year (for non-participants).

Using data from the first analytic dataset, we find that about 79% of the NHSC participants serve in primary care HPSAs one year after completion of their NHSC service. Less than half of participants who are still in primary care HPSAs one year after separation are actually in the same county as the one in which they served while in service (i.e., 43% of participants). There is a fairly steep decline in the retention rate in years 2 and 3 after separation (by about 10 and 3 percentage points, respectively), followed by a lower decline thereafter.

Figure III.3: Retention Rates of NHSC Participants and Non-Participants—Primary Care



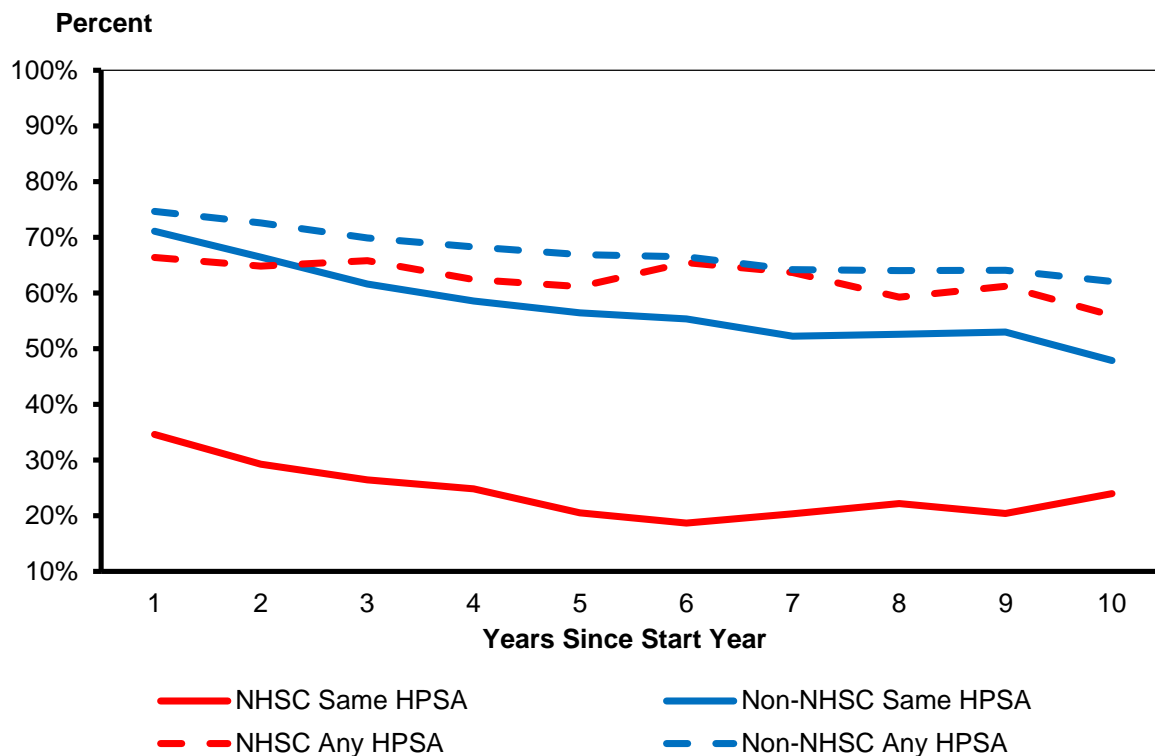
Focusing on non-participants, we note that their retention rates in primary care HPSAs are always higher than the retention rates of participants, both in terms of retention in the same HPSA as well as in terms of retention in a different HPSA. Their retention also drops after we first observe them in the data (their 'start' year). One year after we first observe non-

participants in HPSAs, 94% of them are still in HPSAs. Moreover, a very large fraction of them (89% of all non-participants) remain in the same HPSAs where they were first observed. The retention rates in any HPSAs decline by about 3-4 percentage points every year thereafter, while the retention rates in the same HPSA decline at a slightly faster rate (about 6-7 percentage points per year). These rates indicate that once non-participant providers serve in a HPSA, they tend to remain in those areas, and to some extent even when they move, they migrate from one HPSA to another.

In Figure III.2 we present the retention rates in mental health HPSAs. The retention rates of participants are lower in mental health HPSAs than in the case of primary care HPSAs. The fraction of participants serving in the same HPSA as during the program drops from 35% in the first year to 29% in the second year, and to 27% in the third year since separation. From then on it hovers between value of 19% and 24%. The retention rate of participants in any mental health HPSA is relatively constant over the years, ranging between 56% and 67%.

Similar to primary care HPSAs, non-participants in mental health HPSAs are more likely to stay in the same HPSA than participants. Their retention rate declines by 3-4 percentage points each year since the start year, while the retention rate in any HPSA declines at a lower rate, about 2-3 percentage points. It is important to note that the retention rate in any mental health HPSA is similar across participants and non-participants, especially in the further out years.

Figure III.4: Retention Rates of NHSC Participants and Non-Participants—Mental Health



It is important to note that we dropped from the retention analyses in Figures III.1 and III.2 the NHSC participants who left service in 2015, which is the last year of our timeframe.

Retention Measures Using the Second Analytic Dataset

So far, we have discussed retention statistics using only the first analytic dataset, which is based on NHSC, Medicare and P360 data. While this analytic dataset is very useful in that it tracks the participants' and non-participants' location over time, the number of participants identified in this dataset may be arguably viewed as small (around 12,093 providers of the total of 28,388). We address this issue by presenting in Tables III.1-III.3 the retention rates of NHSC participants using the second analytic dataset. However, we can only construct retention rates as of January 2015, the time when the P360 data was last available to us. We ended up using a number of 16,963 participants for the retention analyses we present below.

The rates in Tables III.1-III.3 indicate the fraction of participants who remain in the same HPSA or any HPSA between the time of service completion and January 2015. As a result, the fraction remaining in HPSAs for the cohort of providers exiting NHSC in 2014 represents a 1-year retention rate, for those exiting in 2013 it is a 2-year rate and so on. Although the rates in Table III.1 are not directly comparable to the rates plotted in Figure III.1, they nonetheless paint a similar picture regarding the retention of participants in HPSAs after service completion.

Given that the retention rates in Tables III.1-III.3 are inherently cohort-specific, we constructed cohort-specific retention rates using the first analytic dataset (Tables A.2 and A.3 in the Appendix). Tables A.2 and A.3 allow for a direct comparison between the retention rates from the first analytic dataset and the retention rates from the second analytic dataset (in Tables III.1 and III.2). As the retention rates from the first analytic dataset are virtually indistinguishable from the retention rates from the second analytic dataset, we conclude that the first dataset provides a comprehensive and representative picture of the entire sample of NHSC participants.

Another advantage of the second analytic dataset was that it allowed us to construct retention rates for providers in Dental Health HPSAs. These rates could not have been constructed with data from the first analytic dataset, as the sample size of dental health providers billing Medicare was extremely small. As can be noticed in Table III.3, the retention rates of dental health participants were similar to the retention rates of providers in primary care and mental health HPSAs.

Table III.1: Retention Rates of NHSC Participants as of January 2015—Primary Care

Year of Exit from NHSC	HPSA & same county	HPSA & other county	Non-HPSA & same county	Non-HPSA & other county	Total matched in P360 data
2000	30	64	12	49	155
2000	19.35%	41.29%	7.74%	31.61%	
2001	36	62	8	44	150
2001	24.00%	41.33%	5.33%	29.33%	
2002	47	59	9	37	152
2002	30.92%	38.82%	5.92%	24.34%	
2003	83	93	16	50	242
2003	34.30%	38.43%	6.61%	20.66%	
2004	160	176	38	113	487
2004	32.85%	36.14%	7.80%	23.20%	
2005	196	211	44	127	578
2005	33.91%	36.51%	7.61%	21.97%	
2006	222	202	52	136	612
2006	36.27%	33.01%	8.50%	22.22%	
2007	190	182	37	110	519
2007	36.61%	35.07%	7.13%	21.19%	
2008	230	144	33	93	500
2008	46.00%	28.80%	6.60%	18.60%	
2009	203	136	42	110	491
2009	41.34%	27.70%	8.55%	22.40%	
2010	287	150	52	113	602
2010	47.67%	24.92%	8.64%	18.77%	
2011	598	333	133	210	1274
2011	46.94%	26.14%	10.44%	16.48%	
2012	857	306	158	208	1529
2012	56.05%	20.01%	10.33%	13.60%	
2013	217	88	40	53	398
2013	54.52%	22.11%	10.05%	13.32%	
2014	832	238	115	99	1284
2014	64.80%	18.54%	8.96%	7.71%	
2015	854	0	161	0	1015
2015	84.14%	0.00%	15.86%	0.00%	
Total	5,042	2,444	950	1,552	9,988
Total	43.11%	29.30%	8.51%	19.09%	

**Table III.2: Retention Rates of NHSC Participants as of January 2015—
Mental Health**

Year of Exit from NHSC	HPSA & same county	HPSA & other county	Non-HPSA & same county	Non-HPSA & other county	Total matched in P360 data
2000	16	14	1	9	40
2000	40.00%	35.00%	2.50%	22.50%	
2001	12	20	1	13	46
2001	26.09%	43.48%	2.17%	28.26%	
2002	19	22	1	11	53
2002	35.85%	41.51%	1.89%	20.75%	
2003	39	32	3	28	102
2003	38.24%	31.37%	2.94%	27.45%	
2004	84	56	11	26	177
2004	47.46%	31.64%	6.21%	14.69%	
2005	71	61	15	40	187
2005	37.97%	32.62%	8.02%	21.39%	
2006	103	74	12	44	233
2006	44.21%	31.76%	5.15%	18.88%	
2007	112	64	17	37	230
2007	48.70%	27.83%	7.39%	16.09%	
2008	114	57	12	35	218
2008	52.29%	26.15%	5.50%	16.06%	
2009	99	57	19	39	214
2009	46.26%	26.64%	8.88%	18.22%	
2010	146	76	25	35	282
2010	51.77%	26.95%	8.87%	12.41%	
2011	390	141	64	106	701
2011	55.63%	20.11%	9.13%	15.12%	
2012	550	182	77	120	929
2012	59.20%	19.59%	8.29%	12.92%	
2013	132	43	12	20	207
2013	63.77%	20.77%	5.80%	9.66%	
2014	489	132	44	67	732
2014	66.80%	18.03%	6.01%	9.15%	
2015	585	0	103	0	688
2015	85.03%	0.00%	14.97%	0.00%	
Total	2,961	1,031	417	630	5,039
Total	49.95%	27.09%	6.48%	16.47%	

**Table III. 3: Retention Rates of NHSC Participants as of January 2015—
Dental Health**

Year of Exit from NHSC	HPSA & same county	HPSA & other county	Non-HPSA & same county	Non-HPSA & other county	Total matched in P360 data
2000	8	15	0	9	32
2000	25.00%	46.88%	0.00%	28.13%	
2001	9	18	1	11	39
2001	23.08%	46.15%	2.56%	28.21%	
2002	11	14	5	16	46
2002	23.91%	30.43%	10.87%	34.78%	
2003	15	27	5	24	71
2003	21.13%	38.03%	7.04%	33.80%	
2004	31	27	9	31	98
2004	31.63%	27.55%	9.18%	31.63%	
2005	29	37	11	22	99
2005	29.29%	37.37%	11.11%	22.22%	
2006	40	30	13	42	125
2006	32.00%	24.00%	10.40%	33.60%	
2007	36	26	12	27	101
2007	35.64%	25.74%	11.88%	26.73%	
2008	26	24	5	26	81
2008	32.10%	29.63%	6.17%	32.10%	
2009	36	17	11	26	90
2009	40.00%	18.89%	12.22%	28.89%	
2010	47	13	11	21	92
2010	51.09%	14.13%	11.96%	22.83%	
2011	107	46	16	39	208
2011	51.44%	22.12%	7.69%	18.75%	
2012	143	58	24	40	265
2012	53.96%	21.89%	9.06%	15.09%	
2013	43	19	12	17	91
2013	47.25%	20.88%	13.19%	18.68%	
2014	150	65	34	36	285
2014	52.63%	22.81%	11.93%	12.63%	
2015	159	0	54	0	213
2015	74.65%	0.00%	25.35%	0.00%	
Total	890	436	223	387	1,936
Total	39.05%	26.66%	10.04%	24.25%	

Finally, Tables A.4 and A.5 in the Appendix show no substantial variation in the retention rates of providers by provider type. Primary care participants are slightly more likely to stay in the

same HPSA same county and less likely to stay in HPSAs in other counties than NP/PAs, while mental health physicians are in general less likely than NP/PAs to remain in HPSAs. We return to this issue in Chapter IV to determine whether differences in retention rates remain after we adjust for the provider's age, gender and other individual level and local area characteristics.

A Comparison with Previous Retention Results

In Lewin (2014), the retention rates are shorter, given the shorter timeframe (up to six years using the first analytic dataset). For the years since separation that overlap with those available in Lewin (2014), we can compare the retention rates directly.

In the case of primary care providers, the “same HPSA” retention rates in the first years after separation from service are lower than in the previous study. Specifically, the retention rates from this study are between 6 to 10 percentage points lower than in Lewin (2014) for the first years since separation, with the difference being larger in the further-out years. This suggests that the primary care providers who left NHSC in the more recent years leave the HPSA where they served at higher rates than before.

However, when comparing the “any HPSA” retention rates, it turns out that although the retention rates from this study are smaller than the ones reported in Lewin (2014), the differences are much smaller than in the case of “same HPSA” retention (about 2-3 percentage points). This suggests that NHSC alumni still remain in HPSA at elevated rates (just as documented in Lewin 2014), but the moves from the “same HPSA” to “any HPSA” locations are more frequent in the recent years than in the past.

Similarly, in the case of mental health providers, the “same HPSA” retention is smaller than in Lewin (2014), by values between 2 and 12 percentage points. The differences in “any HPSA” retention are much smaller (between 1 and 2 percentage points, with one exception). As in the case of primary care providers, this points to: (i) an increase in the frequency with which providers move out of the HPSAs where they served while in NHSC; and (ii) a large fraction of these moves out of “same HPSA” have as a destination another HPSA, such that the “any HPSA” retention is overall very close to the “any HPSA” retention from the previous study.

As we explain above, in our theoretical framework a zero difference between the retention rates participants and non-participants is equivalent to a zero recruiting effect. When the program is successful in attracting providers who would not serve in HPSAs without the incentive, then the program has a recruiting effect, and since the average HPSA preference for the newly attracted providers is lower than the average preference of the rest of the providers, it follows that the post-obligation retention rate of participants is lower than that of non-participants. Importantly, the retention differential becomes larger when the recruiting effect is larger.

In Lewin (2104), the average retention differential between non-participants and participants over the first six years since separation/start year is 11.7 percentage points for primary care providers, and 3.3 percentage points for mental health providers. It turns out that in this study the average retention differential over the first six years since separation/start year is 13.6 and 5.4 percentage points for primary care and mental health providers, respectively. This increase in the retention differential is consistent with an increase in the program recruiting effect. It is in fact possible that the increase in the program generosity and program outreach that were an outgrowth of the ACA and ARRA changes in the 2009-2011 period resulted in more and more providers who would not have served in HPSAs in the absence of the NHSC award. If that were the case, then these new program participants had a smaller retention rate, potentially indicating that the program's recruiting effect over the last few years has increased.

Retention of Participants by Place of NHSC Service

We also analyze the retention patterns of NHSC providers by the place of service to understand whether the institution type they work in is associated with their propensity to remain in HPSAs after service completion.

In Table III.4 we investigate the retention of providers by whether they were working in a Federally Qualified Health Center (FQHC) at the time of NHSC completion. Using the first analytic dataset, we construct the “same HPSA” and “any HPSA” retention rates for the participants who leave service from a FQHC and compare them with all NHSC alumni’s rates.

Table III.4: Comparison of Retention Trends by NHSC Place of Service (FQHC vs non-FQHC locations) – Primary Care

Separation Year	Same HPSA	Any HPSA
<i>In FQHC</i>		
1	49.1%	79.8%
2	41.9%	74.5%
3	39.5%	70.9%
4	36.0%	70.0%
5	35.4%	69.1%
6	35.3%	69.3%
7	36.6%	70.5%
8	33.9%	71.0%
9	36.0%	70.1%
10	30.7%	72.3%
<i>All NHSC</i>		
1	43.0%	78.6%
2	32.8%	73.2%
3	29.8%	70.4%
4	27.4%	70.0%
5	27.1%	69.6%
6	25.5%	68.9%
7	25.8%	69.2%
8	22.8%	69.3%
9	22.1%	67.4%
10	19.0%	67.5%

As shown in Table III.4, providers who serve in FQHCs are virtually across the board more likely to serve in HPSAs after they complete their NHSC obligation. This may potentially indicate that providers who find employment in FQHCs are typically more inclined to serve the populations that seek medical services at FQHCs. If the retention rates in Table III.4 represent any indication that the FQHC participants have a higher preference for serving in HPSAs, it may also be the case that a number of these providers would have gone to HPSAs even in the absence of the NHSC award.

Determinants of Provider Retention in HPSAs

Next, we attempt to determine how much of the retention differential between participants and non-participants is due to the program, and how much due to other characteristics.

Econometric Model

For this purpose, we used the data on NHSC participants and the data on non-participants from the first analytic dataset to estimate regression models in which we control for observable characteristics on each individual (X_i), local area characteristics (Z_i) and an indicator for program participation ($Prog_i$)

$$y_{ij} = \alpha \cdot Prog_i + X_i' \cdot \beta + Z_i' \cdot \delta + \varepsilon_i \quad (1)$$

We estimated model (1) by using the ‘same HPSA’ and the ‘any HPSA’ indicator variables as the dependent variable, respectively. The coefficient of interest, α , indicates the impact of NHSC program participation on the number of years served in a HPSA. The X vector included individual-level characteristics like age, gender and provider type, while the Z vector included Census division indicator variables and local area characteristics (at the zip code level), such as: family income, poverty rate, percent White, percent Black, fraction of the population over 25 with a high school degree and percent of the population over the age of 65. These variables helped control for factors that retain or induce providers to leave from their initial place of service.

Main Results

As in Lewin (2014), we estimated model (1) using a logit specification, separately for primary care and mental health HPSAs, and by using the ‘same HPSA’ and the ‘any HPSA’ indicators as dependent variables. The coefficient estimates are shown in Tables IV.1-IV.4. In each of these tables we present 10 models, one for each year elapsed since separation or start year.

In all models of Table IV.1 we estimate a lower probability of remaining in the same primary care HPSA for participants relative to non-participants. Female providers were slightly less likely to remain in HPSAs, and older providers were more likely to remain in the same HPSA over time. We detect no systematic differences by provider type. Providers leaving service or appearing for the first time in the data in the earlier years (2005 or 2006) had a higher probability of remaining in the same HPSA relative to those whose separation/start year occurred later. It is important to note that the coefficient estimates on the local area characteristics are in many cases statistically significant, indicating that providers are more likely to remain in HPSAs where the poverty rate is higher, the fraction of older population is higher and the ratio of individuals over the age of 25 with a high school degree is lower.⁸

The first year of the analytic dataset was 2005 for non-participants. We coded the start year variable to take the value of 1 for all non-participants, although some of them may have been in their locations for longer periods. We did not detect any differences in the main regression coefficients if we included only providers of ages that are similar to the age of participants.

⁸In Tables IV.1-IV.4, we report in parentheses robust standard errors, clustered by HPSA. The base group is defined as providers who are: male, age 26-35, non-physician and non-NP/PA, having a start year of 2012 or later, and serving in the Northeast. The coefficient on any of the dummy variables included in these models shows the estimated difference relative to the corresponding excluded category. We do not report the intercept and the coefficients on the Census division dummies for reasons of space.

Table IV. 1: “Same HPSA” Logit Models of Retention—Primary Care

Variable	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	8 Years	9 Years	10 Years
NHSC Participant	-2.316*** (0.057)	-2.035*** (0.061)	-1.614*** (0.060)	-1.470*** (0.068)	-1.405*** (0.079)	-1.439*** (0.084)	-1.457*** (0.092)	-1.652*** (0.104)	-1.625*** (0.117)	-1.831*** (0.158)
Female	-0.010 (0.018)	-0.031** (0.015)	-0.025* (0.014)	-0.054*** (0.014)	-0.059*** (0.015)	-0.065*** (0.015)	-0.121*** (0.019)	-0.132*** (0.019)	-0.144*** (0.020)	-0.010 (0.021)
Age 36-45	0.180*** (0.019)	0.230*** (0.020)	0.207*** (0.021)	0.222*** (0.021)	0.213*** (0.027)	0.177*** (0.034)	0.123** (0.049)	-0.106* (0.064)	0.113 (0.117)	0.030 (0.177)
Age 46-55	0.477*** (0.028)	0.573*** (0.027)	0.559*** (0.027)	0.626*** (0.027)	0.647*** (0.031)	0.641*** (0.038)	0.568*** (0.050)	0.349*** (0.065)	0.574*** (0.117)	0.393** (0.179)
Age 56-65	0.659*** (0.039)	0.770*** (0.036)	0.778*** (0.035)	0.847*** (0.034)	0.888*** (0.036)	0.905*** (0.043)	0.846*** (0.052)	0.651*** (0.067)	0.885*** (0.119)	0.672*** (0.180)
Age Over 65	0.914*** (0.064)	1.104*** (0.057)	1.097*** (0.050)	1.153*** (0.050)	1.208*** (0.048)	1.207*** (0.050)	1.240*** (0.065)	1.029*** (0.074)	1.251*** (0.122)	0.966*** (0.181)
MD	-0.011 (0.153)	-0.463*** (0.145)	-0.406*** (0.138)	-0.253* (0.151)	-0.402** (0.165)	-0.342* (0.184)	0.235 (0.329)	0.312 (0.385)	0.499 (0.371)	-0.127 (0.400)
NP	0.128 (0.157)	-0.290** (0.148)	-0.226 (0.141)	-0.071 (0.154)	-0.243 (0.169)	-0.212 (0.185)	0.390 (0.328)	0.447 (0.385)	0.599 (0.373)	0.104 (0.401)
PA	0.007 (0.163)	-0.428*** (0.151)	-0.364** (0.144)	-0.248 (0.157)	-0.389** (0.177)	-0.361* (0.187)	0.156 (0.331)	0.180 (0.389)	0.393 (0.380)	-0.110 (0.408)
Start Year 2005	0.172*** (0.033)	-0.018 (0.028)	0.408*** (0.036)	0.760*** (0.036)	0.695*** (0.039)	0.739*** (0.035)	0.766*** (0.030)	0.641*** (0.026)	0.614*** (0.029)	
Start Year 2006	-0.065 (0.044)	-0.492*** (0.039)	-0.023 (0.042)	0.363*** (0.039)	0.289*** (0.039)	0.445*** (0.036)	0.473*** (0.037)	0.318*** (0.033)		
Start Year 2007	-0.281*** (0.038)	-0.565*** (0.035)	-0.012 (0.041)	0.352*** (0.037)	0.245*** (0.037)	0.418*** (0.034)	0.385*** (0.031)			
Start Year 2008	-0.194*** (0.038)	-0.604*** (0.037)	-0.150*** (0.043)	-0.121*** (0.034)	-0.015 (0.038)	0.112*** (0.036)				
Start Year 2009	-0.197*** (0.040)	-0.672*** (0.038)	-0.705*** (0.042)	-0.098*** (0.037)	-0.073* (0.040)					
Start Year 2010	-0.249*** (0.044)	-1.436*** (0.039)	-0.563*** (0.043)	-0.052 (0.036)						
Start Year 2011	-1.827*** (0.042)	-1.385*** (0.038)	-0.620*** (0.040)							
Log Family Income	-0.271 (0.211)	-0.264 (0.218)	-0.316 (0.218)	-0.329 (0.227)	-0.354 (0.231)	-0.371 (0.232)	-0.678** (0.267)	-0.698*** (0.262)	-0.701*** (0.258)	-0.735*** (0.221)
Poverty Rate	0.030*** (0.005)	0.030*** (0.005)	0.028*** (0.006)	0.027*** (0.006)	0.026*** (0.006)	0.026*** (0.006)	0.020*** (0.007)	0.021*** (0.007)	0.021*** (0.007)	0.023*** (0.007)
Percent White	-0.139 (0.332)	-0.217 (0.323)	-0.434 (0.336)	-0.511 (0.352)	-0.470 (0.352)	-0.399 (0.363)	0.006 (0.387)	0.051 (0.390)	0.040 (0.394)	-0.206 (0.377)
Percent Black	0.528 (0.346)	0.494 (0.331)	0.444 (0.341)	0.445 (0.352)	0.490 (0.358)	0.538 (0.361)	0.754* (0.393)	0.769* (0.397)	0.773* (0.409)	0.630 (0.387)
Pct HS over 25	-3.920*** (0.876)	-3.912*** (0.920)	-3.711*** (0.937)	-3.582*** (0.964)	-3.609*** (0.973)	-3.488*** (0.953)	-3.994*** (1.092)	-4.058*** (1.104)	-3.919*** (1.123)	-4.386*** (1.053)
Pct Pop over 65	2.704** (1.260)	2.728** (1.271)	3.521*** (1.365)	3.674*** (1.401)	3.837*** (1.396)	3.522** (1.374)	3.523** (1.372)	3.434** (1.380)	3.337** (1.416)	3.441** (1.371)
Obs	264,688	245,564	227,167	206,499	191,559	178,020	153,919	140,492	121,641	112,659

Table IV. 2: “Any HPSA” Logit Models of Retention—Primary Care

Variable	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	8 Years	9 Years	10 Years
NHSC Participant	-1.365*** (0.079)	-1.007*** (0.073)	-0.681*** (0.069)	-0.494*** (0.069)	-0.441*** (0.077)	-0.431*** (0.083)	-0.427*** (0.083)	-0.412*** (0.095)	-0.475*** (0.109)	-0.530*** (0.140)
Female	-0.047** (0.024)	-0.065*** (0.022)	-0.068*** (0.019)	-0.091*** (0.019)	-0.099*** (0.018)	-0.105*** (0.019)	-0.136*** (0.023)	-0.142*** (0.023)	-0.151*** (0.025)	-0.030 (0.026)
Age 36-45	0.160*** (0.024)	0.169*** (0.024)	0.165*** (0.022)	0.152*** (0.025)	0.151*** (0.028)	0.097** (0.038)	0.075 (0.055)	0.030 (0.073)	0.159 (0.123)	0.112 (0.191)
Age 46-55	0.487*** (0.038)	0.536*** (0.034)	0.468*** (0.032)	0.508*** (0.032)	0.497*** (0.035)	0.451*** (0.043)	0.402*** (0.055)	0.346*** (0.072)	0.465*** (0.124)	0.327* (0.190)
Age 56-65	0.710*** (0.053)	0.779*** (0.042)	0.729*** (0.040)	0.742*** (0.040)	0.754*** (0.040)	0.707*** (0.048)	0.648*** (0.061)	0.614*** (0.077)	0.732*** (0.127)	0.523*** (0.192)
Age Over 65	0.950*** (0.089)	1.025*** (0.080)	0.974*** (0.060)	0.992*** (0.061)	0.975*** (0.055)	0.930*** (0.059)	0.965*** (0.077)	0.915*** (0.089)	1.062*** (0.133)	0.761*** (0.194)
MD	0.055 (0.246)	-0.816*** (0.262)	-0.729*** (0.218)	-0.441** (0.223)	-0.593** (0.233)	-0.636** (0.288)	0.045 (0.398)	0.098 (0.365)	0.472 (0.331)	-0.269 (0.414)
NP	0.169 (0.254)	-0.696** (0.270)	-0.615*** (0.223)	-0.330 (0.229)	-0.501** (0.240)	-0.558* (0.290)	0.159 (0.398)	0.201 (0.365)	0.557* (0.333)	-0.071 (0.417)
PA	0.081 (0.261)	-0.780*** (0.269)	-0.647*** (0.225)	-0.410* (0.227)	-0.542** (0.242)	-0.580** (0.292)	0.012 (0.401)	0.046 (0.370)	0.471 (0.340)	-0.168 (0.424)
Start Year 2005	0.213*** (0.047)	0.002 (0.040)	0.334*** (0.045)	0.608*** (0.042)	0.529*** (0.044)	0.497*** (0.041)	0.439*** (0.034)	0.392*** (0.035)	0.375*** (0.037)	
Start Year 2006	0.046 (0.058)	-0.435*** (0.049)	0.012 (0.052)	0.319*** (0.045)	0.235*** (0.046)	0.219*** (0.042)	0.237*** (0.040)	0.164*** (0.040)		
Start Year 2007	-0.172*** (0.051)	-0.464*** (0.047)	0.060 (0.055)	0.354*** (0.045)	0.158*** (0.040)	0.234*** (0.037)	0.209*** (0.033)			
Start Year 2008	-0.068 (0.053)	-0.503*** (0.048)	-0.067 (0.056)	-0.050 (0.039)	0.015 (0.044)	0.054 (0.039)				
Start Year 2009	-0.105* (0.058)	-0.589*** (0.053)	-0.560*** (0.050)	-0.055 (0.044)	-0.046 (0.047)					
Start Year 2010	-0.205*** (0.063)	-1.264*** (0.042)	-0.483*** (0.051)	-0.013 (0.044)						
Start Year 2011	-1.574*** (0.041)	-1.219*** (0.038)	-0.497*** (0.047)							
Log Family Income	-0.693** (0.340)	-0.717** (0.349)	-0.865** (0.351)	-0.942*** (0.356)	-0.947*** (0.357)	-0.966*** (0.361)	-1.146*** (0.400)	-1.184*** (0.398)	-1.189*** (0.394)	-1.491*** (0.350)
Poverty Rate	0.067*** (0.013)	0.068*** (0.013)	0.060*** (0.013)	0.054*** (0.013)	0.054*** (0.013)	0.058*** (0.014)	0.052*** (0.014)	0.052*** (0.015)	0.052*** (0.015)	0.054*** (0.013)
Percent White	0.005 (0.603)	0.066 (0.553)	-0.149 (0.561)	-0.168 (0.567)	-0.083 (0.550)	0.060 (0.555)	0.374 (0.552)	0.391 (0.548)	0.416 (0.550)	0.448 (0.555)
Percent Black	0.785 (0.713)	0.833 (0.673)	0.891 (0.686)	0.975 (0.697)	1.031 (0.679)	1.027 (0.676)	1.159* (0.679)	1.115* (0.674)	1.137* (0.690)	1.242* (0.699)
Pct HS over 25	-5.290*** (1.481)	-5.333*** (1.561)	-5.020*** (1.524)	-4.816*** (1.547)	-4.723*** (1.545)	-4.553*** (1.528)	-4.843*** (1.629)	-4.946*** (1.650)	-4.826*** (1.667)	-5.070*** (1.579)
Pct Pop over 65	8.588*** (2.866)	8.714*** (2.783)	9.421*** (2.846)	9.493*** (2.812)	9.728*** (2.774)	9.363*** (2.676)	9.514*** (2.681)	9.428*** (2.697)	9.307*** (2.747)	9.567*** (2.543)
Obs	264,688	245,564	227,167	206,499	191,559	178,020	153,919	140,492	121,641	112,659

Table IV. 3: “Same HPSA” Logit Models of Retention—Mental Care

Variable	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	8 Years	9 Years	10 Years
NHSC Participant	-1.135*** (0.152)	-1.247*** (0.161)	-1.102*** (0.162)	-1.130*** (0.189)	-1.329*** (0.214)	-1.496*** (0.222)	-1.499*** (0.294)	-1.278*** (0.317)	-1.489*** (0.441)	-0.886* (0.478)
Female	-0.010 (0.037)	-0.019 (0.039)	0.006 (0.040)	-0.011 (0.042)	-0.012 (0.043)	-0.013 (0.045)	-0.075 (0.050)	-0.041 (0.052)	-0.068 (0.056)	0.029 (0.065)
Age 36-45	0.093 (0.063)	0.120* (0.072)	0.154* (0.087)	0.298*** (0.104)	0.363** (0.156)	0.573** (0.228)	0.223 (0.490)	-0.199 (0.580)	-2.097 (1.991)	-13.808*** (3.154)
Age 46-55	0.083 (0.069)	0.210*** (0.076)	0.352*** (0.090)	0.528*** (0.108)	0.633*** (0.167)	0.824*** (0.237)	0.467 (0.489)	0.028 (0.587)	-1.595 (1.992)	-13.186*** (3.152)
Age 56-65	0.210*** (0.071)	0.339*** (0.081)	0.449*** (0.097)	0.597*** (0.117)	0.706*** (0.167)	0.964*** (0.235)	0.619 (0.486)	0.208 (0.577)	-1.424 (1.988)	-13.080*** (3.155)
Age Over 65	0.204** (0.093)	0.427*** (0.098)	0.550*** (0.110)	0.698*** (0.124)	0.799*** (0.171)	1.071*** (0.246)	0.810 (0.493)	0.364 (0.582)	-1.217 (1.990)	-12.852*** (3.151)
MD	-0.054 (0.074)	-0.189*** (0.071)	-0.256*** (0.069)	-0.344*** (0.064)	-0.349*** (0.064)	-0.365*** (0.063)	-0.311*** (0.077)	-0.308*** (0.076)	-0.264*** (0.079)	-0.357*** (0.080)
NP	0.049 (0.099)	0.013 (0.099)	-0.019 (0.108)	-0.177 (0.110)	-0.230** (0.105)	-0.275** (0.107)	-0.205 (0.126)	-0.303** (0.134)	-0.364** (0.150)	-0.332** (0.164)
Start Year 2005	0.134* (0.073)	0.049 (0.080)	0.407*** (0.097)	0.680*** (0.100)	0.586*** (0.105)	0.544*** (0.107)	0.344*** (0.125)	0.408*** (0.069)	0.313*** (0.112)	
Start Year 2006	0.094 (0.101)	-0.113 (0.101)	0.245** (0.124)	0.441*** (0.128)	0.378*** (0.139)	0.273* (0.147)	0.142 (0.166)	0.186 (0.124)		
Start Year 2007	0.064 (0.089)	-0.139 (0.097)	0.209** (0.105)	0.457*** (0.108)	0.201* (0.113)	0.236** (0.117)	0.059 (0.128)			
Start Year 2008	0.074 (0.105)	-0.113 (0.101)	0.090 (0.107)	0.022 (0.117)	0.071 (0.121)	0.156 (0.117)				
Start Year 2009	0.000 (0.096)	-0.285** (0.112)	-0.522*** (0.131)	-0.086 (0.117)	-0.113 (0.128)					
Start Year 2010	-0.100 (0.095)	-1.025*** (0.129)	-0.460*** (0.130)	-0.110 (0.127)						
Start Year 2011	-1.094*** (0.124)	-0.941*** (0.129)	-0.475*** (0.120)							
Log Family Income	-0.198 (0.330)	-0.047 (0.300)	0.018 (0.290)	0.087 (0.291)	-0.034 (0.294)	-0.094 (0.274)	-0.373 (0.312)	-0.256 (0.302)	-0.210 (0.338)	-0.362 (0.261)
Poverty Rate	0.044*** (0.015)	0.046*** (0.013)	0.047*** (0.012)	0.051*** (0.012)	0.043*** (0.011)	0.042*** (0.011)	0.042*** (0.010)	0.044*** (0.011)	0.048*** (0.011)	0.041*** (0.010)
Percent White	-0.145 (0.681)	-0.232 (0.595)	-0.380 (0.610)	-0.365 (0.550)	-0.362 (0.539)	-0.481 (0.543)	-0.378 (0.596)	-0.481 (0.611)	-0.466 (0.666)	-0.478 (0.597)
Percent Black	1.739** (0.848)	1.472** (0.727)	1.445** (0.677)	1.332** (0.625)	1.525** (0.637)	1.316** (0.624)	1.251* (0.702)	1.158 (0.715)	1.279* (0.766)	1.416** (0.697)
Pct HS over 25	-4.294** (1.956)	-4.048** (1.756)	-3.541** (1.675)	-3.290* (1.688)	-3.320** (1.625)	-3.457** (1.641)	-1.758 (1.500)	-2.222 (1.501)	-2.383 (1.547)	-3.989*** (1.493)
Pct Pop over 65	1.285 (2.935)	0.460 (2.586)	1.513 (2.484)	2.154 (2.328)	2.398 (2.368)	1.266 (2.314)	2.178 (2.242)	2.841 (2.189)	2.342 (2.291)	1.737 (2.241)
Obs	22,799	20,662	18,692	16,533	14,608	13,232	8,850	7,877	6,614	6,164

Table IV. 4: “Any HPSA” Logit Models of Retention—Mental Care

Variable	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	8 Years	9 Years	10 Years
NHSC Participant	0.065 (0.162)	0.032 (0.171)	0.218 (0.162)	0.075 (0.170)	0.068 (0.163)	0.195 (0.207)	0.005 (0.233)	-0.118 (0.247)	-0.051 (0.317)	0.085 (0.398)
Female	-0.007 (0.040)	-0.004 (0.042)	0.012 (0.042)	-0.005 (0.044)	-0.009 (0.045)	-0.008 (0.046)	-0.040 (0.055)	-0.018 (0.057)	-0.035 (0.065)	0.010 (0.068)
Age 36-45	0.100 (0.072)	0.102 (0.077)	0.082 (0.084)	0.236** (0.100)	0.268 (0.166)	0.172 (0.220)	0.546 (0.432)	0.099 (0.583)	-14.569*** (0.845)	-18.179 (.)
Age 46-55	0.049 (0.077)	0.110 (0.078)	0.118 (0.085)	0.338*** (0.105)	0.457*** (0.173)	0.383* (0.226)	0.725* (0.432)	0.162 (0.576)	-14.398*** (0.720)	-17.817*** (0.150)
Age 56-65	0.173** (0.079)	0.204** (0.082)	0.195** (0.093)	0.364*** (0.116)	0.524*** (0.177)	0.434** (0.220)	0.715* (0.427)	0.197 (0.577)	-14.363*** (0.926)	-17.811*** (0.146)
Age Over 65	0.205** (0.104)	0.283*** (0.104)	0.318*** (0.107)	0.473*** (0.124)	0.601*** (0.178)	0.558** (0.225)	0.867** (0.429)	0.330 (0.571)	-14.180*** (0.398)	-17.665*** (0.154)
MD	0.112 (0.081)	0.066 (0.080)	-0.016 (0.075)	-0.028 (0.070)	-0.030 (0.071)	-0.046 (0.074)	-0.053 (0.085)	-0.068 (0.084)	-0.027 (0.085)	0.003 (0.083)
NP	0.170* (0.102)	0.210** (0.098)	0.200* (0.106)	0.157 (0.118)	0.099 (0.107)	0.098 (0.112)	0.162 (0.128)	0.113 (0.137)	-0.004 (0.136)	0.158 (0.153)
Start Year 2005	0.015 (0.082)	-0.008 (0.088)	0.187* (0.113)	0.435*** (0.105)	0.330*** (0.105)	0.256*** (0.097)	-0.031 (0.114)	0.176** (0.077)	0.147 (0.115)	
Start Year 2006	0.046 (0.107)	-0.111 (0.111)	0.095 (0.140)	0.271* (0.141)	0.210 (0.135)	-0.095 (0.133)	-0.300* (0.154)	-0.067 (0.124)		
Start Year 2007	0.057 (0.094)	-0.021 (0.100)	0.170 (0.124)	0.439*** (0.124)	0.218* (0.115)	0.126 (0.114)	-0.074 (0.118)			
Start Year 2008	0.051 (0.118)	-0.042 (0.106)	0.044 (0.122)	0.088 (0.119)	0.151 (0.120)	0.153 (0.126)				
Start Year 2009	0.002 (0.106)	-0.036 (0.116)	-0.357*** (0.136)	-0.006 (0.118)	-0.022 (0.129)					
Start Year 2010	-0.070 (0.099)	-0.437*** (0.123)	-0.213 (0.140)	0.148 (0.117)						
Start Year 2011	-0.582*** (0.108)	-0.576*** (0.121)	-0.327** (0.140)							
Log Family Income	-0.390 (0.349)	-0.355 (0.326)	-0.395 (0.326)	-0.404 (0.331)	-0.497 (0.316)	-0.576* (0.304)	-0.615* (0.356)	-0.564 (0.358)	-0.431 (0.376)	-0.916*** (0.287)
Poverty Rate	0.047*** (0.018)	0.050*** (0.017)	0.051*** (0.016)	0.052*** (0.015)	0.046*** (0.015)	0.046*** (0.014)	0.059*** (0.015)	0.059*** (0.016)	0.066*** (0.016)	0.048*** (0.014)
Percent White	-0.012 (0.773)	0.018 (0.716)	-0.040 (0.731)	0.046 (0.656)	0.130 (0.657)	0.148 (0.681)	0.153 (0.732)	0.179 (0.721)	0.153 (0.751)	0.155 (0.731)
Percent Black	2.362** (1.090)	2.360** (1.005)	2.467*** (0.929)	2.463*** (0.873)	2.617*** (0.865)	2.744*** (0.854)	2.173** (0.919)	2.410*** (0.926)	2.287** (0.936)	2.464*** (0.906)
Pct HS over 25	-4.745** (2.207)	-4.470** (2.075)	-4.233** (1.910)	-4.111** (1.906)	-3.824** (1.847)	-3.593* (1.906)	-1.789 (1.841)	-2.062 (1.809)	-2.247 (1.870)	-3.912** (1.748)
Pct Pop over 65	2.549 (3.325)	2.645 (3.093)	4.349 (3.031)	4.943* (2.904)	5.527* (2.962)	5.020* (2.941)	5.415** (2.756)	5.419** (2.713)	5.004* (2.757)	5.743** (2.738)
Obs	22,799	20,662	18,692	16,533	14,608	13,232	8,850	7,877	6,614	6,164

Estimating model (1) with the ‘any HPSA’ indicator as the dependent variable, we found very similar patterns in the retention of providers in primary care HPSAs (Table IV.2). The main difference is that the coefficients on family income variable become statistically significant and negative, indicating that providers are less likely to stay in HPSAs where the average family

income is increasing. Along with the estimates on the other local area characteristics (that are directionally similar to the estimates from Table IV.1), these findings are in line with our hypothesis that providers serving in HPSAs have a preference to serve underserved populations.

In the case of mental health HPSAs, male and female providers did not differ in their retention probability in the same HPSA (Table IV.3). Similar to primary care providers, the older the providers the more likely they were to remain in the same mental health HPSA. Also, providers with a separation/start year at the beginning of our timeframe were in general more likely to remain in the same HPSA. In terms of differences in retention relative to primary care HPSAs, we estimated a lower probability to remain in the same mental health HPSA for medical doctors and nurse practitioners relative to other mental health workers, with the effect being stronger in the further out separation/start years. We also estimated more variation in same HPSA retention by Census divisions. Providers in the East South Central and South Atlantic divisions were least likely to remain in the same mental health HPSA. Finally, although the estimates on poverty rate and percent of people over 25 who are high school graduates are directionally the same as in the case of primary care models, we found that a higher proportion of Blacks at the local level increases the retention probability of mental health providers.

As shown in Table IV.4, the difference in retention between participants and non-participants disappeared in the case of mental health 'same HPSA'. Other important features in Table IV.4 are that the differences in retention by age group, provider type, separation/start year and Census division were less pronounced or virtually non-existent, while the differences by local area characteristics are similar to those from Table IV.3.

Marginal Effects

The coefficients in Tables IV.1-IV.4 are logit coefficients and hence do not provide a direct indication of the magnitude of the effect of various characteristics on the average retention probability of providers in HPSAs. We therefore calculate marginal effects, which show the 'ceteris paribus' differences in retention probability (measured in percentage points) relative to the mean retention probability.

In Figure IV.1 we present the marginal effects associated with NHSC participation for primary care HPSAs ('same HPSA' and 'any HPSA', respectively). In the first year since separation/start year, NHSC participants are 39.2 percentage points less likely to remain in the same HPSA relative to non-participants. This difference represents a regression-adjusted difference, obtained by netting out the impact of other (observable) individual socio-demographic and local area characteristics. Given that the unadjusted difference in the retention rate in the same HPSA in the first separation/start year is 46.6 percentage points (=89.5-43.0, from Figure III.1), it follows that 84% (=39.2/46.6) of the observed difference in primary care 'same HPSA' retention is explained by NHSC participation. Almost all of the observed retention difference, 85.6% (=15.3/15.5), is explained by NHSC participation in the case of primary care 'any HPSA' in the first separation/start year. The other ratios between adjusted and unadjusted retention differences in retention between participants and non-participants remained about the same for the other further out separation/start years, for both primary care 'same HPSA' and 'any HPSA' measures.

Figure IV. 1: Differences in the Participants' Retention Probability Relative to Non Participants – Primary Care

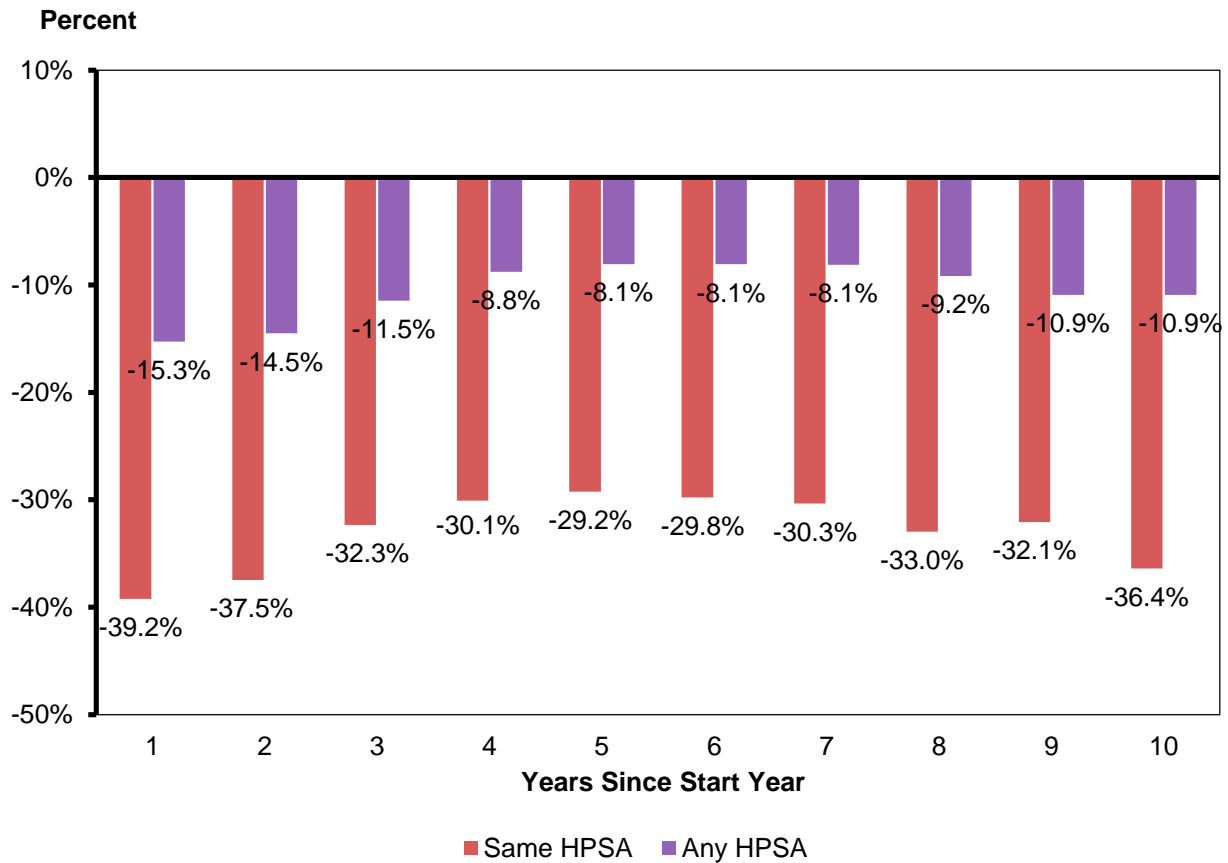
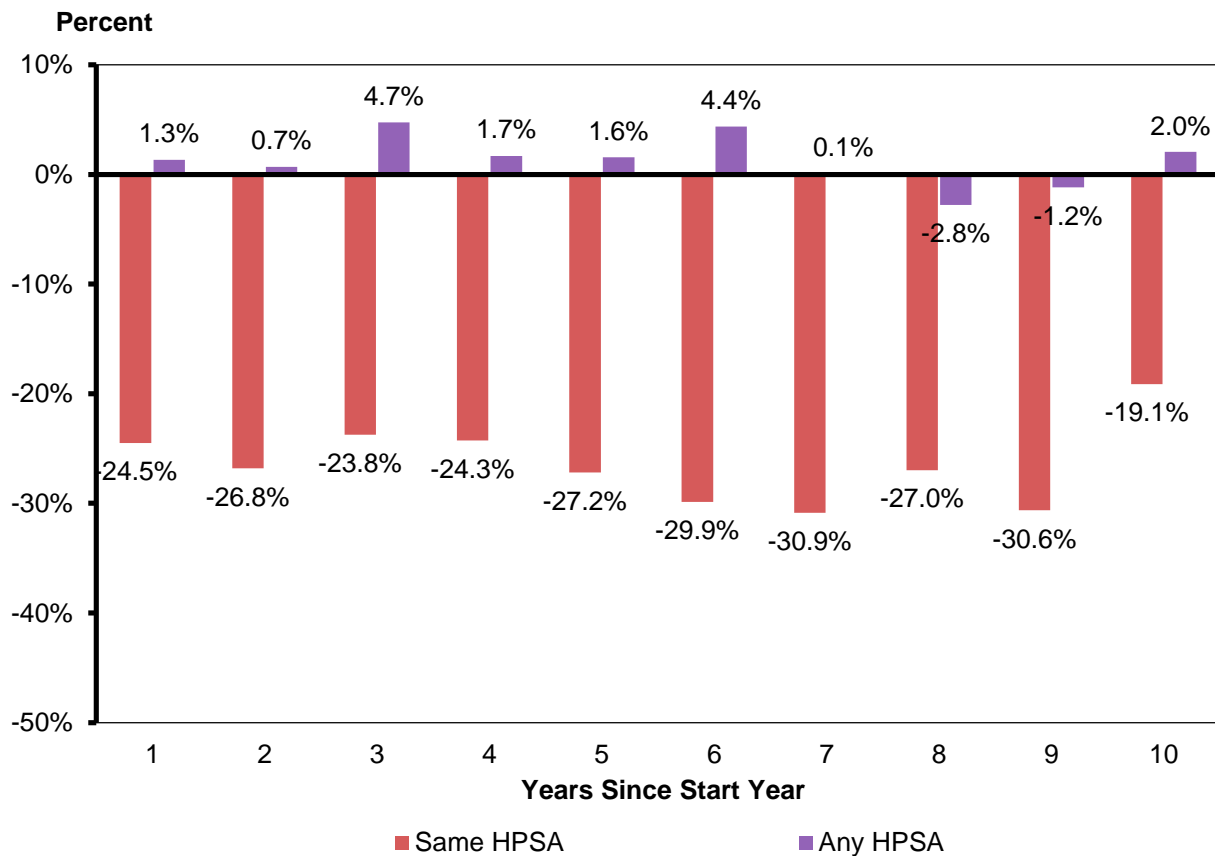


Figure IV.2 presents the regression-adjusted retention differentials by NHSC participation for mental health HPSAs. The retention differentials are lower across the board for the 'same HPSA' measure than in the case of primary care HPSAs. For the 'any HPSA' measure the differences in retention between participants and non-participants were practically zero, as shown by the statistically insignificant coefficients in Table IV.2.

Figure IV.2: Differences in the Participants' Retention Probability Relative to Non-Participants—Mental Health



As shown in Figure III.2, the unadjusted retention in 'any HPSA' was higher for non-participants in the first separation/start years than that of participants. Nonetheless, after accounting for individual-level and local area characteristics, there was no statistically significant difference between the retention of participants and non-participants in mental health HPSAs in any of the separation/start years.

Overall, for the same number of years since separation (i.e., 1 to 6), the estimates in Figures IV.1 and IV.2 are similar to the corresponding estimates from Lewin (2014). For the further out years, we estimate that the retention differential explained by NHSC participation increases. This is not necessarily surprising, as it mirrors the unadjusted differences between participants and non-participants from Figures III.1 and III.2. Although we estimate that the earlier NHSC entrants – which are in essence the providers observed 7 to 10 years after service - tend to stay longer in HPSAs than the more recent entrants (as shown in Tables IV.1-IV.4), it is the flatter retention rate of non-participating providers 7 to 10 years since their start year that is driving these larger differences in the further out years. In other words, after 7 years non-participants tend to leave HPSAs at lower rates than participants.

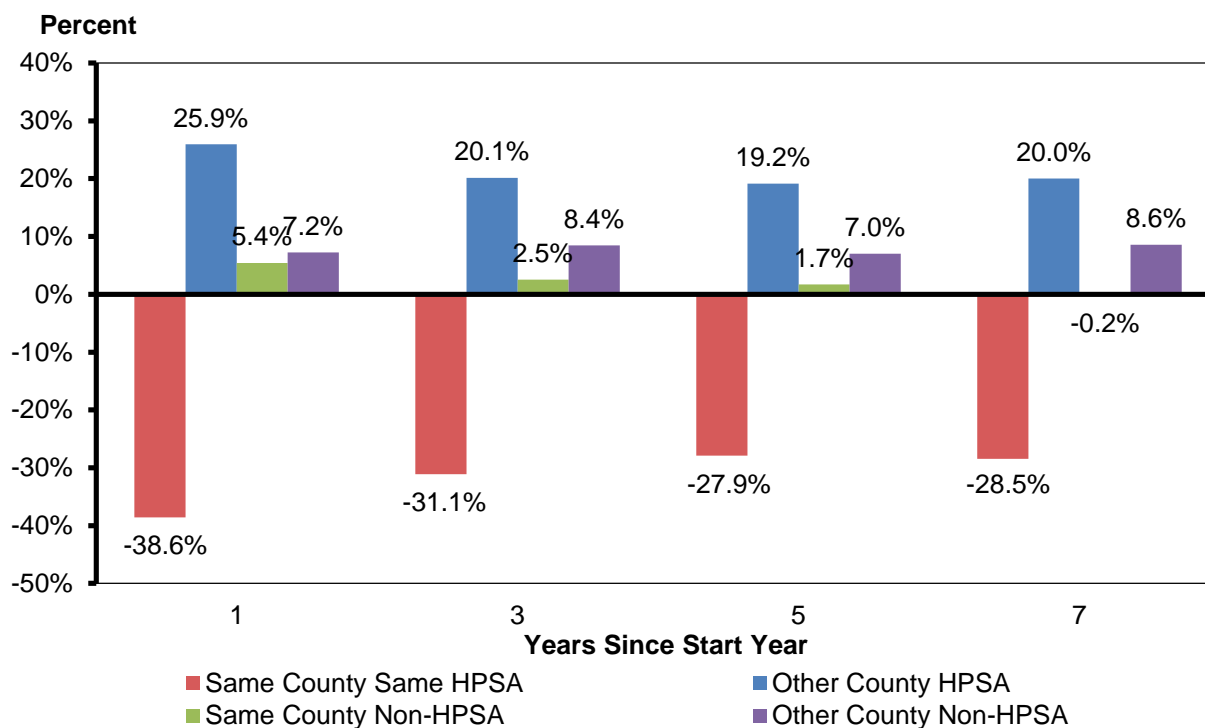
Multinomial Logit Models

A more complex model to estimate the providers' probability to move over the observed period is the multinomial logit. The advantage of this model is that it simultaneously considers the

entire locations choice set available to providers in each year. Specifically, after controlling for the same characteristics from above, this model provides estimates of the probability of each of four mutually exclusive outcomes: (1) the probability of choosing to remain in the same HPSA and same county; (2) the probability of moving to a non-HPSA location within the same county; (3) the probability to move to another HPSA in another county; and (4) the probability of moving to a non-HPSA in another county.

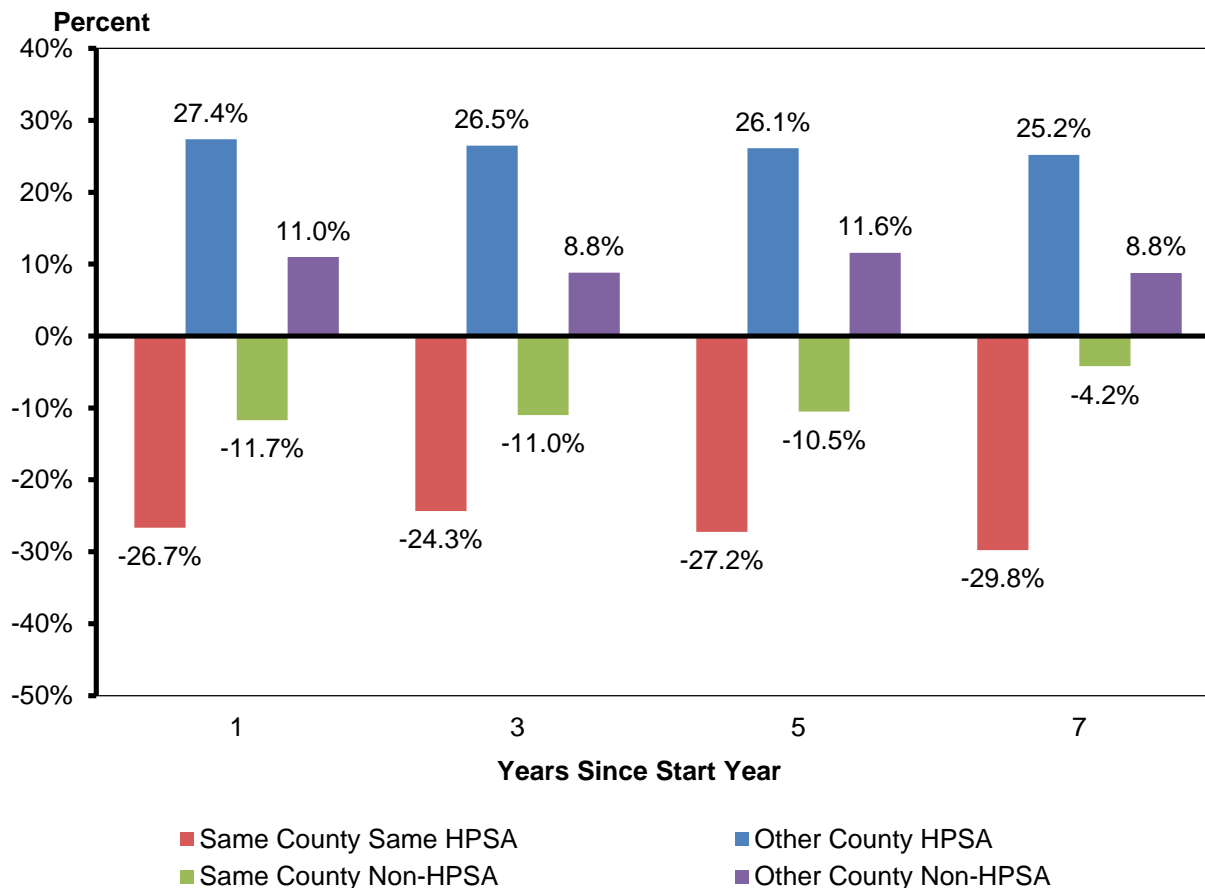
Inclusion of the NHSC participation variable in the multinomial logit model allows for the estimation of the difference in migration probabilities between participants and non-participants to any of the four HPSA/non-HPSA type locations. In Figure IV.3 we present the marginal effects associated with these migration probability differences for primary care HPSAs, while in Figure IV.4 we present the marginal effects for mental health HPSAs. We do not present the actual coefficients from the multinomial logit models for space considerations.

Figure IV.3: Differences in the Participants' Migration Probabilities Relative to Non-Participants—Primary Care



According to our estimates, participants serving in primary care HPSAs are 38.6% less likely than non-participants to remain in the same HPSA in the first separation/start year. At the same time, they are 25.9% more likely to move to a HPSA in another county in the first separation/start year, meaning that overall, they are 12.7 percentage points ($= -38.6 + 25.9$) less likely to remain in any primary care HPSA. The 'same HPSA' and 'any HPSA' estimates from Figure IV.3 are in line with our estimate from Figure IV.1, but the advantage of the multinomial logit model is that it also shows that participants are 5.4% more likely than non-participants to move to non-HPSAs in the same county and 7.2% to move to non-HPSAs in another county.

Figure IV.4: Differences in the Participants' Migration Probabilities Relative to Non-Participants—Mental Health



In addition, as in Lewin (2014), the multinomial logit estimates explain why the mental health participants show no difference in their “any HPSA” retention relative to non-participants. As shown in Figure IV.4, in the first separation/start year participants are 26.7% less likely to remain in the same county same HPSA than non-participants, but 27.4% more likely to move to HPSAs in another county. When these differences are added up they yield an estimate of virtually zero difference between participants and non-participants in terms of retention in any mental health HPSA.

Comparing these findings with the ones from Lewin (2014), we find that there a lot of similarities in terms of the magnitude and sign of the estimates. We nonetheless find that the probabilities to move out of “same HPSA” and move into “Other HPSAs” from this study are a few percentage points larger than the ones from Lewin (2014). As we discuss when we present Figures IV.1 and IV.2 above, these results are consistent with the finding that more recent participants have more frequent moves out of the “same HPSA” and into “any HPSAs”. Overall, “any HPSA” retention remains about the same as in Lewin (2014).

Viewed from the perspective of our conceptual framework, the empirical estimates from this Chapter provide strong evidence that participation in the NHSC programs is not entirely based on selection by preferences. In other words, NHSC has a recruiting effect, as it is able to attract in HPSAs providers who would not serve there without the program award. We return to the estimation of the recruiting effect in Chapter VI. It follows that the NHSC has a bigger effect on

person-years of service in HPSAs than in a case when selection into the program is based only on preferences (and as a result there are no differences in retention between participants and non-participants). Furthermore, another implication is that a larger difference between the retention in a HPSA of NHSC participants and non-participants is a sign of program success, not failure. In fact, in Chapter VI we present estimates showing that despite the lower retention of NHSC participants in HPSA relative to non-participants, the program has a recruiting and a retention effect that ultimately yield substantial increases in the total number of FTE-years in HPSAs.

Retention of NHSC Participants Serving in Indian Health Sites

In this chapter we provide a similar analysis focused on NHSC participants who served in Indian Health Sites (in short, NHSC-IHS providers). We start by showing in Table V.1 a number of relevant descriptive statistics on the population of NHSC-IHS providers.

We identify in the NHSC administrative data a number of 970 NHSC-IHS providers, of which 520 were classified under Primary Care, 234 under Mental Care and 216 under Dental Care. We find in the first analytic dataset a number of 405 such providers, and 773 of them in the second analytic dataset.

Table V.1: Descriptive Statistics of NHSC-IHS Providers

Discipline	All IHS NHSC Providers	IHS NHSC in First Data Set	IHS NHSC in Second Data Set
Allopathic Physician	169	127	148
Osteopathic Physician	48	39	44
Certified Nurse Midwife	36	13	35
Dentist	180	2	137
Health Service Psychologist	31	7	24
Licensed Clinical Social Worker	62	10	46
Licensed Professional Counselor	89	1	57
Marriage and Family Therapist	29		22
Nurse Practitioner	164	114	144
Physician Assistant	125	90	104
Psychiatric Nurse Specialist	1	1	1
Registered Dental Hygienist	36	1	11
TOTAL	970	405	773
Age (at Entry)	38.3	39.2	38.5
Gender			
<i>Males</i>	318	143	266
<i>Females</i>	644	262	507
HPSA Type			
<i>Primary Care</i>	520	370	458
<i>Mental Health</i>	234	32	167
<i>Dental</i>	216	3	148
TOTAL	970	405	773

Using the first analytic dataset, we construct the retention profiles in the same HPSA as well as in any HPSA using the same methods described in Chapter III. We present these retention rates in Figure V.1. Given that IHS sites change their destination fairly frequently over our timeframe, we construct the “same HPSA” and the “any HPSA” retention rates by whether the provider was ever working in an IHS site, and whether the provider was last observed in service in an IHS site.

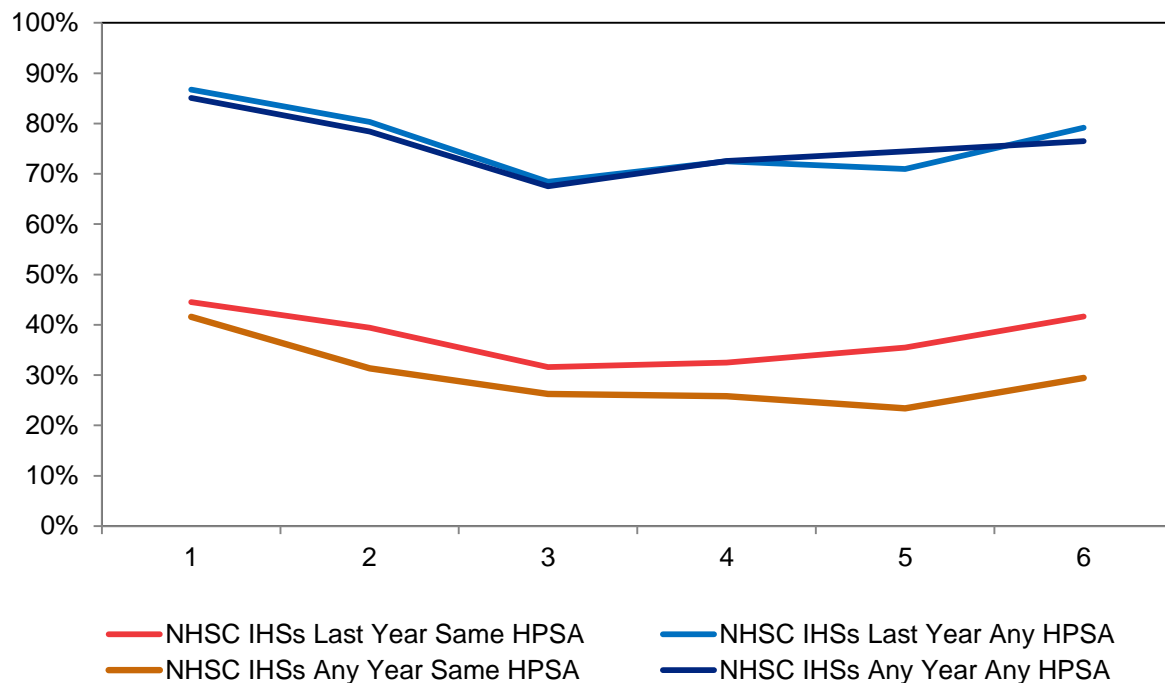
As shown in Figure V.1, the “same HPSA” retention rates are similar to the “same HPSA” retention rates from Figure III.1 for all NHSC providers. The retention rate based on whether

the provider was ever in an IHS is lower than the retention rate of providers who leave NHSC service from IHS sites.

Despite the fact that the “same HPSA” retention of the NHSC-IHS providers who were ever in an IHS site is lower than that of the NHSC-IHS providers who left service from an IHS site (especially for the further out years), the “any HPSA” retention rates of these categories are virtually indistinguishable from each other.

Nonetheless, the NHSC-IHS “any HPSA” retention rates are larger than the “any HPSA” retention rates of all NHSC participants. There a number of limitations that preclude us from making direct comparisons with the “any HPSA” retention rates of all NHSC providers, but this higher retention rate of NHSC-IHS alumni may point to a higher preference for serving IHS site populations, and thus a higher preference for serving in NHSC in general.

Figure V.1: Retention Rates of NHSC Participants in Indian Health Sites – Primary Care



The main limitation in the retention analysis of NHSC-IHS participants comes from the fact that many of the NHSC-IHS participants are likely to be participants in the IHS’s own loan repayment program. If that is the case, we cannot distinguish between NHSC-IHS participants and the NHSC-IHS participants who also have an IHS loan repayment. Their retention rates may be different from each other, and what we observe in Figure V.1 is a combination of these retention rates. Because of this data limitation, we cannot construct retention profiles of non-NHSC providers who serve in IHS sites, as they may be in fact IHS loan repayment participants.

In Tables V.2-V.4 we present retention rates that we calculate using the second analytic dataset. As in the case of all NHSC participants, the retention rates from those tables paint a similar picture as Figure V.1. However, the sample sizes in the year-HPSA cells are sometimes very

small, such that some of the yearly retention rates are less reliable. In fact we exclude the rows where the number of NHSC-IHS participants is very low.

Table V.2: Retention Rates of NHSC-IHS Participants as of January 2015 – Primary Care

Year of Exit from NHSC	HPSA & Current IHS	HPSA & Not Current IHS	Non-HPSA & Current IHS	Non-HPSA & Not Current IHS	Total matched in P360 data
2000	0	1	0	1	2
2000	0.00%	50.00%	0.00%	50.00%	
2001	1	1	1	1	4
2001	25.00%	25.00%	25.00%	25.00%	
2002	0	5	0	0	5
2002	0.00%	100.00%	0.00%	0.00%	
2003	0	1	0	2	3
2003	0.00%	33.33%	0.00%	66.67%	
2004	4	7	1	0	12
2004	33.33%	58.33%	8.33%	0.00%	
2005	0	6	1	0	7
2005	0.00%	85.71%	14.29%	0.00%	
2006	2	6	3	2	13
2006	15.38%	46.15%	23.08%	15.38%	
2007	8	4	3	2	17
2007	47.06%	23.53%	17.65%	11.76%	
2008	5	4	3	1	13
2008	38.46%	30.77%	23.08%	7.69%	
2009	5	4	3	1	13
2009	38.46%	30.77%	23.08%	7.69%	
2010	4	2	2	3	11
2010	36.36%	18.18%	18.18%	27.27%	
2011	3	10	8	3	24
2011	12.50%	41.67%	33.33%	12.50%	
2012	13	17	2	6	38
2012	34.21%	44.74%	5.26%	15.79%	
2013	3	6	1	0	10
2013	30.00%	60.00%	10.00%	0.00%	
2014	15	24	2	2	43
2014	34.88%	55.81%	4.65%	4.65%	
2015	9	23	4	3	39
2015	23.08%	58.97%	10.26%	7.69%	
Total	69	123	33	26	251
Total	23.05%	47.69%	13.51%	15.76%	

Table V.3: Retention Rates of NHSC-IHS Participants as of January 2015 – Mental Care

Year of Exit from NHSC	HPSA & Current IHS	HPSA & Not Current IHS	Non-HPSA & Not Current IHS	Total matched in P360 data
2011	3	8	0	11
2011	27.27%	72.73%	0.00%	
2012	1	5	0	6
2012	16.67%	83.33%	0.00%	
2013	1	2	1	4
2013	25.00%	50.00%	25.00%	
2014	3	15	1	19
2014	15.79%	78.95%	5.26%	
2015	2	11	1	14
2015	14.29%	78.57%	7.14%	
Total	12	46	5	63
Total	27.18%	55.78%	17.04%	

Table V.4: Retention Rates of NHSC-IHS Participants as of January 2015 – Dental Care

Year of Exit from NHSC	HPSA & Current IHS	HPSA & Not Current IHS	Non-HPSA & Current IHS	Non-HPSA & Not Current IHS	Total matched in P360 data
2010	1	2	0	1	4
2010	25.00%	50.00%	0.00%	25.00%	
2011	2	1	1	1	5
2011	40.00%	20.00%	20.00%	20.00%	
2012	5	7	1	1	14
2012	35.71%	50.00%	7.14%	7.14%	
2013	0	0	1	3	4
2013	0.00%	0.00%	25.00%	75.00%	
2014	0	10	1	1	12
2014	0.00%	83.33%	8.33%	8.33%	
2015	1	9	0	2	12
2015	8.33%	75.00%	0.00%	16.67%	
Total	11	35	5	11	62
Total	17.31%	54.40%	11.46%	16.82%	

NHSC Recruiting and Retention Effects

In this chapter we provide a more in-depth analysis of the NHSC’s recruiting and retention effects.

Recruiting Effect

In order to be effective, NHSC must be able to induce some providers to locate in HPSAs given that they would not have otherwise chosen those locations. As documented by the Medicare Provider data, a large number of providers do practice in HPSAs and do not need an incentive to do so. However, those who would have located in HPSAs without the incentive may apply for and receive the incentive if they are eligible. It follows that the program award to these participants are unnecessary payments (or “economic rent”, as it is typically referred to in the economics literature) in the sense that the decision of these providers to locate and serve in a HPSA is not influenced by the program. Hence, the payment of the incentive to these providers does not increase the supply of providers in HPSAs. Conversely, some providers who would not have chosen to practice in HPSAs may be induced to do so by the program. If so, they increase the supply of providers in the area. This is what we call the *recruiting effect* of the NHSC program. A larger recruiting effect translates into a greater success of the program, given that the supply of providers (and ultimately, the volume of medical services provided) in HPSAs is larger than what it would be in the absence of the program.

Econometric Model

To estimate the recruiting effect of the program we consider an econometric model that uses information on the number of providers and program participants at the county-year level over the period between 2005 and 2014, available in the first analytic dataset. Let Y_{it} be the number of providers in county i and year t . We can then write:

$$Y_{it} = \mathbf{X}_{it}' \cdot \boldsymbol{\beta} + \alpha \cdot P_{it} + \varepsilon_{it} \quad (2)$$

where \mathbf{X}_{it} is a vector of characteristics of county i in year t , $\boldsymbol{\beta}$ is a vector of coefficients, and ε_{it} is a random error term. The characteristics in \mathbf{X}_{it} are intended to capture factors that determine providers to choose one location over another, such as local socio-economic and demographic county-level characteristics, while P_{it} denotes the number of NHSC program participants in county i in year t . Since both the dependent variable and the counts of participating providers represent “stock” measures (i.e., the result of inflows and outflows of providers in a given year and in a given county, plus those who stay in the area from one year to the next), we include two lagged terms of the number of providers.

The strategy associated with the model is to predict the number of providers of the relevant type in a county (both HPSA and non-HPSA) as a function of factors that may be associated with the propensity of providers to locate in that area. These factors include the size, age and sex distribution of the population; the socio-economic characteristics of the population, including median income, and percent below poverty; distribution of the population by type of insurance (Medicare, Medicaid, Commercial, other); and other measurable factors that may be related to the attractiveness of the area as a place to practice. The model can be estimated by including only the counties where at least one NHSC participant is observed over the entire timeframe, or by including all counties (with and without NHSC participants). Of course, the NHSC recruiting effect is determined only using data from counties with NHSC participants, and its magnitude should not differ across the two data samples.

Program participants in a county may or may not add to the number of providers in a HPSA. If the program participants would have practiced in that HPSA anyway, without the incentive of the program, they would not add to the expected number of providers. However, if because of the program's incentives, there are more providers in the targeted area than would be expected otherwise, then the program has been successful in adding to providers in that HPSA.

The model in equation (2) estimates the α parameter on P_{it} that indicates whether the increase in the number of providers in HPSAs is between 0 and 1. If the estimated value of α is zero, the program does not add to the number of providers. If the value is one, each program participant adds to the number of providers in HPSAs, and as such all participants have been induced by the program to serve in HPSAs. In other words, the program does not pay any “economic rent” to its participants. If instead the value of the coefficient is zero, then the program only pays economic rent, that is, all program participants would have served in HPSAs even without the incentive. One minus the estimate of α indicates the proportion of participants that would have practiced in the targeted areas without the incentive, while the estimate of α shows the fraction of participating providers that were attracted to HPSAs and who would not have otherwise practiced in HPSAs.

Empirical Estimates

In Table VI.1 we present the regression coefficients obtained by estimating the model in equation (2) for primary care physicians and NP/PAs. In the case of physicians, we estimate that for every 10 primary care NHSC participants, the number of primary care physicians in a HPSA increases by 4.31. This finding is consistent with an important recruiting effect, since it indicates that NHSC participation does increase the number of primary care physicians in HPSAs. In the case of non-physician primary care providers, we find that almost 8 out of 10 new NHSC entrants are providers who would not have served in HPSAs in the absence of the program.

The larger effect for non-physicians may suggest that the NHSC award represents a much larger fraction in the total income of these providers than it is the case for physicians. In this sense, the NHSC program may be a relatively more attractive option for NPs and PAs, as the actual award amounts may be more successful in compensating these providers for the negative HPSA preference they may have.

We also estimate model (2) using the counts of mental health providers and found an effect of 0.594 on NHSC participation, at the same level of statistical significance.

Table VI.1: Recruiting Effect Regression Estimates – Primary and Mental Care

	PC Physicians	NP/PAs	MH Providers
NHSC Participants	0.431*** (0.077)	0.793*** (0.032)	0.594*** (0.032)
PC Physicians Year t-1	1.086*** (0.006)	--	--
PC Physicians Year t-2	-0.080*** (0.007)	--	--
NP/PAs Year t-1	--	1.052*** (0.006)	--
NP/PAs Year t-2	--	-0.030*** (0.007)	--
MH Providers Year t-1	--	--	0.939*** (0.006)
MH Providers Year t-2	--	--	-0.016*** (0.006)
Poverty Rate	0.032 (0.048)	0.059*** (0.021)	0.036* (0.022)
Percent White	-5.923** (2.593)	-1.757 (1.132)	-1.345 (1.189)
Percent Black	-4.946 (3.070)	1.447 (1.346)	0.748 (1.410)
Log Family Income	5.137*** (1.398)	5.041*** (0.616)	2.635*** (0.645)
Percent HS Grads Over 25 Years	5.755 (4.970)	-1.485 (2.178)	-0.034 (2.283)
Percent Population Over 65	-10.280 (8.263)	-10.504*** (3.623)	-2.810 (3.795)
Constant	-42.511** (16.737)	-46.771*** (7.374)	-24.248*** (7.717)
Observations	27,440	27,440	27,440

NOTE: The models include state and year dummies. Standard errors are shown in parentheses.
* p<0.10, ** p<0.05, *** p<0.01.

The other variables we included in these models are intended to capture other factors that are typically correlated with provider's decisions to locate in various areas. Similar to other findings in the literature, we estimate that providers are more numerous in counties where the median family income is larger, the percent of White is larger (in the case of physicians), and the poverty rate is higher (in the case of NPs and PAs, and mental health providers). Ricketts and Randolph (2014) find that physicians move to places lower provider-to-population ratios, but with a higher per capita income and lower unemployment.

As a robustness check, we estimate the two models from Table VI.1 including only observations from the counties in which there were NHSC participants. As expected, the magnitude of the NHSC estimates remains the same; we take this as an additional confirmation that the estimated effect is unlikely to be generated by other non-NHSC factors.

We also estimate models in which we restrict the data to exclude the recent years, to determine whether the recruiting effect has changed over time. In models in which we only include data through 2012, 2013 and 2014 we estimate an effect of 0.415, 0.375, and 0.350 (each highly statistically significant) respectively, for primary care physicians. While these estimates may not suggest much change for primary care physicians, for NP/PAs we estimate effects of 0.373 and 0.257 (with p-values lower than 0.001) when we restrict the data to include only the years through 2010 and 2011, respectively. Including the more recent years the effect on NP/PAs is basically the same as the one reported in the second column of Table V.1. Similarly, in the case of mental health providers, we obtain NHSC estimates of 0.104 and 0.076 (statistically significant at 1%). The increase in the estimated recruiting effect on non-physicians (NPs, PAs and mental health providers) coincides with the ACA and ARRA changes.

Retention Effect

As we discuss in Chapter III, the NHSC program generates a retention effect to the extent that NHSC providers serve in HPSAs longer than what they would if there were no program. Ultimately, this effect is defined following the same logic as in the case of the recruiting effect, of whether the program directly increases the supply of medical services in HPSAs, relative to a case when the program does not exist.

However, it is difficult to gain insights into a counterfactual scenario in which the program is inexistent. The readily available comparison group - that of non-participating providers -, may be very different in terms of unobservable characteristics from the group of participating providers. In turn, these unobservable differences may affect the time spent in HPSAs by the two groups (regardless of the NHSC program), and as such, the comparison between the retention of participants and the retention of non-participants as we present it in Chapters III and IV may not be reflective of a true program retention effect.

Ideally, one would need an experimental setting (or a randomized control trial) in which NHSC participation is randomly allocated to a population of providers. This would ensure that the population of participants and non-participants is similar across all relevant characteristics, and hence, a comparison between the retention of participants and the retention of non-participants would be enough to isolate the program impact on provider retention in HPSAs. The more adequate comparison group we identified for this study is the group of providers who are eligible for NHSC service, but did not receive funding. Assuming that the main reason they were unfunded was funding limitations, this group is directly comparable to the group of participants.

In Table VI.2 we present the retention rates of the primary care unfunded eligible providers who submitted an application in 2013 and 2014. These rates are constructed using the second analytic dataset because these individuals are only out of service for a maximum of two years in January 2015, and because we wanted to include as many eligible unfunded providers as possible in this analysis. Using the retention rates of those who are in “any HPSA” in the application year, we construct an expected (or average) time spent in HPSAs by these providers. Our calculations indicate that over the maximum period of two years of observation afforded by our data, eligible unfunded providers spend on average 1.8 years in HPSAs. We

then compare this time with the time that actual participants spend in HPSAs over the first two years elapsed since their application - which in the vast majority of cases is practically two years, as attrition while in service is very low - it turns out that the NHSC program increases retention in HPSAs by about 10% $(= (2/1.8) - 1)$. This is an estimate of the retention effect of the program over the two years elapsed since the application.

Inherent data limitations (i.e., the data on the eligible unfunded applicants does not go back further than 2013) do not allow us to construct a more general estimate of the retention effect, over a large period of time since NHSC application.

Table VI.2: Retention Rates in HPSAs of Unfunded Eligible Providers – Primary Care

	Application Year	Applicants	In 'Any HPSA' in 2015	Retention Rates
In 'Any HPSA' in Application Year				
	2014	110	98	89.1%
	2013	112	96	85.7%
Not In 'Any HPSA' in Application Year				
	2014	48	31	64.6%
	2013	54	37	68.5%

In Table VI.3 we present similar findings for the mental care providers.

Table VI.3: Retention Rates in HPSAs of Unfunded Eligible Providers – Mental Care

	Application Year	Applicants	In 'Any HPSA' in 2015	Retention Rates
In 'Any HPSA' in Application Year				
	2014	27	23	85.2%
	2013	56	50	89.3%
Not In 'Any HPSA' in Application Year				
	2014	11	8	72.7%
	2013	20	11	55.0%

The rates in Tables VI.2 and VI.3 are unadjusted differences, that is, they are obtained without controlling for the various local-level and individual level characteristics we use above. This is because of the severe limitations of the sample sizes. Nonetheless, it may be reasonable to assume that, as we see in our regression models from this and the previous chapter, variables like age, gender, provider type and other characteristics do not appear to explain much from the differences between the various provider groups.

It is important to note that a large fraction of the unfunded providers who applied from a non-HPSA location did move to a HPSA one or two years after the application. From the viewpoint of our conceptual framework, these are potentially providers who would have moved to HPSA even without the incentive offered through the program. It is remarkable that the fraction of

providers who applied from a non-HPSA location and did not move to a HPSA varies between 30 and 40%, very similar to the recruiting effect estimates from the previous section.

Total Effect of the NHSC Program

In the previous sections of this Chapter, we estimate of: (1) the number of additional providers who serve in HPSAs as the result of NHSC; and (2) the increase in retention in HPSAs due to the incentive. We now translate these effects into the number of annual provider FTEs generated by the program, and for each provider type considered.

The full effect of an incentive program, expressed as the total provider FTE-years generated by the program, T , is obtained using the following expression:

$$T = \Delta P \cdot \tau_r + P_p \cdot (\tau_{r,p} - \tau_{r,np}) \quad (3)$$

The first term in equation (3) calculates the number of additional FTE-years coming from the providers induced by the program, ΔP , and is obtained by multiplying ΔP with the expected years these additional providers serve in HPSAs, τ_r . The product between ΔP and τ_r represents the recruiting effect of the program and it reflects the number of annual provider FTEs generated by the program by attracting into HPSAs providers who would not have served there in the absence of the program. The term τ_r is computed using the retention profiles of the additional providers. The retention profile of these additional providers is inferred from the retention rates of program participants, the retention rates of non-participants (as reported in Figures III.1-III.4), and the recruiting effect estimates from Table VI.1. In the upper part of Table VI.4 we report these inferred retention rates for each of the three groups of providers considered.

The second term in equation (3) measures the retention effect of the program in terms of the annual provider FTEs in HPSAs, by multiplying the number of program participants, P_p , with the difference in the average time spent in HPSAs by program participants and comparable, non-participating providers (i.e., the unfunded eligible providers), $\tau_{r,p} - \tau_{r,np}$. If the average time in HPSAs of program participants, $\tau_{r,p}$, is larger than the average time in HPSAs of non-participants, $\tau_{r,np}$, then the program has a retention effect. The term P_p indicates all program participants, including both providers attracted by the program as well as providers who would have gone to HPSAs without the program. Of course, a higher value for $\tau_{r,p}$ increases the retention effect, as well as the overall effect of the program, T .

Of the 6,209 primary care physicians who entered service between 2000 and 2015, we estimate that 43.1% of them join HPSAs only as a result of the NHSC, i.e., 2,676 providers. In Table VI.4 we report this number as the recruiting effect, expressed in number of providers. If, for simplicity, we assume that each of these providers served full time while in HPSAs, the number of FTE-years generated by NHSC through the recruiting effect is 11,263 ($=2,676 \cdot 4.209$), where 4.209 is the estimate of τ_r and was obtained as described above from the inferred retention rates of providers who joined HPSAs only as a result of the program. The number of 11,263 FTE-years is our estimate of the recruiting effect. These are FTE-years supplied by providers that would not have been offered in HPSAs in the absence of the NHSC program.

The retention effect is obtained by approximating $\tau_{r,p} - \tau_{r,np}$ with $2 - 1.8 = 0.2$, which is the difference we obtain by comparing participants and unfunded eligible providers. Therefore, the total program effect in terms of FTE-years is $2,676 \cdot 4.209 + 6,209 \cdot 0.2 = 12,505$ for primary care physicians. A similar calculation for NPs and PAs NHSC participants yields an estimate of 35,308 FTE-years, and a total of 27,629 FTE-years for mental health providers. The assumption was that $\tau_{r,p} - \tau_{r,np}$ is the same as the difference we use for the calculation of the retention effect of primary care physicians.

Table VI.4: Estimated Recruiting and Retention Effects of the NHSC Program (2000-2015)

Years Since Start Year	PC Physicians	NP/PAs	MH Providers
1	0.582	0.746	0.607
2	0.512	0.688	0.596
3	0.511	0.665	0.631
4	0.536	0.668	0.584
5	0.548	0.667	0.572
6	0.543	0.660	0.648
7	0.567	0.667	0.634
8	0.566	0.668	0.560
9	0.521	0.643	0.593
10	0.591	0.659	0.518
Expected Years in HPSAs	4.209	5.222	4.515
Providers	6,209	8,134	9,587
Recruiting Effect (Providers)	2,676	6,450	5,695
Recruiting Effect (FTE-Years)	11,263	33,681	25,712
Retention Effect (FTE-Years)	1,242	1,627	1,917
Total Effect (FTE-Years)	12,505	35,308	27,629

Of course, these estimates should be viewed with caution. One of the main limitations is that the recruiting effect estimates from Table VI.1 are obtained from models in which we cannot control for other unobservable characteristics that may still be, at least in part, responsible for provider migration patterns. Another limitation is that we can only track providers for up to 10 years after separation. Although our expected years in HPSAs calculations take this into account, a timeframe larger than 10 years may yield larger expected years in HPSAs for the provider types we considered. In addition, the retention effect estimates are limited to at most two years, since the data on the eligible unfunded providers goes back in time only to 2013. Also, in the case of the retention effect calculations, we cannot distinguish between physician and non-physician effects, because of the small number of providers that we were able to track after the time of application. Hence, the $\tau_{r,p} - \tau_{r,np}$ difference does not vary by provider type in our calculations from Table VI.4. Not least, the $\tau_{r,p} - \tau_{r,np}$ difference is approximated with an unadjusted difference between participants and unfunded eligible participants. Ideally, we would need to be able to control for other local-level and provider-level characteristics in a regression setting to net out the impact of other characteristics on the difference, but given the small sample size, that is currently not possible.

However, regardless of the exact value of the total effect on the number of provider-years in HPSAs, the estimates from Table VI.4 point to potential important program effects of the NHSC program in increasing the number of providers in high-need areas. This study advances current knowledge on the NHSC program effect, and offers a pathway for further causal effect analyses, once more data on participants and eligible unfunded providers becomes available in the future.

Conclusions

In this study we continued our analysis of the National Health Service Corps (NHSC) by focusing on the recent retention trends of NHSC program alumni in Health Professional Shortage Areas (HPSAs), the retention patterns of those NHSC participants who serve in Indian Health Service (IHS) sites, and on an analysis of the recruiting and retention effects of the program.

We find that in the case of primary care providers, the “same HPSA” retention rates in the first years after separation from service are lower than in Lewin (2014). This suggests that the primary care providers who left NHSC in the more recent years leave the HPSA where they served at higher rates than before. However, when comparing the “any HPSA” retention rates, it turns out that although the retention rates from this study are smaller than the ones reported in Lewin (2014), the differences are much smaller than in the case of “same HPSA” retention, indicating that NHSC alumni still remain in HPSA at elevated rates (just as documented in Lewin 2014), but the moves from the “same HPSA” to “any HPSA” locations are more frequent in the recent years than in the past. We find similar retention and migration patterns in the case of mental health providers and in the case of Indian Health Service NHSC participants. As we show in Chapter IV, these differences do not seem to be driven by other provider-level or local-level characteristics, such as age, gender, provider type, local area income, or percent of the population under poverty rate.

We further develop our theoretical framework and hypothesize that a zero difference between the retention rates participants and non-participants is equivalent to a zero recruiting effect. When the program is successful in attracting providers who would not serve in HPSAs without the incentive, then the program has a recruiting effect, and since the average HPSA preference for the newly attracted providers is lower than the average preference of the rest of the providers, it follows that the post-obligation retention rate of participants is lower than that of non-participants. Importantly, the retention differential becomes larger when the recruiting effect is larger.

In order to be effective, NHSC must be able to induce some providers to locate in HPSAs given that they would not have otherwise chosen those locations. Some providers who would not have chosen to practice in HPSAs may be induced to do so by the program. If so, they increase the supply of providers in the area. This is what we call the *recruiting effect* of the NHSC program. Also, the NHSC program generates a *retention effect* to the extent that NHSC providers serve in HPSAs longer than what they would if there were no program.

We estimate the recruiting effect is based on an empirical specification in which the total number of providers currently serving in a HPSA is modeled as a function of the number of NHSC participating providers serving in that area. In this model we control for past levels of providers in the area, as well as for a number of relevant local level characteristics that typically influence the location choices of providers. Regarding the retention effect, we make use of a novel dataset, that of providers who were deemed eligible for NHSC funding in the application process, but ended up not receiving funding, mainly because of funding limits.

We provide a number of tentative estimates for the recruiting and retention effects for primary care physicians, NPs and PAs, and mental health providers. In this study we face a number of important (and insurmountable) data limitations in the estimation of the recruiting and retention effects. However, regardless of the exact value of the total effect on the number of provider-years in HPSAs, we find empirical evidence pointing to potential important program effects of the NHSC program in increasing the number of providers in high-need areas.

Appendix

Table A.1: Distribution of the NHSC Workforce by Provider Discipline

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
<i>Allopathic Physician</i>	294	341	419	666	809	979	954	941	911	1038	1460	1805	1753	1583	1821	1678
<i>Osteopathic Physician</i>	79	96	126	190	254	292	306	333	336	383	505	627	620	552	615	565
<i>Chiropractor</i>	0	0	0	7	8	9	7	3	1	1	1	1	1	1	0	0
<i>Certified Nurse Midwife</i>	27	26	44	73	98	102	90	84	84	105	179	204	168	151	175	191
<i>Dentist</i>	172	181	213	305	342	388	399	372	387	536	842	1121	1156	1079	1240	1184
<i>Health Service Psychologist</i>	48	68	117	204	280	340	367	334	344	479	709	843	767	636	725	662
<i>Licensed Clinical Social Worker</i>	55	67	95	158	196	207	217	193	180	257	523	860	916	791	1073	1183
<i>Licensed Prof Counselor</i>	0	7	27	73	113	154	170	141	129	249	527	895	957	882	1193	1381
<i>Marriage and Family Therapist</i>	11	10	10	26	37	33	33	35	37	44	82	133	139	136	168	173
<i>Nurse Practitioner</i>	118	142	217	304	371	398	393	365	340	529	1117	1665	1589	1349	1801	1962
<i>Pharmacist</i>	0	3	3	24	23	5	0	0	0	0	0	0	0	0	0	0
<i>Physician Assistant</i>	111	114	176	333	438	469	408	404	393	554	980	1352	1292	1127	1317	1219
<i>Psychiatric Nurse Specialist</i>	2	4	6	9	9	8	6	6	10	11	14	33	36	27	27	23
<i>Registered Dental Hygienist</i>	5	7	14	27	34	40	39	31	31	56	144	232	194	178	240	295

**Table A.2: Retention Rates of NHSC Participants as of January 2015 –
Primary Care (First Analytic Dataset)**

Year of Exit from NHSC	HPSA & same county	HPSA & other county	Non-HPSA & same county	Non-HPSA & other county	Total NHSC providers in Medicare data
2000	16	47	6	42	111
	14.41%	42.34%	5.41%	37.84%	
2001	33	49	6	39	127
	25.98%	38.58%	4.72%	30.71%	
2002	38	48	7	32	125
	30.40%	38.40%	5.60%	25.60%	
2003	68	78	15	39	200
	34.00%	39.00%	7.50%	19.50%	
2004	118	148	30	81	377
	31.30%	39.26%	7.96%	21.49%	
2005	148	169	30	106	453
	32.67%	37.31%	6.62%	23.40%	
2006	176	157	42	112	487
	36.14%	32.24%	8.62%	23.00%	
2007	146	153	29	90	418
	34.93%	36.60%	6.94%	21.53%	
2008	179	120	27	81	407
	43.98%	29.48%	6.63%	19.90%	
2009	146	112	33	95	386
	37.82%	29.02%	8.55%	24.61%	
2010	208	128	41	93	470
	44.26%	27.23%	8.72%	19.79%	
2011	437	275	107	185	1,004
	43.53%	27.39%	10.66%	18.43%	
2012	642	247	112	156	1,157
	55.49%	21.35%	9.68%	13.48%	
2013	143	74	25	45	287
	49.83%	25.78%	8.71%	15.68%	
2014	549	184	77	78	888
	61.82%	20.72%	8.67%	8.78%	
2015	527	0	110	0	637
	82.73%	0.00%	17.27%	0.00%	
Total	3,574	1,989	697	1,274	7,534
	47%	26%	9%	17%	

Table A.3: Retention Rates of NHSC Participants as of January 2015 – Mental Health (First Analytic Dataset)

Year of Exit from NHSC	HPSA & same county	HPSA & other county	Non-HPSA & same county	Non-HPSA & other county	Total NHSC providers in Medicare data
2000	11	8	1	5	25
	44.00%	32.00%	4.00%	20.00%	
2001	8	13	1	8	30
	26.67%	43.33%	3.33%	26.67%	
2002	12	12	0	6	30
	40.00%	40.00%	0.00%	20.00%	
2003	19	16	2	10	47
	40.43%	34.04%	4.26%	21.28%	
2004	42	34	6	12	94
	44.68%	36.17%	6.38%	12.77%	
2005	32	33	4	26	95
	33.68%	34.74%	4.21%	27.37%	
2006	42	42	6	21	111
	37.84%	37.84%	5.41%	18.92%	
2007	54	28	4	25	111
	48.65%	25.23%	3.60%	22.52%	
2008	52	29	8	18	107
	48.60%	27.10%	7.48%	16.82%	
2009	45	32	10	17	104
	43.27%	30.77%	9.62%	16.35%	
2010	50	43	10	16	119
	42.02%	36.13%	8.40%	13.45%	
2011	154	60	19	29	262
	58.78%	22.90%	7.25%	11.07%	
2012	187	67	21	39	314
	59.55%	21.34%	6.69%	12.42%	
2013	50	18	4	8	80
	62.50%	22.50%	5.00%	10.00%	
2014	165	52	22	20	259
	63.71%	20.08%	8.49%	7.72%	
2015	195	0	33	0	228
	85.53%	0.00%	14.47%	0.00%	
Total	1,118	487	151	260	2,016
	55.46%	24.16%	7.49%	12.90%	

Table A.4: Retention Rates of NHSC Participants by Provider Type as of January 2015 — Primary Care (Second Analytic Dataset)

Year of Exit from NHSC	HPSA & same county	HPSA & other county	Non-HPSA & same county	Non-HPSA & other county	Total Matched in P360
<i>Physicians</i>					
2000	13	19	8	28	68
	19.12%	27.94%	11.76%	41.18%	
2001	25	33	4	22	84
	29.76%	39.29%	4.76%	26.19%	
2002	21	24	4	23	72
	29.17%	33.33%	5.56%	31.94%	
2003	42	40	9	25	116
	36.21%	34.48%	7.76%	21.55%	
2004	79	59	20	44	202
	39.11%	29.21%	9.90%	21.78%	
2005	86	104	24	62	276
	31.16%	37.68%	8.70%	22.46%	
2006	108	93	33	65	299
	36.12%	31.10%	11.04%	21.74%	
2007	104	97	25	60	286
	36.36%	33.92%	8.74%	20.98%	
2008	125	68	18	54	265
	47.17%	25.66%	6.79%	20.38%	
2009	108	73	25	72	278
	38.85%	26.26%	8.99%	25.90%	
2010	129	64	24	58	275
	46.91%	23.27%	8.73%	21.09%	
2011	227	110	48	82	467
	48.61%	23.55%	10.28%	17.56%	
2012	292	105	68	88	553
	52.80%	18.99%	12.30%	15.91%	
2013	73	39	21	29	162
	45.06%	24.07%	12.96%	17.90%	
2014	326	92	57	41	516
	63.18%	17.83%	11.05%	7.95%	
2015	348	0	78	0	426
	81.69%	0.00%	18.31%	0.00%	
Total	2,106	1,020	466	753	4,345
	48.47%	23.48%	10.72%	17.33%	

Year of Exit from NHSC	HPSA & same county	HPSA & other county	Non-HPSA & same county	Non-HPSA & other county	Total Matched in P360
NP/PA's					
2000	14	40	3	18	75
	18.67%	53.33%	4.00%	24.00%	
2001	10	27	4	21	62
	16.13%	43.55%	6.45%	33.87%	
2002	22	33	3	11	69
	31.88%	47.83%	4.35%	15.94%	
2003	32	51	7	21	111
	28.83%	45.95%	6.31%	18.92%	
2004	61	108	16	59	244
	25.00%	44.26%	6.56%	24.18%	
2005	92	98	15	59	264
	34.85%	37.12%	5.68%	22.35%	
2006	100	94	18	59	271
	36.90%	34.69%	6.64%	21.77%	
2007	81	76	10	43	210
	38.57%	36.19%	4.76%	20.48%	
2008	89	69	11	37	206
	43.20%	33.50%	5.34%	17.96%	
2009	85	54	17	36	192
	44.27%	28.13%	8.85%	18.75%	
2010	137	80	27	46	290
	47.24%	27.59%	9.31%	15.86%	
2011	339	200	80	124	743
	45.63%	26.92%	10.77%	16.69%	
2012	515	195	87	116	913
	56.41%	21.36%	9.53%	12.71%	
2013	130	47	18	23	218
	59.63%	21.56%	8.26%	10.55%	
2014	474	141	54	54	723
	65.56%	19.50%	7.47%	7.47%	
2015	476	0	80	0	556
	85.61%	0.00%	14.39%	0.00%	
Total	2,657	1,313	450	727	5,147
	51.62%	25.51%	8.74%	14.12%	

Year of Exit from NHSC	HPSA & same county	HPSA & other county	Non-HPSA & same county	Non-HPSA & other county	Total Matched in P360
<i>Other Providers</i>					
2000	3	5	1	3	12
	25.00%	41.67%	8.33%	25.00%	
2001	1	2	0	1	4
	25.00%	50.00%	0.00%	25.00%	
2002	4	2	2	3	11
	36.36%	18.18%	18.18%	27.27%	
2003	9	2	0	4	15
	60.00%	13.33%	0.00%	26.67%	
2004	20	9	2	10	41
	48.78%	21.95%	4.88%	24.39%	
2005	18	9	5	6	38
	47.37%	23.68%	13.16%	15.79%	
2006	14	15	1	12	42
	33.33%	35.71%	2.38%	28.57%	
2007	5	9	2	7	23
	21.74%	39.13%	8.70%	30.43%	
2008	16	7	4	2	29
	55.17%	24.14%	13.79%	6.90%	
2009	10	9	0	2	21
	47.62%	42.86%	0.00%	9.52%	
2010	21	6	1	9	37
	56.76%	16.22%	2.70%	24.32%	
2011	32	23	5	4	64
	50.00%	35.94%	7.81%	6.25%	
2012	50	6	3	4	63
	79.37%	9.52%	4.76%	6.35%	
2013	14	2	1	1	18
	77.78%	11.11%	5.56%	5.56%	
2014	32	5	4	4	45
	71.11%	11.11%	8.89%	8.89%	
2015	30	0	3	0	33
	90.91%	0.00%	9.09%	0.00%	
Total	279	111	34	72	496
	56.25%	22.38%	6.85%	14.52%	

Table A.5: Retention Rates of NHSC Participants by Provider Type as of January 2015—Mental Health (Second Analytic Dataset)

Year of Exit from NHSC	HPSA and same county	HPSA and other county	Non-HPSA and same county	Non-HPSA and other county	Total Matched in P360
<i>Physicians</i>					
2000	5	6	1	8	20
	25.00%	30.00%	5.00%	40.00%	
2001	6	12	1	6	25
	24.00%	48.00%	4.00%	24.00%	
2002	6	13	1	9	29
	20.69%	44.83%	3.45%	31.03%	
2003	17	9	2	15	43
	39.53%	20.93%	4.65%	34.88%	
2004	26	22	6	14	68
	38.24%	32.35%	8.82%	20.59%	
2005	20	24	10	24	78
	25.64%	30.77%	12.82%	30.77%	
2006	31	29	9	24	93
	33.33%	31.18%	9.68%	25.81%	
2007	43	27	7	19	96
	44.79%	28.13%	7.29%	19.79%	
2008	40	17	9	17	83
	48.19%	20.48%	10.84%	20.48%	
2009	29	22	11	23	85
	34.12%	25.88%	12.94%	27.06%	
2010	36	23	10	16	85
	42.35%	27.06%	11.76%	18.82%	
2011	88	41	29	46	204
	43.14%	20.10%	14.22%	22.55%	
2012	110	44	32	44	230
	47.83%	19.13%	13.91%	19.13%	
2013	27	10	4	10	51
	52.94%	19.61%	7.84%	19.61%	
2014	108	35	23	25	191
	56.54%	18.32%	12.04%	13.09%	
2015	123	0	39	0	162
	75.93%	0.00%	24.07%	0.00%	
Total	715	334	194	300	1,543
	46.34%	21.65%	12.57%	19.44%	

Year of Exit from NHSC	HPSA and same county	HPSA and other county	Non-HPSA and same county	Non-HPSA and other county	Total Matched in P360
NP/PA's					
2000	0	0	0	0	0
	0.00%	0.00%	0.00%	0.00%	
2001	0	0	0	0	0
	0.00%	0.00%	0.00%	0.00%	
2002	0	1	0	0	1
	0.00%	100.00%	0.00%	0.00%	
2003	2	4	0	0	6
	33.33%	66.67%	0.00%	0.00%	
2004	2	1	1	0	4
	50.00%	25.00%	25.00%	0.00%	
2005	2	1	1	1	5
	40.00%	20.00%	20.00%	20.00%	
2006	1	4	0	2	7
	14.29%	57.14%	0.00%	28.57%	
2007	2	3	0	1	6
	33.33%	50.00%	0.00%	16.67%	
2008	6	4	1	4	15
	40.00%	26.67%	6.67%	26.67%	
2009	3	7	0	0	10
	30.00%	70.00%	0.00%	0.00%	
2010	4	8	1	1	14
	28.57%	57.14%	7.14%	7.14%	
2011	24	12	0	6	42
	57.14%	28.57%	0.00%	14.29%	
2012	32	13	7	3	55
	58.18%	23.64%	12.73%	5.45%	
2013	6	5	1	0	12
	50.00%	41.67%	8.33%	0.00%	
2014	37	6	2	4	49
	75.51%	12.24%	4.08%	8.16%	
2015	48	0	6	0	54
	88.89%	0.00%	11.11%	0.00%	
Total	169	69	20	22	280
	60.36%	24.64%	7.14%	7.86%	

Year of Exit from NHSC	HPSA and same county	HPSA and other county	Non-HPSA and same county	Non-HPSA and other county	Total Matched in P360
<i>Other Providers</i>					
2000	11	8	0	1	20
	55.00%	40.00%	0.00%	5.00%	
2001	6	8	0	7	21
	28.57%	38.10%	0.00%	33.33%	
2002	13	8	0	2	23
	56.52%	34.78%	0.00%	8.70%	
2003	20	19	1	13	53
	37.74%	35.85%	1.89%	24.53%	
2004	56	33	4	12	105
	53.33%	31.43%	3.81%	11.43%	
2005	49	36	4	15	104
	47.12%	34.62%	3.85%	14.42%	
2006	71	41	3	18	133
	53.38%	30.83%	2.26%	13.53%	
2007	67	34	10	17	128
	52.34%	26.56%	7.81%	13.28%	
2008	68	36	2	14	120
	56.67%	30.00%	1.67%	11.67%	
2009	67	28	8	16	119
	56.30%	23.53%	6.72%	13.45%	
2010	106	45	14	18	183
	57.92%	24.59%	7.65%	9.84%	
2011	278	88	35	54	455
	61.10%	19.34%	7.69%	11.87%	
2012	408	125	38	73	644
	63.35%	19.41%	5.90%	11.34%	
2013	99	28	7	10	144
	68.75%	19.44%	4.86%	6.94%	
2014	344	91	19	38	492
	69.92%	18.50%	3.86%	7.72%	
2015	414	0	58	0	472
	0.877119	0	0.122881	0	
Total	2,077	628	203	308	3,216
	64.58%	19.53%	6.31%	9.58%	

References

- Center for Medicare and Medicaid Services, 2016. Medicare Provider Utilization and Payment Data: Physician and Other Supplier. Available at: <https://www.cms.gov/research-statistics-data-and-systems/statistics-trends-and-reports/medicare-provider-charge-data/physician-and-other-supplier.html>.
- Health Resources and Services Administration, 2016. National Health Services Corps application process. Available at: <http://www.nhsc.hrsa.gov/index.html>.
- Holmes G.M., 2004. Does the National Health Service Corps improve physician supply in underserved locations? *Eastern Economic Journal*, 30(4), pp. 563-581.
- Holmes G. M., 2005. Increasing physician supply in medically underserved areas. *Labour Economics*, 12, pp. 697-725.
- Health Resources and Services Administration Congressional Justification for 2017, 2016. Available at: <http://www.hrsa.gov/about/budget/budgetjustification2017.pdf>
- Konrad T.R., Leysieffer K., Stevens C., 2000. "Evaluation of the Effectiveness of the National Health Service Corps," Department of the Health and Human Services. Available at: http://mathematica-mpr.com/publications/pdfs/health/national_health_service_corps_fnlrpt.pdf
- The Lewin Group, 2014. Provider Retention in High-Need Areas. Available at: <https://aspe.hhs.gov/pdf-report/provider-retention-high-need-areas>
- Pathman D.E. and Konrad T.R., 2012. Growth and changes in the National Health Service Corps (NHSC) workforce with the American Recovery and Reinvestment Act. *J Am Board Fam Med*. 25(5):723-33.
- Pathman, D.E., Konrad, T.R. and Schwartz, R., 2012(a). Evaluating retention in BCRS programs. Cecil G. Sheps Center for Health Services Research at the University of North Carolina at Chapel Hill.
- Pathman D.E., Fannell J., Konrad T.R., Pierson S., Tobin M. and Jonsson M., 2012(b). Findings of the First Year Retention Survey of the Multi-State/NHSC Retention Collaborative. Multi-State/NHSC Retention Collaborative. Available at: <http://www.oshpd.ca.gov/hwdd/pdfs/REAREports.pdf>
- Ricketts, T. C, and Randolph, R., 2014. The Diffusion of Physicians. *Health Affairs*, 27, pp. 1409-1415.