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Data Analysis, Evaluation, and Recommendations Concerning Health Care Workforce Incentives in Oregon

Final Report

Prepared for: **Oregon Health Authority**

Submitted by: **The Lewin Group, Inc.**

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Glossary of Abbreviations

Advanced Practice Midwives: APN

Behavioral Health Loan Repayment Program: BH LRP

Behavioral Health Providers: BHP

Clinical Nurse Specialists: CNS

Federal Faculty Loan Repayment Program: FF LRP

J1-Visa Waiver: J1 VW

Licensed Practical Nurses: LPN

Medicaid Primary Care Loan Repayment Program: MPC LRP

National Health Service Corps Loan Repayment: NHSC LRP

National Health Service Corps Scholarship Program: NHSC SP

Nurse Anesthetists: NA

Nurse Practitioners: NP

Nursing Education Loan Repayment Program: NE LRP

Oregon Rural Practitioner Tax Credit: RPTC

Oregon State Partnership Loan Repayment Program: SLRP

Physician Assistant: PA

Primary Care Loan Forgiveness Program: PC LFP

Primary Cary Physician: PCP

Registered Nurse: RN

Rural Medical Practitioners Insurance Subsidy Program: RMPIS

Scholars for a Healthy Oregon Program Loan Forgiveness: SHOI

Volunteer Rural Emergency Medical Service Tax Credit: EMS TC

Executive Summary

One of the requirements of House Bill 3396 passed by the Oregon Legislature in 2015 is to study and evaluate Oregon's health care workforce incentive programs, in light of current and projected health care workforce shortages. The Lewin Group was tasked to conduct an analysis of existing strategies to address these shortages and evaluate provider incentive programs to inform future funding decisions by the Oregon Legislative that ensure incentive programs are based on demonstrated effectiveness and are as cost effective as possible. The current study and recommendations will provide the Oregon Health Policy Board and the Legislature with information to help ensure Oregon is supporting programs that are both effective and cost-efficient in terms of recruiting and retaining qualified health care providers, particularly in rural and areas in high need of medical services.

We consider the incentive programs to be effective if the number of provider FTE-years in targeted areas increases as a direct result of the program. Based on this metric, we find empirical evidence that all programs increase the number of provider FTE-years above what would have been available in rural areas over the period between 2010 and 2014 without the programs. Some programs have a recruiting effect—they attract new providers into the area, some have a retention effect—they keep providers in the area longer, while some have both a recruiting effect and retention effect. More specifically, we find that:

- NHSC LRP has an important recruiting effect on primary care physicians, and an even larger effect on NPs and PAs, which makes this program an effective recruiting tool

- NHSC LRP also has a relatively minor retention effect

- The other loan repayment programs (SLRP, BHLRP and MPCLRP) are likely to have similar effects, given that they are similar in terms of award amounts and eligibility criteria

- RPTC and RMPIS have negligible recruiting effect on primary care physicians, but do have a small recruiting effect on NPs and PAs

- Instead, RPTC and RMPIS have a sizeable retention effect on all providers, which makes them efficient retention tools in rural areas

- Costs of attracting an additional FTE-year through any of the programs are lower in the case of NPs and PAs, relative to primary care physicians

- Costs of an additional primary care physician FTE-year are similar across programs, and the same is true for NPs and PAs.

We also formulate a number of recommendations that have the potential to improve the analysis and evaluation of the provider incentive programs in the future. These recommendations are aimed at increasing the programs' recruiting effect, retention effect, or both, as well as improving their cost-effectiveness. Our analysis of the key features of the current programs yields a number of insights into the features that tend to be associated with incentives that offer greater cost-effectiveness. They are centered on issues such as the:

- targeting of benefits
- budget control

- cash vs in-kind benefits

- current vs deferred benefits

- costs incurred today vs costs incurred later

We then assess the current programs through the prism of these features and provide observations on how the programs may be made more efficient and cost-effective.

Also, as future efforts to enhance the effectiveness of these programs should focus on increasing the number of providers who would not serve in rural areas without incentive programs, we formulate a number of recommendations on how to achieve this objective. These include:

- creation of a bidding mechanism allowing providers to offer more years of service in rural areas

- increasing the value of the program "package" (for instance, by allowing for a stipend to cover moving expenses for providers who are not in rural areas)

- relaxing job requirement as a condition for a loan repayment application

- increasing awareness of the availability of programs, by providing a consolidated single source of information and applications across programs

- encouraging multiple program participation

- increasing the amount of awards

- increasing the number of loan repayment awards

- allowing for different award amounts by provider type

Moreover, once participating providers locate to rural areas, we propose a set of measures to increase the retention of participating providers in those areas. These recommendations include:

- encouraging the combination of benefits

- introducing obligation periods

- retaining former obligors in the state

- increasing the number of limited-funded awards

Although they are outside the scope of the incentive programs, changing clinical practices in rural centers, and boosting community support for providers may also have the beneficial effect of increasing retention of providers in rural areas.

Before evaluating the effectiveness of existing incentive programs, we provide an overview of the current health workforce in Oregon to shed light on how providers are distributed across geographic areas of interest, such as rural areas as defined by the Oregon Office of Rural Health, or counties. For this purpose we use 2015 Provider360 data, a proprietary data set that includes information on each licensed individual provider, including name, date of birth, gender, taxonomy classification, and practice location (at the address level). In Table ES-1 we show the total number

of licensed health care providers that we observed in the state of Oregon in 2015.[1] In total, there are 72,766 licensed health care providers, of which 11,567 are physicians. Approximately 60 percent of these physicians offer primary care services.[2] As shown in the second column, there are on average 1.76 primary care providers, 1.37 behavioral health providers and 0.73 dentists per 1,000 Oregon populations. Most of these ratios are similar to, or slightly higher than the corresponding ratios at the national level (shown in the rightmost column).

Table ES-1: Licensed Health Care Providers per Population, by Provider Type

Provider type	Oregon Providers	Providers per 1,000 Population	
		Oregon	**United States**
All Health Care Providers	72,766	18.33	14.79
Physicians	11,567	2.91	2.83
Primary Cary Physicians (PCP)	6,981	1.76	1.71
Non-Primary Care Physicians	4,586	1.16	1.12
Behavioral Health Providers (BHP)	5,434	1.37	1.08
Dentists	2,914	0.73	0.63
Physician Assistants (PA)	1,466	0.37	0.32
Nurse Practitioners (NP)	2,305	0.58	0.56
Clinical Nurse Specialists (CNS)	64	0.02	0.02
Advanced Practice Midwives (APN)	219	0.06	0.02
Registered Nurses (RN)	38,832	9.78	9.66
Licensed Practical Nurses (LPN)	3,737	0.94	2.58
Nurse Anesthetists (NA)	343	0.09	0.15
Population (2014)	3,970,239	--	--

Note: The main source of data for this table is the 2015 Provider360 Data (owned by Optum Services Incorporation). The number of RNs in 2014 comes from the OHA Report "Oregon Health Professions: Occupational and County Profiles". The national-level numbers of RNs and LPNs that are used to construct the ratios in the last column are for the year of 2016 and come from the Kaiser Family Foundation.

Further, in Figure ES-1 we show the ratio of primary care physicians to population in each county. More details on primary non-physician providers, mental health and dental providers are available in the body of the report and in Appendix A. What is important to note is that there is a notable variation in the availability of all types of providers across the Oregon counties.

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[1] It is important to note that for the purposes of this study, when we speak about "providers" we are speaking of health care providers *with an active license.* We recognize that some licensed providers in Oregon may not be actively practicing, or may not be practicing full-time. In any one area, the number of "providers" identified through the study is likely to exceed the number of providers actually delivering care. Our model takes this into consideration in terms of projecting demand and supply.

[2] Primary care includes the following categories: family practice, general practice, internal medicine, OB-GYN and Pediatrics. Behavioral health providers include psychologists, social workers, and marriage and family therapists.

Figure ES-1: Licensed Primary Care Physicians per 1,000 Populations, by County
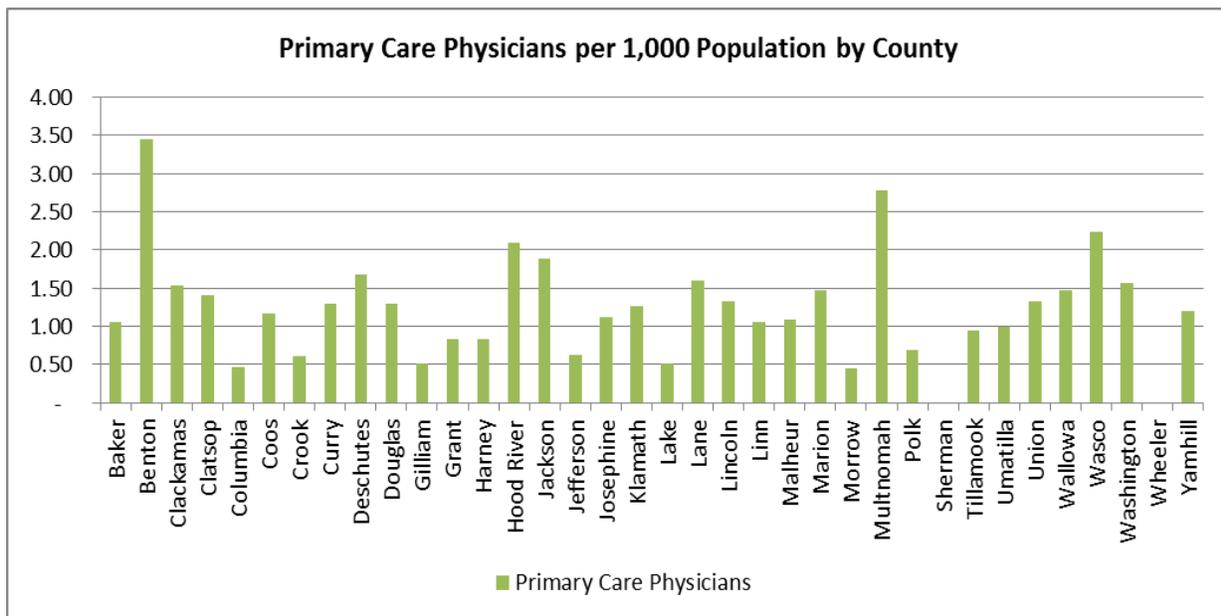
After reviewing the current state of the health workforce in Oregon, we analyze the patterns in the utilization of medical services by various segments of the population, using claims data from Oregon's 'All Payer All Claims' (APAC) data. With these elements, we construct forecasts of the future demand for medical service of the Oregon population, as well as forecasts of the supply of providers over the period between 2016 and 2020.

Starting with the current stock of health care providers, we apply a set of provider-specific annual growth rates to determine the future supply of providers over the forecasting period. In principle, the health workforce is shaped by the entry of new providers into the workforce, and the by mortality, retirement and migration of current providers. However, given that this detailed information about the dynamics of the Oregon's health workforce is not available for this project, we constructed the projections in Table ES-2 using a set of growth rates derived from the "Oregon Health Professions – Occupational and County Profiles" from OHA.

Table ES-2: Projected Demand and Supply for Oregon Providers by Provider Type

Provider Type	2015	2016	2017	2018	2019	2020
	Demand					
Primary Care Physicians	7,094	7,146	7,250	7,358	7,469	7,580
Specialty Care Physicians	4,689	4,736	4,823	4,906	4,995	5,088
Behavioral Health	5,487	5,484	5,521	5,549	5,587	5,618
Dentists	2,963	2,985	3,028	3,068	3,115	3,156
Physician Assistants	1,495	1,512	1,535	1,557	1,582	1,608
Nurse Practitioners	2,337	2,348	2,376	2,407	2,435	2,465
	Supply					
Primary Care Physicians	6,883	6,917	6,952	6,987	7,022	7,057
Specialty Care Physicians	4,505	4,631	4,761	4,894	5,031	5,172
Behavioral Health	5,291	5,317	5,344	5,371	5,398	5,425
Dentists	2,856	2,857	2,858	2,859	2,859	2,860
Physician Assistants	1,455	1,497	1,541	1,585	1,631	1,679
Nurse Practitioners	2,261	2,381	2,507	2,640	2,780	2,927

Comparing the forecasts from Table ES-2, we estimate that the state-level gap between demand and supply for primary care physicians will grow to about 500 providers by 2020. Similar gaps may be emerging for other categories, but note that in the cases of nurse practitioners and physicians assistants our forecasts indicate that the supply may be greater than the demand. However, it may be that the growth rates in the number of NPs and PAs are too large. The current growth rates may be capturing trends that are specific only for the last few years, dominated by the Affordable Care Act and other initiatives. In the future, the growth rates for these two categories may be smaller.

However, our demand projection does not take into account that a part of the real demand for services is not met because of provider shortages. In fact, our analysis of the APAC data reveals that patients in rural areas receive a lower number of visits than patients in urban areas. This may be partly due to the fact that the number of providers per population practicing in rural areas is lower than in urban areas. Under this scenario, there is a significant gap between demand and supply for all provider types, and in some cases, that gap is substantial. It is therefore important for the state to address these widening shortages, and as our empirical analysis shows, an efficient way to do this is through provider incentive programs.

Moving on to program participation, Table ES-3 shows the number of participants in each of the majority of the programs available over the period between 2010 and 2015. In Table ES-3 we indicate participation in the following programs:[3]

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[3] In Chapter III we also discuss the following programs: Federal Faculty Loan Repayment Program (FF LRP); Scholars for a Healthy Oregon Program Loan Forgiveness (SHOI); Nursing Education Loan Repayment Program (NE LRP); and the Primary Care Loan Forgiveness Program (PCLFP). Given that participation in some of these programs is very low, or individual-level data is unavailable, we decided to exclude them from Table ES-3.

- The Oregon Rural Practitioner Tax Credit (RPTC)

- Rural Medical Practitioners Insurance Subsidy Program (RMPIS)

- The Volunteer Rural Emergency Medical Service Tax Credit (EMS TC)

- J1-Visa Waiver

- Medicaid Primary Care Loan Repayment Program (MPC LRP)

- Behavioral Health Loan Repayment Program (BH LRP)

- Oregon State Partnership Loan Repayment Program (SLRP)

- National Health Service Corps Loan Repayment (NHSC LRP)

- National Health Service Corps Scholarship Program (NHSC SP)

Overall, the total number of participants increased from 3,119 providers to 3,224 participants by 2014. The number of participants in state funded programs such as RPTC and EMS TC remained relatively stable, the number of participants in the loan repayment programs increased, while the number of participants in the malpractice insurance subsidy program (RMPIS) declined during this period.

Table ES-3: Participants in Provider Incentive Programs, by Year and Program

Programs	2010	2011	2012	2013	2014	2015
RPTC	2,137	2,164	2,203	2,214	2,216	104*
RMPIS	861	822	769	702	687	639
EMS TC	557	565	572	562	520	269*
J1 VW	66	64	59	74	75	84
MPC LRP	-	-	-	-	17	42
BH LRP	-	-	-	-	-	14
SLRP	-	6	11	27	40	50
NHSC	127	185	235	257	262	346
NHSC LRP	122	179	222	240	237	316
NHSC SP	5	6	13	17	25	27
Total Participants	**3,119**	**3,186**	**3,255**	**3,272**	**3,224**	**1,520***

Note: * indicates that the data on these programs for 2015 is incomplete.

We measure the recruiting effect of the programs using regression models in which the number of providers in a rural area is a function of the number of participants in that area, while the retention effect is measured by assessing the difference between the number of years spent in rural areas by program participants and the number of years spent in rural areas by non-participating providers. Table ES-4 summarizes this analysis and provides our estimates of the additional number of FTE-years generated in the rural areas of Oregon by the providers that participated in the incentive programs over the 2010-2014 period.

We find empirical evidence that all programs increase the number of provider FTE-years above and beyond what would have been available in rural areas without the programs. This is reflected by the strictly positive values in the rightmost column of Table ES-4. As shown by the

recruiting and retention effect columns in Table ES-4, we also find that some programs have both a recruiting and retention effect, some have only a recruiting effect, while others are largely limited to a retention effect. For instance, the 64 primary care physicians participating in the NHSC loan repayment program generate an additional 99 FTE-years in rural areas due the program's recruiting effect, and an additional 32 FTE-years as a result of the program retention effect, for a total of 131 FTE-years that would not have been available in rural areas without the program. Given that the state loan repayment had few participants in our data, we assumed the same program effects for those participants as in the case of the NHSC's loan repayment program.

Table ES-4: Recruiting, Retention and Total Program Effects by Provider Type

	Providers	Recruiting Effect (FTE-years)	Retention Effect (FTE-years)	Total Effect (FTE-years)
Primary Care Physicians				
RPTC	827	0	736	**736**
RMPIS	459	0	459	**459**
SLRP	26	39	13	**52**
BHLRP	--	--	--	**--**
MCPLRP	8	15	4	**19**
NHSC	64	99	32	**131**
NHSC & RPTC	30	58	18	**76**
NPs and PAs				
RPTC	632	90	510	**600**
RMPIS	78	54	57	**111**
SLRP	20	56	7	**63**
BHLRP	14	39	5	**44**
MCPLRP	15	43	5	**48**
NHSC	108	301	40	**341**
NHSC & RPTC	74	250	28	**278**

Using the estimates from Table ES-4 and the total costs of the programs, we then estimate the cost of attracting one additional provider FTE in a rural area (or the "marginal" cost), as the ratio between the total cost of the program and the number of FTE-years generated by the program.

Table ES-5: Program Average Costs, Marginal Costs and Cumulative Costs by Provider Type

	PC Physicians			NP/PAs		
	Average cost ($)	Cumulative Cost ($)	Marginal cost ($)	Average cost ($)	Cumulative cost ($)	Marginal cost ($)
RPTC	5,000	18,350	20,787	5,000	17,800	18,960
RMPIS	3,890	14,626	14,820	3,890	14,081	9,866
SLRP	23,386	60,804	30,402	23,386	65,000	19,303
BH LRP	--	--	--	20,000	52,000	16,471
MCP LRP	27,321	71,035	29,909	27,321	65,000	22,198
NHSC (No RPTC)	25,000	65,000	31,756	25,000	65,000	20,587
NHSC & RPTC	30,000	94,000	36,908	30,000	91,000	24,233

Note: The average costs for SLRP and MPC LRP are equal to the average awards observed in the data for a year of commitment. In the absence of data on the time in service, the cumulative costs of those programs were calculated by assuming a service period that is equal to the typical service period in NHSC LRP. Also, due to lack of data BH LRP average costs is equal to the maximum award under that program.

As can be noted in Table ES-5, the marginal cost per one new FTE-year is smaller for NHSC PA/NP participants than for NHSC primary care physicians, a result that may potentially be extrapolated to all loan repayment programs. Also, the difference between the additional cost of providers who participated in both NHSC and RPTC and the NHSC participants who do not participate in RPTC is smaller for NHSC NP/PAs than for NHSC physicians. These are primarily due to the larger recruiting effect. In either case, the increase in the estimated additional costs due to participation in RPTC among additional providers is lower than the actual cumulative RPTC award per participant during the entire period they serve in the rural areas. In addition, comparing the RPTC and RMPIS programs, it appears that the RMPIS program is relatively more cost effective in increasing the number of provider years in rural areas. Finally, all incentive programs appear to have lower additional costs for NP/PAs than for primary care physicians. Nonetheless, the additional cost estimates are of the same order of magnitude for each program.

The main conclusion of this report is that all incentive programs analyzed are successful in increasing the number of providers in rural areas in Oregon. Some programs are better recruiting tools, while other programs are better retention tools. Our program and policy recommendations are aimed at further increasing the efficacy and cost-effectiveness of programs in the future. Also, our data collection recommendations ensure that future program evaluations will have a deeper and wider scope, hence more effectively informing funding decisions by the Oregon Legislative.

I. Introduction

To help meet the requirement of House Bill 3396 passed by Oregon legislature and to assess Oregon's current and projected health care workforce shortages, the Lewin Group was tasked to conduct an analysis of the Oregon health care market and existing programs to address these shortages and evaluate provider incentive programs to inform future funding decisions by the Oregon Legislature The current study and recommendations will provide the Oregon Health Policy Board and the Legislature with information to ensure Oregon is supporting programs that are both effective and cost-efficient in terms of recruiting and retaining qualified health care providers, particularly in rural and areas in high need of medical services.

Our analysis of the various incentive programs offered to Oregon providers began with an examination of the main characteristics of the health care market in Oregon. We analyzed the current size, distribution and composition of the health care workforce in Oregon, along with the size and mix of the patient population throughout the state and in rural and medically underserved areas that are served by providers participating in relevant incentive programs. We first set out to assess the demand for key health care providers across the geographic areas in Oregon, evaluate the shortages of these providers in rural and medical provider shortage areas currently and in the near future, and examine the current incentive programs for health care providers who serve in those rural and underserve areas.

These analyses encompassed three major focus areas: (1) the Oregon health care market; (2) existing incentive programs available to Oregon clinicians (both state and federally funded); and (3) an assessment of potential other incentive programs. Based on previous rates of growth in the population of providers and on observed utilization patterns in the Oregon patient population, we constructed forecasts of the demand for and supply of providers over the period between 2016 and 2020. Next, in order to assess the provider incentive programs and to gain a thorough understanding of their breadth and outreach within the state, we provide an overview of the current programs and program participation rates. We also present historical trends and changes in the composition of providers who participate and providers who do not participate in federally and state funded incentive programs.

Using various proprietary and administrative data sets covering the 2011-2015 period, we find that all current provider incentive programs we analyzed increase the number of FTE-years in rural areas. This work was performed under Task 2 of this project (Lewin, 2016(2)). We measure the impact of the incentive programs in two related ways. First, we consider a program "recruiting" effect, defined as the program's ability to attract providers into targeted areas who would not be there without the program. Second, we consider a "retention" effect, defined as the program's ability to induce providers to stay in targeted areas longer than they would in the absence of the program. We find empirical evidence that some programs have both a recruiting and retention effect, some have only a recruiting effect, while others are largely limited to a retention effect. Overall though, all programs are effective in increasing the number of FTE-years relative to the level without programs. This is consistent with findings from other studies (e.g., Holmes, 2005). Also, combining estimated program effects with the program costs, we calculate the cost of attracting an additional FTE-year in a rural area. This cost, also called the marginal cost, while it varies among programs, it is of the same order of magnitude across programs.

We currently estimate that about a third of the NHSC participating primary care physicians and about two-thirds of the NHSC participating NP/PAs are providers who would not have served in rural areas in Oregon in the absence of that program. The estimates are robust to a number of alternative regression specifications and they reflect a substantial recruiting effect of the NHSC loan repayment program. Combining this estimate with conditional retention rates in HPSAs after program completion, we construct estimates of the additional cost of inducing a new FTE into a rural area of $31,756. As we discuss in Lewi n (2016(2)), the actual additional cost per one new FTE is undoubtedly even lower. Even so, our additional cost estimate points to a solid return to investment for the NHSC program in Oregon. This is mainly driven by the probability of providers to serve in HPSAs even after completion of their obligation, and by the fact that many of the NHSC participants serve in HPSAs only as a result of the program. Although this estimate applies only to NHSC, it is likely that the effect of the Oregon loan repayment programs is similar in magnitude to the effect of NHSC, and potentially higher, as Oregon's programs are able to be managed for better local results.

Despite a number of inherent (and insurmountable for the time being) limitations, the empirical results we obtained allow us to formulate a number of policy and program recommendations. The data limitations we faced in this project provided us with a unique opportunity to formulate a number of detailed recommendations on how these limitations may be successfully overcome in the future, with the ultimate goal of being able to inform solid program evaluation and policy-making.

II. The Oregon Health Care Market

In this chapter we examine the Oregon population and its characteristics that are potential drivers of the demand for health care services and providers. Using the American Community Survey (ACS) data and the county level data from Area Health Resource File (AHRF), we developed detailed socio-demographic and health insurance profiles of the Oregon population.

A. Characteristics of the Oregon Population

In Tables II.1-II.4 below, we provide a number of descriptive statistics centered on the characteristics of the overall population of Oregon and its distribution by a number of dimensions of interest. Table II.1 shows that of the total population of 3.97 million in 2014, 52% have employer-provided insurance, 23% have Medicaid and 18% have Medicare. The fraction of individuals who have other sources of health insurance is relatively small, while the fraction of uninsured is about 10%. Of course, these data do not reflect the full impact of the Affordable Care Act on insurance. Most notably, it is possible that the proportion of individuals without any health insurance has declined since the ACS information was collected in 2014.

Table II.1. Oregon Population by Age and Sources of Health Insurance (ACS, 2014)

	Employer	Medicaid	Medicare	Tricare	VA	IHS	Other	None	Total
Age <=18	481,024	369,376	4,391	18,133	1,016	7,753	48,198	41,834	**910,120**
Age 19-34	443,966	187,330	11,698	14,120	12,107	5,833	68,149	161,271	**854,604**
Age 35-44	318,774	96,688	10,524	5,439	8,106	3,609	32,143	76,891	**522,852**
Age 45-54	307,135	84,726	23,279	7,001	12,275	3,154	37,887	67,159	**507,631**
Age 55-64	310,084	88,672	46,764	11,228	23,035	3,579	64,883	50,484	**542,074**
Age >=65	182,739	84,201	616,062	30,273	67,448	4,014	1,949	2,342	**632,958**
Total	**2,043,722**	**910,993**	**712,718**	**86,194**	**123,987**	**27,942**	**253,209**	**399,981**	**3,970,239**

As expected, these rates vary substantially by age group, and as shown in Table II.2, they vary significantly by race/ethnicity as well.

Table II.2. Rates of Insurance by Race/Ethnicity Groups in Oregon (ACS, 2014)

	Employer	Medicaid	Medicare	Tricare	VA	IHS	Other	None
White	0.543	0.195	0.212	0.023	0.036	0.001	0.067	0.082
Hispanic	0.376	0.384	0.050	0.012	0.010	0.006	0.031	0.212
Black	0.392	0.406	0.107	0.027	0.017	0.000	0.039	0.118
Asian	0.542	0.195	0.088	0.020	0.006	0.000	0.122	0.100
Am Indian	0.383	0.352	0.136	0.014	0.055	0.475	0.030	0.178
Other Race	0.447	0.345	0.102	0.022	0.026	0.042	0.067	0.095

Table II.3 signals that important changes lie ahead in the race/ethnicity distribution of the Oregon population, as shown for instance by the large fraction of Hispanics in the age group below 18. Other races (defined in this context as other than the ones considered, or as more than one race) also have a much higher proportion in the below 18 age group relative to its proportion in the

most senior age group (i.e., above 65). These trends indicate that over the next decades Oregon will likely transition from a state with a large White majority to a state with significant minority populations.

Table II.3. Race/Ethnicity Distribution in Oregon by Age Group (ACS, 2014)

	White	**Hispanic**	**Black**	**Asian**	**Am Indian**	**Other Race**
Age <=18	0.644	0.216	0.020	0.042	0.009	0.069
Age 19-34	0.721	0.155	0.020	0.051	0.008	0.045
Age 35-44	0.733	0.150	0.019	0.055	0.010	0.033
Age 45-54	0.815	0.089	0.015	0.049	0.010	0.022
Age 55-64	0.871	0.046	0.016	0.036	0.010	0.021
Age >=65	0.917	0.029	0.008	0.024	0.006	0.015

The change in the population toward a much higher fraction of minorities (especially Hispanics) may be important to note, because, as we see in Table II.4, Hispanics are much more likely to be uninsured, more likely to be insured through Medicaid, and less likely to have employer-provided insurance. Also, Hispanics (and other minorities) are much more likely to be under the federal poverty line (FPL) or in the 101-200 FPL category than Whites.

Table II.4 Fraction of Individuals Relative to the Federal Poverty Line by Race/Ethnicity (ACS, 2014)

	Under FPL	**101-200 FPL**	**201-300 FPL**	**301-400 FPL**	**401-500 FPL**	**FPL >=501**
White	0.139	0.178	0.178	0.135	0.104	0.265
Hispanic	0.271	0.338	0.199	0.090	0.037	0.065
Black	0.402	0.171	0.131	0.102	0.050	0.144
Asian	0.186	0.158	0.151	0.107	0.111	0.287
Am Indian	0.300	0.276	0.154	0.096	0.090	0.084
Other Race	0.288	0.193	0.151	0.125	0.085	0.157

Furthermore, in Tables A.1-A.3 in the Appendix we provide additional insights into the geographical distribution of the Oregon population by local levels of geography. [4]

Also, using the Census Bureau's population counts in zip code tabulation area (ZCTA) we determined that 36.5 percent of Oregon's population resides in rural areas. The definition of rural we used for this calculation is the definition provided by the Oregon Office of Rural Health by zip code. Also, since the population counts available from the Census Bureau are available only by ZCTAs (and not by zip code), the calculation is restricted to 417 Oregon zip codes (out of the total of 467 zip codes) for which the zip code exactly matches to the zip code tabulation area in Census data.

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[4] It is important to note that in order to reduce the risk of identification of the surveyed individuals, the ACS does not permit the systematic identification of counties in its public version of the data. The lowest level of geography in the ACS is the Public Use Microdata Area (PUMA), and one of the main criteria for defining a PUMA is that it includes at least 100,000 individuals.

B.   An Overview of Oregon's Health Workforce

Next, we focus on the existing supply of health care providers, by discipline and geographic area. We present a thorough overview of the current health workforce in order to shed light on how providers are distributed across geographic areas of interest, such as rural areas (as defined by the Oregon Office of Rural Health) or county. For this purpose we use 2014 and 2015 Provider360 data, a proprietary data set that is owned by Optum Services Incorporation. This data set includes information on each individual provider, including name, date of birth, gender, taxonomy classification, and practice location (at the address level, including the 5-digit zipcode). These pieces of information are collected and updated regularly, from state licensing databases and other national level provider databases available from the Center for Medicaid and Medicare services, as well as other sources.

Using Provider360 data, in Table II-5 we show the total number of health care providers that we observed in the state of Oregon in 2015. In total, there are 72,766 health care providers, of which 11,567 are physicians.[5] Approximately 60 percent of these physicians offer primary care services.[6] The estimated number of behavioral health providers is 5,434, while the number of dentists is 2,914. Physician assistants (PAs), nurse practitioners (NPs) and registered nurses (RNs) represent three of the largest categories of non-physician providers.

Table II-5: Licensed Health Care Providers per Population, by Provider Type

Provider type	Oregon Providers	Providers per 1,000 Population	
		Oregon	**United States**
All Health Care Providers	72,766	18.33	14.79
Physicians	11,567	2.91	2.83
Primary Cary Physicians (PCP)	6,981	1.76	1.71
Non-Primary Care Physicians	4,586	1.16	1.12
Behavioral Health Providers (BHP)	5,434	1.37	1.08
Dentists	2,914	0.73	0.63
Physician Assistants (PA)	1,466	0.37	0.32
Nurse Practitioners (NP)	2,305	0.58	0.56
Clinical Nurse Specialists (CNS)	64	0.02	0.02
Advanced Practice Midwives (APN)	219	0.06	0.02
Registered Nurses (RN)	38,832	9.78	9.66
Licensed Practical Nurses (LPN)	3,737	0.94	2.58
Nurse Anesthetists (NA)	343	0.09	0.15
Population (2014)	3,970,239	--	--

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[5] It is important to note that for the purposes of this study, when we speak about "providers" we are speaking of health care providers *with an active license.* We recognize that some licensed providers in Oregon may not be actively practicing, or may not be practicing full-time. In any one area, the number of "providers" identified through the study is likely to exceed the number of providers actually delivering care. Our model takes this into consideration in terms of projecting demand and supply.

[6] Primary care includes the following categories: family practice, general practice, internal medicine, OB-GYN and Pediatrics. Behavioral health providers include psychologists, social workers, and marriage and family therapists.

Note: The main source of data for this table is the 2015 Provider360 Data (owned by Optum Services Incorporation). The number of RNs in 2014 comes from the OHA Report "Oregon Health Professions: Occupational and County Profiles". The national-level numbers of RNs and LPNs that are used to construct the ratios in the last column are for the year of 2016 and come from the Kaiser Family Foundation.

The next step is to link the distribution of providers to the actual population in local areas to better understand the extent to which medical services are provided in those areas. As shown in the second column, there are on average 1.76 primary care providers, 1.37 behavioral health providers and 0.73 dentists per 1,000 Oregon populations. Most of these ratios are similar to, or slightly higher than the corresponding ratios at the national level (shown in the rightmost column).

Figure II-1: Primary Care Physicians per 1,000 Populations, by County
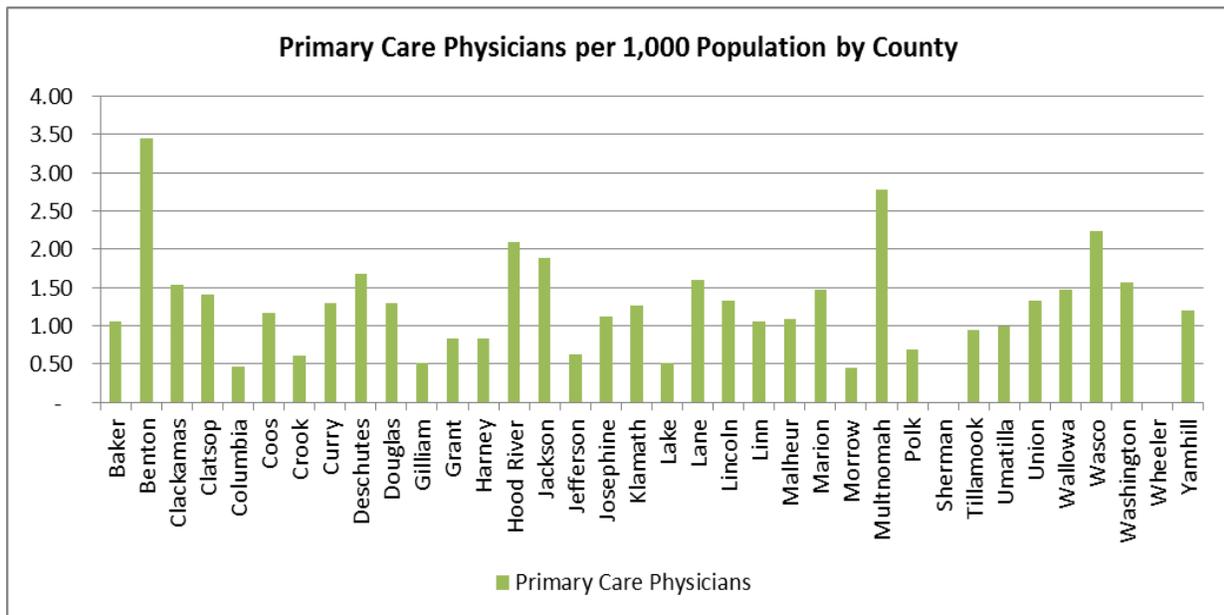
The Office of Rural Health classifies 340 zip codes (out of the total number of 467 zip codes across the 36 counties of Oregon) as rural areas. Given that Provider360 includes the provider's zipcode, we further examine the distribution of providers by zip code, county and rural area. The number of physicians, primary care physicians, behavioral providers and the number dentists by county are shown in Table A.4 in the Appendix.[7] For instance, Multnomah County, the most populated county in the state, has a total of 3,740 physicians, of which 2,154 are primary care physicians, hence the number of primary care physicians per 1,000 populations in that county is 2.77 (Appendix Table A.6). Appendix Table A.6 and Figure II.1 show that the availability of primary care physicians per population is the highest in Benton County, with almost 3.45 primary care physicians per 1,000 populations and is lowest in Morrow County with 0.45 primary care physicians per 1,000 populations.

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[7] The distribution of providers by provider type and by zip code is examined to determine the number of providers in rural areas as per ORH classification of urban/rural status of zip codes. The distribution of health care providers by zip code is available in a separate spreadsheet and available upon request.

In addition, Figures II.2-II.4 indicate the ratio to population of behavioral health providers, dentists and non-physician providers, respectively, in each county. More details on these statistics are available in Tables A.6 and A.7 in the Appendix. As in the case of primary care physicians, there is a notable heterogeneity across counties in the availability of behavioral health providers, dentists and non-physicians.

Figure II-2: Behavioral Health Providers per 1,000 Populations, by County
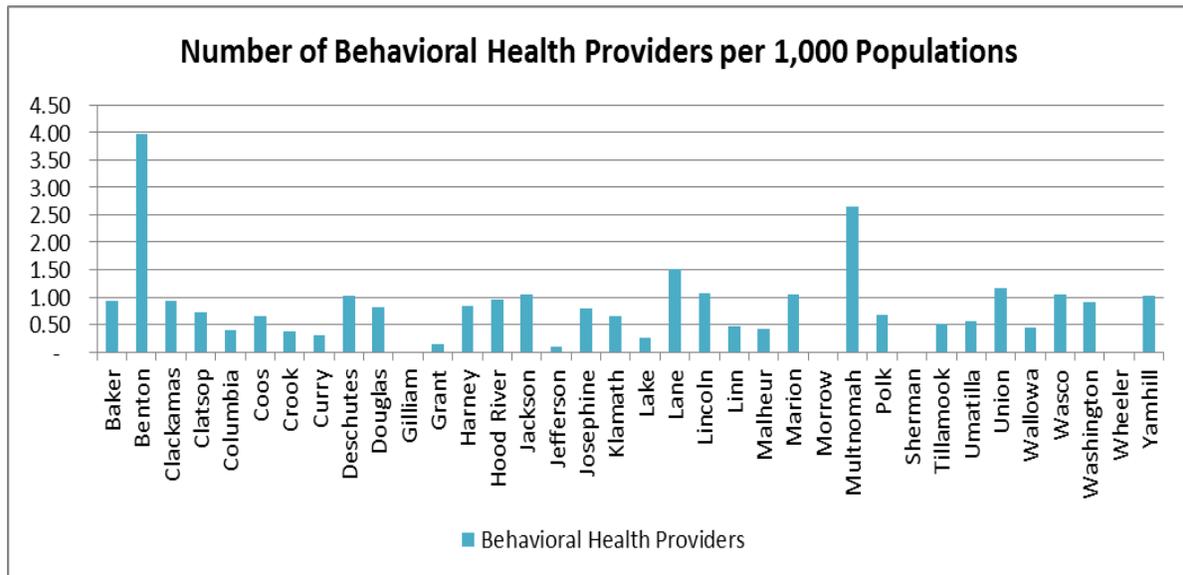
Figure II-3: Dentists per 1,000 Populations, by County
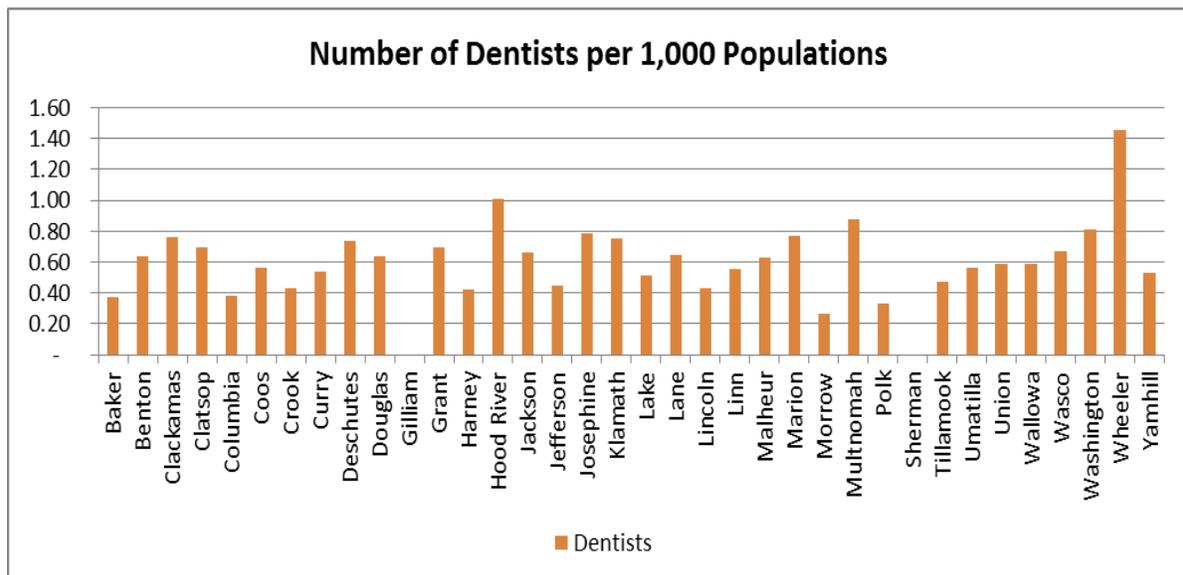
Figure II-4: Primary Care Physicians, NPs and PAs per 1,000 Populations by County in Oregon
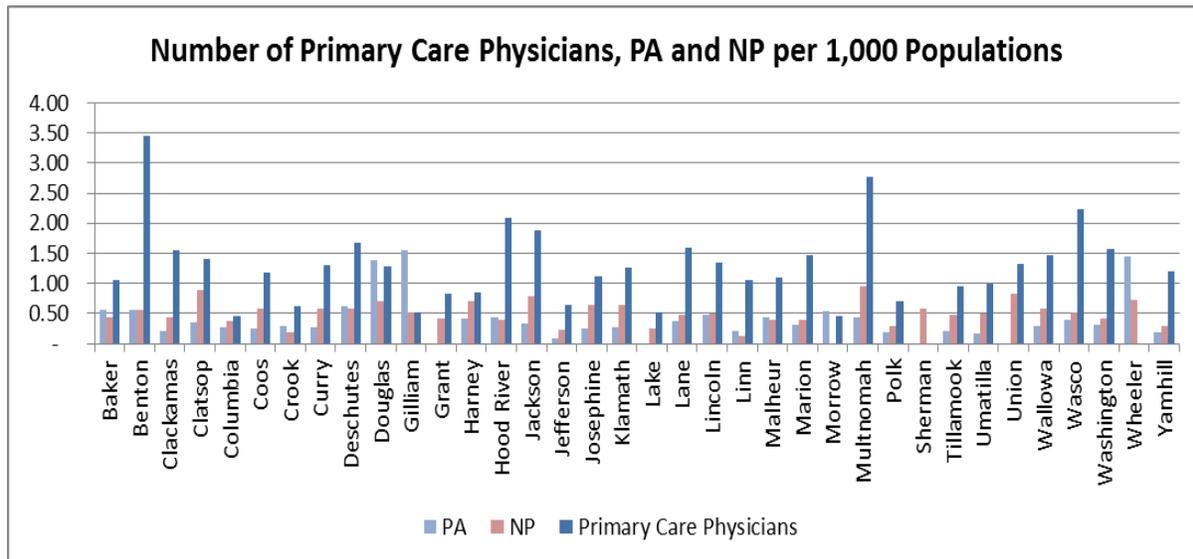
Not surprisingly, the fraction of providers serving in rural areas is smaller than the fraction of providers serving in urban areas. Using Oregon's Office of Rural Health classification of each zip code into rural or urban areas, we present the percentages of health care providers serving in rural vs urban areas in Table II.6 below.[8]

Table II.6: Distribution of Health Care Providers in Rural and Urban Areas

Provider Type	Rural	Urban	Unknown
Physicians	19.3	79.1	1.6
Primary Cary Physicians (PCP)	20.1	78.5	1.4
Non-Primary Care Physicians	18.1	80.1	1.8
Behavioral Health Providers (BHP)	15.1	82.2	2.6
Dentists	24.9	73.0	2.2
Physician Assistants (PA)	30.6	68.7	0.8
Nurse Practitioners (NP)	25.9	72.1	1.9
Clinical Nurse Specialists (CNS)	12.5	84.4	3.1
Advanced Practice Midwives (APN)	17.4	81.3	1.4
Licensed Practical Nurses (LPN)	19.0	77.7	3.3
Nurse Anesthetists (NA)	27.4	70.3	2.3

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[8] The list of zip codes and their urban or rural status as classified by the Office of Rural Health in Oregon is available at: http://www.ohsu.edu/xd/outreach/oregon-rural-health/data/rural-definitions/. We also constructed statistics that are similar to those in Table II.6 using of the Census Bureau's definition of rural/urban areas, along with the definition of the Metropolitan Statistical Area, used by the Office of Management and Budget. Also, we identified the Health profession Shortage Area (HPSA) status of each zip code in Oregon using data available from the Center Medicaid and Medicare Services and HRSA. These statistics are available upon request.

Note: The rural status is based on the classification of each zip code as rural or urban by the Office of Rural Health. The numbers of providers by zip code are estimated from Provider360 data.

Only about one fifth of all physicians who serve in Oregon actually practice in rural areas. The fraction of behavioral health providers serving in rural areas is even smaller, 15.1%, while the fractions of PAs, NAs and NPs in rural areas are the highest (although always smaller than one third in the case of each of these provider types).

It is important to note that this pronounced imbalance in the distribution of medical providers across rural and urban areas actually translates into smaller provider-to-population ratios in rural areas relative to urban areas. As shown in Table II.7, the number of all providers per 1,000 people in rural areas is 9.53, while in rural areas it is 19.69. These ratios are smaller in rural areas for all major provider types (physicians, PCPs, BHPs, dentists, PAs and NPs). For instance, the ratio of PCPs in urban areas in 2.25, compared to about 1.0 in rural areas; however, the differences are smaller across rural versus urban in the case of NPs and PAs. These findings once more emphasize the important role provider incentive programs may have in attracting providers in rural and underserved areas.

Table II.7: Providers per 1,000 People in Rural and Urban Areas in Oregon

Provider Type	Rural	Urban
All Providers	9.53	19.69
Physicians	1.60	3.76
Primary Cary Physicians (PCP)	1.00	2.25
Behavioral Health Providers (BHP)	0.59	1.84
Dentists	0.52	0.87
Physician Assistants (PA)	0.32	0.41
Nurse Practitioners (NP)	0.43	0.68

Note: The rural status is based on the classification of each zip code as rural or urban by the Office of Rural Health. The numbers of providers by zip code are estimated from Provider360 data, while the population estimates used for the above calculations are population counts in Census zip code tabulation areas. The calculation is only restricted to 417 Oregon zip codes (out of 467 zip codes) for which the zip code exactly matches to the zip code tabulation area in Census data.

C. A Forecast of Demand and Supply for Oregon's Health Workforce

In this section we present a forecasting analysis that will offer insights into the need for the services of various Oregon providers in future years. Coupled with a forecast of the supply of providers over the same period, the comparison between future health workforce demand and supply will be the basis of a "gap" analysis at the county and state level.

1. *Demand Projection*

Our demand projection is constructed based on the realized demand for services, as reflected in Oregon's All Payer All Claims (APAC) data. The APAC data covers the 2011-2014 period and it includes all claims made by Oregon patients during this timeframe. This dataset has information on the patients' sources of health insurance (i.e., Medicare, Medicaid, or commercial insurance), as well as information on the provider type, discipline and specialty. Using APAC data we construct measures of the utilization of medical services (in the form of visits) by age groups, race,

gender, insurance type and county. Next we use the Census and the ACS data to construct projections of the Oregon population by the same dimensions, and then apply the APAC-based measures of utilization to the future population, under the assumption that the current patterns of utilization remain unchanged. Finally, we translate the forecasted utilization into the number of providers needed, assuming that the currently observed productivity of providers remains the same in the future.

To construct the projection of the Oregon population by county, age, race and insurance type, we rely on two major datasets: the 2010 Census and the 2008-2014 ACS data. We start with the Census projections of the overall population in Oregon over the 2015-2020 period. To obtain county-level projections – which are not available based on the 2010 Census data - we used Census data from 2000 and applied the distribution of the Oregon population by county from that dataset to the 2015-2020 projections.

Next, in order to construct population projections by age group, race and insurance type, we use 2008-2014 ACS data on the Oregon population and estimate regression models in which the proportion of total population count in each cell defined by these categories is modeled as a function of cell characteristics such as age group, gender, race, health insurance type and time period. The estimates from this regression are used to calculate the predicted distribution of the population, which is then apportioned to the county level. Using data from all years between 2008 and 2014, our regression approach has the advantage that it takes into account all trends and patterns in the population and its health insurance that we document in Section II.A above. Specifically, we allow for the increase in the average age, Medicaid population and overall insurance rates.

Using the APAC data, we determine the number of patients by year, county, age group, gender, race and insurance type. Then we count the number of visits associated with each provider type. [9] The provider type categories we considered are: primary care physicians, non-primary care physicians, behavioral health providers, dentists, physician assistants (PAs), nurse practitioners (NPs), registered nurses (RNs) and other categories of nurses. We determine the utilization rates for a given provider type as the number of per patient visits in the cells defined by age group, sex and insurance type. We then multiplied these utilization rates with the respective counts of the projected patient population to estimate the total number of visits or encounters demanded for that type of provider in the future. The projected numbers of visits are then aggregated up to the county level to reflect the total utilization by county.

Finally, we translate the future utilization into the number of providers demanded using the estimated productivity of each provider type as reflected in the APAC data. We measure the productivity as the number of annual visits offered by the providers in each provider type. We then divide the projected utilization in each county by the productivity for a given provider type to obtain the number of provider types demanded by county over the 2016-2020 period. Table II.8 below presents our baseline forecasts of the demand for providers at the state level.

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[9] We refer to any encounter with a provider as a visit, irrespective of the care setting. Therefore, for the purposes of our analysis, a claim from an encounter with a provider of any type in any inpatient hospital is also categorized as a visit. Also, utilization rates of primary care provider services are based only on visits to primary care providers.

Table II.8: Projected Demand for Oregon Providers by Provider Type (Base Line)

Provider Type	2015	2016	2017	2018	2019	2020
Primary Care Physicians	7,094	7,146	7,250	7,358	7,469	7,580
Specialty Care Physicians	4,689	4,736	4,823	4,906	4,995	5,088
Behavioral Health	5,487	5,484	5,521	5,549	5,587	5,618
Dentist	2,963	2,985	3,028	3,068	3,115	3,156
Physician Assistant	1,495	1,512	1,535	1,557	1,582	1,608
Nurse Practitioner	2,337	2,348	2,376	2,407	2,435	2,465
Clinical Nurse Specialist	68	69	69	69	70	70
Adv. Practice Mid-wife	221	221	222	224	224	227
Registered Nurse	39,436	39,833	40,522	41,241	41,975	42,722
Licensed Practical Nurse	240	242	244	248	252	255
Nurse Anesthetist	359	364	371	379	386	396

Note: The numbers of providers in 2015 are the actual provider counts from Provider360. The numbers corresponding to other years represents our projected demand for providers.

2. *Supply Projection*

Starting with the current stock of health care providers, we apply a set of provider-specific annual growth rates to determine the future supply of providers over the 2016-2020 period. In principle, the health workforce is shaped by the entry of new providers into the workforce, and the by mortality, retirement and retention of current providers. However, given that this detailed information about the dynamics of the Oregon's health workforce is not available for this project, we construct the projections in Table II.9 using growth rates derived from the "Oregon Health Professions – Occupational and County Profiles" from OHA.

Table II.9: Projected Supply for Oregon Providers by Provider Type (Base Line)

Provider Type	2015	2016	2017	2018	2019	2020
Primary Care Physicians	6,883	6,917	6,952	6,987	7,022	7,057
Specialty Care Physicians	4,505	4,631	4,761	4,894	5,031	5,172
Behavioral Health	5,291	5,317	5,344	5,371	5,398	5,425
Dentist	2,856	2,857	2,858	2,859	2,859	2,860
Physician Assistant	1,455	1,497	1,541	1,585	1,631	1,679
Nurse Practitioner	2,261	2,381	2,507	2,640	2,780	2,927
Clinical Nurse Specialist	62	61	60	58	57	56
Adv. Practice Mid-wife	216	222	228	234	240	247
Registered Nurse	38,717	39,298	39,887	40,486	41,093	41,709
Licensed Practical Nurse	234	240	247	253	260	267
Nurse Anesthetist	335	336	338	339	340	342

Comparing the forecasts from Tables II.8 and II.9, we estimate that the state-level gap between demand and supply for primary care physicians will grow to about 500 providers by 2020. Similar gaps may be emerging for other categories, but it is important to note that in the cases of nurse practitioners and physicians assistants our forecasts indicate that the supply may be higher

than the demand. However, it may be the case that the growth rates in the number of NPs and PAs are too large. The current growth rates may be capturing trends that are specific only for the last few years, dominated by the Affordable Care Act and other health initiatives. In the future, the growth rates for these two categories may in fact be smaller.

Although the forecasts we present in Tables II.8 and II.9 are at the state level, they in fact are obtained by summing up provider counts from the county level. Our original demand and supply forecasts are at the county level, but we decided not to report them in this document for reasons of space. They are available in large Excel spreadsheets and we can provide them upon request.

An important caveat to keep in mind is that our baseline demand projection does not take into account that a part of the real demand for services is not met because of provider shortages. In fact, our analysis of the APAC data reveals that patients in rural areas have lower numbers of visits than patients in urban areas. This may suggest that at least some of the difference is caused by the fact that the number of providers (per population) practicing in rural areas is lower than in urban areas. In Table II.10 we present a demand projection constructed under the assumption that the utilization rates observed in urban areas should be the utilization rates prevailing in all areas, both rural and urban.

Table II.10: Projected Demand for Oregon Providers by Provider Type (Scenario 1)

Provider Type	2015	2016	2017	2018	2019	2020
Primary Care Physicians	7,695	7,715	7,790	7,871	7,949	8,030
Specialty Care Physicians	4,913	4,926	4,975	5,026	5,078	5,128
Behavioral Health	6,444	6,460	6,528	6,590	6,654	6,725
Dentist	4,292	4,305	4,348	4,393	4,436	4,479
Physician Assistant	1,705	1,710	1,729	1,748	1,763	1,780
Nurse Practitioner	2,488	2,496	2,522	2,549	2,573	2,598
Clinical Nurse Specialist	159	160	161	162	164	165
Adv. Practice Mid-wife	330	333	337	341	344	350
Registered Nurse	51,077	51,214	51,724	52,239	52,759	53,291
Licensed Practical Nurse	795	798	804	814	825	832
Nurse Anesthetist	619	620	626	636	643	650

Note: The numbers of providers in 2015 are the actual provider counts from Provider360. The numbers corresponding to other years represents our projected demand for providers.

As can be noticed, the projected demand for providers is markedly higher for all provider types than the estimates from Table II.8. Under this scenario, there is a significant gap between demand and supply for all provider types, and in some case, that gap is substantial. However, the scenario in Table II.10 should be viewed as an upper limit of the projected demand, because it is unlikely that all the difference in utilization across rural and urban areas is caused entirely by provider shortages. In fact, many rural area residents travel to urban areas to obtain care, particularly specialty care. Viewed from this perspective, it is likely that the future demand for services lie somewhere in between the baseline scenario projection from Table II.8 and the forecasts in Table II.10.

Finally, it is important to highlight that as part of the analysis using APAC data, we examined the Medicaid population in each county and constructed measures of utilization of medical services for this population. In Table A.10 in the Appendix we present the fraction of the Medicaid population in each county in Oregon, along with the percent of all visits in the county that are attributed to the Medicaid population for each provider type. It is noteworthy that although the Medicaid population represents about 25% of the entire population, it generates visits that are always higher than this percentage in the total of visits supplied by each provider type (except for Dentists).

3. *"Gap" Analysis*

As discussed above, comparing the projected demand and supply under various policy-relevant scenarios should provide insights into whether "gaps" are expected to emerge in given geographical areas, or for various provider types. Incentive programs designed to attract and retain providers in areas with low provider-to-population ratios may play a key role in closing this gap. However, to understand the extent of the impact of these incentive programs in Oregon on increasing the supply of providers in the state would require evaluation of these programs. Task 2 of the project is dedicated to that effort. Potential extensions to this analysis include excursions into other "what-if" scenarios that would yield different paths for the demand and supply of the health care workforce, as well as analyses in which the impact of provider incentive programs is specifically considered.

III. Provider Incentive Programs in Oregon

In this section we provide a detailed discussion of the provider incentive programs, focusing on their purpose, eligibility criteria, and targeted service population.   We also compare the programs in terms of total funding, administrative costs, and funding per participant, and summarize the changes that occurred in the funding and scope of these programs over the last few years.

A.   Main Features of Incentive Programs

The incentive programs we considered were state-funded and federal-funded programs, and encompassed loan repayment programs, loan forgiveness programs, scholarships, tax credits and insurance subsidies. The loan repayment programs we considered are the following:

State Funded:

- Medicaid Primary Care Loan Repayment Program (MPC LRP)
- Primary Care Loan Forgiveness Program (PCLFP)
- Primary Care Services Loan Repayment Program (PCS LRP)
- Behavioral Health Loan Repayment Program (BH LRP)
- Scholars for a Healthy Oregon Program (Loan Forgiveness) (SHOI)

Federally Funded:

- Oregon State Partnership Loan Repayment Program (SLRP)
- Federal Faculty Loan Repayment Program (FF LRP)
- National Health Service Corps Loan Repayment (NHSC LRP)
- Nursing Education Loan Repayment Program (NE LRP)

These programs vary in generosity from awards up to $20,000 (BH LRP) to awards of up to $50,000 (NHSC LRP) and $105,000 (MPC LRP), and differ by the provider types that are eligible to apply and by the population served. For instance, MPC LRP is offered to providers who serve Medicaid patients up to a maximum requirement of 15 percent from their patient mix, while BH LRP is offered to behavioral health workers in exchange for at least 1 year of service in Mental Health Professional Shortage Areas.

The tax credit programs that we considered are:

- The Oregon Rural Practitioner Tax Credit (RPTC)
- The Volunteer Rural Emergency Medical Service Tax Credit (EMS TC)

As their name indicates, they offer tax credits to providers who offer rural medical care. In the case of RPTC, the program offers a tax credit of up to $5,000 annually[10] to eligible providers, while EMS TC provides a $250 tax credit for emergency medical respondents in rural areas.

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[10] During the period studied, providers received a flat $5,000 credit; this was changed in the 2015 legislature but we are not able to evaluate those changes in the current study.

Finally, RMPIS provides subsidies to qualifying physicians and NPs in rural areas to offset the cost of medical malpractice insurance.

Table III.1 below presents a large number of program-specific details, including total funding per year, eligible providers, eligibility conditions, year when the program was established, and other relevant features.

Table III.1: Summary of Various Incentive Programs in Oregon

Programs in Oregon	Description
Programs using State Funding	
(1) Rural Medical Practitioners Insurance Subsidy Program (RMPIS)	

Overseen by OHA (since 2003); administered by ORH
 	
Provides subsidies to qualifying physicians and NPs in rural areas to offset cost of medical malpractice insurance
 	
Funding: $8.2 million for 2015-17 biennium
 	
Eligible providers:
(1) A practitioner who has a rural practice that meets the criteria established by the Office for the purposes of ORS 315.613 is eligible for a subsidy under the Program, if the practitioner:
    A. Holds an active, unrestricted license or certification;
    B. Is covered by a medical professional liability insurance policy issued by an authorized carrier with minimum coverage of $1 million per occurrence and $1 million annual aggregate; and
    C. Is willing to serve patients with Medicare coverage and patients receiving medical assistance in at least the same proportion (determined by the Office).
(2) A nurse practitioner (employed by a licensed physician) who is covered by a medical professional liability insurance policy that names and separately calculates the premium for the nurse practitioner.
(3) A practitioner whose medical professional liability insurance coverage is provided through a health care facility, as defined in ORS 442.400, and also meets the requirements of the detailed rule (4).	

(2) Medicaid Primary Care Loan Repayment Program (MPC LRP)	

Medicaid Primary Care Loan Repayment Program (MPC LRP) is overseen by OHA (since 2013); administered by ORH Provides loan repayment for providers serving Medicaid patients in Oregon
 	
Funding: $4 million (2013-2015) Unfunded by 2015 Legislature; an Additional $2 million allocated in 2016 Legislative Session.
 	
Program participants must agree to serve Medicaid patients in excess of the percentage of eligible patients in the county.
 	
Program participants must commit to practice either:
    A. Full-time in a qualifying practice site for at least three years.
    B. Part-time in a qualifying practice site for at least five years.
Practitioner in Oregon that can apply:
• A Dentist in general or pediatric practice; An Expanded Practice Dental Hygienist;
• A Physician (MD or DO) who practices in the specialties of family medicine, general practice, general internal medicine, geriatrics, pediatrics, or obstetrics and gynecology;
• A Nurse Practitioner who practices in the specialties of adult health, women's health care; geriatrics; pediatrics; psychiatric mental health; family practice, or nurse midwifery;
• A Physician Assistant who practices in the specialties of family medicine, general practice, general internal medicine, geriatrics, pediatrics or obstetrics and gynecology;
• A general, child and adolescent, or geriatric Psychiatrist; a Clinical Psychologist; a Licensed Clinical Social Worker; a Marriage or Family Therapist.	

Programs in Oregon	Description
(3) Scholars for a Healthy Oregon Program (SHOI)	

Scholars for a Healthy Oregon Program (SHOI) is Administered by OHSU (established in 2013) and it is a loan forgiveness program. The program offers full tuition and fees to 21 OHSU medical, PA, Dental and APN students in exchange for obligation to serve in a OHSU approved underserved site for a one year longer than total years of funding received.

Funding: $2.5 million (2013-2015)

To be eligible for funding under SHOI, students must be admitted to OHSU as an Oregon Resident or Oregon Heritage student for the 2016-17 academic year in one of the following clinical degree programs:
- Doctor of Medicine (MD)
- Doctor of Dental Medicine (DMD)
- Master of Physician Assistant Studies (MPAS)
- Master of Nursing (MN) in: Adult Gerontology Acute Care Nurse Practitioner; Family Nurse Practitioner; Nurse Anesthesia; Nurse Midwifery; Pediatric Nurse Practitioner; Psychiatric Mental Health Nurse Practitioner

Additional priority consideration will be given to applicants who are:
- Students who live in eligible locations and community and/or graduated from eligible schools
- First generation college students
- Students from a diverse or underrepresented community

| **(4) Primary Care Loan Forgiveness Program (PCLFP)** | |

This program is administered by Office of Rural Health (established in 2010). It provides loan repayment to 2nd/3rd year students who are enrolled in Oregon rural training track for funding up to 3 years.

Funding: $700,000 (2013-2015); typical awards are $35,000/year

A prospective primary care practitioner who wishes to participate in the program shall submit an application to the office in accordance with rules adopted by the office. To be eligible to be a participant in the program, a prospective primary care practitioner must:
- Have completed the first year of the prospective primary care practitioners medical education;
- Be enrolled in a medical education program in Oregon that emphasizes training rural health care practitioners and is approved by the office;
- Execute a service agreement stating that, immediately upon the prospective primary care practitioners completion of residency or training as established by the office by rule, the prospective primary care practitioner will practice as a primary care practitioner in a rural setting in this state approved by the office for at least as many years as the number of years for which the practitioner received loans from the Primary Health Care Loan Forgiveness Program; and
- Meet other requirements established by the office by rule.

| **(5) Primary Care Services Loan Repayment Program (PCS LRP)** | |

 Administered by Office of Rural Health
Provides loan repayment to providers offering primary care services in exchange for at least 3-years of service in underserved and rural areas (2-years for PA/NPs)
Funding: currently unfunded

Programs in Oregon	Description
(6) The Oregon Rural Practitioner Tax Credit (RPTC)	
This program is administered by Office of Rural Health and Oregon Department of Revenue (since 1989) Provides $5,000 tax credit annually to eligible providers, optometrists, and dentists. Funding: $8.5 million/year A resident or nonresident individual who is certified as eligible under ORS 442.561, 442.562, 442.563 or 442.564, and is licensed as a physician under ORS chapter 677, licensed as a physician assistant under ORS chapter 677, licensed as a nurse practitioner under ORS chapter 678, licensed as a certified registered nurse anesthetist under ORS chapter 678, licensed as a dentist under ORS chapter 679 or licensed as an optometrist under ORS 683.010 to 683.340 is entitled to the tax credit.	
(7) The Volunteer Rural Emergency Medical Service Tax Credit (EMS TC)	
EMS TC is administered by the Office of Rural Health and Oregon Department of Revenue (since 1989) Provides a $250 tax credit for emergency medical respondents in rural areas (25 or more miles away from population centers). Funding: $150,000/tax year A resident or nonresident individual who is certified as eligible under ORS 442.561 (Certifying individuals licensed under ORS chapter 679 for tax credit) to 442.570 (Primary Care Services Fund) and who is licensed as an emergency medical services provider under ORS chapter 682 shall be allowed a credit against the taxes that are otherwise due under ORS chapter 316 if the Office of Rural Health certifies that the individual provides volunteer emergency medical services in a rural area that comprise at least 20 percent of the total emergency medical services provided by the individual in the tax year.	
(8) Behavioral Health Loan Repayment Program (BH LRP)	
This program is administered by the Office of Rural Health. It offers loan repayment to behavioral health workers in exchange for at least 1 year of service in Mental Health Professional Shortage Areas. Typical award is up to $20,000 per participant per year of obligatory service This program is only available to unlicensed behavioral health providers that have completed, or will complete within 8 months of applying to this program, a master's level or higher degree program in one of the following fields: • Clinical Social Work; Psychiatry; Counseling or Clinical Psychology; Professional Counseling; Marriage and Family Counseling; Psychiatric Nursing (licensed PMHNPs are eligible to apply) Applicants must be employed at or contracted to begin working at a qualified site within 8 months of the date of application. Applicants must also be registered with their respective professional board and working toward the requirements of licensure in their discipline.	

Programs in Oregon	Description
Programs using Federal Funding	
(1) Oregon State Partnership Loan Repayment Program (SLRP)	
SLRP provides loan repayment in exchange for a 2-year service obligation in Health Professional Shortage Areas. Funding (HRSA): $300,000/year and typical awards are up to $35,000/year (Administered by ORH) Eligibility. A SLRP candidate must be: a US citizen at the time the application is submitted; contracted to begin working or already working in a HPSA designated service site; providing services in primary care. Qualified providers are: • Allopathic or Osteopathic Physicians specializing in Family Medicine, General Pediatrics, General Internal Medicine, Gerontology, General Psychiatry or Obstetrics/Gynecology • Primary Care NP or PA or Certified Nurse-Midwives or Registered Nurse • Dentists (DMD/DDS) or Dental Hygienists • Licensed Mental Health or Behavioral Health Professionals: Clinical or Counseling Psychologists, Clinical Social Workers, Professional Counselors, Marriage and Family Therapists, or Psychiatric Nurse Specialists • Pharmacists	
(2) National Health Service Corps Loan Repayment (NHSC LRP)	
Provides loan repayment to primary care providers in exchange for service obligation in Health Professional Shortage Areas Funding (HRSA): $4.6 million/year and typical awards are up to $50,000 for a 2-year commitment	
(3) National Health Service Corps Scholarship Program (NHSC SP)	
Provides scholarship to pursue primary care and commit to serve in Health Professional Shortage Areas Funding (HRSA): $1.1 million (2013)	
(4) Nursing Education Loan Repayment Program (NE LRP) (Now "NurseCorps")	
Provides loan repayment to Registered Nurses and Advanced Nursing Practitioners in exchange for a minimum of a 2-year service in Health Professional Shortage Areas Funding (HRSA): $1.2 million (2013)	
(5) Federal Faculty Loan Repayment Program (FF LRP)	
Provides loan repayment to health professions graduates from disadvantaged backgrounds who serve as faculty at an eligible health profession college or university Pays up to $40,000 in exchange for at-least 2-year service in Health Professional Shortage Areas Funding (HRSA): $44,000 (2013)	

Table III.2 below systematizes some of the information in Table III.1, as it shows what providers are eligible for the incentive programs considered.

Table III.2 Eligibility for Incentive Programs by Provider (and Medical Student) Type

	PC Physician	Specialty Physician	PC PA	PC NP	Optometrist	Dentist	Dental Hygienist	Mental/BH	RN	CRNA	EMS	CN Midwives	Pharmacist
Providers													
Program													
RMPIS	X	X		X				X					
MPC LRP	X		X	X		X	X	X					
RPTC	X	X	X	X	X	X[b]				X			
EMS TC											X		
BH LRP			X[a]					X					
SLRP	X		X	X		X	X	X	X			X	X
Students													
SHOI	X	X	X	X		X				X		X	
PC LRP	X		X	X									

NOTE: [a] indicates Psychiatric Mental Health Nurse Practitioner; [b] indicates Expanded Practice Dental Hygienist.

Next, in Table III.3 we provide an inventory of the program changes. It is important to point out that over the period we are considering for the analysis (2010-2015), there were only a limited number of changes in the features of the state programs considered.[11] On the federal side, however, we detected important changes in the funding and provisions of the NHSC programs.

[11] However, as noted above, there were substantial changes in 2015 to the RPTC which we are not able to evaluate in this study.

<div align="center">

Table III.3: Changes in the Features of the Incentive Programs

</div>

Programs in Oregon	Description
Programs using State Funding	
The Oregon Rural Practitioner Tax Credit (RPTC)	

1. Optometrists
    a. Up until 2013
        i.   60% or more of professional practice time is spent in eligible area (Baker, Gilliam, Grant, Harney, Lake, Malheur, Morrow, Sherman, Wallowa, Wheeler
        ii.   Must have consulting privileges with Eligible Rural Hospital
    b. Taking effect January 1, 2014
        i.   Must provide a minimum of 20 hours per week of patient care, averaged over the month in the eligible rural areas ; this removes the 60% clause
        ii.   Grandfather clause, that says "Those who receive the credit for Tax Year 2013 would qualify for the next 10 years, but only if they meet the new requirements that take effect on January 1, 2014"
2. Dentists
    a. Up until 2013
        i.   60% or more of professional practice time is spent in eligible area (Baker, Gilliam, Grant, Harney, Lake, Malheur, Morrow, Sherman, Wallowa, Wheeler) OR
        ii.   Oregon-licensed dentists who practice in an OR town with less than 5,000 inhabitants that is 25 or more miles from another source of full-time general dental care.
    b. Taking effect January 1, 2014
        i.   Must provider a minimum of 20 hours per week of patient care, averaged over the month in the eligible rural areas; this removes the 60% clause
        ii.   Grandfather clause, that says "Those who receive the credit for Tax Year 2013 would qualify for the next 10 years, but only if they meet the new requirements that take effect on January 1, 2014"
3. MDs, Dos, DPMs, NPs, Pas, CRNAs
    a. Up until 2013
        i.   60% or more of professional practice time is spent in eligible area (Baker, Gilliam, Grant, Harney, Lake, Malheur, Morrow, Sherman, Wallowa, Wheeler)
    b. Taking effect January 1 2013
        i.   For DOs, MDs and PAs, participation in Medicare and Medicaid Programs is required. Eligible practitioners must be willing throughout the tax year to serve patients with Medicare or Medicaid coverage in at least the same proportion to their total number of people in the eligible areas of their county, not to exceed 20% Medicare patients or 15% Medicaid patients.
        ii.   Must provide a minimum of 20 hours per week of patient care, averaged over the month in an eligible rural area.
        iii. Grandfather clause that says "Those who receive the credit for Tax Year 2013 would qualify for the next 10 years, but only if they meet the new requirements that take effect on Jan 1, 2014".

Programs in Oregon	Description
Rural Medical Practitioners Insurance Subsidy Program (RMPIS)	

- The criteria changed in 2011:
  - From 2007-2011
    - Up to 80 percent for doctors specializing in obstetrics;
    - Up to 60 percent for doctors specializing in family or general practice who provide obstetrical services; and
    - Up to 40 percent for all other eligible doctors
  - From 2011 on
    - 80 percent for physicians specializing in obstetrics and nurse practitioners certified for obstetric care;
    - 60 percent for physicians specializing in family or general practice who provide obstetrical services;
    - 40 percent for physicians and nurse practitioners engaging in one or more of the following practices:
      - Family practice without obstetrical services;
      - General practice without obstetrical services;
      - Internal medicine;
      - Geriatrics;
      - Pulmonary medicine;
      - Pediatrics;
      - General surgery; and
      - Anesthesiology; and
    - 15 percent for physicians and nurse practitioners other than those included above

| **Programs using Federal Funding** ||
| **NHSC LRP** ||

- Affordable Care Act (ACA) allowed extending service contracts of physicians, NPs, and PAs
- ACA appropriated $1.5 billion in new funding for NHSC over a five-year period beginning in FY 2011
- ACA contained provisions to support the recruitment and retention of primary care providers in underserved communities for the purposes of expanding service sites, increasing the clinician-base, increasing the value of LRP awards, instituting a half-time service option, and allowing for limited teaching and other non-clinical work.
- The American Recovery and Reinvestment Act (ARRA) designated $300 million to expand the NHSC
- NHSC abolished its HPSA score floor requirement and extended Loan Repayment Program eligibility to include sites located within all HPSAs
- NHSC added a half-time service option and increased maximum loan repayment amounts from $50,000 to $60,000 for an initial 2-year contract
- NHSC revamped its application system and streamlined its assignment process to efficiently facilitate additional enrollment
- NHSC interchangeably funded clinicians with both ARRA funds and regular annual appropriations

B. Participation in Incentive Programs

In this section we examine the extent of participation in the various provider incentive programs. Table III.4 shows the number of participants in each of the financial programs available over the

period between 2010 and 2015. [12] Overall, the total number of participants increased from 3,119 providers in 2010 to 3,338 providers in 2012 and then gradually declined to 3,224 participants by 2014. Much of the increase in 2012 is due to the increase in the number of participants in NHSC LRP. On the other hand, the number of participants in state funded programs such as RPTC and EMS TC remained relatively stable. There has been a steady decline in the number of participants in the malpractice insurance subsidy program (RMPIS) during this period.

Table III.4: Participants in Provider Incentive Programs, by Year and Program

Programs	2010	2011	2012	2013	2014	2015
RPTC	2,137	2,164	2,203	2,214	2,216	104*
RMPIS	861	822	769	702	687	639
EMS TC	557	565	572	562	520	269*
J1 VW	66	64	59	74	75	84
MPC LRP	-	-	-	-	17	42
BH LRP	-	-	-	-	-	14
SLRP	-	6	11	27	40	50
NHSC	127	185	321	257	262	346
NHSC LRP	122	179	222	240	237	316
NHSC SP	5	6	13	17	25	27
NHSC others	0	0	86	0	0	3
Total Participants	**3,119**	**3,186**	**3,341**	**3,272**	**3,224**	**1,520***

Note: * indicates that the data on these programs for 2015 are incomplete.

In terms of the number of participants, RPTC is the largest program and the number of participants remained relatively stable at around 2,200 providers over our timeframe. This is consistent with our assessment from the previous section that there were no substantial changes in the funding, scope or eligibility of this program during the study period. On the other hand, there has been a substantial increase in NHSC participation over recent years; this is most likely a result of the injection of additional federal funding under the American Recovery and Reinvestment Act (ARRA) in 2009 and the Affordable Care Act (ACA) in 2011, as well as more ambitious efforts on the part of Oregon staff supporting the program[13] to compete for as much of the award slots as possible.[14] Although a few changes in terms of eligibility rules for RMPIS have been made in the recent past, it is unlikely that such changes may explain the gradual decline in the number of program participants. Further study is required to understand the specific cause of

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[12] We discuss in the previous section the characteristics of the: Federal Faculty Loan Repayment Program (FF LRP); Scholars for a Healthy Oregon Program Loan Forgiveness (SHOI); Nursing Education Loan Repayment Program (NE LRP); and the Primary Care Loan Forgiveness Program (PCLFP). Given that participation in some of these programs is very low, or individual-level data is unavailable, we decided to exclude them from Table III.4 and from our empirical analysis in Chapters IV, V and VI.

[13] The PCO serves as the state liaison for the NHSC in each state, and conducts outreach and advises on the availability of the program. Given that the PCO also contributes to the determination of need as defined by Shortage Areas/HPSAs, they can impact the number of awards provided to clinicians in their state..

[14] Source: https://aspe.hhs.gov/report/provider-retention-high-need-areas/american-recovery-and-reinvestment-act-arra-and-patient-protection-and-affordable-care-act-aca-funding-expansion.

the decline in participation in this program, but it is possible that as providers get employed with hospitals they drop from RMPIS since hospitals cover their insurance premium.

Table III.5: Funding and Award by Program 2010-2015

Program	Funding	Award per Recipient
RPTC	- $8.5 Million (on average) per year during 2010-2015. - No significant change in total amount during 2010-2015.	Up to $5,000 tax credit per year
RMPIS	$8.2 million 2015-17 biennium (note earlier comment); $2.5 million spent	$3,820 per year (on average)
EMS TC	- $100,000 (on average) per year during 2009-2011 - $150,000 (on average) per year during 2011-2013	$250 tax credit per year
J1 VW	N/A	N/A
MPC LRP	- $4 million for 2013-2015 - $2.15 million in 2014 - $1.5 million in 2015	$32,000 loan repayment per year (on average)
BH LRP	$207,000 (in 2015)	Full-time providers: Up to $20,000/year for serving at least 1 year Part-time providers: Up to $10,000/year for serving at least 2 years
SLRP	- $457.5 thousand (on average) spending per year during 2011-2012; - $1 million (on average) spending per year during 2013-2014; - $462 thousand spending in 2015	Up to $35,000 loan repayment per year of full-time service
NHSC LRP	- $3.6 million in 2013	$25,000 loan repayment per year of full-time service
NHSC SP	- $1.2 million in 2013	$55,000 in scholarship payment per year

Note: N/A is Not Applicable.

Table III.5 shows the availability of funding and the average award per recipient during 2010-2015 timeframe. The overall funding and the award per recipient under RPTC did not change substantially during these six years. On the other hand, funding for NHSC and SLRP increased substantially in recent years. Funding for EMS TC program also increased significantly during 2011-2013 period with no change in award per recipient. It is important to note that the amount of the incentive payment under, say, RPTC is $5,000 in tax credit per year, which is much lower than the incentive payments available under the NHSC LRP ($25,000) program or the Oregon SLRP ($35,000) per year. Given the constant increase in the number of NHSC participants once additional funds under the ARRA and the ACA were made available, it may be the case that effects of incentive programs on recruiting and retaining providers in high need areas may be detectable only after these programs become sufficiently generous to offset the potential costs and inconvenience of providers who relocate to rural areas.

Historically, the provider incentive programs have been developed separately to respond to an identified need, and hence they may not necessarily complement each other. In fact, given the program designs and the eligibility criteria, it is possible for many providers to participate in

multiple programs and receive substantial financial benefits in the aggregate. For example, RPTC may be used alongside loan repayment programs as well as RPMIS. The combined impact is that a provider may receive $40,000 annually in loan assistance, a tax credit of $5,000, and have a portion of the medical insurance premium being paid under RMPIS. The availability of these financial resources would have further implications on the recruitment and retention of providers in high need areas, since past research indicated that the generosity of financial incentive is an important driver of provider retention in medically shortage and rural areas. Hence, we also examine to what extent providers participate in multiple incentive programs.

Table III.6 shows the number of health care providers participating in more than one of these incentive programs. The diagonals in each of the panels of Table IV.2 indicate the number of providers who participate in only one program, while the numbers above the diagonal indicate the number of providers participating in two programs. Participation in more than two programs is very rare, and we capture it by adding rows like 'RPTC+RMPIS'. The numbers on those rows indicate simultaneous participation in RPTC, RMPIS and any other program.

Table III.6: Number of Individual Providers Participating in Two or More Incentive Programs

2011						
	RPTC	RMPIS	EMS TC	J1 VW	SLRP	NHSC
RPTC	1551	537	4	12	2	55
RMPIS	-	278	0	0	0	0
EMS TC	-	-	561	0	0	0
J1 VW	-	-	-	47	0	0
SLRP	-	-	-	-	4	0
NHSC	-	-	-	-	-	128
RPTC + RMPIS	-	-	0	1	0	2

2012						
	RPTC	RMPIS	EMS TC	J1 VW	SLRP	NHSC
RPTC	1619	491	3	15	4	68
RMPIS	-	271	0	3	0	0
EMS TC	-	-	568	0	0	0
J1 VW	-	-	-	40	0	0
SLRP	-	-	-	-	7	0
NHSC	-	-	-	-	-	249
RPTC + EMS TC	-	0	-	0	0	1
RPTC + RMPIS	-	-	0	1	0	3

2013							
	RPTC	RMPIS	EMS TC	J1 VW	SLRP	NHSC	
RPTC	1668	451	3	16	13	70	
RMPIS	-	244	0	3	0	0	
EMS TC	-	-	559	0	0	0	
J1 VW	-	-	-	54	0	0	
SLRP	-	-	-	-	14	0	
NHSC	-	-	-	-	-	184	
RPTC + RMPIS	-	-	0	1	0	3	

2014							
	RPTC	RMPIS	EMS TC	J1 VW	SLRP	NHSC	MPC LRP
RPTC	1648	465	3	16	18	75	5
RMPIS	-	216	0	2	0	1	0
EMS TC	-	-	517	0	0	0	0
J1 VW	-	-	-	55	0	0	0
MPC LRP	-	-	-	-	0	0	12
SLRP	-	-	-	-	20	0	-
NHSC	-	-	-	-	-	185	-
RPTC + RMPIS	-	-	0	2	2	1	0

As can be noted, most of the providers who participate in multiple programs do so by participating in RPTC and RMPIS and in RPTC and NHSC. For instance, in 2014 there were 262 NHSC program participants in Oregon. Of those, 75 participated in RPTC and only one of them participated in both RPTC and RMPIS. Similarly, of the total of 2,216 RPTC program participants in 2014, 465 also participated in RMPIS. Exactly half of the SLRP participants also participated in multiple programs in 2014.

Turning to the distribution of participating providers by discipline, we show in Table III.7 that in the case of NHSC the majority of participants are nurse practitioners, physicians and physician assistants. In 2015 there has been a substantial increase (i.e., 25 percent) in the number of physicians and nurse practitioners under the NHSC program in Oregon compared to the numbers in 2014. Also, the number of licensed clinical social worker doubled from 22 in 2014 to 44 in 2015. Increased numbers of these providers would ultimately increase the provider-to-population ratio in high need areas and therefore improve the access to the services provided by these health care providers.

Table III.7: Distribution of NHSC Participants by Discipline

Provider Discipline	2010	2011	2012	2013	2014	2015
Physicians	30	35	40	50	53	67
Nurse Practitioner	28	40	54	57	59	74
Physician Assistant	22	33	39	36	33	47
Certified Nurse Midwife	3	2	1	2	3	3
Dentist	19	26	30	35	37	34
Registered Dental Hygienist	4	6	5	6	7	12
Health Service Psychologist	1	4	6	6	9	11
Licensed Clinical Social Worker	7	16	28	27	22	44
Licensed Professional Counselor	10	19	29	32	33	44
Marriage and Family Therapist	2	3	3	4	4	9
Psychiatric Nurse Specialist	1	1	1	2	2	1
Other	0	0	85	0	0	0
Total	**127**	**185**	**321**	**257**	**262**	**346**

Note: In 2012, 85 participants that are listed under provider discipline category of "Other" include 68 NELRP (Nurse Education LRP) and 17 NSP (Nurse SP) program participants.

Not least, the availability of providers across different types of health care delivery settings provides an indication of the number of patients they serve and of the amount of services they deliver in those settings. In rural and medically shortage areas, a large part of the population access their health care services through Federally Qualified Health Centers (FQHCs) and Rural Health Clinics (RHCs). In Table III.8 we show that over 60 percent of NHSC participants are serving in through FQHCs around the state, and about 18 percent of the NHSC participants provide mental health care through Community Mental Health Centers (CMHCs). Also, Table A.9 in the Appendix shows the distribution of NHSC participants by discipline and by whether they serve in rural vs urban areas.

Table III.8: Distribution of NHSC Participants by Site Type

Health Care Delivery Setting	2010	2011	2012	2013	2014	2015
Federally Qualified Health Centers (FQHC)	102	133	147	162	174	211
Certified Rural Health Clinic (RHC)	4	9	14	15	13	28
Community Mental Health Center (CMHC)	14	19	0	30	47	62
Other Health Facility	7	24	160	50	28	45
Total	**127**	**185**	**321**	**257**	**262**	**346**

C. Program Metrics and Performance: A Literature Review

As part of this project, we created an extensive environmental scan of peer-reviewed journals, reports, white papers, research projects, and other unpublished literature to identify and summarize findings related to the measures of effectiveness of various types of provider incentive programs. Our main focus was on the metrics used to determine the success of programs in terms of recruiting and retaining providers in targeted areas, but we also reviewed literature centered

on measuring the impact of other factors that play a role in the providers' decision to serve in targeted areas.

Among the performance metrics that have been used in the literature are: (i) provider retention rates in high-need areas; (ii) the number of participants the program was able to attract; (iii) the marginal cost for recruiting each additional provider; (iv) the size and the type of the patient population served; or (v) the number of provider-years served in rural and underserved areas while providers were participating in the program, and/or after completion of program obligation. Specific to Oregon, a 2014 report for the Oregon Health Policy Board offers a number of potential performance measures like the: (i) number of placements/slots filled; (ii) number of patients seen by obligated service providers; (iii) number of patient visits to obligated service providers; (iv) retention of providers over time; (v) reduction in the need of medical services; or (vi) return on investment (ROI) from the program to the greater community.

In order to accurately measure the actual impact of the incentive programs, it is important to account for the circumstances, characteristics or factors that are unrelated to programs, but which can influence the individual provider's decision to serve in targeted areas. Being able to isolate the impact of these factors opens the door to the estimation of a true causal program effect. Beyond salary and compensation packages, past literature has identified the following as determinants of the providers' decisions to locate, serve and remain in rural or underserved areas: (i) exposure to rural life through education, recreation, or upbringing; (ii) opportunities for personal growth; (iii) self-identity (or common background with the patients); (iv) mission-based values (or being dedicated to serving particular communities); (v) clinic support; (vi) provider team quality; (vii) effective reimbursement mechanisms; or (viii) availability of information technology. Also, individual characteristics have been found to play a role in the decision to serve in a rural area, such as the provider's gender, age, marital status, family size, amount of student loan debt, and whether the provider participated in rural programs while in medical school.

However, large parts of the literature we reviewed suffer from a number of shortcomings. For instance, a lot of the literature focused on the link between provider characteristics and features of their educational programs on one hand, and the alleviation of provider shortages on the other hand, yields findings that are based on small-sample surveys. In many cases, these results may not be generalizable to larger samples of providers. Moreover, in some studies the surveys elicit information on decisions that providers or medical students contemplate in the future. The actual outcome of those decisions may be different when providers are actually making the decision to locate in a rural area.

Perhaps the most important critique to the currently available literature on incentive programs is that the performance metrics that have been proposed in the past are in many cases unrelated to measures of performance that would follow from a conceptual framework centered on the individual provider's decision to locate in a high need area. For instance, when evaluating the effectiveness of incentive programs, counting the number of program participants that the program was able to recruit may not be the right measure of success since many of these providers would have probably practiced in rural areas even in the absence of the rural program. Similarly, in the absence of the right comparison, a higher retention of these providers in rural areas may not necessarily indicate true program success. In fact it is likely that those drawn to rural areas strictly as a result of the program have a *lower* retention than those who would have

gone there even without the program, since they are likely to have a lower preference for being in a rural area than the providers who serve there without the incentives.

Based on a conceptual framework we articulate in Chapter V of this report, we propose to evaluate the success of the incentive programs ***in terms of the increase in the number of providers in targeted areas as a direct result of the program, as well as the extent to which time served in those areas increases due to the program***. We call the first effect the *recruiting effect* of the program, and it is measured as the number of providers who would not have located in those areas without the program. The second effect is called the *retention effect*, and it reflects the amount of time a typical participating provider spends in a targeted area above what he or she would have in the absence of the program. We measure the recruiting effect of the programs using regression models in which the number of providers in a rural area is a function of the number of participants in that area, while the retention effect is measured by assessing the difference between the number of years spent in rural areas by program participants and the number of years spent in rural areas by non-participating providers.

Our full literature review is available in Appendix B of this report.

IV. Retention Analysis of Program Participants

To be able to measure the benefits of the incentive programs considered in this study, we need to determine by how much the number of providers in targeted areas increases as a direct result of the program, as well as the extent to which time served in those areas increases due to the program. As noted earlier, we call the first effect the *recruiting effect* of the program, and it measures the number of providers who would not have located in those areas without the program. The second effect is called the *retention effect*, and it reflects the amount of time a typical participating provider spends in a targeted area above what he or she would have in the absence of the program. In this section we focus on the retention analysis. While typically recruiting is viewed as preceding retention, in this report we examine the retention effects first, because that analysis yields a number of relevant program-specific descriptive statistics that are then used in the econometric analysis of the recruiting effects. We return to recruiting effects in the next chapter.

A.   Retention Profiles of Oregon Program Participants

Many state-funded incentive programs do not stipulate a specific obligation to serve in a rural area for a certain period of time. Programs like RPTC, RMPIS or EMS TC only require the provider to be located in a rural area in order to claim the benefit. As a result, for those programs we construct retention profiles over the years in which these providers are located in a rural area within the state. Moreover, these programs differ in another way from the loan repayment, loan forgiveness, and tuition subsidy programs. In general, anyone who satisfies the required criteria can apply and receive the incentive. In contrast, the loan repayment and tuition subsidy award offers a finite number of awards to qualified applicants, based on the amount budgeted for the program. There may be more qualified applicants than there are awards available, in which case the awards are rationed among qualified applicants based on other benefits the applicant may bring, such as a particular specialty in short supply or willingness to serve in a particular area where shortages are more pronounced. We provide a comprehensive discussion in the report summarizing the work performed under Task 1 for this project (Lewin, 2016).

To perform this retention analysis, we first merged by name and other individual characteristics data obtained from OHA on program participation for RPTC, RMPIS, EMS TC and J1 VW over the 2011-2015 period with the Provider360 data to identify the location of these providers over time.[15] Using information on the location zipcode available in Provider360 file over the period between 2011 and 2015, and information from the Office of Rural Health on which zipcode is part of a rural or non-rural area, we count the number of program participants who serve up to four years in rural areas. For instance, if we observe a certain RPTC participating provider in 2011 in a rural area, we track that provider over time and determine the number of years he or she has been located in a rural area until the end of our timeframe, 2015. Providers who appear for the first time in the data in 2012 can only be tracked up to three years for example.

Provider360 (P360) is a proprietary data base maintained by Optum, which includes the name, location, and other characteristics of virtually all practicing providers in the United States. For

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[15] We did the same for the SLRP, MCLRP and BHLRP. Given that participation in, as well as graduation from these programs is low over our timeframe, we were not able to conduct reliable retention analyses in rural areas for these programs. We return to the *potential* impact of these programs on recruiting and retention in Chapter IV.

physicians, it is more current than the AMA Masterfile in its attempts to update information on all physicians annually. For providers, such as dentists, advanced practice nurses, physician assistants, and others, it may be the only single source for such information.

In Table IV.1 we present the number of individual providers who were first observed in a rural area in any of the years between 2011 and 2015 for each of the state-funded programs considered. These are individual providers that we were able to identify in P360 data. Of the 1,978 participating providers that we observed for the first time in a rural area in 2011, 1,880 remained in rural areas one year later, 1,754 remained in rural areas two years later and so on. The right panel of Table II.1 shows the conditional retention rates in rural areas over a period up to four years since they were first observed in a rural area. The conditional retention rate is the ratio of providers who remain in rural areas in year *t+1*, given that they were in a rural area in year *t*.

As before, most participating providers participate in RPTC and RMPIS, with a small number of participants in EMS TC and J1 VW. The conditional retention rates are relatively similar across programs, and they remain high across the years.

Table IV.1 Retention Profiles in Rural Areas of Participants in State Programs

	Years in Rural Areas in Oregon					Retention Rates by Years in Rural			
	0	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
	Any Program (RPTC, RMPIS, EMS TC or J1 VW)								
2011	1,978	1,880	1,754	1,724	1,597	0.95	0.93	0.98	0.93
2012	138	103	105	90	0	0.75	1.00	0.86	
2013	207	182	153	0	0	0.88	0.84		
2014	201	139	0	0	0	0.69			
2015	253	0	0	0	0				
	RPTC								
2011	1,693	1,612	1,508	1,481	1,359	0.95	0.94	0.98	0.92
2012	113	82	86	74	0	0.73	1.00	0.86	
2013	179	157	134	0	0	0.88	0.85		
2014	170	118	0	0	0	0.69			
2015	178	0	0	0	0				
	RMPIS								
2011	754	722	679	681	640	0.96	0.94	1.00	0.94
2012	37	26	27	23	0	0.70	1.00	0.85	
2013	39	36	28	0	0	0.92	0.78		
2014	42	30	0	0	0	0.71			
2015	48	0	0	0	0				
	EMS TC								
2011	12	11	10	10	10	0.92	0.91	1.00	1.00
2012	2	2	2	1	0	1.00	1.00	0.50	
2013	2	2	2	0	0	1.00	1.00		
2014	1	1	0	0	0	1.00			
2015	1	0	0	0	0				

	Years in Rural Areas in Oregon					**Retention Rates by Years in Rural**			
	0	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
	J1 VW								
2011	20	19	17	17	14	0.95	0.89	1.00	0.82
2012	2	2	2	2	0	1.00	1.00	1.00	
2013	8	8	7	0	0	1.00	0.88		
2014	8	4	0	0	0	0.50			
2015	10	0	0	0	0				

In Tables IV.2 and IV.3 we present the number of primary care physicians and NP/PAs that are observed in our data in rural areas. The retention patterns remain similar to the ones in Table II.1 for these categories of providers.

Table IV.2 Retention Profiles in Rural Areas of Primary Care Physicians Participating in State Funded Programs

	Years in Rural Areas in Oregon					**Retention Rates by Years in Rural**			
	0	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
	Any Program (RPTC, RMPIS, J1 VW)								
2011	785	760	721	718	654	0.968	0.949	0.996	0.911
2012	40	24	31	26	0	0.600	1.000	0.839	
2013	67	61	46	0	0	0.910	0.754		
2014	68	43	0	0	0	0.632			
2015	79	0	0	0	0				
	RPTC								
2011	678	655	620	615	555	0.966	0.947	0.992	0.902
2012	34	21	27	22	0	0.618	1.000	0.815	
2013	62	56	42	0	0	0.903	0.750		
2014	53	33	0	0	0	0.623			
2015	59	0	0	0	0				
	RMPIS								
2011	409	400	378	380	357	0.978	0.945	1.000	0.939
2012	14	8	10	8	0	0.571	1.000	0.800	
2013	19	19	14	0	0	1.000	0.737		
2014	17	12	0	0	0	0.706			
2015	23	0	0	0	0				
	J1 VW								
2011	16	16	14	15	13	1.000	0.875	1.000	0.867
2012	2	2	2	2	0	1.000	1.000	1.000	
2013	8	8	7	0	0	1.000	0.875		
2014	7	3	0	0	0	0.429			
2015	9	0	0	0	0				

Table IV.3 Retention Profiles in Rural Areas of Primary Care NPs and PAs Participating in State Funded Programs

	Years in Rural Areas in Oregon					Retention Rates by Years in Rural			
	0	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
	Any Program (RPTC, RMPIS, EMS TC)								
2011	473	452	418	393	383	0.956	0.925	0.940	0.975
2012	48	38	35	29	0	0.792	0.921	0.829	
2013	67	58	49	0	0	0.866	0.845		
2014	70	51	0	0	0	0.729			
2015	81	0	0	0	0				
	RPTC								
2011	458	440	407	384	371	0.961	0.925	0.943	0.966
2012	45	35	34	28	0	0.778	0.971	0.824	
2013	63	55	48	0	0	0.873	0.873		
2014	66	50	0	0	0	0.758			
2015	58	0	0	0	0				
	RMPIS								
2011	65	62	59	56	55	0.954	0.952	0.949	0.982
2012	4	4	3	3	0	1.000	0.750	1.000	
2013	1	1	1	0	0	1.000	1.000		
2014	8	5	0	0	0	0.625			
2015	6	0	0	0	0				

B. Retention Profiles of NHSC Participants

As in the case of Oregon program participants, we match the individual NHSC providers in Oregon over the period between 2011 and 2015 to the Provider360 database in order to track the practice location of these providers over time and determine their retention rates in targeted areas beyond the completion of their program obligation. One of the main differences from the Oregon tax credit and insurance subsidies programs is that the NHSC program has a service obligation. We analyze both the retention of providers during their obligation period in rural areas, and the retention of these providers in rural areas after the end of their obligation. These statistics should be important in themselves, but given the lack of data on the state-funded loan repayment programs, they may also serve the purpose of approximating the retention in rural areas of providers participating in those Oregon programs.

Based on our analysis of data on NHSC participation in Oregon (collected from HRSA by the Oregon Health Authority) we identified 667 unique NHSC participants in the state during the 2011-2015 period. The number of NHSC participants in each year over the 2011-2015 timeframe is, respectively, 185, 235, 257, 262 and 346. Based on first and last name, we identified in each corresponding year 128, 178, 176, 182 and 234 of those providers in the Provider360 database (a total of 420 unique providers). Due to incomplete information on OR NHSC participants, we do

not use NHSC participants who completed their service obligation in 2010.[16] Furthermore, since Provider360 tracks location up to 2015, we were unable to conduct a retention analysis of those NHSC participants who ended their obligation in 2015 or beyond. Therefore, we only focus on NHSC participants who completed their obligation during the 2011-2014 timeframe. This implies that our examination of the retention profiles is limited to the 186 NHSC participants who have completed their NHSC obligation during 2011-2014 and are also uniquely matched to Provider360 based on their names.

Table IV.4 below shows the distribution of these 186 NHSC participants by the year their obligation ends, and by provider type. The provider types are: primary care (PC) – physicians and non-physicians; behavioral health (BH) providers; and other types of providers including dentists.

Table IV.4 Distribution of OR NHSC Participants (Matched to Provider360) by Provider Type

Obligation End Year	NHSC Participants	PC Physician	PC Non-Physician	NHSC BH Provider	NHSC Other
2011	13	2	4	5	2
2012	52	4	19	9	20
2013	63	7	24	26	6
2014	58	11	15	22	10
Total	**186**	**24**	**62**	**62**	**38**

Note: Primary care physicians include family practice, internal medicine, pediatrics and OB-GYN. Primary care non-physicians include PAs, NPs, certified nurse midwives and licensed practical nurses. Behavioral health providers include psychologists, health service psychologists, licensed professional counselors, marriage and family therapists and psychiatric nurse specialists.

Table IV.5 below shows the rate of retention of NHSC primary care and mental health providers in primary care and mental care HPSAs, respectively, as of 2015. We find that, for example, 64 percent of the primary care NHSC participants in Oregon who completed their NHSC obligation in 2014 are still practicing in HPSA areas in Oregon as of 2015. Also, we note that NHSC primary care alumni of earlier years have lower retention rates in HPSAs as of 2015. For instance, approximately 33% of the NHSC primary care providers who completed obligations in 2011 are still practicing in PC HPSAs in Oregon, while providers who ended their obligation later on have retention rates above 46%.

Regarding NHSC behavioral health providers, we find that overall they have higher retention rates in HPSAs compared to the rates of primary care providers. However, the mental health HPSAs may be different from primary care HPSAs, such that the higher retention rates among behavioral health providers may indicate that the proportion of providers who would not have gone to HPSAs in the absence of NHSC is lower in the case of behavioral health NHSC participants than among NHSC primary care providers.

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[16] The data on providers who participate in NHSC in Oregon starts from the last quarter of 2010.

Table IV.5 Retention of NHSC Participants as of 2015 by Obligation End Year

Obligation End Year	In PC HPSA	PC Providers	% in PC HPSA	In MH HPSA	MH Providers	% in MH HPSA
2011	2	6	33.3	4	5	80
2012	10	22	45.5	8	9	88.9
2013	17	30	56.7	18	24	75
2014	16	25	64	17	22	77.3
All	45	83	54.2	47	60	78.3

Next, Table IV.6 shows the retention rates of NHSC providers by the number of years since the completion of their NHSC obligation. Almost 63 percent of the primary care NHSC participants in Oregon are still practicing in primary care HPSAs 1 year after obligation completion. Also, among the 28 NHSC primary care providers that we track for 3 years following their obligation completion, the retention rate in primary care HPSA areas 3 years after obligation is 50 percent. Similarly, the retention rate of the primary care NHSC providers 2 years after their NHSC obligation period is about 48 percent. As in Table II.5, the retention rates of mental health providers are higher across the board than the retention rates of primary care providers.

Table IV.6 Retention of NHSC Participants as of 2015 by Years since Obligation Completion

Years since Completion	In PC HPSA	PC Providers	% in PC HPSA	In MH HPSA	MH Providers	% in MH HPSA
0	86	86	-	62	62	
1	54	84	62.8	50	61	80.6
2	28	58	48.3	32	38	84.2
3	14	28	50	12	14	85.7
4	2	6	33.3	4	5	80

Note: Percent retained uses the total number of providers observed by years since obligation as the denominator.

These post-service retention rates are smaller than the national retention rates reported in Negrusa, Ghosh and Warner (2014) in the case of primary care providers, and larger in the case of mental health providers. These differences may be due to the fact that in the case of Oregon participants we do not track them outside the state in the post-obligation period, or because of inherent differences between providers serving in Oregon under NHSC and the rest of the NHSC participants. More analyses, based on information that is not available in the data used for this project, may be needed to determine the actual cause of these differences. In Table A.12 in the Appendix we show the retention rates of primary care physicians and non-physicians (i.e., nurse practitioners and physician assistants), respectively, by the year of obligation completion. However, it should be noted that in most cells in Tables IV.5-IV.6 and Table A.12, the sample sizes are relatively small. While we do not have reasons to believe the providers used to construct these calculations are not representative, the retention rates in these tables should be viewed and interpreted with caution.[17] Also, for PC providers, the retention is lower than national averages reported in 2014 in Negrusa, Ghosh and Warner (2014), but the difference with that study is that

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[17] Another potential illustration of the small sample size issue is the fact that in some cases the retention rates are increasing and then decreasing in Tables IV.5-IV.6 and A.12. While this is not a-priori impossible, it is relatively unlikely to be the case.

providers leaving a state and remaining in a PC HPSA in another state were tracked, whereby they are not in this study. It is almost certainly the case that the actual retention is higher when this is taken into consideration.

1. Retention Rates of RPTC and NHSC Participants

We now turn our attention to the retention rates of primary care NHSC participants who also participated in Oregon's Rural Provider Tax Credit (RPTC) program. Among the 86 primary care NHSC primary care participants, 40 providers also participated in the RPTC program. Given that these NHSC providers get an additional financial incentive through RPTC, we compare the retention profiles of those who participated in RPTC and of those who did not. The top panel of Table IV.7 shows the retention rates in primary care HPSAs of the primary care NHSC participants who also participated in RPTC program. The bottom panel of the table shows the retention rates among the primary care NHSC providers who did not participate in the RPTC program.

It is interesting to note that the retention of primary care NHSC providers who also participated in the RPTC program is higher than the retention rate of primary care NHSC participants who were not in RPTC program. For example, 67.5 percent of primary care NHSC providers who also were also in RPTC still continue to practice in primary care HPSA areas in Oregon 1 year after the completion of NHSC obligation, while the retention rate for primary NHSC providers who did not participate in RPTC is 61.4 percent. The difference in the retention rates 2 years after the completion of NHSC obligation among the RPTC participants and non-participants is greater: 53.6 percent among RPTC participants versus 43.3 percent among non-participants in RPTC program. The higher retention rates among the primary care NHSC participants compared to their non-RPTC counterparts may suggest that the financial incentive available under the RPTC program is inducing NHSC primary care participants to stay in HPSA areas beyond the completion of their NHSC service obligation. However, this result may also be due to a selection process. That is, those who would have stayed regardless of the tax credit tend to apply for the credit, while those who would leave despite the tax credit do not. It is difficult to sort out the causal influence of the tax credit from a possible selection effect. Moreover, this increase in retention needs to be put in relation to the cost of this increase in retention. We return to this issue in Chapter VI.

Table IV.7 Retention of Primary Care NHSC Participants as of 2015 by Years since Obligation Completion – participants in RPTC and non-participants

Years since Completion	PC HPSA	Not PC HPSA	Total (Observed)	% Retained in PC HPSA
NHSC PC providers: In RPTC program				
0	40		40	
1	27	13	40	67.5
2	15	13	28	53.6
3	8	5	13	61.5
4	0	2	2	0.0

Years since Completion	PC HPSA	Not PC HPSA	Total (Observed)	% Retained in PC HPSA
	NHSC PC providers: NOT in RPTC program			
0	46		46	
1	27	17	44	61.4
2	13	17	30	43.3
3	6	9	15	40.0
4	2	2	4	50.0

Note: Percent retained uses the total number of providers observed by years since obligation as the denominator.

C. Retention Profiles of Non-Participating Providers

Next, we examine the retention rates of non-participating providers who practice in rural areas. Such a comparison will provide a basis for estimating the net impact of the incentive on retention. It may provide insights into whether the program is successful in attracting providers who would not serve in those areas in the absence of the program. Specifically, a lower retention rate among program participants relative to that of non-participants is consistent with the possibility that at least some participants locate to HPSAs only as a result of the program. Since they are unlikely to have a special preference for being in a HPSA, the may choose to move out of HPSAs at faster rates than non-participating providers who chose to be in HPSAs without the incentive. It is also possible that some of the obligated providers leave as they do not find the level of community support that they would need in order to continue to stay in those areas.

In Table IV.8 we present the retention profiles of the providers who serve in rural areas without participating in any of the state or federal programs. It is important to note that the retention rates of non-participants tend to be lower than those from Tables IV.1-IV.3. These lower retention rates translate into shorter periods of time on average spent by these providers in rural areas than participating providers.

Table IV.8 Retention Profiles in Rural Areas of Non-Participating Providers

	Years in Rural Areas in Oregon					Retention Rates by Years in Rural			
	0	1	2	3	4	1	2	3	4
	All Providers								
2011	6,453	6,113	5,564	5,506	5,239	0.947	0.910	0.990	0.952
2012	842	732	670	619	0	0.869	0.915	0.924	
2013	1,472	1,227	1,107	0	0	0.834	0.902		
2014	1,126	799	0	0	0	0.710			
2015	1,919	0	0	0	0				
	PC Physicians								
2011	408	353	284	281	238	0.865	0.805	0.989	0.847
2012	48	28	21	16	0	0.583	0.750	0.762	
2013	127	66	47	0	0	0.520	0.712		
2014	143	54	0	0	0	0.378			
2015	183	0	0	0	0				

	Years in Rural Areas in Oregon					Retention Rates by Years in Rural			
	0	1	2	3	4	1	2	3	4
	NPs and PAs								
2011	208	185	145	138	118	0.889	0.784	0.952	0.855
2012	40	26	21	17	0	0.650	0.808	0.810	
2013	72	35	25	0	0	0.486	0.714		
2014	78	27	0	0	0	0.346			
2015	255	0	0	0	0				

It is possible that, at least in part, these retention differences reflect selection of providers into program participation, such that a simple comparison of the retention rates across these two categories does not reflect a true program effect. However, given the available data, we cannot conduct additional tests to determine the extent to which this selection occurs. Nonetheless, this retention differential points to a potential retention effect of the incentive programs. In other words, although we cannot confirm a direct causal relationship based on the data available, it is likely that program participation increases the time spent by participating providers in a targeted area beyond what they would have in the absence of the programs.

V. Estimating the Recruiting Effects of Incentive Programs

In this section we provide an analysis to evaluate the effectiveness of the various Oregon incentive programs in terms of their ability to attract providers to locate and practice in certain targeted underserved or rural areas. In return for receiving the incentive, the eligible provider must be located in or move to a geographical area designated by the program. These targeted areas are usually rural areas, or other areas where it is believed that the population is "underserved" because of too few providers of certain types in the vicinity.

To be effective, the program must induce some providers to locate in targeted areas that would not have otherwise chosen. Many providers do, of course, choose to practice in these areas and do not require an incentive to induce them to do so. However, those who would have located in the targeted areas without the incentive may, of course, apply for and receive the incentive, if they are otherwise qualified. Hence, the incentive payments to such a type of program participants are unnecessary payments (or "economic rent", as it is typically referred to in the economics literature) in the sense that these participants would have been practicing in the targeted areas even without the incentive, and the payment of the incentive to these providers does not increase the supply of providers to the targeted area. Some providers, however, who would not have chosen to practice in the targeted areas may be induced to do so by the incentive. If so, they increase the supply of providers in the area. This is a major purpose of the programs, and this is what we call the *recruiting effect* of the incentive programs. From a policy perspective, the best outcome is to determine the optimal range of energy and resources that are needed to bring into rural areas those providers who are unlikely (or less likely) to go to those areas.

A. Main Econometric Model

To estimate the impact of the program (or programs) on recruiting consider the following econometric model. First, divide the state in areas that are targeted by the program (or programs) for increasing the supply of providers of a given type (or types) and those that are not. There will presumably be multiple areas that are targeted by the program. Each of these discrete areas becomes a unit of analysis. Similarly, the non-targeted areas will not be one large area, but rather also become units that are generally homogenous within the areas in terms of population density and socio-economic characteristics. In our case, we allow for the unit of analysis to be determined by the distinction between rural and non-rural areas within the Oregon counties. Specifically, as each county has zipcodes that are determined to be rural areas and zipcodes that are determined to be non-rural areas by the Oregon Office of Rural Health, we construct two observations for that county in a given year. In the case of counties that have only rural or non-rural areas respectively, we construct only one observation for those counties in a given year.[18]

The strategy associated with the model is to predict the number of providers of the relevant type in an area (both targeted and non-targeted) 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

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[18] While a full analysis for various location types, such as low-income areas, may be useful, the data available for this study only allowed for analyses at the geographical level of rural area versus non-rural area.

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.

Program participants in an area may or may not add to the number of providers in the area. If the program participants would have practiced in the particular area 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 the targeted area.

Our econometric model allows us to estimate a parameter that indicates whether the increase in the number of providers in a rural area is between 0 and 1. If the value of the coefficient 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 targeted areas, and there is no "economic rent". In a general context, economic rent is defined as the excess amount received over and above what is normally expected. In our case, given that the intended purpose of the program is to attract providers who would rather not serve in rural areas, the program award is an excess payment for providers who would serve in rural areas without incentives. 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 a targeted area even without the incentive. One minus the coefficient indicates the proportion of participants that would have practiced in the targeted areas without the incentive, while the coefficient provides an estimate of the providers that were attracted to the area and who would not of otherwise have practiced in the targeted area. This is our empirical estimate of the recruiting effect.[19]

B.   Regression Estimates

In Table A.8 in Appendix A we present cumulative estimate from the regression models described in the previous section. A complete list of the regression coefficients is available in Tables A.9 and A.10 in Appendix A. In these models using data from 2011 to 2014, the count of providers in each target area is modeled as a function of the number of providers participating in Oregon programs and the number of providers participating in incentive programs.[20] We also included a number of relevant county-level characteristics that may be correlated with the decision of providers to locate in target areas, such as county population, median family income, percent of the population covered by Medicaid, percent of the population that is covered by Medicare, percent of the population with employer provided insurance, percent of non-insured individuals, percent of non-Whites, percent below poverty, percent of various age groups and indicator variables for calendar years. Given that programs are mainly targeted to primary care providers, we estimate models in which the count of providers (i.e., the dependent variable) is the count of primary care physicians and the count of NP/PAs.

As indicated by the cumulative coefficients in Table A.8, in none of the models do the state programs appear to have an impact on the number of providers. The aggregate count of all state program participants has a small magnitude (0.011), is positive (as predicted by our conceptual

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[19] More details on the specification of the econometric model are available in Appendix C.

[20] We excluded 2015 from the analysis since data on Oregon program participation is incomplete for that year.

framework), but is statistically insignificant. This should perhaps not come as a surprise, since the award amount of the programs with larger participation (RPTC or RMPIS) is potentially low in relation to total compensation (especially for physicians), while program participation in the more generous state-funded programs (such as the loan repayment programs) is very limited and concentrated at the end of our timeframe. Nonetheless, in most cases, the cumulative coefficients on programs like RPTC are positive for both primary care physicians and NP/PAs. These coefficients are small, indicating that if these programs have recruiting effects, they tend to be small. It is likely that more statistical power (i.e., more data and more variation in the outcome variables) is needed to be able to detect these effects at statistically significant levels.

The cumulative estimate on the NHSC terms is positive but statistically insignificant for primary care physicians and positive, and statistically significant for NPs and PAs. In light of our interpretation from the previous section, between 64% and 68% of the primary care NPs and PAs locating in HPSAs in Oregon would not have gone in those areas in the absence of the NHSC program. These estimates are consistent with the possibility that the NHSC loan repayment program has a substantial impact on recruiting new NPs and PAs in rural areas.

In Table A.11 we re-estimated the models from Table A.8 by restricting the data to include only rural areas in each county over the same timeframe. In the case of primary care physicians, the effect of NHSC program is between 0.292 and 0.317 and it is statistically significant at the 5% level. In the case of NP/PAs, the NHSC estimates remain similar in size, but become statistically insignificant. We interpret the NHSC coefficients in the primary care physician models as indication for the existence of a recruiting effect in rural areas. Although not directly comparable, the estimates for primary care physicians in NHSC are larger than the NHSC effects obtained by Holmes (2005). Holmes finds that in the long-run (i.e., over a period of 8-10 years), the NHSC SP (not LRP) increases the supply of physicians in highly and moderately underserved areas by 12.2%. He defines the underserved areas differently from HPSAs or rural areas, by mainly using provider to population information for that purpose.

In addition, In Table A.11 we detect a statistically significant effect of RMPIS of about 0.19 for NPs. Moreover, when we combine the number of NPs and PAs who participate both in RPTC and RMPIS the effect increases to 0.23 and remains statistically significant. The difference of 0.04 may be attributable to participation in RPTC, although we do not have sufficient variation in the data to actually conclude that this difference is statistically significant. These results highlight that that RPTC and RMPIS are very likely to have non-negligible recruiting effects on non-physicians.

As the NHSC effect is dominated by the loan repayment program, we tested the hypothesis that the effect of the state loan repayment programs has a similar effect as NHSC. Unfortunately, due to the very small number of participants in those programs (in 2014 and 2015, 40 and 50 participants in SLRP, and 17 and 42 in MCLRP, respectively) and due to the limited amount of variation in the data, we are not able to estimate any statistically significant recruiting effects of those programs.[21]   More details on empirical specification of our models, as well as robustness checks we performed are available in Appendix C.

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[21] To the extent that there is in fact a true effect of these programs – an effect that we cannot detect at a conventional statistical level due to the constraints of the data -, we also tested whether the effect of these programs (if any) is

statistically significantly different from the effect of the NHSC program. For this purpose, we estimated regression models in which we combined the providers in the state loan repayment programs and tested whether the coefficients on that variable is statistically the same as the coefficient on NHSC participation. A t-test of the equality of coefficients yielded a low test statistic, which means that we cannot reject the hypothesis of equal effects.   Strictly speaking, this means that we cannot claim that the Oregon programs have the same effect as NHSC. However, it also very likely that there is too little variation in state loan repayment participation, and hence it is basically nearly impossible to reject the null hypothesis (equality of effects) with the current data.

VI. The Effect of Incentive Programs in Terms of Added FTE-Years

In the previous chapters, we described the estimation of: (1) the number of additional providers who serve in targeted areas as the result of incentive programs; and (2) the increase in retention in the targeted areas due to the incentive. We now translate these effects into the number of annual provider FTEs generated by each program and for each provider type considered.

A.   Recruiting Effect of the Incentive Programs

In the case of NHSC primary care physicians there are 64 unique primary care physicians who have not participated in RPTC program (during NHSC obligation) and completed their obligation during the 2011-2014 time frame. According to our regression estimates in Table XX, 31.7 percent of them are physicians who were attracted to serve in rural areas in Oregon only because of the program. This is a group of 20 providers ($\approx$64*0.317). Given that primary care physician NHSC participants tend to stay about 2.6 years in HPSAs during NHSC service, the increase in FTE-years during service obligation coming from these providers is (64*0.317) * 2.6 $\approx$ 53. As shown in the first column of Table VI.1 below, the average time spent by these physicians in rural areas in our data is 4.9 years (including the average obligation period, of 2.6 years)[22], which means that the additional 2.3 years providers spend in rural areas after they complete their obligation generate another 46 FTE-years. Note that these additional 46 FTEs do not entail any budgetary efforts from policy makers in the sense that these are years of service beyond the contractually obligated years. In summary, for the primary care physicians who are induced to serve strictly because of the program, the total annual FTEs generated by program is: 53 + 46 = 99 FTE-years. This estimate is the recruiting effect of the NHSC program. As mentioned before, an important caveat is that this is potentially an underestimate of the true retention program, as at the end of our timeframe some program participants may still be serving in rural areas after the end of their obligation.

Table VI.1 Expected Years Spent by Participating Providers in Rural Areas

	Expected Years in Rural Areas	Additional Years Relative to Non-Participants
	Primary Care Physicians	
RPTC	3.7	0.9
RMPIS	3.8	1.0
SLRP*	4.9	0.7
BH LRP	--	--
MCP LRP	4.9	0.7
NHSC	4.9	0.7
NHSC & RPTC	5.8	1.0
Non-participants	2.8	--

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[22] The calculation of time in rural areas includes time spent in those areas by NHSC participants from the time they entered service, which in some cases could be before 2011.

	Expected Years in Rural Areas	Additional Years Relative to Non-Participants
	NPs and PAs	
RPTC	3.6	0.8
RMPIS	3.6	0.9
SLRP*	4.3	1.1
BH LRP	4.3	1.1
MCP LRP	4.3	1.1
NHSC	4.3	1.1
NHSC & RPTC	5.2	1.1
Non-participants	2.7	--

Similarly, there are 30 NHSC physicians who have also participated in the RPTC program during the same time period. Among them, the number of those induced by the incentive to practice in the targeted areas is about: 10 (30*0.317≈10). For them, the increase in FTE during service obligation is about: (30*0.317) * 2.6 ≈ 26. In addition, these providers spent an additional 3.2 years in rural areas after their obligation, so the total FTE-years generated by NHSC primary care physicians who also participate in RPTC is 26 + 32 = 58. This recruiting effect, as well as the recruiting effect from above (i.e., the 99 FTE-years), are shown in Table VI.2 below.

B. Retention Effect of the Incentive Programs

Next, considering those providers who accepted incentives, but would have located in a targeted area without the incentive, we define the retention effect as the FTE-years providers serve on top of what they would have in the absence of the program. In other words, even though these providers should behave the same as the non-participants who practice in rural areas, their retention in target areas may be higher than that of non-participants simply because of the obligation. For instance, if the service obligation of a program is, say, two years, it is likely that participating providers will stay in the target area in those two years at higher rates than non-participants, who although have the same characteristics as the participants who locate in rural areas without incentives, may experience unexpected life events that make them move away from those areas.

In case of NHSC primary care physicians who do not participate in RPTC the number of these providers is 44 (≈64*(1-0.317)). The expected number of years non-participant primary care physicians stay in the rural areas is 2.8 years, and the expected number of years the NHSC primary care physicians stay in the rural area is about 3.5 years (including the obligation period).[23] Therefore, the retention effect is equivalent to an increase in the number of FTE-years of 32 (≈44*(3.5-2.8)). Similarly, among the NHSC physicians who have also participated in RPTC, the number of participants who would have located in rural areas without incentives is: 30*(1-0.317) ≈

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[23] This value is different from the average time spent in rural areas by NHSC primary care physicians from Table VI.1 (i.e., 4.9 years), because as non-participants can be observed in the data only from 2011 onward, we restrict the calculation to only the period between 2011 and 2015. This way we ensure the comparability between NHSC participants and non-participants. Of course, this restriction may understate the retention difference between NHSC participants and non-participants.

20. The expected number of years the NHSC primary care physicians stay in the targeted area is about 3.8 years (including the obligation period). Therefore, the increase in FTE-years due to the retention effect of these physicians is 18 (≈20*(3.8-2.8)). The total effect of NHSC primary care physicians is then 131 FTE-years (=99+32) over the period considered, and 76 FTE-years (=58+18) in the case of primary care physicians who participate in both NHSC and RPTC.

In Table VI.2 we present the estimates of the total effects of all the programs considered for both primary care physicians and NPs and PAs. Applying the same logic as in the examples above, we find that some programs have only a retention effect (RPTC, RMPIS in the case of primary care physicians), while the other programs have both a recruiting effect and a retention effect. In the cases of programs that generate both effects, the recruiting effect tends to be substantially larger than the retention effect. Most importantly, as shown by the rightmost column in Table VI.2, in the case of all programs and for each provider type, the programs have a positive impact on the number of FTE-years in rural areas. These are FTE-years that would not be supplied in those areas without the programs.

Table VI.2: Recruiting, Retention and Total Program Effects by Provider Type

	Providers	Recruiting Effect (FTE-years)	Retention Effect (FTE-years)	Total Effect (FTE-years)
Primary Care Physicians				
RPTC	827	0	736	**736**
RMPIS	459	0	459	**459**
SLRP	26	39	13	**52**
BHLRP	--	--	--	**--**
MCPLRP	8	15	4	**19**
NHSC	64	99	32	**131**
NHSC & RPTC	30	58	18	**76**
NPs and PAs				
RPTC	632	90	510	**600**
RMPIS	78	54	57	**111**
SLRP	20	56	7	**63**
BHLRP	14	39	5	**44**
MCPLRP	15	43	5	**48**
NHSC	108	301	40	**341**
NHSC & RPTC	74	250	28	**278**

As mentioned above, due to the fact that participation into the state-funded loan repayment programs is limited, and in some cases the number of providers ending their obligation is very low, we could not identify any statistically significant effect of these programs. However, it does not mean that those effects are truly zero. In fact, given that those programs are similar in structure, administration, target population and generosity, one can reasonably assume that they have a similar effect as the NHSC LRP program, if not higher due to the ability of program administrators to customize the program to the needs of the provider and the community. Therefore, the magnitude of the NHSC effect we estimate serves as a benchmark or a range over

which the true effect of the Oregon loan repayment programs may be laid. The estimates in Table VI.2 for these programs are based on the regression coefficients and retention differences we estimated for the NHSC program. We suggest that the effects of these programs are at least as great—and potentially higher—than for the NHSC program.

C. Additional Cost per One Added FTE-Year

Using the estimates from the previous section we can now estimate the cost of attracting an additional FTE in a rural area. Following the NHSC example, we assume that the typical NHSC award amount is $50,000 for an obligation period of two years.   Given that Oregon NHSC participants stay on average for 2.6 years in rural areas, the total outlays spent on the 64 NHSC primary care physicians who have not participated in the RPTC program during their obligation is 64*(2.6/2) * $50,000=$4.16 million. Dividing this total cost by the total number of FTEs generated by the program we obtain the **additional cost per one additional FTE-year of $31,756** (= $4.16 million/(99+32)). This cost is typically called a "marginal" cost in the economics literature.

With all the necessary caveats in place, this estimate should provide some guidance on the order of magnitude for the additional cost per FTE in the case of this program. It is important to note that because the additional providers stay in rural areas even after the obligation period, the additional cost per one new FTE is much lower than what it would have been had they not stayed longer in those areas after the completion of their obligation. However, the overall additional cost is higher than the actual cost per year of $25,000 per NHSC participant. This is mainly driven by the 0.317 estimate from Table A.11, which indicates that approximately 31.7 percent of the 64 NHSC primary care physicians are providers who locate in rural areas strictly because of the program. Any increase in the number of additional providers induced by the program and/or an increase in the number of years these providers are retained in rural areas would lower the additional cost. Nonetheless, as we note above, the period over which providers are observed after obligation completion is artificially short, such that our estimate is likely to be higher than the 'true' additional cost per FTE estimate. On the other hand, we may have overestimated the retention effect due to selection bias. Focusing only on the providers who do not locate in rural areas without the program, then the additional cost is much lower, $13,131 (=20*2.6*$25,000/99). Of course, this is a hypothetical estimate, because one cannot target the incentive only to those who would not have located in a rural area without it.[24] As in the general case, this estimate is driven by the additional years spent in rural areas by these providers beyond their NHSC service obligation period. For these years, there is no additional cost in terms of dollar outlays. The policy implication of these calculations is clear: if the number of additional providers who are attracted to rural areas because of the program increases, then the additional cost of one new FTE-year becomes smaller. We return to this point in Chapter VIII.

For PAs and NPs, the proportion of additional NHSC non-physicians is larger than the proportion estimated for the physicians (0.644, as shown in Table A.8, relative to 0.317 in Table A.11). We identify in our data a number of 108 NHSC non-physician clinicians who did not participate in RPTC and 74 non-physician clinicians who participated in both NHSC and RPTC programs. The estimated additional cost per one additional NP/PA FTE as a result of

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[24] However, there may be ways to better target these resources, for instance by reviewing applications, or checking applicant demographic profiles.

participation in NHSC and RPTC is $24,233, while the additional cost per one new NP/PA FTE as a result of participation only in NHSC is $20,587.

We show these estimates, as well as the estimates for the other programs, in Table VI.3 below. The calculations for the all the programs are performed in the same way as in the examples above. In Table VI.3 we also include the average cost, which is simply the amount of the award for an individual in a given year, as well the cumulative cost paid to one provider during the period that provider participates in one or more programs. For instance, in the case of RPTC participants, the cumulative cost is obtained by multiplying the yearly award with the average time spent in the program (from the first column of Table VI.1).

It is important to note that in the case of NHSC primary care physicians who also participate in RPTC, the additional cost increases. The total dollar amount spent on the 30 NHSC primary care physicians who also participate in the RPTC program is 30*(2.6/2) * $60,000 + 30*(5.8-2.6)*$5,000=$2.82 million. This cost accounts for both the NHSC and RPTC award amounts ($25,000 and $5,000, respectively, per year), and for the fact that these providers stay in rural areas on average an additional 3.2 years (=5.8-2.6) after NHSC obligation completion. The estimated additional cost per one additional FTE-year for these providers is $36,908. This increase relative to the additional cost of $31,756 is driven by the RPTC award of $5,000 per year. However, the RPTC award provides an additional incentive to stay in rural areas, which is potentially reflected by the larger number of years served in rural areas by those NHSC physicians relative to primary care physicians who participate only in NHSC. This retention effect is in fact the reason why the additional cost increases by slightly less than $10,000 (or the RPTC award for two years). This increase in additional costs should be put in relation to the gain in expected years served in rural areas. This implies that there are diminishing returns in terms of the number of provider years in rural areas from multiple program participation.

Table VI.3 Additional Cost per New FTE by Program and Provider Type

	PC Physicians			NP/PAs		
	Average cost ($)	Cumulative Cost ($)	Marginal cost ($)	Average cost ($)	Cumulative cost ($)	Marginal cost ($)
RPTC	5,000	18,350	20,787	5,000	17,800	18,960
RMPIS	3,890	14,626	14,820	3,890	14,081	9,866
SLRP	23,386	60,804	30,402	23,386	65,000	19,303
BH LRP	--	--	--	20,000	52,000	16,471
MCP LRP	27,321	71,035	29,909	27,321	65,000	22,198
NHSC (No RPTC)	25,000	65,000	31,756	25,000	65,000	20,587
NHSC & RPTC	30,000	94,000	36,908	30,000	91,000	24,233

As can be noted, the estimated additional cost per one new FTE is smaller for NHSC PA/NP participants than for NHSC primary care physicians. Also, the difference between the additional cost of providers who participated in both NHSC and RPTC and the NHSC participants who do not participate in RPTC is smaller for NHSC NP/PAs than for NHSC physicians. These are primarily due to the larger recruiting effect. In either case, the increase in the estimated additional costs due to participation in RPTC among additional providers is lower than the actual cumulative RPTC award per participant during the entire period they serve in the rural areas.

Comparing the RPTC and RMPIS programs, it appears that the RMPIS program is relatively more cost effective in increasing the provider years in rural areas. This difference is largely due to the higher recruiting effect of the RMPIS program, and it is particularly visible in the case of NP/PAs. Finally, all incentive programs appear to have lower additional costs for NP/PAs than for physicians. Nonetheless, the additional cost estimates are of the same order of magnitude for each program and for each program type.

In our report for Task 2 (Lewin, 2016(2)), we evaluated Oregon provider incentive programs based on two major, and related criteria: the ability to attract qualified providers into select, targeted areas that are considered underserved and the ability to retain qualified providers in these areas. In that report, we provided quantitative estimates of both a recruiting effect (attracting qualified providers into targeted areas in which they would not otherwise serve) and a retention effect.

In this section, we present certain desirable features that incentive programs should have. These features, based on empirical evidence, a priori analyses, and the literature on incentives, are features that tend to be associated with incentives that offer greater cost-effectiveness. That is, they allow one to achieve one's goals at lower cost. After a brief discussion of these features or criteria, we review the Oregon provider incentive programs and comment regarding the features they possess.

D. Features Associated with Efficient, Cost-Effective Incentive Programs

Incentive programs are programs designed to offer qualified candidates an incentive to induce them to engage, voluntarily, in activities that they are not likely to engage in without the particular incentive or other incentives. In the case of Oregon's provider incentive programs, the primary goal is to induce additional qualified providers to serve in select, underserved areas that they were not likely to serve, and/or to serve in those areas for longer periods of time than they otherwise would. If the program is successful, the underserved area will receive greater services than they otherwise would. A relatively more efficient, more cost-effective incentive program, is able to do this at a lower cost.

The following are general propositions regarding characteristics or features associated with efficient, cost-effective incentive programs.

1. Targeted Programs (A)

An efficient incentive program is more likely to be able to target candidates who otherwise would not have engaged in the activities implicitly desired by the incentive program. If incentive recipients would have engaged in the desirable activities even without the incentive, much of the funding resources invested in the program will not be effective in *increasing* the supply of qualified provider services to the needed areas than what would likely have been there in the absence of the program. Hence, non-discriminating programs that offer

> Incentives that are "across-the-board" are likely to be less efficient than programs that attempt to target those outside of the underserved areas to provide services in select, targeted areas.

an "across-the-board" incentive to all those who happen to practice in a given set targeted areas may induce some to move to the area, or to stay longer in an area. But, there is a likelihood that a

large number of participants in such programs would be practicing in those areas, regardless of the incentive. Moreover, it may be desirable to further expand or contract the incentive across areas where need is greater, or less. If the incentive does not have a ready ability to target—to reduce or expand the areas that are eligible for the incentive, it may be a blunt instrument, so to speak, with which to increase provider services in where they are needed the most. Hence, incentives that are "across-the-board" are likely to be less efficient than programs that attempt to target those outside of the underserved areas to provide services in select, targeted areas.

2. Budget Control (B)

A potentially important feature of an incentive program is the ability to control the budget and expenditures of the program. A program that has a set budget under which one can make a finite

number of awards and be sure that the number of participants receiving the incentive, given the cost of the incentive, does not exceed the budget is a desirable feature. Hence, incentive programs for which all providers meet the eligibility requirements are entitled to the incentive can increase budget uncertainty if, for example, more

> A program for which awards are allocated based on merit, and for which one can terminate new awards when the budget for that time period is exhausted, offers greater budget control.

apply and obtain the incentive than planned or anticipated. A program, for which explicit awards are allocated to qualified applicants based on the merit of the applicant, and for which one can terminate new awards when the budget for that time period is exhausted, offers greater budget control.

3. Cash or Cash-like versus In-kind Incentives (C)

In general, incentives that represent general purchasing power to the recipient or awardee tend, for a given cost of providing the incentive, to have a greater value and greater incentive effect than incentives that are provided in-kind. For example, a cash payment of $X for those eligible providers serving in rural areas are likely to be valued more highly, on average, than a voucher for continuing professional education with the same nominal value. The reason is that the cash can be used for a variety of purposes, including purchasing continuing professional education, while the voucher can only be used for one purpose.

An incentive such as loan repayment may be considered a cash-like incentive in many cases. In particular, if most potentially eligible providers have student loans which must be paid, loan repayment may be equivalent to cash in that a portion of the provider's earned income that would have been allocated to repay the loan is, because of the loan repayment benefit, freed up as general purchasing power to the provider. Hence, it is roughly equivalent to cash, rather than an in-kind, benefit.

> Cash incentives are in general preferred to in-kind benefits. However, in-kind benefits may be more attractive to some providers than for others (e.g., a stipend for moving expenses to a rural area

There are exceptions to this general proposition. An in-kind incentive may be structured such that it is likely to be particularly attractive to providers with certain characteristics that are considered particularly desirable to induce to practice in a rural or underserved area. Hence, the nature of the incentive itself helps to discriminate among potentially eligible providers to select out those with the desirable characteristics. Consider two examples. First, assume that it is

concluded that it is beneficial to attract providers who are not currently practicing in rural areas. An incentive that may help to do this might be a stipend for moving expenses, but only for those who move from a non-rural or underserved area to a rural or underserved area. Second, suppose it is desirable to attract family practice providers that have a strong desire to continue to improve their professional education and credentials. In this case, continuing education tuition vouchers may be preferred to a more general cash or cash-like incentive.

A second issue concerns taxes. Pure cash incentives, unless explicitly provided an exception in both state and federal legislation, would be treated as ordinary income and subject to state and federal income taxes, paid by the recipient. Even if the state were to exempt them from taxation, it is likely that they still would be subject to federal tax. Taxes then drive a wedge between the nominal value of the cash incentive and the actual value of the incentive to the recipient, net of taxes. Many in-kind benefits, on the other hand, like a tuition voucher for continuing education, would not be taxed. Hence, even though one dollar in cash may be valued by the recipient as one dollar, while one dollar's worth of an in-kind benefit may be valued by the recipient at only $0.90, if the recipient is in the 25% tax bracket, the in-kind benefit will be more highly valued. The value of the in-kind benefit, of $0.90, will be larger than the after-tax value of the cash benefit, of $0.75. Because of the tax issue, it is important when considering the relative cost-effectiveness or efficiency of incentives to evaluate the cost of the incentive net of the tax revenue that will be returned to the government.[25]

4.   Current (Up Front) versus Deferred Benefit Incentives (D)

Individuals, in general, have positive personal rates of time preference. That is, they have positive discount rates. A dollar today is valued more highly than a dollar one year from now or, more generally, an immediate benefit is typically valued more highly than an equally dollar denominated benefit that is deferred to the future. Because of this time preference, or positive personal discount rate, incentives that provide an immediate benefit will be more highly valued, in general, than otherwise equal incentives that are available only later in time. Because current benefits are more highly valued, they will have a greater effect on inducing providers to practice in rural and underserved areas than benefits that are deferred. Because of this, we would anticipate that providing an incentive that repays a loan that is due currently would, other things being equal, be more highly valued than, for example, a retirement benefit that is received only years in the future. Also, viewed from this perspective, it is possible that a loan repayment award is a more successful recruiting tool, while a retirement benefit is a more successful retention tool.

> Providing an incentive that repays a loan today would, all else constant, be more highly valued than, for example, a retirement benefit that is received only years in the future.

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[25] Note the state, which pays for the incentive, will receive any state taxes on the cash benefit. However, the state will not necessarily receive the federal taxes. Taking the "high ground" in cost-benefit analysis would still assess the cost as net of both state and federal taxes, in that the portion of the cash incentive that is taxed at the federal level releases resources that can be used for other purposes. However, from the narrow perspective of the state, it may be difficult not to include the federal taxes as a cost of providing the cash benefit.

5. Costs Incurred Today versus Costs Incurred Later (E)

The costs of providing an incentive that requires an investment well before the benefit is realized - in terms of greater provider services in rural or underserved areas - is generally more costly, other things being equal, than are costs incurred closer to the time when the program's benefits occur. The reason is similar to that in the discussion of current versus deferred benefits to the recipient. The state and its taxpayers have a positive discount rate. Because of this positive discount rate, a dollar in cost incurred today, for example, is more costly than a dollar in cost that will be incurred a year from now. Hence, program incentives for which costs are incurred substantially before any program benefits accrue, such as programs paying medical school tuition, tend to be more costly for the state than an equivalent incentive that is provided in the form of a loan repayment while the provider is practicing in a rural area. On the other hand, when the state makes loan repayment programs available, it needs to take into account inflation and other factors. In addition, for medical students, tuition subsidies may be more valuable than loan repayments, as they pay tuition today, at today's rate.

> Program incentives for which costs are incurred before any program benefits accrue, such as programs paying medical school tuition, tend to be more costly for the state than a loan repayment while the provider is practicing in a rural area.

E. Observations on Oregon Provider Incentive Programs

In this section, we briefly review and provide observations regarding the major Oregon provider incentive programs. We refer to the criteria presented in the discussion, and use the letter associated with the particular criterion (e.g., (A) denotes "Targeted program") to reference the criterion. This section is intended to complement the more quantitative analyses of each program, presented in the Task 2 report.

1. Rural Practitioner Tax Credit (RPTC)

The RPTC offers a tax credit of up to $5,000 for physicians, dentists, nurse practitioners, physician assistants and other practitioners, depending on where they practice and how far their location is from a town of at least 40,000. The tax credit is offered "across-the-board" to all who meet the eligibility requirements.

The tax credit approach has the advantage of being a "cash-equivalent" type of benefit, as opposed to "in-kind," and therefore is efficient in the (C) dimension. The "across-the-board" nature of the benefit makes it less likely to be a highly targeted incentive (A). It is not likely to target, especially, those practitioners who would not have otherwise practiced in rural areas. In fact, a provision of the program allows the provider to apply for and receive up to three years of tax credits retroactively. Hence, for these providers, it would be difficult to argue that they would not have been practicing in the rural area without the RPTC. In addition, the RPTC does not target, within rural areas, those areas that are in greater need than others. Finally, because the program is open, passively, to all who meet the eligibility requirements, the cost of the program may be difficult to control, at least in the short run, because it depends from year to year on how many eligible providers apply (B).

2. *Rural Medical Practitioners Insurance Subsidy Program (RMPIS)*

Medical liability insurance premium subsidies are offered to physicians and nurse practitioners varying by 80% and 15% of premium, depending on the nature of the provider's practice, for those providers practicing in designated rural areas and are not in an employment relationship where the employer is paying the liability insurance premium. Because most or all of these practitioners would obtain medical liability insurance in any case, the value of the subsidy is very similar to a cash (compared to in-kind) benefit (A). Moreover, it is paid approximately during the time period in which the provider is providing health care services (E). However, there is a finite budget each year. It is apparently difficult to predict whether there will be sufficient funds to provide the full subsidy to all eligible providers. When it becomes clear that the budget is insufficient, the subsidies are reduced according to a pre-determined hierarchy. The potential for this reduction undoubtedly reduces the incentive effect for those practitioners who are vulnerable to reductions, which presumably may make the incentive less effective than it would otherwise be (B). The reduction rules do tend to put priorities on certain types of practitioners (e.g., family practitioners), and therefore provides some limited amount of targeting (A). While targeted directly to practitioners not working within organizations that pay directly for medical liability insurance, this program may have an impact on others in the field. It may be that a pure cash stipend, regardless of who pays for medical liability insurance to offset that cost, may be as efficient.

3. *Scholars for a Health Oregon Initiative (SHOI)*

SHOI is a publicly funded scholarship program offered to select students enrolled at the Oregon Health Science University (OHSU) in primary care-related degree programs in Doctor of Medicine, Doctor of Dental Medicine, Master of Physician Assistant Studies, and Master of Nursing programs in various advanced practice nursing curricula. In return for tuition and fees, the recipient agrees to serve in a rural or underserved urban site, in primary care, for a period that is one year longer than their period over which they received tuition and fee forgiveness.

The program is limited in that only OHSU students are eligible. Moreover, preference is given to applicants who are from rural areas. This "targeting" of the program may limit its effectiveness in that it may tend to select out a high proportion of students who would have served in rural and underserved areas anyway. However, it may be the means by which those who would like to serve in these areas are unable to finance their training (A).[26] The program requires that funds be obligated for tuition for several years prior to receiving the benefits of the awardees service in rural and underserved areas. Other things being equal, this makes it a more costly program than, for example, a loan repayment program in which costs are incurred as the provider is practicing in rural or underserved areas. Moreover, it may limit flexibility in that, if priorities change over a period of two or three years, resources are already committed to the students in the program (E). On the other hand, it may be better for the state to pay the students' tuition in the current period,

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[26] This can be tested by following up on all applicants, those who are awarded the SHOI scholarships and those who are not, to determine if the disappointed applicants are able to receive desired medical training, and to learn where they serve afterward, if they are trained.

rather than address the problem in the form of a loan repayment program in the future, after student loan debt will have accumulated as a result of the loan's interest rate.

4. *Oregon State Partnership Loan Repayment Program (SLRP)*

The SLRP program offers loan repayment to selected eligible providers who agree to work in a Health Professional Shortage Area (HPSA) for a not-for-profit practice site in primary care. Primary care providers include physicians in primary care, dentists, advanced practice and registered nurses, physician assistants, and licensed behavioral health professionals and counselors. The program offers loan repayment up to $35,000 for two years, in return for a two year obligation to serve in the HPSAs.

Because awardees can be selected from among all eligible applicants, the program allows for selection, to an extent, based on additional criteria such as where the provider will actually practice and which type of provider is added to the area. However, a feature of the program that may reduce its effectiveness in adding providers who would not have otherwise served in the HPSA is that the program requires that the applicant have a position at a site secured at the time of application (A). One recommendation may be to dispatch providers who receive awards to those sites that are in higher need, based on an assessment performed by the state on which location needs new providers. Loan repayment is a cash-like incentive in that it releases provider income or general purchasing power that otherwise would have been allocated to repaying the loan (C). Moreover, because the number of awardees is selected from among qualified applications, the budget can be directly controlled by selecting fewer, or more, awardees, depending on the budget (B). In addition, the expenditure of the funds or the awards approximately coincides with the provision of benefits by awardee in the current period (E).

5. *Medicaid Primary Care Loan Repayment Program (MPC LRP)*

This loan repayment program includes providers ranging from physicians, nurse practitioners and physician assistants, dentists, dental hygienists, and behavioral health providers. Awardees, in return for repayment of a portion of their loan, agree to serve at least three years (full time) or five years (part time), at a qualifying location and provide services to a proportion of Medicaid that reflects the proportion of Medicaid recipients in the population.

This program targets specific providers and, in particular, ensures that they serve Medicaid patients (A). In addition, 80% of the awardees must be new to the site they are committing to work, while the other 20% could be providers who have been working in that site for up to 2 years. In other respects, it is similar to other loan repayment programs.

VII. Policy Recommendations

In this chapter we articulate several policy recommendations that are aimed at increasing the effectiveness of the current incentive programs. More specifically, the focus is on increasing the number of providers that current programs attract and retain in rural and underserved areas.

We start this section by recalling that, given that once programs are successful in recruiting, they tend to generate a higher number of additional FTEs than the FTEs generated through increased retention. It follows that a greater emphasis on recommendations that increase recruiting may better increase the effectiveness of programs, as this would offer greater leverage to increasing the number of providers in targeted areas. We discuss recommendations that may boost each program's recruiting effect, retention effect, or both.

A. Improving Recruiting

As we discuss in the Task 2 report (Lewin, 2016(2)), a program is considered successful from a recruiting perspective if it is capable of attracting providers into a targeted area that would not have served there without the program. From this perspective, not all participating providers serving in a targeted area should be viewed as being induced to do so as a direct result of the program. In fact, it is likely that some participating providers would have gone to that area without the program. The award amounts paid to the latter category of participating providers are unnecessary payments, as they do not change the behavior of those providers in a way that is consistent with the purpose of increasing the amount of medical services provided to patients in rural areas of the state. Hence, the policy implications are clear. It is recommendable to increase the number of providers that are induced by the program and to the extent possible, reduce the program awards to providers who would serve in rural areas without the program. Nonetheless, as we show in Lewin (2016(2)), even those providers who would serve in rural areas without the award increase the number of FTE-years generated by the program through increased retention in rural areas. In what follows, we provide details on the potential ways in which the state of Oregon can achieve a greater return in recruiting, retention, or both.

1. A Bidding Mechanism

In many of the programs, and most specifically, the loan repayment programs, there are more qualified applicants that there is available budget to make awards. One way to increase the effectiveness of such programs is to allow all qualified applicants to "bid" for awards, where the "bid" is a dimension which increases the FTE to the rural areas. This may be done by allowing applicants to offer additional years of obligated service. This mechanism would generate added points for the award decision, such that those who offer to serve longer years in rural areas are moved up the list in the award decision process. More importantly, the number of years served in rural areas will increase relative to the current state. From a cost perspective, this increase will have a cost of zero if the bidding is set up in such a way that those who offer to serve additional years agree to receive no payments or additional loan payments for those additional years. If the annual award for the additional years is between zero and the typical award amount, the cost of the additional FTE-years that applicants offer through bidding is still lower than the budget resources needed to fund an equivalent increase in the number of FTE-years through the normal program.

However, it is possible that some of the providers willing to bid additional years are providers who would serve in rural areas without the incentive. These providers will be inclined to offer to serve additional years for a zero or reduced award amount beyond the initial obligation if that is the way to increase their chances to become a program participant. That is, if they had planned on a career practicing in a rural area anyway, it does not cost that much to bid more years of obligated service. Ultimately, they would have served the additional years anyway, so any award they receive in any of the years they obligate to serve is a "surplus" payment for them.[27] Nonetheless, the number of provider FTE-years in rural areas will increase because the obligation to serve ensures that even those who would have gone to rural areas without the incentive will actually have a higher retention rate than in the absence of the bidding mechanism.

On the other hand, the opportunity to bid for additional years will increase the recruiting effect inasmuch as the number of 'marginal' providers who would not serve without the award is large enough. A 'marginal' provider is understood as being someone who does not prefer to serve in a rural area, but can be induced to do so with the program. In any case, for those obtaining awards the number of FTE-years served in rural areas will be larger than it is currently the case.

2. An Incentive "Package"

Also, it may be important to add program features that would be most valued by providers who are not currently serving in a targeted area, to induce them to move to such an area. For example, if program participation would result in a move from a non-qualified area to a target area, a moving expense stipend of a non-trivial amount could be offered. Other non-financial features that would be most valued by providers who are not currently serving in a targeted area may include support with spousal employment.

3. Relax Job Requirement as Condition for a Loan Repayment Award

In the case of some loan repayment programs, there is a requirement for providers to first obtain a job in an underserved area in order to be eligible for the program. Arguably, those who would go to those areas without the program are more likely to search and obtain a job, and therefore have it in hand at the time for applications, relative to providers who serve only as a result of the program. Even worse, it is likely that providers who are already serving in rural areas without the program, apply and get accepted in the program. In order to increase the program's recruiting effect, it is advisable to relax the job requirement as a pre-condition for program application. In this way, the

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[27] Assume that there is a distribution of the preference for serving in a rural area in the population of program applicants. The bidding mechanism may in fact reduce the probability of being accepted in the program for those with the highest negative preferences and increase the probability of being accepted in the program for those with smaller, but still negative, preferences. As those who would serve in rural areas anyway are more likely to bid additional years when the award on the additional years is larger, it is conceivable that a range for the award on the additional years exists, such that the number of providers who would not serve without the program is larger than the number of providers who would serve with the program. In that way, the bidding mechanism will boost the program's recruiting effect. This range will be a function of the distribution of preferences to serve in rural areas.

program will be more likely to act in a desired way, that is, induce providers to serve in rural areas. Of course, securing and serving in an acceptable position in the rural or targeted area would still be a necessary for final acceptance and loan repayment. A potential solution is to collect applications from people interested in applying and then dispatch them to a site where the state needs them to work, based on an assessment of where then need is greatest.

4. *Increase Awareness of the Availability of Programs*

Some providers may be induced to serve in rural areas once they learn about them. Easy access to program information may help attract providers who would not have gone to rural areas in the absence of the program. Increasing awareness in general may be done through appropriate dissemination of information through relevant medical, dental, nursing, physician assistant and behavioral health undergraduate and graduate programs, through the use of social media, and other sources. At the same time, and equally, if not more important, develop a truly "one-stop" website source with available information for all programs, eligibility requirements, application procedures, and further contact points.

Finally, it is advisable to make the application process as easy, understandable and low cost as possible. In particular, for Oregon sponsored programs, a technical solution whereby one could apply for multiple programs by entering a common set of data requirements would lower costs and increase applicants across the board. Also it might be useful to inform providers if they would be eligible for multiple programs while they are in the targeted areas.

However, there may be providers who are already serving in rural areas that learn about the programs. If the number of eligible applicants who are induced to serve as a result of the increased program awareness is larger than the number of applicants that are already serving in rural areas, then increased program awareness has the net effect of increasing the program's recruiting effect.

5. *Multiple Program Participation*

In our empirical work, we found a larger recruiting impact among the non-physicians who participate in both RPTC and RMPIS than the recruiting effect among those participating in only one program of these two programs. This finding may indicate that in some cases it may be worth encouraging providers to draw two or more benefits to boost the overall recruiting effect of programs.

However, we did not find other combinations of programs that increase the recruiting effect. This is in part because in the data there were only a limited number of program combinations that occurred over the timeframe of our analysis. Another reason is that even in the case of observed cases of multiple program participation, the variation in the data was limited to be able to obtain reliable statistical estimates on recruiting.

Nonetheless, even without additional empirical evidence on the effect of combining programs on recruiting, it is intuitive that being able to participate in multiple programs has the effect of increasing the value of the "package" for providers. In this sense, if providers with negative preferences for rural areas are induced to serve there by being compensated for these negative preferences, having a combined total of benefits that is larger than the award of only one program may potentially increase the number of providers with negative preferences to serve in rural

areas. Since these are the providers who would not serve in rural areas without incentives, allowing for multiple program participation can conceivably have the effect of increasing the recruiting effect.

On the other hand, the discussion about how the bidding mechanism described above can increase both the number of providers who serve in rural areas and the number of providers who would not serve there without incentives, applies in this case as well. It is likely that those who are ready to serve in rural areas anyway would be more likely to apply for programs if they are allowed to combine them. As before, if the number of eligible providers with negative preferences who are at the "margin" is large enough to dominate the number of providers who would serve in rural areas without programs, then multiple program participation can, on net, successfully increase the recruiting effect.

6. Increase Award Amounts

Allowing for the award amounts to increase in value may have the result of suggesting to a larger number of providers with negative preferences that they consider the possibility of serving in those areas. The same argument discussed above applies here too: a more generous award would increase the number of providers with negative preferences who are at the "margin". Also, as above, if the number of providers at the margin (i.e., those who would not serve without incentives) dominates the number of providers who are ready to serve without incentives, then this recommendation may increase the recruiting effect. Good candidates for this recommendation are the programs that have a high recruiting effect. Based on our work performed in Task 2 (Lewin, 2016(2)), we find that programs like loan repayments are much more likely to induce providers to practice in rural areas. Programs like the tax credit are more successful in retaining providers who decided to locate to rural areas, an thus would be less likely to reach those providers that are at the "margin".

7. Increase Number of Loan Repayment Awards

If feasible from a budgetary perspective, it may be efficacious to increase the number of loan repayment program slots. However, this initiative builds on the assumption that the "margin" is "dense" enough. In other words, there exists a sufficiently large pool of eligible applicants who can be induced to serve in rural areas by the availability of the award.[28]

8. Different Award Amounts by Provider Type

One of our empirical findings was that the loan repayment programs tend to have higher recruiting effects among NP/PAs than among primary care physicians. If there is a large number of NP/PAs who are at the margin (i.e., the density of the preferences distribution around the value of the award amount is high), then it may be worth increasing the award amount for those

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[28] If the density of the distribution of preferences is high around the value that is equal to the (negative of the) award amount, then an increase in the number of program slots would increase the "margin. Conversely, if the density of the preferences distribution is low around the value of the award amount, then an increase in the number of program slots would not increase the number of applicants who would not have served without the award. It would instead increase the applications from providers who would serve in rural areas without incentives. If the latter effect is dominated by the former, then the recruiting effect would increase. This depends on how many providers are at the margin given the current distribution of preferences and the current value of the awards.

providers. That way the recruiting effect may be further increased. More generally, the same argument applies to the case of primary care physicians. If there are many primary care physicians who may be moved to the margin if the award amount increases, then such an increase in program generosity may contribute to the increase in the program's recruiting effect.

B. Improving Retention

In the case of programs with a recruiting effect, improved recruiting increases the number of providers serving in rural areas. On the other hand, it may be the case that those induced by the program leave rural areas once they complete their initial obligation. In fact, Negrusa, Ghosh and Warner (2014) find evidence that providers participating in the NHSC LRP leave HPSAs at higher rates than non-participating providers, a finding that is consistent with the possibility that participating providers have on average a lower preference to serve in targeted areas than non-participating providers. Hence, once their obligation is complete, they tend to leave those areas without serving many more years beyond their obligation. It is therefore possible that increasing recruiting may have the effect of reducing retention in the case of programs with an obligation, like the loan repayment programs.

Similarly, in the case of programs without an obligation, increased recruiting may translate into a greater number of providers who have a lower preference for rural areas, i.e., providers who would not practice there without incentives. Subsequently, because of the lower preference for rural areas, they will have on average lower retention rates over specified periods of time. The net impact of the program is therefore the result of these effects of opposite sign.

As we discuss in detail in the Task 2 report, the recruiting effect tends to dominate the retention effect for many programs. Nevertheless, in this section we focus on recommendations that have the goal of increasing retention, or at least maintaining retention at the same level as before when recruiting is increased.

1. Changing Clinical Practices

The providers who are induced to serve only as a result of the programs (i.e., the recruiting effect) have a low preference to serve in rural areas. They locate to rural areas only because the programs, all else constant, offer them enough compensation to offset their negative preference for living and working in a rural area. However, the continuous decision providers make over time on whether to continue to serve in a rural area or to move to a non-rural area is determined not only by their compensation package, amount of the award and their location preference, but also by their actual experience once they locate in a rural area. Providers cannot form accurate ex-ante expectations on neither how their rural experience will unfold, nor how they will perceive that experience. In other words, serving in a rural area is an "experience" good for many providers. Some of these providers may re-evaluate their assessment of living and serving in rural areas. If it is an 'upward' re-evaluation, then the provider tends to stay longer in rural areas after obligation completion. The same applies to programs without obligation. Of course, once this change in preference occurs for a given provider, his or her retention in rural areas increases.

This change in perception may be caused by factors that pertain to the individual, such as having a sense of fulfilment, or the perception of making a difference in the lives of other people, as well as by factors that are actionable from a policy perspective. In the best case, the actual experience of

life and career in the rural area is better than anticipated. Examples of potential reasons for positive re-evaluations of rural areas may include: a high level of community support, well-trained supporting staff, or a positive working environment. This could translate into: having an effective practice administrator; financial stability of the practice; clinicians being able to provide a full range of services for which they are trained; or clinicians having more backup from senior and/or supervising clinicians (Pathman et al, 2012). To the extent that these characteristics can be changed by policy makers in substantial and systematic ways, the retention of providers in rural areas will increase relative to the programs' current retention effects.

An important way in which perceptions can change is by fostering and enhancing team-based care in rural areas. This may not be possible in all rural locations, but it may potentially be feasible in FQHCs and other centers with multiple providers on site. This modality of providing health care services not only enables collaboration among physicians, but it may also have the desirable effect of attracting and retaining other providers in a rural locations. For instance, under team-based care, a physician may find valuable professional collaborators in their fellow physicians serving in the same location. This collaboration may be materialized in mentoring opportunities or learning of new procedures. In addition, a non-physician program participant working under team based care may value highly the opportunities to learn from and collaborate with physicians and other non-physicians in their team.

While we recognize that changing or adoption of team-based practices is not within the scope of the incentive programs, a beneficial by-product of team-based settings in rural areas may be to increase the effectiveness of incentive programs.

2. Increase Community Support

Other ways in which perceptions of participants may change in positive ways include the availability of amenities like good schools for their children, support in finding job opportunities for spouses or partners, or access to cultural events and opportunities. As before, these elements are not directly actionable within the scope of the incentive programs; nonetheless, if they are achieved as a result of other state- or local-level programs or initiatives, they can contribute to an increase in provider retention in rural areas.

Pathman et al (2012) indicates that there are several community support related features that can influence retention in rural areas: a sense of belonging in the community, satisfactory professional opportunities for the spouse or partner, and a sense of safety and security for the provider's family in the community.

3. Combine Benefits

In our empirical analysis under Task 2 we found that the expected years in rural practice is larger for NHSC participants who participate in the RPTC program, than it is for those who only participate in NHSC. To the extent that this option is feasible from a budgetary perspective, it may be useful to recommend combining those benefits once a NHSC participant is approaching the end of their service obligation. Even in the case of NHSC providers who would serve without the incentive, combining the two benefits has the effect of increasing the retention effect, because this way their probability of leaving the area as a result of a random shock is lowered.

Although providers can apply for the RPTC program while they participate in NHSC, this recommendation is predicated on the possibility that there is a lack of information regarding the RPTC program and/or a high cost of applying for the program.

4. Include Obligation for Some Programs

To the extent possible, it may be useful to consider including an obligation to serve for a year or more in the case of programs like RPTC and RMPIS. For example, when an eligible provider completes the request for a tax credit for year *t*, he or she states also that they will remain in the targeted area in year *t+1*. If they do, they will also receive a tax credit for year *t+1*. But, if they do not, they will be required to repay their tax credit year from year *t*. In this way the retention of those who would serve even without the incentives would increase, as they will be less likely to move out as a result of a random shock.

In addition, this will potentially increase in a similar fashion the retention of providers induced by the program who have a positive revision in the ex-post perception of the rural experience (relative to their initial expectations). Moreover, as some providers who would serve without the incentive may have a negative change in the way they perceive the rural experience, they will try to leave right away. The obligation to serve will ensure that, disgruntled as they may be, they leave the rural area only at the end of their obligation period. Therefore, the introduction of an obligation period for the programs that do not have one can increase the retention effect across all categories of program participants.

5. Retain Former Obligors in the State

Negrusa, Ghosh and Warner (2014) found that once NHSC participants complete their obligation, many of them move away from the location where they served, but many tend to move to other similar areas. To further increase the retention effect, it may therefore be important to induce former obligors to remain within the state (from NHSC as well as from the state loan repayment programs). Providing incentives to these providers in the form of tax credits and insurance subsidies would help in the effort to retain them within the state and will have the effect of increasing the amount of services supplied to rural locations in Oregon.

6. Increase the Number of Limited-Funded Awards

This measure would increase the number of loan repayment participants and to the extent that the new participants are similar to those who would have received the awards without this proposed expansion in the number of awards, the number of FTE-years in rural areas would increase. This is merely the result of having more program participants who generate a higher volume of FTE-years. This assumes that the new participating providers who are similar to the ones already participating are sufficiently numerous. Within the same budget this could be done by reducing the value of the individual amount. To actually verify whether the new participants would behave in the same way as the funded participants, one would need to compare funded and unfunded providers to determine whether the unfunded participants locate to rural areas without the incentive.

VIII. Data Recommendations

The work we performed with the administrative data received from OHA for this project helped us have a detailed understanding of the advantages and limitations of these data. While the APAC data, as well as the individual-level data on provider participation in the various programs offer unique opportunities for analysis and evaluation, there are a number of shortcomings which, if addressed in the future, may provide much more comprehensive insights into the drivers of program participation, provider retention and program effectiveness that would be valuable for improving programs in the future.

A. Collect Information on All Program Applicants

To better inform decision-makers on the efficiency and cost-effectiveness of these programs, it is paramount to collect longitudinal data on all program applicants, including those not offered awards. One of the main obstacles when attempting to accurately measure the impact of programs on recruiting and retention of providers is the lack of a valid comparison group. So far, we have used non-participating providers as a counterfactual for participating providers. For instance, in assessing the effect of programs on retention in rural areas, we compared the program participants' average number of years in rural areas with the average number of years in rural areas of non-participants.

However, as we caution in Task 2, this difference may or may not be entirely due to the program. In fact, there may be many underlying characteristics, such as rural upbringing, type of medical school attended, or preferences for being in a rural area, which make non-participants very different from participants. These characteristics, in turn, are not observable in the available data, and therefore their impact on the individual provider's decision to locate and remain in a rural area cannot be isolated from the true program effect.

Nonetheless, it can be argued that those providers who are eligible for the program but are not awarded funding because of the limited number of slots may serve as a valid comparison group, as they have similar underlying characteristics as the participating providers. A comparison between funded and unfunded providers may allow the researcher to effectively net out the impact of unobservable characteristics on the decision to locate and stay in a rural area, thus opening the door to a causal estimation of the program effect on the recruiting and retention of providers in rural areas.

A causal estimate of the program effect could then be used to further understand the success of programs on recruiting and retaining providers in target area, as well as the cost effectiveness of these impacts. It could also be used to simulate "what-if" scenarios in which policy-makers assess the impact of policies aimed at alleviating the maldistribution of providers in rural areas with the help of incentive programs.

B. Collect Additional Provider-level Information

Some of the characteristics that are correlated with the providers' decision to locate to a rural area, such as rural upbringing, race/ethnicity, marital status, spousal employment status, family size, compensation package, or level of community support, may potentially be obtained through more systematic data collection efforts. This additional information would further help us control

for the impact of factors that are unrelated to programs that nonetheless influence the providers' decision to move to target areas, and estimate the program effect more precisely. For instance, having more information on the demographic characteristics of providers, we may form a better idea on whether they tend to choose rural locations based, in part, on the demographic composition of the community. A potential list may include the following common variables to be collected across all programs:

1. Demographic information: Age, Race/ethnicity, marital status, medical school or last school attended.

2. Family information: spousal employment status, family size, number of children.

2. Rural attachment: birth location, whether previously located in rural areas, or any history of rural upbringing.

3. Practice characteristics: team-based or group practice vs solo practice, quality of administrative support, support from non-physicians clinicians, size of the team, compensation, patient volume and composition etc.

Not least, additional information on provider characteristics may help in the identification of those who would locate and serve in rural areas even in the absence of the program. This in turn would help in further increasing the recruiting effect of programs, as well as lower the marginal cost of one additional FTE-year in rural areas, by targeting those for whom the program incentive is more likely to make a difference in the location decision.

C. Field a Provider Survey

However, even with more focused administrative efforts to collect additional individual-level provider information, a number of relevant characteristics would remain undocumented. A potential solution would be to field a comprehensive survey on program applicants, including those not offered awards in order to determine:

i. key factors that drive their decision to locate and stay in rural/underserve areas;

ii. the importance of program's financial incentives versus other factors in their decision to apply for programs and remain in target areas

iii. level of difficulty associated with the application process

iv. experience with clinical practices in target areas

v. level of community support and its role in the location decision

vi. experience with service in target areas

vii. other socio-demographic characteristics that are difficult to obtain through administrative efforts (e.g., spousal employment status, or family size).

The survey that is fielded by Oregon every two years called the "Physician Workforce Survey" is focus mainly on characteristics related to providers' practice, health conditions and patients they treat, or payments they accept. The survey does not collect information on the factors affecting the providers' decision to locate and remain in underserved or rural areas. Our recommendation is to field a provider survey (or add new fields to the current survey) that is focused on identifying the key drivers of the individual provider's choice to locate and remain in rural areas.

Another survey of potential use would be a survey of providers who serve in target areas, but did not apply for the incentive programs. This data would allow for the identification of the:

    i.   availability and accessibility of information related to programs

    ii.   perception about the level of financial incentives

    iii.   perception of whether additional benefits, such as relocation bonuses, or better community support, would make them more likely to apply for incentive programs.

We are aware that some of this information is now collected by both the Office of Rural Health and the Primary Care Office.

D. Collect Data on Tele-Medicine

Currently there is no systematic way to collect data on the amount of services that providers supply in the form of tele-medicine throughout the state. Such information would be valuable in order to accurately determine the volume of services provided in rural areas, and the degree to which telemedicine can substitute for providers who practice in a specific area. In addition, this information would be useful in order to better understand the gaps between demand and supply of services in the future, and to assess whether tele-medicine may represent a feasible solution to remedy these gaps.

E. Identify Providers in APAC Data

As APAC data includes the universe of medical claims in the state, identifying providers in APAC data would allow for a clear tracking of the volume, nature of services supplied and populations served in target areas by providers in general, and by participating providers in particular. This would also permit assessments of the productivity of providers, and of potential differences in the productivity of participating providers relative to non-participating providers. To the extent managed care encounters are identified and tracked in APAC data, one could also assess differences between volume and productivity across practice types as well. Identification of participating providers would rely on combining APAC data with data on program participation over time. As of now, it is difficult to identify individual providers in APAC data, as in most cases only identifiers of practices or health care facilities are being reported.

F. Create a Unique Provider Identifier

Additional research and evaluation of incentive programs would be greatly enhanced if it were possible to construct a common provider unique identifier that would allow researcher to determine multiple program participation over time in a consistent fashion. Currently there is no standardized ID used across programs to track multiple program participation. In the current study, we used provider's name, specialty and other demographics to uniquely identify and track them over time and across programs.

Candidates for unique provider identifiers are NPIs or unique licensing numbers. As not all providers have an NPI or a licensing number, it may be useful to create personal identifiers using the provider's social security number. Of course, these data would not be public, and all data processes involved would need to be undertaken by administrative staff under all strict data

security protocols. The end result could be an "encrypted" SSN, which would not be the real provider SSN, but a unique personal identifier that can be made available to researchers under appropriate data use agreements. This is standard practice for military personnel data, and the researcher can request access to such data from the repository of all military personnel data, the Defense Manpower Data Center (DMDC), in which a unique military service member is identified across multiple data sets with the help of an encrypted SSN. DMDC holds the key that allows the match between the real SSN and the scrambled SSN; for data protection and security reasons, this key is never made available to entities outside DMDC. A potential alternative may be to request that all providers serving in Oregon obtain an NPI.

G.   Create a Comprehensive Provider Dataset

With the help of a unique provider identifier, it would be possible to track all providers in the state longitudinally in a centralized fashion and record the year of entry in the program(s), location of the place of service in every year, main services provided, along with the provider's age, gender, marital status, provider type, discipline, specialty, size of practice and so on.

This comprehensive database, linked to APAC data, may then be used for workforce policy, as well as for monitoring of the volume of services provided by participants and non-participants.   Among other things, it would help with the tracking and monitoring of migration patterns over time and could open the door to evaluations of how public health improved as a result of the providers induced by programs, in the form of: number of lives saved, decrease in preventable hospitalizations and emergency department visits, or decrease in incidence/prevalence of various diseases. Such measures could be subsequently used as additional metrics of program success, as well as a way to measure the marginal value of one additional FTE-year generated by the program

To some extent, an alternative to this comprehensive dataset is the longitudinal data made available by CMS on all providers billing Medicare. This data can be used for providers with a valid NPI to obtain more accurate information on their practice location and develop retention profiles of both program participants and non-participants. However, this data does not include the entire universe of providers, the number of individual level socio-demographic characteristics is very limited, and the population served is limited. The OHA already has elements of this database in place or planned in the near future. PCO's provider data list is expected to be completed by October 2016, while the Provider Database is scheduled to be complete in 2017.

Not least, the data collection efforts should also permit aggregation at levels that are different from rural areas. Most of the state programs are targeted to rural areas, but there was a lack of data on other dimensions of interest, like underserved populations, uninsured populations, Medicaid populations, or low income populations. These additional data elements would enable more detailed analyses of shortages other than from those in broadly defined rural areas.

IX. Key Qualifiers and Limitations

Our conclusions should be viewed with some caution, given the multiple limitations we faced in our empirical work. For instance, one of the main data sets we used, Provider360, which aims to provide a current inventory of all providers in the nation, yielded a larger number of providers in various areas of Oregon than the actual number. This is potentially due to the fact that not all licensed providers are actively practicing. While this issue is more noticeable in areas with fewer providers, the overall counts obtained using Provider360 are in line with the total number of providers from administrative sources (cite some report…). Also, neither Provider360 neither the administrative datasets from OHA contained information on the individual and socio-demographic characteristics of participating providers. These unobserved characteristics may be correlated with the providers' decision to participate in incentive programs and the decision to serve in rural areas. Strictly speaking, failing to control for these confounding characteristics may render the program estimates inaccurate. Consequently, the calculations of the additional cost per one FTE-year may be less reliable as well. However, our estimates lie within reasonable bounds and are in line with hypothesized values that are informed by a flexible conceptual framework.

Another limitation comes from the fact that participation in the SLRP, BHLRP and MCLRP is very small over the period we considered for this analysis. As a result, we do not have sufficient variation in the data to detect statistically significant effects of these programs on the recruitment of providers in rural areas. We instead approximate the effect of these programs with the effects we estimated for the NHSC LRP, for which we had a larger amount of data. Also, as some of the programs provide relatively small incentives, it is possible that the true effect on recruitment of new providers to rural areas (if it exists at all) is very difficult to detect with the current data. We do wish to emphasize that we are not collapsing the inability to detect statistically significant impacts with a conclusion that there are not positive recruitment and/or retention effects as a result of these programs.

Also, it is important to recall that in order to determine whether a program has a retention effect, we compared the retention of participants in targeted areas with that of non-participants. While our findings (of higher retention among participants) are consistent with the assertion that the state programs contribute to an increase in the retention of providers in rural areas, we cannot rule out with the current data the possibility that those differences are in part due to the selection of some providers in the programs. If that were the case, then our estimated retention effects may be overestimated. On the other hand, given that our timeframe is short, our estimated retention effects are potentially understated. The short timeframe may cause the recruiting effects we identify to be underestimated as well.

Not least, we note that in our estimations of additional FTE-years generated by the programs we assumed that participating providers work full time once they locate in rural areas. This may not necessarily be true, but it was not possible to analyze this important question within the confines of this project. One way to test this assumption would be to assess the volume of services supplied by participating providers in rural areas. This analysis would rely on merging the individual-level administrative data on participating providers with Oregon's All Payer All Claims (APAC) data base, which contains the entire universe of claims in Oregon over the last few years. Finally, while other levels of geography than rural areas may be relevant for

evaluation and policy making, the limitations of the data did not allow us to conduct our empirical analysis at other levels of aggregation.

X. Conclusions

Using data over the 2011-2014 period and employing aggregate models of the counts of providers in a given target area as a function of the number of providers participating in incentive programs in those areas, we find substantial recruiting effects of RMPIS, RPTC and NHSC loan repayment programs. This, by the way, is consistent with our findings in other studies at the national and state levels. Unfortunately, given the limitations already noted of the data on Oregon-funded provider incentives, we cannot detect statistically significant effects of the Oregon state programs on the recruitment of providers in rural areas. Reasons for this include the small number of participation in some of the programs, that the timeframe is short, that variation over time and across geographical areas within the state is low, and/or because of insufficient statistical power in the data. As some of the programs provide relatively small incentives, it is possible that the true effect on recruitment of new providers to rural areas (if it exists at all) is very difficult to detect with the current data. We do wish to emphasize that we are not collapsing the inability to detect statistically significant impacts with a conclusion that there are not positive recruitment and/or retention effects as a result of these programs.

In fact, we do find evidence that the state programs contribute to an increase in the retention of providers in rural areas, as reflected by the differences in retention in rural areas between program participants and non-participating providers. At this point we cannot rule out the possibility that those differences are in part due to the selection of some providers in the RPTC program.

We currently estimate that about a third of the NHSC participating primary care physicians and about two thirds of the NHSC participating NP/PAs are providers who would not have served in rural areas in Oregon in the absence of that program. The estimates are robust to a number of alternative regression specifications and they reflect a substantial recruiting effect of the NHSC loan repayment program. Combining this estimate with conditional retention rates in HPSAs after program completion, we construct estimates of the additional cost of inducing a new FTE into a rural area of $31,756. As we discuss in the report the actual additional cost per one new FTE is undoubtedly even lower. Even so, our additional cost estimate points to a solid return to investment for the NHSC program in Oregon, which is mainly driven by the probability of providers to serve in HPSAs even after completion of their obligation, and by the fact that many of the NHSC participants serve in HPSAs only as a result of the program. Although this estimate applies only to NHSC, it is likely that the effect of the Oregon loan repayment programs is similar in magnitude to the effect of NHSC.

We also documented a number of relevant characteristics of the Oregon population, along with descriptions of the current size, distribution and composition of the health care workforce in Oregon. We then constructed projections of the demand for and supply of various provider types in each county in Oregon over the period between 2016 and 2020.

We find evidence of a pronounced imbalance in the distribution of providers across rural versus urban areas within the state. Less than one fifth of physicians serve in rural areas, while the fraction of PAs and NPs serving in rural areas is lower than one third. Also, there is a notable heterogeneity across counties in terms of provider-to-population ratios for physicians, behavioral health providers, dentists and non-physicians, with the more rural counties having lower

provider-to-population ratios. This pronounced imbalance in the distribution of medical providers in rural areas in Oregon emphasizes the important role provider incentive programs may have in attracting providers in rural areas.

In addition to the current maldistribution of providers, Oregon may face an even more acute lack of medical services in the future, as the fraction of the population that is more likely to be insured through Medicaid and less likely to have employer-provided insurance is projected to increase. Also, these categories of the population are much more likely to be under the federal poverty line (FPL) or in the lower FPL categories, and although declining as a result of the ACA, their un-insurance rates may still be relatively large. Our analyses of the APAC data indicate that if current population trends continue over the next years, the number of visits demanded will continue to increase. Comparing these projections of the demand for providers with our provider supply forecasts indicate that some gaps between demand and supply are likely to emerge in the future. Under certain scenarios, these gaps may prove to be substantial.

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Appendix A - Tables

Table A.1 Race/Ethnicity Distribution of the Oregon Population by Public Use Microdata Area (ACS, 2014)

Public Use Microdata Area (PUMA)	White	Hispanic	Black	Asian	Am Indian	Other Race	Total
Umatilla, Union, Baker & Wallowa Counties PUMA	94,855	22,361	590	993	2,865	3,733	**125,397**
North Central Oregon--The Dalles City PUMA	81,459	22,140	636	1,469	5,788	2,214	**113,706**
Klamath, Malheur, Lake & Harney Counties PUMA	85,066	18,582	505	1,041	2,391	4,568	**112,153**
Deschutes County PUMA	149,403	13,295	787	2,106	764	3,903	**170,258**
Columbia, Lincoln, Clatsop & Tillamook Counties PUMA	136,858	11,744	795	1,614	2,290	5,730	**159,031**
Linn & Benton Counties PUMA	173,472	16,211	813	7,207	3,413	4,641	**205,757**
Lane County (West Central)--Eugene City (West & South) PUMA	115,382	16,639	2,724	4,264	489	8,685	**148,183**
Lane County (East Central)--Eugene (Northeast) & Springfield Cities PUMA	88,059	7,821	596	2,766	2,102	4,971	**106,315**
Lane County (Outside Eugene & Springfield Cities) PUMA	93,771	5,145	54	1,052	402	3,254	**103,678**
Josephine, Coos & Curry Counties PUMA	146,801	10,352	760	1,775	1,452	7,140	**168,280**
Jackson County (Central)--Medford & Central Point Cities PUMA	84,958	13,640	909	1,213	0	4,807	**105,527**
Jackson County (Outside Medford & Central Point Cities)--Ashland City PUMA	86,949	11,895	0	1,460	410	3,753	**104,467**
Douglas County PUMA	95,288	5,498	722	1,505	1,486	2,908	**107,407**
Marion County (West Central)--Salem (North), Keizer Cities & Hayesville PUMA	59,263	35,876	1,503	5,949	545	5,065	**108,201**
Marion County (West Central)--Salem City (South) & Four Corners PUMA	80,707	18,454	2,220	2,940	527	3,182	**108,030**
Marion County (Outside Salem & Keizer Cities)--Woodburn & Silverton Cities PUMA	78,385	28,963	167	727	227	1,839	**110,308**
Yamhill & Polk Counties PUMA	141,286	26,049	2,057	4,077	1,241	4,997	**179,707**
Portland City (North & Northeast) PUMA	76,735	12,411	14,086	6,330	737	6,773	**117,072**
Portland City (East) PUMA	79,535	20,182	7,394	12,570	1,140	8,279	**129,100**
Portland City (Southeast) PUMA	79,042	15,483	838	8,679	723	5,758	**110,523**
Portland City (Central East) PUMA	89,469	8,565	4,764	6,247	804	5,684	**115,533**
Portland City (Northwest & Southwest) PUMA	115,392	6,252	5,424	10,012	278	6,820	**144,178**
Multnomah County (East)--Gresham & Troutdale Cities PUMA	110,611	23,945	6,305	12,093	893	5,910	**159,757**
Clackamas County (South & East)--Damascus City PUMA	96,891	9,075	0	669	1,066	2,048	**109,749**
Clackamas County (Northwest)--Oregon City, Milwaukie & Happy Valley Cities	136,530	15,221	3,343	9,469	661	5,094	**170,318**
Clackamas County (Northwest)--Lake Oswego, West Linn, Wilsonville & Canby Cities	94,655	8,694	428	6,829	144	4,127	**114,877**
Washington County (Southeast)--Tigard, Tualatin & Sherwood Cities PUMA	86,798	10,057	652	6,002	524	3,480	**107,513**
Washington County (West)--Forest Grove, Cornelius Cities, Bethany & Oak Hills	71,629	16,631	1,473	16,966	287	4,094	**111,080**
Washington County (Central)--Hillsboro City PUMA	72,129	23,787	909	10,062	179	6,320	**113,386**
Washington County (Central)--Beaverton City (West) & Aloha PUMA	68,678	21,793	4,350	14,702	141	3,976	**113,640**
Washington County (Northeast)--Beaverton City (East & Central) & Cedar Mill PUMA	81,767	19,418	972	7,367	281	7,303	**117,108**
Total	**3,051,823**	**496,179**	**66,776**	**170,155**	**34,250**	**151,056**	**3,970,239**

Table A.2 Age Distribution of the Oregon Population by Public Use Microdata Area (ACS, 2014)

Public Use Microdata Area (PUMA)	<=18	19-34	35-44	45-54	55-64	>=65	Total
Umatilla, Union, Baker & Wallowa Counties PUMA	31,955	25,125	15,472	14,092	15,897	22,856	**125,397**
North Central Oregon--The Dalles City PUMA	25,232	20,157	14,216	13,158	17,850	23,093	**113,706**
Klamath, Malheur, Lake & Harney Counties PUMA	26,639	21,623	13,101	14,236	16,198	20,356	**112,153**
Deschutes County PUMA	36,758	32,481	22,189	22,339	25,893	30,598	**170,258**
Columbia, Lincoln, Clatsop & Tillamook Counties PUMA	31,375	28,206	17,154	21,369	27,289	33,638	**159,031**
Linn & Benton Counties PUMA	46,806	51,645	22,802	23,688	27,503	33,313	**205,757**
Lane County (West Central)--Eugene City (West & South) PUMA	31,222	45,100	17,467	16,123	18,739	19,532	**148,183**
Lane County (East Central)--Eugene (Northeast) & Springfield Cities PUMA	23,670	25,854	12,326	13,895	13,216	17,354	**106,315**
Lane County (Outside Eugene & Springfield Cities) PUMA	19,542	14,207	10,771	14,446	19,474	25,238	**103,678**
Josephine, Coos & Curry Counties PUMA	33,240	28,480	16,171	20,350	27,973	42,066	**168,280**
Jackson County (Central)--Medford & Central Point Cities PUMA	25,622	23,017	11,975	12,588	12,537	19,788	**105,527**
Jackson County (Outside Medford & Central Point Cities)--Ashland City PUMA	21,724	16,191	12,180	13,466	17,684	23,222	**104,467**
Douglas County PUMA	21,194	17,989	11,022	14,020	17,635	25,547	**107,407**
Marion County (West Central)--Salem (North), Keizer Cities & Hayesville PUMA	32,518	24,243	12,194	14,341	12,520	12,385	**108,201**
Marion County (West Central)--Salem City (South) & Four Corners PUMA	23,848	27,222	13,930	12,860	13,369	16,801	**108,030**
Marion County (Outside Salem & Keizer Cities)--Woodburn & Silverton Cities PUMA	32,104	19,160	14,811	12,681	14,038	17,514	**110,308**
Yamhill & Polk Counties PUMA	46,263	37,855	20,590	22,885	22,854	29,260	**179,707**
Portland City (North & Northeast) PUMA	23,047	33,443	22,967	14,037	13,323	10,255	**117,072**
Portland City (East) PUMA	32,064	30,318	18,258	18,085	13,547	16,828	**129,100**
Portland City (Southeast) PUMA	20,445	30,441	19,804	15,570	13,445	10,818	**110,523**
Portland City (Central East) PUMA	19,207	30,476	21,706	16,468	15,216	12,460	**115,533**
Portland City (Northwest & Southwest) PUMA	25,535	38,840	21,198	17,970	21,851	18,784	**144,178**
Multnomah County (East)--Gresham & Troutdale Cities PUMA	43,320	35,449	22,040	17,713	19,905	21,330	**159,757**
Clackamas County (South & East)--Damascus City PUMA	27,069	19,921	11,534	15,395	16,787	19,043	**109,749**
Clackamas County (Northwest)--Oregon City, Milwaukie & Happy Valley Cities	37,265	35,342	23,251	23,933	24,191	26,336	**170,318**
Clackamas County (Northwest)--Lake Oswego, West Linn, Wilsonville & Canby Cities	27,781	18,648	16,123	16,933	16,503	18,889	**114,877**
Washington County (Southeast)--Tigard, Tualatin & Sherwood Cities PUMA	24,728	24,605	15,269	14,728	14,305	13,878	**107,513**
Washington County (West)--Forest Grove, Cornelius Cities, Bethany & Oak Hills	29,738	20,353	18,463	14,959	13,312	14,255	**111,080**
Washington County (Central)--Hillsboro City PUMA	29,294	26,996	18,319	14,520	10,681	13,576	**113,386**
Washington County (Central)--Beaverton City (West) & Aloha PUMA	30,808	25,769	17,057	16,445	13,537	10,024	**113,640**
Washington County (Northeast)--Beaverton City (East & Central) & Cedar Mill PUMA	30,107	25,448	18,492	14,338	14,802	13,921	**117,108**
Total	**910,120**	**854,604**	**522,852**	**507,631**	**542,074**	**632,958**	**3,970,239**

Table A.3 Oregon Population Relative to Federal Poverty Line by Public Use Microdata Area (ACS, 2014)

Public Use Microdata Area (PUMA)	Under FPL	101-200 FPL	201-300 FPL	301-400 FPL	401-500 FPL	FPL >=501	Total
Umatilla, Union, Baker & Wallowa Counties PUMA	27,935	29,113	24,568	18,253	8,488	17,040	**125,397**
North Central Oregon--The Dalles City PUMA	22,844	25,390	21,681	15,245	10,157	18,389	**113,706**
Klamath, Malheur, Lake & Harney Counties PUMA	30,826	27,771	19,147	13,054	7,809	13,546	**112,153**
Deschutes County PUMA	18,659	39,421	35,436	20,037	14,925	41,780	**170,258**
Columbia, Lincoln, Clatsop & Tillamook Counties PUMA	26,317	36,014	28,002	23,380	20,395	24,923	**159,031**
Linn & Benton Counties PUMA	44,003	37,499	34,299	24,901	19,256	45,799	**205,757**
Lane County (West Central)--Eugene City (West & South) PUMA	32,761	31,901	25,889	22,504	11,100	24,028	**148,183**
Lane County (East Central)--Eugene (Northeast) & Springfield Cities PUMA	17,638	24,277	22,750	13,844	8,973	18,833	**106,315**
Lane County (Outside Eugene & Springfield Cities) PUMA	15,701	20,849	18,113	16,157	9,690	23,168	**103,678**
Josephine, Coos & Curry Counties PUMA	29,277	39,195	32,536	23,177	11,664	32,431	**168,280**
Jackson County (Central)--Medford & Central Point Cities PUMA	19,996	24,064	23,431	13,532	10,863	13,641	**105,527**
Jackson County (Outside Medford & Central Point Cities)--Ashland City PUMA	17,984	24,533	16,952	12,783	11,534	20,681	**104,467**
Douglas County PUMA	22,664	22,932	22,029	11,931	12,010	15,841	**107,407**
Marion County (West Central)--Salem (North), Keizer Cities & Hayesville PUMA	24,652	36,584	17,904	8,391	10,154	10,516	**108,201**
Marion County (West Central)--Salem City (South) & Four Corners PUMA	18,679	25,114	19,617	16,000	5,091	23,529	**108,030**
Marion County (Outside Salem & Keizer Cities)--Woodburn & Silverton Cities PUMA	18,683	25,065	19,100	13,636	13,940	19,884	**110,308**
Yamhill & Polk Counties PUMA	29,465	31,473	36,500	29,562	15,346	37,361	**179,707**
Portland City (North & Northeast) PUMA	21,439	21,236	16,907	13,537	12,063	31,890	**117,072**
Portland City (East) PUMA	28,387	39,447	23,571	15,324	6,293	16,078	**129,100**
Portland City (Southeast) PUMA	16,596	21,472	22,052	14,311	9,676	26,416	**110,523**
Portland City (Central East) PUMA	16,013	15,856	18,707	13,108	11,077	40,772	**115,533**
Portland City (Northwest & Southwest) PUMA	23,214	12,732	15,514	10,686	14,694	67,338	**144,178**
Multnomah County (East)--Gresham & Troutdale Cities PUMA	31,671	27,890	34,367	26,517	12,123	27,189	**159,757**
Clackamas County (South & East)--Damascus City PUMA	9,945	21,833	19,674	13,532	10,831	33,934	**109,749**
Clackamas County (Northwest)--Oregon City, Milwaukie & Happy Valley Cities	16,758	30,926	26,706	23,049	23,905	48,974	**170,318**
Clackamas County (Northwest)--Lake Oswego, West Linn, Wilsonville & Canby Cities	11,486	13,375	14,452	12,448	11,865	51,251	**114,877**
Washington County (Southeast)--Tigard, Tualatin & Sherwood Cities PUMA	11,879	14,295	21,957	9,932	10,143	39,307	**107,513**
Washington County (West)--Forest Grove, Cornelius Cities, Bethany & Oak Hills	9,460	13,428	19,521	12,247	11,661	44,763	**111,080**
Washington County (Central)--Hillsboro City PUMA	18,080	14,118	24,264	13,356	15,276	28,292	**113,386**
Washington County (Central)--Beaverton City (West) & Aloha PUMA	18,639	16,735	17,329	18,504	11,446	30,987	**113,640**
Washington County (Northeast)--Beaverton City (East & Central) & Cedar Mill PUMA	19,870	24,383	12,567	10,803	11,548	37,937	**117,108**
Total	**671,521**	**788,921**	**705,542**	**503,741**	**373,996**	**926,518**	**3,970,239**

Table A.4: Distribution of Providers by Discipline and County

County	Total Providers	Physicians	Primary Care Physicians	Non-PC Physicians	Behavioral Health	Dentists
Baker	201	29	17	12	15	6
Benton	2082	460	298	162	344	55
Clackamas	5367	1020	609	411	365	301
Clatsop	454	95	53	42	27	26
Columbia	397	35	23	12	20	19
Coos	677	119	73	46	41	35
Crook	183	22	13	9	8	9
Curry	180	43	29	14	7	12
Deschutes	2555	491	285	206	173	125
Douglas	1327	258	138	120	87	68
Gilliam	8	1	1	0	0	0
Grant	50	7	6	1	1	5
Harney	103	7	6	1	6	3
Hood River	381	83	48	35	22	23
Jackson	2894	633	396	237	220	139
Jefferson	111	15	14	1	2	10
Josephine	1139	151	94	57	66	66
Klamath	794	152	83	69	42	49
Lake	31	4	4	0	2	4
Lane	5919	932	571	361	543	230
Lincoln	568	105	62	43	50	20
Linn	884	181	127	54	56	66
Malheur	265	48	33	15	13	19
Marion	3946	788	481	307	339	251
Morrow	70	5	5	0	0	3
Multnomah	20301	3740	2154	1586	2060	683
Polk	561	69	54	15	53	26
Sherman	2	0	0	0	0	0
Tillamook	189	47	24	23	13	12
Umatilla	643	110	76	34	42	43
Union	307	58	34	24	30	15
Wallowa	59	11	10	1	3	4
Wasco	350	100	57	43	27	17
Washington	7166	1392	882	510	510	456
Wheeler	8	0	0	0	0	2
Yamhill	1119	177	123	54	104	54
Unknown	11475	179	98	81	143	58
Total	**72,766**	**11,567**	**6,981**	**4,586**	**5,434**	**2,914**

Source: Provider360 data. The numbers correspond to years 2014-2015.

Table A.5: Distribution of Non-Physician Providers by Discipline and County

County	PA	NP	CNS	APM	RN	LPN	NA
Baker	9	7	0	0	119	0	2
Benton	49	49	4	4	980	9	0
Clackamas	79	174	2	26	2,579	6	66
Clatsop	13	33	0	1	341	0	4
Columbia	13	18	0	9	52	2	0
Coos	16	36	3	4	671	5	11
Crook	6	4	0	0	94	1	4
Curry	6	13	0	1	94	0	2
Deschutes	105	100	2	6	1,846	5	3
Douglas	148	76	0	7	932	5	3
Gilliam	3	1	0	0	-	0	0
Grant	0	3	0	0	45	0	0
Harney	3	5	0	0	45	0	0
Hood River	10	9	0	1	232	0	3
Jackson	68	164	4	11	2,190	8	8
Jefferson	2	5	0	0	105	0	0
Josephine	21	53	2	2	521	5	15
Klamath	18	42	1	1	401	4	0
Lake	0	2	0	0	46	0	1
Lane	130	173	4	5	3,365	96	25
Lincoln	22	23	0	1	350	0	7
Linn	24	16	1	2	651	3	6
Malheur	13	12	0	1	263	0	6
Marion	103	131	5	15	3,552	12	13
Morrow	6	0	0	0	25	0	0
Multnomah	343	740	31	75	11,930	51	103
Polk	15	22	0	1	229	3	1
Sherman	0	1	0	0	3	0	0
Tillamook	5	12	0	0	144	0	2
Umatilla	12	38	1	0	537	6	7
Union	0	21	0	0	231	0	1
Wallowa	2	4	0	0	62	0	0
Wasco	10	13	0	1	353	0	1
Washington	179	231	2	38	5,120	12	37
Wheeler	2	1	0	0	3	0	0
Yamhill	20	29	0	4	606	1	4
Unknown	11	44	2	3	115	8	8
Total	**1,466**	**2,305**	**64**	**219**	**38,832**	**242**	**343**

Source: Provider360 data. The numbers correspond to years 2014-2015. The number of Registered Nurses is from 2014, available from the OHA Report "Oregon Health Professions: Occupational and County Profiles".

Table A.6: Distribution of Providers per 1,000 Populations by Discipline and County

County	Population	Providers per 1,000 Populations				
		Physicians	Primary Care Physicians	Non-PC Physicians	Behavioral Health	Dentists
Baker	16,059	1.81	1.06	0.75	0.93	0.37
Benton	86,316	5.33	3.45	1.88	3.99	0.64
Clackamas	394,972	2.58	1.54	1.04	0.92	0.76
Clatsop	37,474	2.54	1.41	1.12	0.72	0.69
Columbia	49,459	0.71	0.47	0.24	0.40	0.38
Coos	62,475	1.90	1.17	0.74	0.66	0.56
Crook	20,998	1.05	0.62	0.43	0.38	0.43
Curry	22,335	1.93	1.30	0.63	0.31	0.54
Deschutes	170,388	2.88	1.67	1.21	1.02	0.73
Douglas	106,972	2.41	1.29	1.12	0.81	0.64
Gilliam	1,932	0.52	0.52	-	-	-
Grant	7,180	0.97	0.84	0.14	0.14	0.70
Harney	7,126	0.98	0.84	0.14	0.84	0.42
Hood River	22,885	3.63	2.10	1.53	0.96	1.01
Jackson	210,287	3.01	1.88	1.13	1.05	0.66
Jefferson	22,192	0.68	0.63	0.05	0.09	0.45
Josephine	83,599	1.81	1.12	0.68	0.79	0.79
Klamath	65,455	2.32	1.27	1.05	0.64	0.75
Lake	7,838	0.51	0.51	-	0.26	0.51
Lane	358,337	2.60	1.59	1.01	1.52	0.64
Lincoln	46,406	2.26	1.34	0.93	1.08	0.43
Linn	119,356	1.52	1.06	0.45	0.47	0.55
Malheur	30,359	1.58	1.09	0.49	0.43	0.63
Marion	326,110	2.42	1.47	0.94	1.04	0.77
Morrow	11,187	0.45	0.45	-	-	0.27
Multnomah	776,712	4.82	2.77	2.04	2.65	0.88
Polk	77,916	0.89	0.69	0.19	0.68	0.33
Sherman	1,710	-	-	-	-	-
Tillamook	25,342	1.85	0.95	0.91	0.51	0.47
Umatilla	76,705	1.43	0.99	0.44	0.55	0.56
Union	25,691	2.26	1.32	0.93	1.17	0.58
Wallowa	6,820	1.61	1.47	0.15	0.44	0.59
Wasco	25,515	3.92	2.23	1.69	1.06	0.67
Washington	562,998	2.47	1.57	0.91	0.91	0.81
Wheeler	1,375	-	-	-	-	1.45
Yamhill	101,758	1.74	1.21	0.53	1.02	0.53
Total	3,970,239	2.91	1.76	1.16	1.37	0.73

Source: Provider360 data. The numbers corresponds to year 2014-2015. The counts of population by county are from the Area Health Resource File (AHRF) as of 2014.

Table A.7: Non-Physicians per 1,000 Populations by Discipline and County

County	Providers per 1,000 Populations		
	PA	**NP**	**RN**
Baker	1.81	1.06	7.41
Benton	5.33	3.45	11.35
Clackamas	2.58	1.54	6.53
Clatsop	2.54	1.41	9.10
Columbia	0.71	0.47	1.05
Coos	1.90	1.17	10.74
Crook	1.05	0.62	4.48
Curry	1.93	1.30	4.21
Deschutes	2.88	1.67	10.83
Douglas	2.41	1.29	8.71
Gilliam	0.52	0.52	-
Grant	0.97	0.84	6.27
Harney	0.98	0.84	6.31
Hood River	3.63	2.10	10.14
Jackson	3.01	1.88	10.41
Jefferson	0.68	0.63	4.73
Josephine	1.81	1.12	6.23
Klamath	2.32	1.27	6.13
Lake	0.51	0.51	5.87
Lane	2.60	1.59	9.39
Lincoln	2.26	1.34	7.54
Linn	1.52	1.06	5.45
Malheur	1.58	1.09	8.66
Marion	2.42	1.47	10.89
Morrow	0.45	0.45	2.23
Multnomah	4.82	2.77	15.36
Polk	0.89	0.69	2.94
Sherman	-	-	1.75
Tillamook	1.85	0.95	5.68
Umatilla	1.43	0.99	7.00
Union	2.26	1.32	8.99
Wallowa	1.61	1.47	9.09
Wasco	3.92	2.23	13.83
Washington	2.47	1.57	9.09
Wheeler	-	-	2.18
Yamhill	1.74	1.21	5.96
Unknown	-	-	-
Total	2.91	1.76	9.78

Source: Provider360 data. The numbers correspond to years 2014-2015. The counts of population by county are from Area Health Resource File (AHRF) as of 2014.

Table A.8 Regression Models of Providers as a Function of Participants

	PC Physicians			NP/PAs		
	(1)	(2)	(3)	(1)	(2)	(3)
OR Participants	0.011			-0.001		
	(0.2)			(0.01)		
NHSC Participants	0.123	0.307	0.439	**0.676**	**0.646**	**0.644**
	(0.44)	(0.44)	(0.49)	(0.30)	(0.29)	(0.29)
RPTC		0.042	0.046		0.008	-0.010
		(0.04)	(0.04)		(0.02)	(0.02)
RMPIS		-0.074	-0.070		-0.040	-0.019
		(0.07)	(0.10)		(0.04)	(0.05)
EMSTC		-0.072	-0.060		0.044	0.085
		(0.09)	(0.11)		(0.06)	(0.06)
J1VW			-0.216			
			(1.86)			
State LRP			-0.430			-1.840
			(2.34)			(1.29)

NOTE: The estimates in bold are statistically significant at the 5% level.

Table A.9 Regression Models of PC Physicians as a Function of Program Participation

	PC Physicians		
	(1)	(2)	(3)
PC Physicians lag 1	0.573***	0.583***	0.719***
	(0.10)	(0.10)	(0.12)
PC Physicians lag 2	0.497***	0.485***	0.348***
	(0.10)	(0.10)	(0.12)
OR Participants Only	-0.053		
	(0.18)		
OR Participants Only lag 1	-0.077		
	(0.29)		
OR Participants Only lag 2	0.141		
	(0.23)		
RPTC		0.135	0.136
		(0.13)	(0.17)
EMS TC		-0.396	-0.570
		(0.48)	(0.50)
RMP IS		-0.219	-0.227
		(0.44)	(0.49)
J1 Visa Waiver			0.946
			(3.50)
State LRP			-0.019
			(1.34)
Medicaid LRP			-4.677*
			(2.75)
RPTC lag 1		0.102	0.108
		(0.43)	(0.48)
EMS TC lag 1		-0.037	0.212
		(0.47)	(0.51)
RMP IS lag 1		-0.499	-0.349
		(0.54)	(0.62)
J1 Visa Waiver lag 1			-1.909
			(3.63)

	PC Physicians		
	(1)	(2)	(3)
State LRP lag 1			-0.841
			(1.89)
RPTC lag 2		-0.195	-0.195
		(0.44)	(0.51)
EMS TC lag 2		0.362	0.295
		(0.40)	(0.43)
RMP IS lag 2		0.645*	0.491
		(0.33)	(0.43)
J1 Visa Waiver lag 2			1.356
			(2.97)
State LRP lag 2			1.317
			(2.79)
NHSC Only	1.568**	1.639***	1.427**
	(0.64)	(0.59)	(0.63)
NHSC Only lag 1	-2.451***	-2.819***	-2.730***
	(0.87)	(0.89)	(0.96)
NHSC Only lag 2	1.006	1.487	1.673
	(0.99)	(0.93)	(1.03)
Hosp_beds	0.010	0.010	0.012
	(0.01)	(0.01)	(0.01)
Median Family Income	0.000	0.000	0.000
	(0.00)	(0.00)	(0.00)
Pct Employer Insurance	-0.006		
	(0.48)		
Pct Medicaid	-0.535*	-0.690**	-0.639**
	(0.31)	(0.27)	(0.28)
Pct Medicare	-0.606	0.165	0.143
	(0.83)	(0.25)	(0.26)
Pct No Insurance	-0.216	0.062	-0.038
	(0.58)	(0.26)	(0.28)
Population	-0.000***	-0.000***	-0.000***

	PC Physicians		
	(1)	(2)	(3)
	(0.00)	(0.00)	(0.00)
Pct below Poverty	0.343	0.092	-0.023
	(0.37)	(0.32)	(0.37)
Pct Hispanic	-0.088		
	(0.29)		
Pct Female	0.092		
	(0.23)		
Pct Age below 18	-0.867		
	(1.19)		
Pct Age 19-34	-1.072		
	(1.19)		
Pct Age 35-44	-0.120		
	(1.09)		
Pct Age 45-54	-1.168		
	(1.00)		
Pct Age 55-64	-0.911		
	(1.21)		
Year 2014	2.650	2.162	2.995
	(1.99)	(2.09)	(2.23)
Constant	79.475	5.818	9.112
	(94.41)	(15.93)	(17.08)
Observations	87	87	87

NOTE: Standard errors in parentheses. * $p<0.10$, ** $p<0.05$, ***$p<0.01$. The model in column 3 has a more parsimonious specification to ensure a sufficient number of degrees of freedom once the full list of program participation variable is included in the model.

Table A.10 Regression Models of NP/PAs as a Function of Program Participation

	(1)	(2)	(3)
NP PAs lag 1	0.635***	0.613***	0.615***
	(0.18)	(0.18)	(0.18)
NP PAs lag 2	0.453**	0.478**	0.473**
	(0.19)	(0.19)	(0.19)
OR Participants Only	-0.164		
	(0.12)		
OR Participants Only lag 1	0.236		
	(0.19)		
OR Participants Only lag 2	-0.074		
	(0.15)		
RPTC		0.000	-0.023
		(0.08)	(0.08)
EMS TC		0.262	0.338
		(0.30)	(0.30)
RMP IS		-0.030	-0.049
		(0.28)	(0.30)
State LRP			-0.557
			(0.76)
Medicaid LRP			0.950
			(1.46)
RPTC lag 1		0.286	0.415
		(0.27)	(0.29)
EMS TC lag 1		-0.447	-0.457
		(0.29)	(0.30)
RMP IS lag 1		0.186	-0.078
		(0.34)	(0.38)
State LRP lag 1			0.913
			(1.11)
Medicaid LRP lag 1			
RPTC lag 2		-0.278	-0.402

	(1)	(2)	(3)
		(0.28)	(0.29)
EMS TC lag 2		0.228	0.206
		(0.25)	(0.25)
RMP IS lag 2		-0.196	0.106
		(0.21)	(0.26)
State LRP lag 2			-2.274
			(1.62)
NHSC Only	-1.372***	-1.391***	-1.197***
	(0.40)	(0.36)	(0.38)
NHSC Only lag 1	1.549***	1.630***	1.377**
	(0.56)	(0.55)	(0.56)
NHSC Only lag 2	0.500	0.408	0.496
	(0.66)	(0.60)	(0.61)
Hosp_beds	-0.005	-0.007	-0.008
	(0.01)	(0.00)	(0.00)
Median Family Income	-0.000	-0.000	-0.000
	(0.00)	(0.00)	(0.00)
Pct Employer Insurance	0.038		
	(0.31)		
Pct Medicaid	-0.070	-0.022	0.005
	(0.20)	(0.17)	(0.17)
Pct Medicare	-0.033	-0.135	-0.159
	(0.55)	(0.15)	(0.16)
Pct No Insurance	-0.051	-0.121	-0.055
	(0.38)	(0.16)	(0.17)
Population	0.000	0.000	0.000
	(0.00)	(0.00)	(0.00)
Pct below Poverty	-0.220	-0.178	-0.073
	(0.24)	(0.20)	(0.21)
Pct Hispanic	-0.036		
	(0.19)		

	(1)	(2)	(3)
Pct Female	0.005		
	(0.15)		
Pct Age below 18	0.080		
	(0.78)		
Pct Age 19-34	0.154		
	(0.78)		
Pct Age 35-44	-0.026		
	(0.71)		
Pct Age 45-54	0.049		
	(0.65)		

	(1)	(2)	(3)
Pct Age 55-64	0.163		
	(0.80)		
Year 2013	0.119	-0.369	-0.234
	(1.24)	(1.22)	(1.31)
Constant	3.743	12.935	9.159
	(62.20)	(9.90)	(10.15)
Observations	87	87	87

NOTE: Standard errors in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.
The model in column 3 has a more parsimonious specification to ensure
a sufficient number of degrees of freedom once the full list of program
participation variable is included in the model.

Table A.11 Regression Models of Providers as a Function of Participants Using Only Data from Rural Areas

	PC Physicians			NP/PAs		
	(1)	(2)	(3)	(1)	(2)	(3)
OR Participants	-0.003			**0.136**		
	(0.2)			(0.05)		
NHSC Participants	**0.292**	**0.297**	**0.317**	0.894	0.381	0.737
	(0.17)	(0.18)	(0.19)	(0.70)	(0.29)	(0.84)
RPTC		0.001	-0.007		0.034	0.002
		(0.02)	(0.02)		(0.06)	(0.05)
RMPIS		-0.005	-0.051		**0.249**	**0.182**
		(0.04)	(0.06)		(0.11)	(0.10)
EMSTC		-0.040	-0.025		0.144	0.125
		(0.08)	(0.11)		(0.17)	(0.13)
J1VW			1.14			
			(1.14)			
State LRP			0.135			-1.351
			(0.42)			(2.03)

Table A.12 Retention of Primary Care NHSC Participants as of 2015 by Obligation End Year

Obligation End Year	PC HPSA	Not PC HPSA	Total	% Retained in PC HPSA
Physicians				
2011	2	0	2	100.0
2012	2	2	4	50.0
2013	6	1	7	85.7
2014	7	4	11	63.6
All	17	7	24	70.8
Non-Physicians				
2011	0	4	4	0.0
2012	8	10	18	44.4
2013	11	12	23	47.8
2014	9	5	14	64.3
All	28	31	59	47.5

Appendix B - Literature Review

For this project we provide an extensive environmental scan of peer-reviewed journals, reports, white papers, research projects, and other unpublished literature to identify and summarize findings related to the measures of effectiveness of various types of provider incentive programs. In this literature review we give special attention to the recruitment and retention of providers in high need areas in Oregon and the rest of the country. We complement studies, such as Barnighausen et al. (2009) and Campbell et al (2012) that provide a thorough review of the literature on provider incentives, by discussing more recent studies and by focusing on the creation of an exhaustive inventory of program performance metrics. The different evaluation criteria that have been used in the literature to measure the effectiveness of incentive programs are centered on provider retention rates in high-need areas, as well as the number of participants the program was able to attract, the marginal cost for recruiting each additional provider, the size and the type of the patient population served, and the number of provider-years served in rural and underserved areas while providers were participating in the program, and/or after completion of program obligation.

Recruiting and Retaining Medical Workforce in High Need Areas

There is a substantial literature on the various factors that affect the providers' decisions to locate in high need areas. Hancock et al. (2009) argue that in order to reduce persistent provider shortages in rural areas, before evaluating provider incentive programs the focus of policymakers should be directed toward a thorough understanding of the factors and influences that determine individual providers' decisions to locate in rural areas. They interview, in-depth, 22 physicians who were born in rural and urban areas from northeastern California and northwestern Nevada to investigate the reasons behind their practice location choice. The study finds that exposure to rural life through education, recreation, or upbringing increases the chances of future rural practice as it addresses the provider's desire for familiarity, sense of place, community involvement and self-actualization. These results support a health policy focus on the recruitment of rural-raised and community-oriented applicants to medical school, residency, and rural practice. In addition, local mentorship and ''place-specific education'' can further support the integration, and thus longer-term retention, of new rural physicians.

Walker et al (2010) also find that personal motivators, career motivators and clinic support are paramount to the decision primary care providers make to locate in underserved areas. Identifying key personal motivators during medical school and while providers are serving in underserved areas may enhance strategies for recruiting and retention of these providers in the long run. Through interviews with 42 primary care physicians from Los Angeles county, Walker et al (2010) identify a number of personal motivators, such as opportunities for personal growth, self-identity (or common background with the patients) and mission-based values (or being dedicated to serving particular communities). They also identify career motivators like salary and benefits, work hours and lifestyle, career satisfaction, family, geography and loan repayment programs. Finally, clinic support factors included positive work environment, provider team quality, effective reimbursement mechanisms and availability of information technology. Another potential solution to reduce shortages in high need areas may be to attract primary care providers that are close to retirement to serve in those areas on a part-time basis (Nusbaum, 2009).

Another study by Duffrin et al (2014) examined what factors influence primary care physicians to choose rural practice locations to better develop the rural workforce in North Carolina. The authors sent a survey was to all primary care physicians licensed in the state of North Carolina, a total of 2829, and received 975 usable responses (return rate 34.5%). They found that solo practice, critical access hospital, community health center, or federally qualified health center sites were strongly associated with rural practice. Physician pay was also a factor in choosing a work site, financial support from a hospital, and medical school loan repayment also was correlated with rural practice. The majority rural physicians (72%) reported being from a town of less than 11,000. The authors argue that the current definition of rural being used to identify students most likely to practice in rural areas is inaccurate. They also propose a definition of rural as an area with a population of less than 11,000, as they found that such an area is the best predictor of choice to practice in rural North Carolina. Competitive pay, medical student loan repayment, and involvement with civic organizations were also found to be positively correlated with choosing a rural practice location. The survey indicated that financial support from a hospital or other healthcare organization was found to increase the chance of choosing a rural practice location. The authors argue that financial incentives, such as loan repayment, salary guarantees, and practice assistance, should continue to assist in attracting primary care physicians to rural areas. The authors suggest tailoring recruitment efforts to students being raised in an area of less than 11,000.

Using logistic regressions in which they modelled the decision of a number of primary care physicians to serve in medically underserved communities (MUC), Wayne et al. (2010) measure how predictive several factors identifiable at the time of enrollment in medical are for the probability of subsequent practice in a MUC. They find that providers who attended high school in a rural area were three times more likely to work in an MUC. Also, physicians who began medical school at age 25 or older, and who were members of an underrepresented minority were twice as likely to work in a MUC relative to their counterparts. The information used in this analysis comes from a survey of attitudes toward serving in MUCs that all students who enrolled after 1993 in the University Of New Mexico School Of Medicine were asked to complete at matriculation.

Similarly, Boscardin et al (2014) find that community health field experience, learning another language, becoming more aware of perspectives of individuals from other backgrounds and attending schools with a higher social mission score represent educational and individual factors that were strongly associated with the medical students' intention to practice in underserved areas.

Price et al (2009) used a Web-based survey to investigate medical students' interest in loan repayment programs. The survey was sent to medical students and residents at 6 university programs in Texas during the 2005–2006 academic year. A total of 818 students and 529 residents responded to the survey. Of the respondents, 96% of students and 85% of residents had taken out loans for education with about 62% of students and residents expected their debt to exceed $100,000. More than half of students and residents expected educational debt to influence their choice of practice type and practice area. About 52% of students and 38% of residents indicated an interest in participating in a loan repayment program that involved service in a medically underserved area, and women and members of minority groups were more likely to express interest.

Rabinowitz et al (2011) found that women physicians are less likely than men to practice in rural areas. With women representing an increasing proportion of physicians, there is concern that this could exacerbate the rural physician shortage. The Physician Shortage Area Program (PSAP) of Jefferson Medical College (JMC) is one of a small number of medical school rural programs shown to be successful in addressing the rural physician shortage. The authors point out that relatively little is known about the specific impact of PSAP and JMC on women. They used the 2007 practice location and specialty for PSAP and non-PSAP graduates, a total of 2394 physicians from the 1992 to 2002 JMC graduating classes and found that women PSAP graduates were more than twice as likely as non-PSAP women to practice in rural areas, 31.7% versus 12.3%. The outcomes for men were similar, a 51.8% versus 17.7%. PSAP outcomes were also similar for women and men practicing rural family medicine and rural primary care.

Although not directly relevant for the retention of providers in high need areas, there are a number of lessons to be learned from the strategies and best practices developed by private health networks to ensure high provider retention rates. Provider retention is a critical issue for health plans and service delivery networks, especially in Medicaid managed care, where low reimbursement rates make recruiting and retaining providers very challenging. Research indicates that there are significant costs associated with losing a network physician. A Colorado Permanente Medical Group study showed that patients whose primary care physician had left the medical group had more hospital admissions, emergency room and specialty visits, and laboratory and x-ray tests (Magrid et al., 2001). Dissatisfaction with care may also lead to higher rates of patient disenrollment.

The Association for Community Affiliated Plans, which represents 18 Medicaid-focused health plans and one integrated service delivery network across 11 states, conducted a comprehensive study of four of its member health plans in 2004 to assess the actions and policies that may inhibit adequate provider recruitment and retention. The top four challenges for recruitment and retention reported by plan executives were: 1) low payment rates; 2) clinicians' preference for private patients; 3) scarcity of providers, particularly in rural regions; and 4) frustration with referral and pre-authorization processes (The Commonwealth Fund, 2005). The health plans emphasized the importance of two key modes of retention—sustaining relationships with providers through regular meaningful communication and keeping up to date with technology offerings to ease administrative burden.

Health plan leaders achieved the greatest success in improving provider relations in the following five areas:

1. *Payment practices, payment incentives, and financial assistance*—providing prompt payment for care or offering incentives for high-quality care
2. *Utilization management practices*—updating referral processes, improving authorization practices, improvements to customer service
3. *Communications and provider outreach practices*—conducting site visits and engaging in frequent written communication, holding provider recognition events, and updating provider outreach processes
4. *Practices to simplify administrative burdens*—includes simplifying the eligibility verification process, the credentialing process, and encounter data submission process

5. *Enabling service practices*—health plans may provide certain services to ease burden on provider. Services may include transportation services, child care, interpreter services, and providing phone service to facilitate contact between patient and care manager

Kaiser Permanente, a national leader in provider retention, offered a similar set of best practices centered on enculturation and mentoring, as well as demonstrating strong leadership qualities such as setting expectations, providing feedback, providing recognition, and active listening (King and Speckart, 2006).

Education and Training of Medical Students to Serve in High Need Areas

In addition to understanding what rural area factors and influences, as well as individual characteristics, affect providers choice to locate in high need or rural areas, it is important to recognize that certain components of the providers' medical education may increase the likelihood that providers go to these areas.

The role of the medical school programs' commitment to rural practice is integral to rural clinician recruitment and retention. Among the policies aimed at addressing the issue of reducing provider shortage in rural and remote areas, comprehensive medical school rural programs appear to be successful. These programs offer a rural-focused admissions process or an extended rural clinical curriculum. One of the very few such programs that allows for the tracking of participants over a longer period of time is the Physicians Shortage Area Program (PSAP) of Jefferson Medical College. (Rabinowitz et al. (2005) show that over 70 percent of PSAP graduates were still practicing family medicine in the same rural area in 2011, 20 to 25 years after they first began practice in their respective rural areas. Also, the 11- to 16-year retention rate for PSAP graduates in rural family medicine was 68 percent. [29] Also, graduates have been found to be more than eight times more likely to become rural family physicians, compared to their non-PSAP peers (Rabinowitz, 1998).

In a related study, Rabinowitz et al. (2008) considered six medical school rural programs and found that the rural retention rate for graduates ranges between 78 percent and 87 percent and that the median duration of rural primary care physicians practicing in the same area is about seven years. These medical schools target students with the predisposition to be primary care providers in rural underserved areas and all programs considered achieved success in augmenting the rural physician workforce. For instance, the proportion of physicians who practice in a rural setting is around 9 percent nationwide, but the proportion among the graduates of institutional rural programs is much higher, between 26 percent and 92 percent.

Also, participation in PSAP, as well as attending college in a rural area were important predictive factors of retention in rural primary care (Rabinowitz et al., 2001). Other variables, such as sex, medical school curriculum, NHSC Scholarship Program participation, and expected peak practice

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[29] The Physician Shortage Area Program (PSAP) of Jefferson Medical College is a special admissions and educational program designed to increase the supply of rural family physicians. The program recruits and selects medical school applicants who have resided or trained in a rural area or small town and are committed to practicing family medicine in a similar environment. The program provides faculty mentorship and career support during medical school.

income were not. Women PSAP graduates were more than twice as likely as non-PSAP women to practice in rural areas (31.7 percent versus 12.3 percent) (Rabinowitz et al., 2011).

In addition, a meta-analysis of six medical school rural programs (including the Rural Physician Associate Program at the University of Minnesota Medical School, the University of Minnesota Medical School at Duluth, the Upper Peninsula Program at Michigan State University College of Human Medicine, the Physician Shortage Area Program at Jefferson Medical College, the Rural Medical Education Program at the State University of New York, and the Rural Medical Education Program at the University of Illinois College of Medicine) concluded that such programs have been highly successful at increasing the supply of rural physicians, with an average of 53 percent to 64 percent of graduates practicing in rural areas (Rabinowitz et al., 2008). The rural retention rates of 79 percent to 87 percent across all programs evaluated, under varying definitions of retention, are also significantly higher than the national average.

Another example of a rural program is the Minnesota Rural Physician Associate Program (RPAP), which has an intensive third year medical school curriculum that focuses on community teaching and mentorship. Fifty-nine percent of graduates of this program remained in rural areas, compared to only 18 percent among their peers who did not participate in the program (Verby et al., 1991).

Also, 65 percent of those who participated in three of the University of Missouri's Rural Track Pipeline Program's four components have stayed in the index state, and more than 57 percent of those same students also practice in rural areas (Quinn et al., 2011). In comparison, less than 9 percent of physicians practice in rural areas nationally. The program's pipeline begins with medical school preadmissions for undergraduate students who have a rural background and an interest in becoming a physician in a rural area.

A study using combined 2005 Masterfile data from the American Medical Association and American Osteopathic Association indicate that although Doctors of Osteopathy (DOs) comprise 4.9 percent of the total national active clinical workforce, they contribute 10.4 percent to the rural primary care provider workforce (Fordyce et al., 2012). Osteopathic primary care physicians are also more likely than allopathic primary care physicians to practice in rural persistent poverty areas (12.4 percent and 9.1 percent, respectively). Osteopathic students play a vital role in increasing the supply of physicians in rural areas, and their ongoing participation is critical to addressing existing primary care shortages as well as meeting additional demand among the newly insured population under the ACA.

Also, HRSA administers several grant programs authorized under Title VII and Title VIII of the Public Health Service Act to support training and scholarship programs nationwide. Title VII supports a variety of programs in the health professions, while Title VIII provides funding nursing workforce education programs. Title VII and Title VIII programs use both HPSA and MUA designation to prioritize awards.

Primary care physicians graduating from Title VII programs are two to four times more likely than other graduates to practice in medically underserved communities (Hooker, 2009). The program has been lauded for its emphasis on deploying physician assistants into primary care and underserved areas. Other studies have found similar results, namely that Title VII funding is significantly associated with expansion of the primary care physician workforce and increased

accessibility to physicians (Rabinowitz et al., 2005). Recent research indicates 54 percent of trainees directly funded by Title VII or Title VIII programs received at least a portion of their medical training in HPSA or other medically underserved community (HRSA, 2014).

Area Health Education Center (AHEC) Primary Care Residency Training programs, another Title VII effort, focus on family medicine and acculturate trainee in rural health. The program draws state and federal financial incentives and is coordinated through states' Recruitment and Retention Committee and Health Departments.

HRSA also manages the NURSE Corps, formerly the Nursing Scholarship and Loan Repayment Program, a program of scholarships and loan repayment for registered nurses who agree to serve in a facility with a critical shortage of nurses. In addition to the Title VII and Title VIII programs, DHHS administers other programs that aim to increase the size and reach of the primary health care workforce, such as the Indian Health Service (IHS). Arkansas, Colorado, and Texas, among other states, are using state appropriations from Medicaid Graduate Medical Education (GME) financing to improve accountability and address state primary care workforce needs. Medicaid GME funding is being used to provide assistance to medical schools that meet certain conditions to support primary care, direct funding to individual students in exchange for primary care practice in the state, recruiting bonuses or signing bonuses for primary care services in underserved areas in the state (Council on Graduate Medical Education, 2004).

It is also important to recognize that students often associate primary care with low income expectations, low class rank and high educational debt (Henderson et al., 1996). Though students commonly enter medical school with a positive perception of primary care, by their fourth year of medical school, they are increasingly likely to disagree with the assertions that primary practice is prestigious, adequately compensated, and allows more control over working hours (Lynch et al., 1998). Several strategies have been proposed to bolster the image of primary care and to improve the perception of primary care among students.

- Primary care mentorship programs:
  - Students are more likely to emulate their primary care mentors if they support the students' independence and facilitate greater feelings of competence (Indyk et al., 2011)
  - The impact of understanding primary care and the challenges of primary care in medically underserved communities is important in students' decision to specialize in primary care (Indyk et al., 2011)
  - Working with a well-respected clinical mentor may increase chances of students selecting an internal medicine residency (Indyk et al., 2011)
- Required primary care experiences during medical training
  - A required third-year primary care clerkship that creates an ongoing relationship between students and their patients is recommended
- Reducing number of work hours or length of residency
  - Forty-five percent of non-primary care fourth-year medical students indicated that they were either planning to enter primary care or they would change to a primary care specialty with appropriate adjustments in income, hours worked, or loan repayment (Rosenthal et al., 1994). This suggests that changing certain

factors that affect lifestyle (reduction in administrative burden, for example) may impact the recruitment of primary care physicians, and potentially the retention as well.

- Changing the length of residency
  - A survey of 442 third-year family practice residents found that most students favored a 3-year residency program and a minority supported extending training to 4 years (Duane et al., 2004). Pilot programs that shorten medical education to three years in exchange for a commitment to enter family medicine residencies are currently being tested.

Provider Incentive Programs and Their Effectiveness

There are a number of provider incentive programs that have been put in place at the state and federal level.

State-level Programs

Many states have set up loan repayment and scholarship programs in an effort to draw primary care physicians into rural or otherwise medically underserved areas in exchange for financial support. State-supported programs largely arose to fill a workforce shortage when NHSC staffing declined in the late 1980s and in response to unsuccessful health care workforce reform proposals in the 1990s (Leichter, 1992). One of the reasons why states create their own programs even though federal options are available is the perception that state-designed programs are more attuned and customized to the specific needs of the state's underserved communities. Also, these local initiatives are more likely to create a lasting impact, and that the smaller size of the programs and closer relationships with the community allow for more innovation and flexibility (Pathman et al., 2000; Weissert, 1994). The mission and structure of most state loan repayment or scholarship programs are similar to those of federal programs, albeit with substantial state-to-state variation in design and operation (Pathman et al., 2000). Variation arises due to specific local needs or the need to conform to the political forces that shape enacting legislation. Some programs, for example, offer a part-time service obligation, while others offer resident support and direct financial incentive programs, which are less common at the federal level. Certain other programs administered by HRSA, like the State Loan Repayment Program (SLRP), help fund state support-for service programs, but do not directly provide funding to individual students.

Among state service programs, there is significant variation in anticipated retention. (Pathman et al., 2012(b)). In this study, the authors analyzed a number of state loan repayment programs that were jointly funded with other HRSA-administered programs (such as SLRP) in addition to similar programs that were solely supported with state funds. Also, Pathman et al., 2004(a) considered 69 state-funded programs and found that the service completion rates were uniformly high among loan repayment, direct incentive, and resident support programs, but lower for service-option loan and scholarship programs. Physicians who participated in the state-based programs also reported more satisfaction than non-obligated physicians and over half of the clinicians remained for over eight years. Program directors who were interviewed for this study attested to the relative ease in administering these programs. Pathman et al (2004) takes into account the cost of participants to buy out of the initial arrangements and finds that higher penalties for buyouts were associated with lower physician satisfaction and lower retention. However, high penalties cut buyout rates, a finding that is in line with previous research

indicating that high penalties can cut buyout rates by as much as one-third (Duttera and Blumenthal, 2000).

An important topic in the assessment of the effectiveness of state-based programs is the comparative advantage of one program type over the others. For instance, Pathman et al. (2000) identify several advantages of direct incentive programs over loan repayment programs, including the administrative and logistical advantages of not needing to verify the eligibility of applicants' educational loans, thereby broadening of number and scope of individuals eligible to participate. A direct incentive program would not limit the pool of potential participants only to providers who have educational loans. This is potentially important, since there is no evidence that only providers with student loans are worth recruiting to high need areas.

Interestingly, loan repayment programs are currently being tested in private, local markets as well. Excellus Blue Cross/Blue Shield of Rochester partnered with four local hospitals and a major employer group in the Rochester, New York region to institute a loan repayment program in 2012, with the goal of increasing access to adult primary health care in the Rochester area. Approximately $600,000 per year for the subsequent four years is be available through local institutions to provide loan repayment to primary care physicians in exchange for a minimum of four years of service in nearby counties. The program is financed through a small surcharge on Excellus BlueCross BlueShield commercial inpatient claims at four local hospitals (Rochester General Health System, 2013).

State level programs also include visa waivers to allow foreign national providers to practice in high need areas. A recent article uses the Nebraska Health Professional Tracking System (NE-HPTS) to track 240 physicians who were enrolled in the J-1 visa waiver and the state loan repayment programs from 1996 to 2013 (Opoku et al., 2015). The authors aimed to comparatively analyze the effectiveness of each program. The J-1 visa waiver program is a program that waives the 2-year requirement for international medical graduates (IMGs) to return to their home countries. The waiver requires IMGs to serve 3 years in HPSAs. The loan repayment program offered by Nebraska (the Nebraska State Loan Repayment Program) requires a 50% local match with state funds from federal funds that provide a maximum annual amount of $40,000 for up to 3 years. Both programs have a minimum obligatory period of 3 years and were implemented in 1994, which allows for logical comparison. The authors linked data from the Nebraska Office of Rural Health (ORH), Area Resource File, and Nebraska birth and marriage records to the NE-HPTS data. The ORH data provided individual physician information, birth and marriage records to determine the marriage and family status, The Area Resource File provided county-level socioeconomic and demographic information. The study included current and past enrollees of the two incentive programs, between 1996 and 2012, which was following longitudinally until 2013. Only physicians with an initial rural county practice were included. The two key dependent variables defined were movement and length of rural stay. Movement was defined as moving from a rural area to an urban area or out of state. "Urban" was defined as a metropolitan area. Out of the 93 counties in Nebraska, 9 were identified as urban. The main independent variable was the "program" variable, either the waiver program or the loan repayment program, which were mutually exclusive. The study included Rural/Urban Continuum codes to include a "measure" or rurality. The authors also included a qualitative aspect to the study, conducting interviews of physician recruiters and a hospital administrator. The interviews were aimed to gauge the perceptions on the two

programs in Nebraska. Overall, the average lengths of stay in rural Nebraska were 4.1 and 8.1 years for the J-1 visa waiver and state loan repayment programs, respectively. Including only those that finished the obligatory 3 year period, the average stays were 5.6 and 9.7 years for the waiver and loan repayment programs, respectively. The authors ran a multilevel survival regression model, which validated the descriptive statistics that J-1 visa waiver enrollees were more likely to leave rural Nebraska when compared to the loan repayment program.

Another study evaluated the impact of the J-1 visa waiver program in the state of Washington (Kahn et al., 2010). Under the J-1 waiver program, each state is allocated 30 annual waiver slots, with obligatory requirements of 3 years for primary care and 5 years for specialists in Washington. The authors used longitudinal data of 155 physicians which received these waivers between 1995 and 2003. Data included information on physicians' specialties, medical schools and residency programs, their J-1 waiver employers, and the terms of their employment contracts. The authors augmented the data with publically available information on U.S. work addresses for the waiver participants. The authors also used a 29 question survey which asked questions about physicians' experience with the J-1 visa waiver program and their employment history. The study uses Rural-Urban Commuting Area Codes (RUCAs) as the geographical measure of rural or urban practice status. RUCAs are smaller areas than counties which assess the interdependence based on commuting flows and allows for a more accurate representation of rural vs. urban status for providers. The authors performed linear regression and Kaplan-Meier survival analysis to portray physician retention over time. Seventy-seven physicians replied to the survey, with 51% of those characterizing their practice as serving primarily low-income populations. These results are "self-reported". Respondents reported serving a median of 26 months and mean of 34 months in underserved areas after their obligatory terms ended. Regression analysis only identified "staying in the state of Washington" that correlated with physicians spending time serving underserved populations after completing their obligations. The study also found that after the waiver students completed their obligations, 91% of them relocated to urban practice locations.

Thompson et al (2009) investigate whether international medical students contribute to reducing the shortage of rural primary care in the U.S. The authors compared the practice location of IMGs and US medical graduates (USMGs) practicing in primary care specialties. They used the 2002 AMA physician file to determine the practice location of all primary care physicians (about 205,063) in the United States and linked practice locations to the Rural-Urban Commuting Areas, and defined areas into urban, large rural, small rural, and isolated small rural areas. The difference between the percentage of IMGs and percentage of USMGs in each type of geographic area was calculated and repeated for each Census Division and state. They found that one quarter (24.8% or 50,804) of primary care physicians are IMGs and that IMGs are significantly more likely to be female (31.9% vs 29.9%, $P < .0001$), older (mean ages 49.7 and 47.1 year, $P < .0001$), and less likely to practice family medicine (19.0% vs 38%, $P < .0001$) than USMGs. They found only two Census Divisions in which IMGs were relatively more likely than USMGs to practice in rural areas (East South Central and West North Central). The authors conclude that IMGs do fill the gaps in the primary care workforce in many rural areas, but that varies widely across states.

A study evaluating the impact of two physician return-for-service (RFS) agreements -the Family Medicine Bursary and the Special Funded Residency Position - identifies important impacts on

physician retention in remote areas of Canada (Matthews et al., 2013). RFS agreements offer financial support to physicians who agree to work in underserved communities in the form of bursaries, student loan remission, funding training positions or unrestricted funds. The Family Medicine Bursary offers funding to medical students and residents working in family medicine, psychiatry, or other specialty where a shortage has been identified. The Special Funded Residency Position offers postgraduate training positions with salary and benefits. Both programs require work in the same province for one year for each year of funding received. The authors linked administrative data (name, medical school, sex, type of bursary, number of years of funding) from each of the two programs' administrators with data from a physician and medical practice database (name, sex, medical school, specialties, addresses, licenses). The study conducted the analysis in two parts. The first method was to evaluate the proportion of RFS physicians who completed their obligations in full for those who participated between 1997 and 2009. The authors included geographic designations of rural, small urban or urban based for practice location. Rural was defined as populations less than 10,000. The study found that 71.6% of the RFS physicians completed their obligations in full. The largest proportion of those who completed their obligations received the Family Medicine Bursary (44%), with the second receiving the Special Funded (20%), and the rest with other programs. Trainees that received the Special Funded incentive were 11 times less likely to complete their obligation than those participating in the Family Medicine Bursary. The study found that only 18% of the participants started their practice in a rural location. The second part of the study compared retention rates of RFS physicians to non-RFS physicians. The second portion of the study followed physicians who began their practice between 2000 and 2005 until 2010 or the physician terminated their license in the province. The authors found that RFS physicians were 3.2 times less likely to leave their province of practice compared to non-RFS physicians. The Kaplan-Meier survival results showed that 90% of RFS physicians remained in the same province, compared to 60% of the non-RFS physicians.

A recent paper provides an examination of economic impacts that are related to a change in the regulatory environment surrounding advanced practice registered nurses in North Carolina (Conover and Richards, 2015). More specifically, the article estimates the economic impact of removing some of the more restrictive scope-of-practice regulations (SSoPRs) on APRNs. These restrictions include, but are not limited to diagnosing, treating, and prescribing medications without a licensed physician having to be present. The authors conduct the demand analysis for APRNs in multiple stages. The first stage the authors only assume a "natural" demand change due to demographic factors, including population growth and changes in age and sex to estimate the baseline demand for APRNs over the period of 2012 to 2020. The second stage to estimate the demand change was to include the impact of the Affordable Care Act over the same time period, assuming North Carolina does not expand Medicaid to get a lower bound and then assuming a Medicaid expansion for the demand upper bound. The authors estimate a total demand increase for APRNs in North Carolina between 17.5% and 20.1%. The study then estimates the changes in this projected demand if the regulations on APRNs are relaxed. In 2012, the study estimates a market expansion from $260 million to $481 million resulting from less restrictive APRN regulation. The final results indicated that reduced regulations on the practices of APRNs would reduce the shortage of North Carolina's nonfederal physicians by at least 41%, the anesthesiologists by at least 85%, OB/GYNs by at least 17%, and Primary Care MDs by at least 92%.

Renner et al (2010) assessed the influence of loan repayment and other factors on the recruitment and retention of healthcare providers in rural Colorado. The authors also compared the motivations and attitudes of these rural providers with their urban counterparts. A survey was sent to 122 healthcare providers who had participated in one of three loan repayment programs in Colorado between the years of 1992 and 2007: the Colorado Health Professional Loan Repayment Program; the Colorado Rural Outreach Program; and the Dental Loan Repayment Program of Colorado. Differentiation between rural and urban communities was accomplished by using the Rural Urban Commuting Area. Of the 93 respondents included in the study, 57 worked in rural communities and 36 worked in urban communities within the specified timeframe. Of the rural participants, 74% were already working in or intending to work in an eligible community when they were made aware of the loan repayment program. Of those planning to work in a rural community regardless of any loan repayment option, 42% reported that the loan repayment program had an important influence on the specific community in which they chose to practice. Of the rural participants already working in a rural community, 38% reported loan repayment as being an important factor in their retention. The most important factors the rural providers cited for their recruitment were the location of the community, scope of practice, and family fit with the community. The most important factors for the urban providers were the location of the community, salary, and scope of practice. Among the rural providers, 36% attended rural high schools, while 9% of urban providers attended rural high schools. From the rural providers who were planning on practicing in a rural area regardless of any loan repayment option, 37% had attended rural high schools. Of rural participants 22% cited the desire for a higher income as an important reason to leave their communities, while the desire for a higher income was the most commonly cited reason for the urban providers.

Federal-level Programs

One of the largest incentive programs that are currently available to providers at the federal level is the National Health Service Corps. Since 1972, NHSC has enabled health care facilities in underserved communities across the nation to compete with private medical practices, health systems, and hospitals for community-responsive and culturally competent clinicians. Experience has shown that the misdistribution of clinicians does not remedy by itself (NHSC, 2000). According to Pathman and Konrad (2012) among all federal initiatives implemented since the 1960s to address the medical workforce shortage and mal-apportionment, the NHSC is a key resource.

Prior to the 2012 NHSC retention analysis commissioned by BCRS, the last large-scale evaluation of NHSC retention was conducted through a 1998 survey of NHSC clinicians and alumni from the 1980s and early 1990s (Konrad et al., 2000). This evaluation used survival analysis to demonstrate that over the years, retention rates were higher among clinicians who had completed the Loan Repayment Program rather than the Scholarship Program (57.2 percent of LRP clinicians remained at the service site at least one month after service completion, compared to only 20.7 percent of those in the Scholarship Program). Those in the Scholarship Program were also found to be less likely to be working in any practice that focused on care for the underserved. The hazard ratio of leaving the original service site over time for LRP participants ranged between 0.63 and 0.72 for "any underserved site." These findings align with the results of retention rates of state loan repayment programs (Pathman et al., 2004(a)). When measured from the date clinicians began serving within their programs, the hazard ratio of leaving one's original service site over

time was 1.96 for scholarship program participants relative to loan repayment program and direct incentive program participants (Pathman et al., 2004(a)).

While some studies report that program participants of loan repayment and scholarship programs are more likely to serve in underserved areas, retention rates from these programs may suffer from self-selection bias and therefore may not be indicative of the true program effect on retention (Rittenhouse et al. 2008). This bias arises as those who choose to apply for NHSC enrollment may be different from non-applicants along various unobserved characteristics. Using AMA Masterfile Data to follow three different physician cohorts from 1976 to 1996, Holmes (2004, 2005) accounts for selection bias while estimating the transition probabilities of NHSC enrollees and non-enrollees moving from period 1 (3-5 years after graduation) to period 2 (8-10 years after graduation). For many enrollees, this is the transition from the initial service obligation to the post-service period. He finds that enrollees are less likely than non-enrollees to stay in their initial place of practice and that the decrease in enrollees is not directly attributable to community characteristics or the nature of being an underserved area, but rather due to the fact that the enrollees' initial location preferences are constrained, as some of these locations are not approved by the NHSC.

In the long run approximately 3 percent of physicians supported by NHSC are retained in highly underserved areas and 10 percent in moderately underserved areas (Holmes, 2004). He estimates that if NHSC tuition subsidies were to be increased by $5,000 per enrollee, the funds would yield a 1.7 percent increase in the long term (post-service) physician supply over current physician supply in highly underserved communities. Assuming a current repayment amount of $30,000/year, the estimated elasticity is 0.1 with respect to the loan repayment amount, which indicates that a 10 percent increase in the NHSC LRP would yield a 1 percent increase in long term post-service physician supply over current physician supply in highly underserved communities. Holmes also estimates that a $1,000 rise in tuition costs increases the likelihood of NHSC enrollment by 0.36 percentage points.

General retention of the medical workforce in rural, urban and frontier sites has also become more balanced over the years. Among clinicians serving in 2005, retention rates did not differ significantly for those across these three types of communities. In 1998, however, retention at all points in time was higher for those who served in rural practices (Pathman et al., 2012(a)). A common perception is that retention is shorter in rural areas because shortages are generally more prevalent and more critical in rural areas. However, Pathman et al. (2004) demonstrated that physician retention in any area is similar—shortage areas arise because of lower recruitment rates rather than lower retention rates. Pathman, Konrad, and Ricketts (1992) examined whether there is an association between characteristics of a physician's training and the amount of time that he or she chooses to stay in rural practice. The results indicated that among NHSC Scholarship Program physicians, no retention differences existed for those who trained or have lived in rural areas previously. Additionally, public school graduates in the NHSC were found to remain in rural areas for shorter periods of time than private school graduates. For rural physicians, only the type of medical school predicted retention. At the time of study, NHSC physicians were also substantially less likely than non-NHSC physicians to be working in their index practices after eight years of employment (13 percent versus 44 percent) and in nonmetropolitan counties (25 percent versus 52 percent). Long-term retention rates of NHSC clinicians in their original practices have not improved significantly over the years.

Among 2005 alumni, 46 percent remained in their index practice for at least two years, while only 26.4 percent remained after four years (Pathman et al., 2012(a)). It has also been shown that the presence of NHSC participants in underserved areas increases the supply of nonparticipating physicians in those areas on average by 6 percent (Pathman et al., 2006). From 1981 to 2001, rural single-county HPSAs staffed by NHSC enrollees saw an average increase of 1.4 non-NHSC primary care physicians per 10,000 population, compared to a 0.57 mean increase in counties without NHSC enrollees, a finding which remained statistically significant even after adjusting for baseline county demographics and health care resources. The workforce growth in NHSC-supported HPSA counties was due in part to initial differences in the availability of primary care physicians and hospitals relative to other counties – which lead to flows of both NHSC and non-NHSC providers into those counties-, and in part possibly due to factors not incorporated within the study, such as stronger leadership and community organization in NHSC-staffed counties. Researchers also suggest that this growth coincided with the emergence of NHSC's loan repayment program and the expansion of state-run scholarship and loan repayment programs. The increase in non-NHSC physicians may have come from NHSC alumni, physicians who were serving obligations to state programs, or unobligated physicians who were attracted to the local medical communities that were improved by NHSC staffing (Pathman et al. 2006).

During the past two decades, NHSC renewed its programmatic focus on retaining providers beyond their service terms. These efforts included shifting resources toward the expansion of the LRP, which was found to be more effective at promoting retention than SP. The GAO reported in 1995 that the cost-per-LRP recipient was 37 percent lower than the cost-per-SP recipient, when adjusted for the time-value of money and defaults (US GAO, 1995).20 In recent years, substantial funding for LRP and SP programs has come from the American Recovery and Reinvestment Act (ARRA), and more recently from the Affordable Care Act (ACA), which has allowed extending service contracts of physicians, NPs, and PAs.

The Multi-State NHSC Retention Collaborative, a consortium of 11 state Primary Care Offices, funded a study on the retention of clinicians within their states who serve in NHSC or in similar state-based programs (Pathman et al. 2012(b)). Using data from two key surveys—the 2012 national NHSC medium and long-term retention study and the survey of clinicians in NHSC and state programs in 11 states participating in the Collaborative, this evaluation sought to identify the circumstances and characteristics of clinicians, service sites, and service experiences that contribute to longer retention. Examining the current and recent NHSC and state-program participants' plans to remain in their original service sites for one, two, and up to ten years, the authors find that of the 1,558 NHSC and state service program participants surveyed, 69 percent remained or anticipated remaining in their service sites for at least one year beyond their service terms, 48 percent anticipated remaining at least three years, and 20 percent anticipated remaining at least ten years. Consistent with previous studies, a significantly higher proportion of NHSC Loan Repayment Program participants anticipate remaining in service sites beyond contractual terms (70 percent compared to 36 percent at one year, 35 percent compared to 13 percent at five years, and 19 percent compared to 2 percent at 10 years, respectively). Within the NHSC Loan Repayment Program, anticipated retention rates are similar across the eleven states.

After simultaneously controlling for the clinicians' disciplines and demographics, factors relating to principal reason for service and type of practice account for 16.3 percent of variation

across clinicians in their plans to remain in their service sites for at least two years beyond their service term, and for 18.7 percent of the variation at five years (Pathman et al., 2012(b)). The factors that have a positive effect on retention include:

- Being a physician (as opposed to a nurse practitioner, physician assistant, dentist or mental and behavioral health practitioner);

- Being age 30 or over, non-Hispanic White race/ethnicity, having children, and serving in a state where one grew up and where one trained;

- Principally motivated by the chance to work with underserved populations rather than for the programs' financial support; and

- Serving in a rural health facility, mental health or substance abuse treatment facility, a prison, or "other" type of facility.

Factors relating to clinicians' satisfaction with work and practice, family integration into the broader community, and overall assessment of their service program explain 28.6 percent of variation across clinicians in their plans to remain in their service sites for at least two years beyond their service term and for 27.1 percent at five years (Pathman et al., 2012(b). These factors include:

- Feeling of belonging and safety within the community for the clinician and clinician's family;

- Satisfaction with the program administrator, salary, the assessment of the practice overall, and access to specialist consultation; and

- Overall satisfaction with the service program and the program staff support.

Other findings from the study regarding socio-demographic characteristics that contribute to retention are summarized as follows (Pathman et al., 2012(b)):

- Physicians and mental health clinicians are more likely to remain in their service sites than nurse practitioners, physician assistants, or dentists at five and ten years beyond the service term agreement. The anticipated retention rate among dentists increases over time relative to other disciplines, and matches that of physicians and mental health practitioners 10 years post service terms.

- Clinicians who are older than 29 years, non-Hispanic White, have children, and grew up and/or trained in the state where they serve are more likely to anticipate remaining in their service sites than younger, minority, childless, and out-of-state clinicians. Anticipated retention was not found to be associated with gender or marital status.

- Clinicians primarily motivated by the financial support aspect of program are less likely to anticipate remaining in their service sites over time. Those in the NHSC LRP are more likely to rate their desire to serve underserved populations as an equal or higher motivation than financial assistance, compared to SP or state program participants.

- Variation in satisfaction with the NHSC Loan Repayment Program exists among states. Participants in California and Kentucky are more likely to report having their expectations exceeded, while those in North Carolina, North Dakota, and Nebraska are more likely to report that their expectations were not met.

- Rural versus urban location of practice site was not statistically significantly associated with anticipated retention among participants. However, rural/urban differences in retention were found for specific states. For example, NHSC LRP participants serving in rural counties of Kentucky and Nebraska show higher anticipated retention than LRP clinicians in urban counties of their states.

- Also, anticipated retention rates among rural participants of New Mexico's state loan repayment program are higher than for peers serving in the urban counties of that state. Conversely, anticipated retention in many other state programs, such as the Alaska support-for-service program, is higher in urban counties than rural counties.

- The following factors are consistently associated with higher anticipated retention rates: overall satisfaction with the practice, having a satisfactory relationship with the practice administrator, salary and income, and access to specialist consultation for patients.

- Retention is more likely among clinicians who report a greater sense of clinician/family fit with the community.

- NHSC Loan Repayment Program clinicians report higher average satisfaction with their work and practices than NHSC Scholarship Program participants. Minimal variation of this finding was seen across the 11 states studied.

- Rates of anticipated retention are higher for those serving in rural health centers, prisons, and mental health and substance abuse facilities than in FQHCs, Indian Health Service sites, or tribal sites.

- Higher proportions of clinicians working in hospital-based clinics anticipate remaining in their sites over time than those working in any other type of site.

A recent Lewin Group report (2014) examines retention rates and trends of medical providers participating in the National Health Service Corps (NHSC) scholarships and loan repayment incentive programs between 2000 and 2013. The analysis focused on medical providers serving in Health Professional Shortage Areas (HPSAs) throughout the United States. The report compared the retention rates in HPSAs between providers that participated in the scholarship and loan repayment programs to those that did not participate. The study found that NHSC programs increase provider years in HPSAs. Precisely, 49% of primary care NHSC participants were located in the same HPSAs after one year of obligation completion and 35% of the participants were located in the same HPSAs after six years after obligation. NHSC defines provider retention on a yearly basis within the original service or HPSA site. The previous route to measure retention taken by HRSA's Bureau of Health Workforce used the time between the completion of the last service contract and the date of departure from the site.

Ullrich et al (2013) investigated the participants in the Primary Care Incentive Program. The authors used the National Provider Identifier files to identify how many physicians declare their specialty to be one of the types of primary care specified in the ACA. The authors determined the practice location using the ZIP codes from the NPI data and classified the corresponding Rural Urban Commuting Area (RUCA) code. Both the number and proportion of providers eligible to receive Primary Care Incentive Payments in 2011, 2012, and 2013 increased during the years used to determine eligibility (2009, 2010, and 2011). For most practice types, rural providers were more likely to be eligible for Primary Care Incentive Payments. However, rates of eligibility varied between provider types. Rural Family Practice physicians were less likely to be eligible for

Primary Care Incentive Payments than their urban counterparts. The study found that Family Medicine physicians were more likely to be eligible for the PCIP than were all other primary care provider specialties in almost all practice locations.

Analyzing the same program, Shane et al. (2013) use Medicare claims data from 2009 to estimate the percent of rural medical providers, primary care physicians and non-physician practitioners, who qualify for payments under the Primary Care Incentive Payment Program. Under this program, if certain management services represent 60% or more of Medicare allowable charges, then the provider qualifies for a 10% bonus calculated on the primary care portion of allowable charges. The study estimates that more than 70% of the rural providers would qualify for these payments. The authors follow CMS's guidelines to calculate a provider's primary care percentage, which excludes emergency, hospital, inpatient, and drug/laboratory charges from the total allowable charges. The study randomly selected primary care physicians (PCPs) and non-physician practitioners (NPPs) and categorized all providers geographically based on Rural Urban Commuting Area codes which resulted in large rural, small rural, and isolated rural categories for these providers. The resulting provider list included just over 1,000 providers for which the authors obtained the respective 2009 claims data. The authors then analyzed the services provided by the PCPs and NPPs to calculate the potential incentive payments by each rural category. On average, incentive payments under the Primary Care Incentive Payment Program were approximately $8,000 for PCPs and $3,000 for NPPs. The results of the study have interesting implications for rural providers who aim to receive the Primary Care Incentive Payment program incentives. Hypothetically, a shift away from single or small practices can lead to substantial additional practice revenue. The study asserts that regional systems employing large numbers of PCPs and/or NPPs have the potential for substantial bonuses that could yield enough revenue to increase the supply of additional providers.

Performance Metrics of Provider Incentive Programs

From a conceptual perspective, the ideal measure of performance for a provider incentive program is the number of providers who would *not* have served in a high need area in the absence of the program. Or, put another way, it is the increase in the number of providers serving in the area, compared to what the number would have been without the program and its incentives. A related measure may be the amount of services supplied by providers in those areas or to underserved communities *only* as a result of the program. However, such metrics are difficult to construct in practice, because it is likely that many participating providers would have participated even without the enticement offered by the programs. Hence, one must implicitly estimate a counterfactual comparison group—the number of providers that would have been in the defined area if the program did not exist. As discussed in sections IV and V, there are a number of factors that are related to the decision to practice in a high need area, such as rural upbringing or participation in rural programs while in medical school. Frequently, such characteristics are not available to the researcher, and therefore a direct estimation of the number of additional participants as a result of the program is not feasible. A solution to this problem is to identify other measures that are easier to observe and are highly correlated with the 'true' performance metric. In past studies, a number of such measures have been proposed, such as: (i) the retention rates of participating providers in high need areas; (ii) the amount of services supplied by the participating providers; (iii) the reduction of provider shortage in a given high

need area; or (iv) the number of provider-years among participating providers. We discuss in turn each of these metrics categories below.

The definition of retention may be approached in several ways. Retention metrics may be linked to the length of retention and the times at which retention is measured. For example, retention may be measured from the first day of a clinician's service contract obligation, the day that the clinician concludes his or her initial service obligation, or the day that he or she completes the final service contract if a renewal contract was signed. Additionally, retention may be defined by location—whether the clinician remains in the same specific service site as under the service contract, remains within the same community but at a different practice location, remains within the same county or geographic region, or serving at any practice that prioritizes primary care for underserved communities (Pathman et al., 2012(b)).

NHSC typically assesses retention on the basis of the number of years remaining within either the original service site or within the same HPSA. The point in time from which retention is measured may vary, but it is worth noting that the HRSA Bureau of Clinician Recruitment and Services (BCRS) in its 2012 nationwide retention study of NHSC providers (Pathman et al., 2012(a)) opted to measure retention as the time between completion of the last service contract and the date of departure from either the index site or an alternative underserved site. The outcome of interest was the percentage of NHSC clinicians who were "still working in their NHSC service sites and within the broader set of practices that focus on care for the underserved at specific points in time after they had completed their NHSC service terms." For clinicians who apply for and are granted renewal of Loan Repayment contracts after completing their initial Scholarship Program or Loan Repayment Program term, retention was calculated from the end of their last renewal contract (Pathman et al., 2012(a)).

Retention metrics used in federal, state, academic, and other types of programs vary widely with respect to length of assessment period, and degree of geographic inclusion in the retention criteria.

Retention Metrics

For primary medical care providers and primary oral care providers, retention in NHSC was evaluated under different criteria in the currently available studies. Table B.1 below summarizes the retention metrics that were previously used in the literature. Although these metrics were used for the NHSC programs, they can be easily applied to any other provider incentive program.

Table B.1: Retention Metrics Used to Assess Effectiveness of Incentive Programs

			Time Frame		
Study/source	**Population**	**Location**	**Short-term**	**Medium-term**	**Long-term**
Pathman et al., 1992	NHSP SP physicians	(a) Remained in index site (b) Remained in index community (c) In practice in any rural county	-	Three years after initial date of employment	Eight years after initial date of employment

Study/source	Population	Location	Time Frame		
			Short-term	Medium-term	Long-term
Konrad et al., 2000	All NHSC LRP and SP clinicians	(a) Index site retention (b) Any underserved site retention	One month beyond period of obligation	One year beyond service obligation	Over four years beyond service obligation
Holmes, 2004	Physicians with a self-declared primary care specialty	(c) High underserved community (d) Moderate underserved (e) Non-US, not contiguous (f) Non-US, contiguous (g) Non-US metropolitan	-	Three to five years after graduation from medical school	Eight to ten years after graduation from medical school
Holmes, 2005	NHSC LRP and SP physicians	(a) Remained in initial community (b) Practiced in any underserved location	-	Five years from initial placement	-
NHSC, 2012	NHSC primary mental and behavioral health providers	Continued to practice in a HPSA	-	Four years after service completion	-
Pathman and Konrad, 2012	All NHSC LRP and SP clinicians	Continuing to practice in a HPSA	Up to one year	-	Ten years and beyond
Pathman et al., 2012(a)	All NHSC LRP and SP clinicians	(a) Remained in Index site (b) Worked in other practices that focus on care for the underserved	One month to one year after service completion	Two to five years after service completion	Seven to twelve years after service completion

In 2008 and 2012, extensive retention surveys were administered to NHSC providers. The 2012 survey commissioned by BCRS assessed retention in the short-term (1 month to 1 year after service terms are completed), mid-term (2-5 years), and long-term (7-12 years) (Pathman et al, 2012(a)). By contrast, NHSC employs slightly different criteria in its assessment of primary mental and behavioral health care providers. Retention for these groups of clinicians is measured as the percent continuing to practice in a HPSA four years after completion of the service term (National Health Services Corps, 2012).

In the BCRS survey, retention was assessed with respect to remaining within the same practice where the clinician served during his or her NHSC contract term, but also with respect to working in other practices that focus on serving underserved populations. This is similar to the approach taken by Holmes (2004) who, instead of defining retention solely on the basis of index site retention, as was common and remains a widespread practice, used a holistic definition of retention in underserved locations by studying both index site retention and retention in any underserved location after leaving the original service practice.

In the 2012 BCRS survey, "remaining within the last NHSC service site" was calculated as the number of months from the self-reported date of service completion until the date the clinician reported leaving the site at which he or she last served when completing the last NHSC service contract. "Working in practices that were focused on care for the underserved" was calculated from alumni's self-reported information of working in practices that focused on care for the underserved at a given point in time. Those who reported working in non-clinical positions, were in training positions, were not working at the point in time, were not working in a practice that they indicated as focused on providing care for the underserved, and were not still working at their last NHSC service site, were considered to be not working in a "practice that focused on care for the underserved (Pathman et al., 2012(a))."

The researchers who led the BCRS survey suggest that future studies of retention of NHSC clinicians would benefit from a more "clearly and consistently defined measure of the *location* of sites that qualify as successful retention outcomes (e.g., same site, any underserved site, any rural site, any 'safety net' employer, high reliance on Medicaid, etc.) as well as more focus on a consistent and meaningful measure of *duration* of retention." Further, the researchers suggested that more attention be given to the definition and benchmarking of "success," as well as the suitability of using various comparison groups (e.g., health professionals recruited to communities of similar circumstances but without a service obligation, or those working in similar settings under a state-based or other type of service obligation) (Pathman et al., 2012(b)).

In response to suggestions from the early 1990s that NHSC could enhance retention if it accepted only applicants from primary care-oriented schools, Pathman et al. (1992) sought to determine, separately for NHSC scholars and physicians not affiliated with NHSC, whether retention in rural practice may be longer for physicians who graduated from public medical schools, were trained in a community hospital-based residences, or participated in rural training programs as medical students or residents. The indices of retention used in this study were percentage of physicians who continued working in nonmetropolitan areas, and the percentage of physicians who remained in their index practices.

A distinction between retention at primary sites versus secondary sites may be important. Satellite clinical practice locations are generally located in areas apart from the main clinic in an effort to expand clinical access to patients in more remote areas. Typically, these sites have less patient volume than the main practice site, which is ultimately reflected in staffing. Retention at original service site may be low, but once retention in the site's area (or another underserved area) is taken into account, actual retention in high need areas may be higher. In fact, Lewin (2014) found that a large number of NHSC participants that leave the location in which they served while in NHSC actually move to another underserved area.

Many state-issued, institutional, or other types of programs tend to use their own retention metrics that may be more relevant to local conditions than federal metrics.   Generally, the differences lie in the length of time assessed and geographic inclusion criteria. For example, in evaluating retention in state programs, Pathman et al. (2004(a)) tracked retention at two-year intervals to measure the percentage of clinicians remaining in the index practice at discrete points in time. Of the 69 state programs operating in 1996, the average level of assistance did not differ significantly across the five types of programs reviewed (scholarships, service-option loans, loan repayment, direct financial incentives, and resident support). Four-year and eight-year retention in index practice were used as the primary metrics of retention in the study. Average minimum service term was 12 months in resident support programs, 18 months in scholarship programs, 10 months in service option loan programs, 29 months in loan repayment programs, and 36 months in direct incentive programs (Pathman et al., 2004(a)).

To assess long-term retention of graduates of the Physician Shortage Area Program (PSAP) of Jefferson Medical College, Rabinowitz (2013) defines retention for this program as the percentage of individual graduates practicing in the same rural areas in 2011 as they were initially, 20 to 25 years after they first began practice. Practice location was considered to be the same area if it was in the same rural county or an adjacent county as when the graduate was first located (Rabinowitz et al., 2013). 'Rural' was defined as counties that are not designated as standard metropolitan areas.

Other programs aimed at increasing the supply and retention of rural clinicians define retention in varied ways. For example, the term *rural* is sometimes used without further explanation, or it may refer to a non-Standard Metropolitan Statistical Area county (non-SMSA), or communities of population below a certain threshold. Oftentimes, studies use population under 25,000 or under 50,000 as a benchmark (Rabinowitz et al., 2008). The length of retention may vary across studies as well, ranging from 1 year to 25 years.

Services Supplied

Another measure of program success may be the change in the amount and type of services supplied to underserved communities or underserved areas. A study by The Lewin Group (Lewin, 2014b) found that as a result of a Medicare incentive payment the number of Medicare primary care providers increased on average by about 2.8 providers per county annually in 2010 and 2011. The Affordable Care Act includes two key provisions regarding reimbursement to primary care providers: (a) it provides a 10 percent incentive payment under the Medicare Primary Care Incentive Payment Program (PCIP) program to eligible providers; and (b) it raises the Medicaid primary care reimbursement rate at least up to 100 percent of the Medicare rate. The study also found that the number of primary care physicians with PCIP eligible specialty increased by about 10 percent in response to the 10 percent incentive payment under the PCIP policy. Also, a 7 percent increase in the number of claims for 25 minute office visits due to the PCIP policy was estimated. On the other hand, in response to the PCIP policy, there was a 9.3 percent increase in the average allowed charges (for eligible services) among primary care providers with PCIP eligible specialties. Although the analysis was program-specific, Lewin (2014b) may provide some guidance on how to approach and measure an incentive program's impact on the amount and type of services supplied in underserved areas.

Provider Shortage Reduction

In terms of metrics built around the reduction of provider shortages, Winters-Moorhead and Kooker (2008) suggest four indicators for monitoring RN shortages in Hawai'I. They construct a scorecard for monitoring and evaluating progress in addressing the shortage. This would be based on four performance indicators: capacity building, recruitment and retention, career development, and workforce analysis and development. This study uses two separate data sets to examine whether medical students and young physicians in Hawai'i follow the same pattern. A retrospective study of graduates of the University of Hawai'i John A. Burns School of Medicine from 1993-2006 was performed examining the relationship between practice location and high school attended for those practicing in Hawai'i. In addition, a survey was conducted with the first, second and third year medical students examining their practice intentions as related to where they grew up. Both data sets were analyzed using Chi Squared tests to determine the significance of associations between individuals from rural backgrounds practicing or intending to practice in rural areas. The relationship in both cases showed that students and physicians from rural areas were more likely to practice in rural areas. However, 81% of all respondents reported being willing to consider practicing in rural area, especially if lifestyle, work environment, and employment opportunities were favorable.

Number of Provider-Years

The program performance metric that would arguably not be confounded by other unobservable factors is the additional number of providers the program attracts over and above the number of providers (or provider-years) serving in an area if the program were not in effect. Analyzing the impact of NHSC, Holmes (2004) estimated that if NHSC tuition subsidies were to be increased by $5,000 per enrollee, the funds would yield a 1.7 percent increase in the long term (post-service) physician supply over current physician supply in highly underserved communities. Also, he estimated that a 10 percent increase in NHSC LRP would yield a 1 percent increase in the long term post-service physician supply over the current physician supply in highly underserved communities.

Lewin (2014) provides a simulation of a conceptual framework in which the decision of an individual provider to move to a HPSA or a non-HPSA location is a function of the wages in each of the two locations, loan repayment amount (available only in a HPSA location), an average of the (unobservable in practice) preference for each of the two locations, standard deviations of these preferences and a standard deviation of random shocks that influence the provider's location decision. Under a number of scenarios in which the values of these parameters are allowed to vary, the simulations translate the transition probabilities from one location to another in terms of additional provider-years in underserved locations that are generated purely by the program.

Appendix C – Conceptual Framework and Technical Details

A Stylized Model of the Provider's Location Choice

In our conceptual framework, the value of each location (i.e, rural or non-rural) has three components. The first component is the value that the individual places on the non-pecuniary factors associated with living in the location (climate, environment, local amenities and so on). The second component accounts for the pecuniary value of the location and has two parts: (1) the individual's current period wage in the location and (2) the discounted value of expected future utility including wages if the individual chooses the location in period *t+1*. The third component consists of a completely random, period-specific location shock that is unrelated to the individual's preference for the location. This shock accounts for the net impact of unobservable factors that might induce individuals to choose a location they dislike or leave a location they like. Any number of factors might have period-specific (i.e., temporary) effects, including birth of a child, an illness, and death of a parent who was living elsewhere.

Incentive programs have the effect of increasing the value of moving to a rural area, all else constant. If the value an individual provider places on serving in a rural area is higher than serving in a non-rural area, then that provider is likely to choose a rural location even in the absence of the incentive. Awards made to these providers are unnecessary payments, in the sense that these awards do not change the providers' behavior in a way that is consistent with the purpose of increasing the amount of medical services provided to patients in rural areas of the state. In economic parlance, these providers receive "economic rents".

However, other providers have a value for serving in a rural area that is lower than the value associated with serving in a non-rural area. In particular, these are providers who, all else constant (i.e., same pecuniary aspects and random shocks) have on average a negative preference (i.e., non-pecuniary factors) for serving in a rural area. If the value of the incentive program is sufficiently large to compensate for the negative preference for rural areas, then the provider may be induced to serve in a rural area. These are providers who are the "margin", as they can be convinced to locate and serve in a targeted area as a result of the programs.

Calculating the Full Effect of Programs

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:

$$T = \Delta P \cdot \tau_r + (P_p - \Delta P) \cdot (\tau_{r,p} - \tau_{r,np}) \qquad (2)$$

The first term in equation (2) 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 rural areas, 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 rural areas 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. If these additional providers have higher retention rates in rural areas, that would translate into a larger value for τ_r, hence increasing the FTE-years in rural areas, as well as the overall effect of the program, T. Also, note that in the case of programs with an obligation period, τ_r includes time spent in rural areas during, as well as after, the obligation period. In

practice, the upper bound of the timeframe for which we have observations will be four years. Hence, we are likely to underestimate the additional FTE-years obtained, as τ_r is the lower bound of the average time spent in rural areas by the ΔP providers.

The second term in equation (2) measures the retention effect of the program in terms of the annual provider FTEs in rural areas, by multiplying the number of program participants who would have gone to rural areas even in the absence of the program, $P_p - \Delta P$, with the difference in the average time spent in rural areas by program participants and non-participating providers, $\tau_{r,p} - \tau_{r,np}$. If the average time in rural areas of program participants, $\tau_{r,p}$, is larger than the average time in rural areas of non-participants, $\tau_{r,np}$, then the program appears to increase retention in rural areas. The term P_p indicates all program participants, including both providers attracted by the program as well as providers who would have gone to rural areas without the program. As discussed in the previous chapter, the former category consists of providers who would not have served without the program (i.e., ΔP), while the latter group is of providers who accrue economic rent (i.e., $P_p - \Delta P$). Of course, a higher value for $\tau_{r,p}$ increases the retention effect, as well as the overall effect of the program, T. In practice, we cannot determine which individual provider belongs to one category or the other in our data, and therefore we assume for simplicity that $\tau_r = \tau_{r,p}$.[30] As in the case of the recruiting effect, the short timeframe that was available for this study is likely to generate a lower bound estimate for both $\tau_{r,p}$ and $\tau_{r,np}$.

It is interesting to note that, all else constant, if more providers are induced to locate to rural areas only as a result of the program (i.e., ΔP increases), the recruiting effect generated by these providers would increase. However, the retention effect would mechanically decline since the number of individuals accruing economic rent $(P_p - \Delta P)$ decreases. The net effect on the overall program effect, T, is determined by whether the recruiting effect dominates the retention effect. Given the estimates presented in Tables II.1-II.3 and in Table II.8, which appear to indicate a higher retention of program participants than that of non-participant (i.e., $\tau_{r,p} - \tau_{r,np} > 0$), it is unlikely that the retention effect dominates the recruiting effect. This is a relevant issue, as it may indicate which aspect of the program should be targeted by policy makers in order to increase the number of provider services in rural areas. We return to this discussion later on, but for now we turn our attention to the calculation of T for each program and for each provider type. In the next two sections we provide an example of how we calculate the full program effect using the retention analysis and the regression estimates from the previous two chapters.

Regression Analysis

The coefficient on program participants in program j, α_j, provides an estimate of the effect of the program on adding providers to targeted areas.

Let P_{it} be the number of providers in area i during time period t. We can then write:

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[30] A recent study by Negrusa, Ghosh and Warner (2014) actually finds evidence that the retention of NHSC providers in HPSAs after the end of their obligation is lower than the retention of non-participating providers. They attribute this difference to the lower preferences NHSC participants may have on average for serving in high need areas than non-participants who served in those areas without the program (https://aspe.hhs.gov/pdf-report/provider-retention-high-need-areas).

$$P_{it} = X_{it}' \cdot \beta + \alpha_j \cdot P_{ijt}^p + u_{it} \tag{1}$$

where X_{it} is a vector of characteristics of area i at time t, β is a vector of coefficients, and u_{it} is a random error term. If the characteristics X_{it} can explain the number of providers across the different geographic areas, then the expected number of providers in area i and in period t is equal to the expected value of P_{it}, $E(P_{it})$. We also include in equation (1) a variable indicating the number of providers who are program participants in program j in area i and in period t, denoted by P_{ijt}^p.

Also, as 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 target area, plus those who stay in the area from one year to the next), we include two lagged terms of the number of providers and two lagged terms of the number of participating providers. As a result, in Table III.1 we aggregate the coefficients on the current period program participants with the coefficients on the lagged terms of the participants variables to obtain cumulative effects of program participation on the current stock of providers.

Moreover, for each of these two provider types we estimate, respectively, a model in which we include the count of participants in any Oregon program, a model in which the number of Oregon participants is broken into the number of participants in the larger state programs, and finally a model in which we include the number of Oregon participants in a longer list of state programs, including the J1 Visa Waiver and the state loan repayment programs. In all these models, we include the count of NHSC participants with its lags, as well as two lagged values of all the state program participants.

As robustness checks, we also estimated a large number of alternative model specifications: with and without lags, with just one lag, lags for the provider and no lags for participants, lags for participants and no lags for providers, with time trends, without time trends, with year dummies, without year dummies. We also estimated first-difference models in which the dependent variable is the change in the number of providers over two consecutive years, and the main covariates are changes over time in the number of Oregon and NHSC participants, respectively. Finally, we estimated models in which the outcome variable and the independent variables of interest are expressed in terms of provider-per-population measures. In some cases, these models attribute implausible changes in the number of providers to the number of program participants, mainly because it does not allow for a delayed effect as we did in the models in Table III.1. In other specifications, the estimates are not different from the ones in Tables III.1 and III.2.