AIR Opportunity Fund: Impact of Primary Care Health Professional Shortage Area Designation on Provider Supply

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Summary

Improving primary care access and quality is essential to reducing health disparities because primary care is the main point of direct contact for patients with the greater health care system and is a key component of preventive care.[1]

In 2018, the Health Resources and Services Administration (HRSA) estimated that the 256,220 full-time equivalent primary care physicians in the United States fell nearly 17,000 short of meeting the national demand for primary care, and by 2030 the shortage is predicted to exceed 32,000 physicians. Current and predicted shortages of primary care providers are unevenly distributed across the United States, resulting in wide variation in the availability of primary care and leaving many rural areas significantly underserved.[2]

To alleviate the shortage of primary care providers in counties, HRSA and state primary care offices (PCOs) work together to designate counties as primary care Health Professional Shortage Areas (pcHPSAs) and to offer financial and immigration visa incentives to providers, especially primary care physicians, who practice within these designated counties. In 2021, there were a total of 838 entire county (full) pcHPSAs in the 50 states and the District of Columbia (of 3,148 total counties). More than 83 million people currently live in full or partially designated pcHPSAs, accounting for more than a quarter of the U.S. population.[3] These counties also tend to exhibit other social determinants of health associated with reduced access to care such as poverty, rurality, unemployment, and high proportions of residents of color.[4]

Key Findings

- There is a significant unmet need for primary care in the United States.
- Demand is predicted to continue to outpace the supply of primary care physicians.
- HRSA designates counties as full or partial primary care Health Professional Shortage Areas (pcHPSAs) and provides monetary incentives for providers, especially physicians, to serve the pcHPSA county populations.
- Full pcHPSA designation is associated with a significant increase in the population-adjusted physician rates in rural counties (compared with rural non-pcHPSA counties) starting 3 years after designation. Designation led to an average of **5.4 additional** physicians in rural pcHPSA counties after 7 years.
- Significant and similar increases in population-adjusted advanced nurse practitioner rates were not found in rural pcHPSAs.

[i] Dajun Lin was initially involved in the project, from January 2022 to September 2022.

In this study, we examine the impact of full pcHPSA designation on provider supply and assess whether the financial and immigration visa incentives are effective in attracting primary care providers to practice in designated counties. Because the United States forecasts an even greater shortage in primary care providers, it is important from a policy perspective to consider whether the current pcHPSA designation program is effective in (a) attracting primary care providers to practice in shortage areas, (b) increasing primary care utilization for individuals with health insurance coverage, and (c) improving health outcomes for residents in shortage areas. We find that a full pcHPSA designation is associated with an increase in the population-adjusted primary care physician rates in rural counties (compared with rural non-pcHPSA counties) starting 3 years after designation. We do not observe a similar increase in population-adjusted physician rates in nonrural full pcHPSA counties (compared with nonrural non-pcHPSA counties) or when comparing all full pcHPSA counties with all non-pcHPSA counties; this suggests that the incentives provided by the pcHPSA designation are not equally effective in all counties. It is unclear if the incentives offered are ineffective in nonrural pcHPSAs or if the lack of impact observed in nonrural pcHPSAs could be due to an insufficiently similar comparison group or a lack of statistical power.

Primary Care Health Professional Shortage Area Designation Process

Prior research shows that better access to primary care, usually measured by higher primary care provider density, improves a broad range of health outcomes.[5,6,7,8,9] However, HRSA predicts that the United States will face a shortage of 20,000 primary care providers by 2025.[10]

HRSA defines a pcHPSA as a geographic county, a population group (e.g., Medicaid-eligible population in a county), or a health care facility. Counties must apply for pcHPSA designation through the state PCOs. The application needs to include relevant county-level information to confirm eligibility based on a pcHPSA score. HRSA determines the threshold pcHPSA score annually and uses (a) the population-to-primary-care-provider ratio, (b) the percentage of population below 100% of the federal poverty level, and (c) the travel time to the nearest source of care outside the designation.[11]

Once counties or subcounty areas are designated as pcHPSAs, primary care providers choosing to practice in the pcHPSA counties and provide services to the local community are entitled to federal incentive programs. The most significant are (a) the National Health Service Corps (NHSC) scholarships and repayments of up $50,000 in student loans; (b) the J-1 visa waiver program, which waives the visa-processing steps and fees for international physicians who want to continue to practice in the United States post-residency; and (c) the Medicare bonus payments to physicians for care they deliver to Medicare beneficiaries.[12] While NHSC scholarships and repayments are applicable to physicians and other health practitioners (e.g., physicians assistants and nurse practitioners), J-1 visa waiver and Medicare bonus payments are reserved for physicians.

A geographic area, such as county, can have a full or partial pcHPSA designation. A county where the population-to-primary-care-provider ratio meets a specified threshold—3,500 people for every full-time primary care physician—is designated as a full pcHPSA, whereas a county where only a part of the population exceeds the population-to-provider ratio is designated as a partial pcHPSA.[13] In this study, we particularly focus on full pcHPSAs because we have data on population and provider counts at the county level instead of the subcounty level. To assess the impact of the partial pcHPSA designations, we would need subcounty-level population and provider counts pre- and post-designation that align with the geographic area designated as a partial pcHPSA or otherwise risk obtaining unreliable effect sizes for partial pcHPSAs. State PCOs annually assess needs in the state, determine areas that are eligible for HPSA designation, and submit designations. HRSA decides on final designation status.

It is important to determine if the HPSA designation program is adequate for incentivizing primary care professionals to provide services to the population residing in the pcHPSA counties or if additional incentives—or an overall HPSA program redesign—is necessary to mitigate primary health care shortages.

Data

We used the HRSA Area Health Resource File (AHRF) data for information on pcHPSA designations for full, partial, and non-pcHPSA counties between 2010 and 2019. In addition, we used HRSA's AHRF data (based on the American Medical Association Physician Master files) for county-level counts of

- primary care physicians (includes nonfederal doctors of medicine [MDs] and doctors of osteopathic medicine [DOs]) for general practice, family medicine, general internal medicine, general pediatrics, and obstetrics/gynecology and
- advanced practice nurses (APNs).

To account for variation among counties over time, we also included a variety of county-level characteristics based on the following publicly available data sets:

- Integrated Public Use Microdata Series National Historical Geographic Information System data, to capture total population, percentage female, minority race/ethnicity, age categories, percentage foreign born, and percentage female-headed households at the county level.
- Economic Resource Service data from the U.S. Department of Agriculture (USDA), Small Area Income and Poverty Estimates data from the U.S. Census Bureau, and Local Area Unemployment Statistics (LAUS) data from the Bureau of Labor Statistics, to capture the rural–urban continuum, median household income, unemployment rates, and poverty rates.
- Small Area Health Insurance Estimates program files from the U.S. Census Bureau to obtain county-level health insurance coverage rates.

Full pcHPSA Designations Between 2010 and 2019

Exhibit 1 shows that between 2010 and 2019 there was a decline in the number of counties designated as full pcHPSAs. Of the 2,156 total counties in the United States for which we had information about pcHPSA status,[ii] 779 were full pcHPSA counties in 2010 and 340 were full pcHPSA counties in 2019. Most of the full pcHPSA counties in the East Coast, West Coast, and Southwestern United States were redesignated from full pcHPSA to partial pcHPSA status. Designation status of full pcHPSA counties in the Southern United States did not change. Part of the decline in full pcHPSAs can be attributed to the Shortage Designation Modernization Project (SDMP) as part of the Patient Protection and Affordable Care Act (ACA),[iii] which was implemented in 2014.[iv] [14]

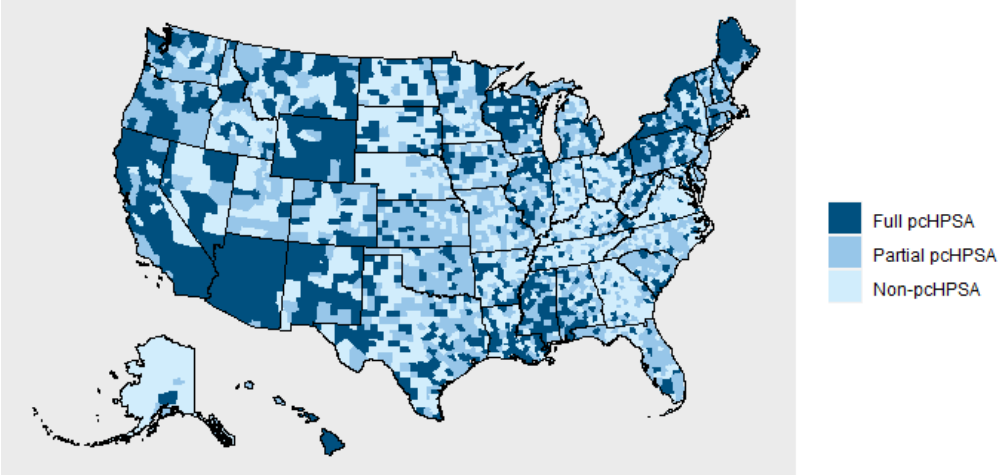
[ii] We restricted the number of counties to those for which we had consistent pcHPSA status information from 2010 to 2019 as well as information on outcomes and county characteristics.

[iii] A prior study[14] found that (a) after 2014 the country saw a large decrease in the number of counties with full pcHPSA designation and a concurrent and comparable increase in the number of counties with partial pcHPSA designation; (b) for full pcHPSA counties, the population-to-primary-care-provider ratio increased from around 2,500 to 1 before 2014 to around 3,500 to 1; (c) for partial pcHPSA counties, the population-to-primary-care-provider ratio stayed consistent at below 2,000 to 1 throughout the decade.

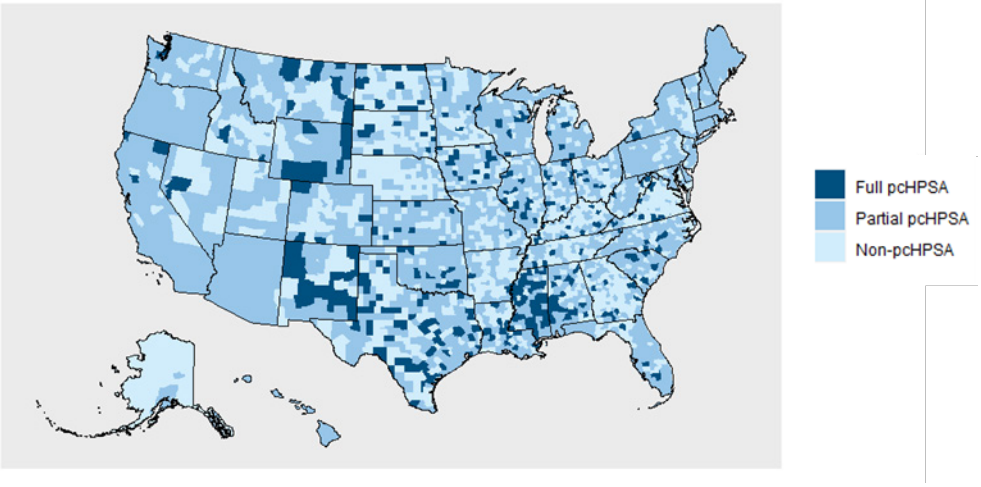
[iv] Prior to the ACA, there were 673 full pcHPSA counties in 2013, and there were 349 full pcHPSA counties in 2015, after the implementation of the SDMP as part of the ACA in 2014.

Exhibit 1. pcHPSA Designation, by County, in 2010 and 2019

2010:



2019:



Note. The heat maps account for full, partial, and non-pcHPSAs for 2,156 total U.S. counties with pcHPSA status information. From HRSA Area Health Resource File.

Treatment and Comparison County Assignment

To rigorously evaluate the impact of full pcHPSA county designations on primary care provider counts, we compare population-adjusted primary care physician and advanced nurse practitioner counts before and after the treatment (pcHPSA designations) in full pcHPSA counties (treatment group) to non-pcHPSA counties, which did not receive the treatment, over the same time period (comparison group). We limited the treatment group to counties that were designated as a full pcHPSA on or after 2012 to ensure a sufficient number of pre-designation observations. As a result, of 930 counties with a full pcHPSA designation at any time between 2010 and 2019, we only consider the impact of pcHPSA

designations on 128 counties. To reduce any potential noise and bias in our results, we dropped the remaining 802 counties from the analysis. In addition, we excluded counties with a partial pcHPSA designation from the treatment group because (a) a number of counties were designated initially as full pcHPSAs prior to redesignation to partial pcHPSA status between 2012 and 2018 and (b) for the counties redesignated as partial pcHPSAs from non-pcHPSA status between 2012 and 2018, the impact might not be robust when examining outcomes at the county level. Counties with non-pcHPSA designation (398 counties) were included in the comparison group as long as they had not been designated as full or partial pcHPSAs at any point between 2010 and 2019. To limit any potential bias in our study from the SDMP, we only considered the impact of designation in counties that were designated full pcHPSAs from 2012 onward. In addition, we ensured that counties designated full pcHPSAs in 2012 or 2013 were not redesignated as partial pcHPSAs because of the SDMP in 2014.

Exhibit 2 shows that the number of years a county was exposed to the treatment (full pcHPSA designation) varied from 7 years (for the 46 counties that were designated full pcHPSAs in 2013) to 1 year (for the 20 counties that were designated full pcHPSAs in 2018). On average, counties in the treatment group had 4 years of post-designation yearly observations.

Exhibit 2. Exposure of Full pcHPSA Designation Treatment for Treatment Counties, by Treatment Cohort

Year	Cohort 1	Cohort 2	Cohort 3	Cohort 4	Cohort 5	Cohort 6	Cohort 7	Total full pcHPSA counties
2010	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	0
2013	46	0	0	0	0	0	0	46
2014	46	26	0	0	0	0	0	72
2015	46	26	6	0	0	0	0	78
2016	46	26	6	5	0	0	0	83
2017	46	26	6	5	12	0	0	95
2018	46	26	6	5	12	13	0	108
2019	46	26	6	5	12	13	20	128

Note. We only include counties that were assigned a full pcHPSA designation between 2012 and 2018 as part of the treatment group. Counties were assigned to treatment status in year $t + 1$ if they received full pcHPSA designation in year t. From Area Health Resource File.

Comparing County Characteristics

Observable county characteristics among full pcHPSAs and non-pcHPSAs are compared in Exhibit 3. As the exhibit shows, treatment counties were significantly more likely to (a) have a higher uninsured rate among the 18- to 64-year-old population (17.4% vs. 15.7%), (b) have a higher poverty rate (15.9% vs.13.2%), (c) be rural (13.3% vs. 3.5%), (d) have more urban counties (59.4% vs. 48.6%), (4) have a larger Hispanic population (9.7% vs. 8.4%), and (e) have a larger elderly population (17.5% vs. 16.4%).[v] In addition, treatment counties had a significantly lower White, non-Hispanic population (82.6% vs. 84.2%) and a lower population of female residents (50.0% vs. 50.6%). To address these differences, we included the observable county characteristics as covariates in a regression model when estimating the impact of the designation on population-adjusted provider rates.

Trends in Primary Care Physicians and Advanced Practice Nurses

First, we present trends in county-level, population-adjusted rates for two types of health care providers of primary care services—primary care physicians and APNs. We present health care provider counts for counties that were designated full pcHPSAs at any point between 2012 and 2018 (pcHPSAs) separately from counties that were not designated full or partial pcHPSAs between 2010 to 2019 (non-pcHPSAs).

Using population-adjusted provider rates between 2010 to 2019, Exhibit 4 shows that the 128 pcHPSAs had a lower average population-adjusted physician rate than the 398 non-pcHPSAs (0.96 vs. 1.43 physicians per 1,000). Similarly, the average population-adjusted APN rate is lower in pcHPSA counties than in non-pcHPSA counties (0.46 vs. 0.70 APNs per 1,000). The trends in population-adjusted physician rates were relatively static in both pcHPSAs and non-pcHPSAs. The population-adjusted APN rate increased sharply between 2010 and 2019 in both pcHPSAs and non-pcHPSAs, suggesting a secular trend of growing APN counts in all counties regardless of pcHPSA designation status.[15] Despite the increasing trends in APN rates in both pcHPSAs and non-pcHPSA, pcHPSAs continued to have a consistently lower average APN rate each year.

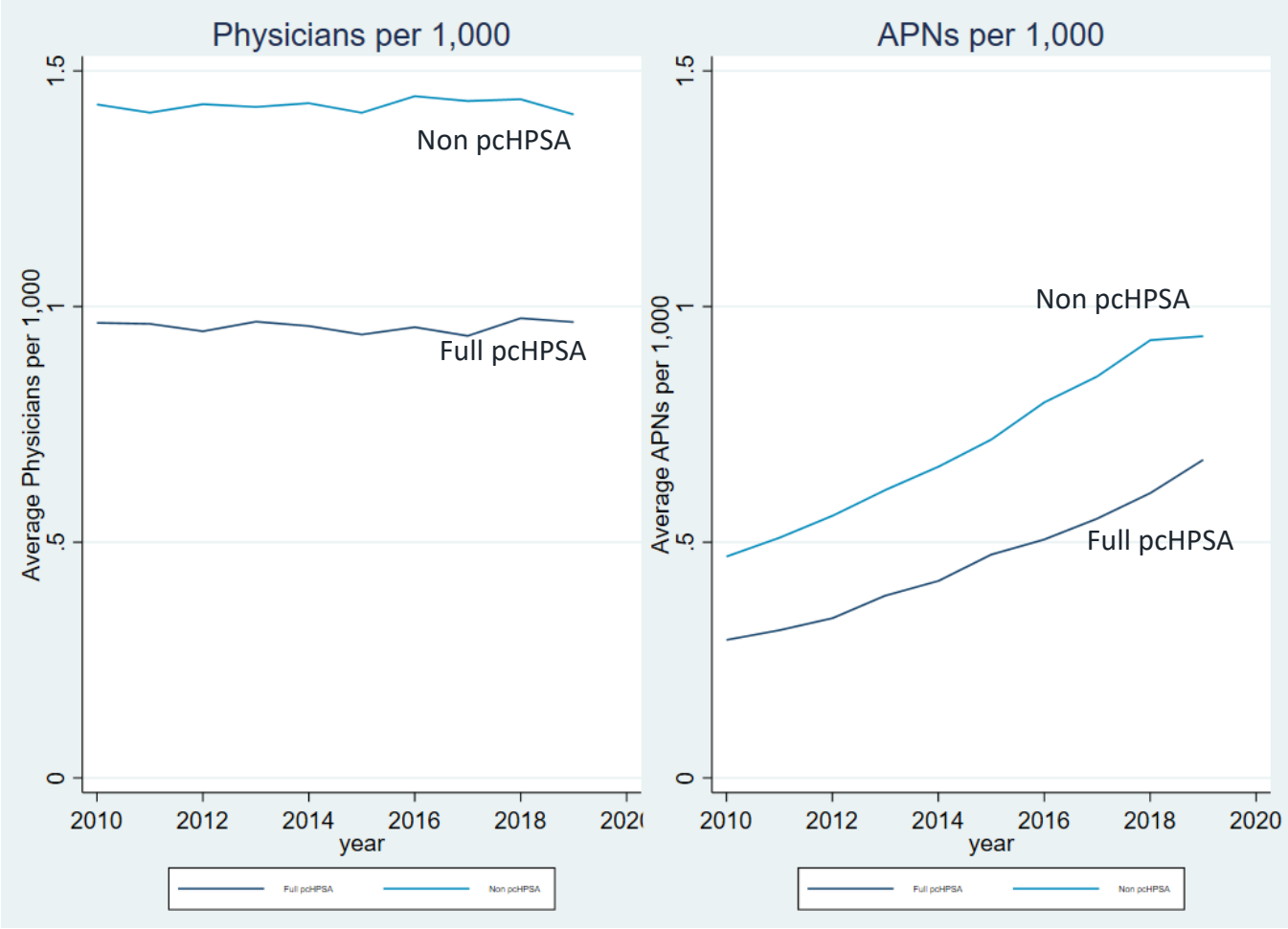
[v] We define counties as rural if they were assigned a Rural–Urban Continuum Code of 7 (urban population of 2,000 to 19,999 not adjacent to a metro area) to 9 (completely rural, or less than 2,500 urban population not adjacent to a metropolitan area).

Exhibit 3. County Characteristics, by Treatment Status

County characteristics	Full pcHPSA counties (treatment)	Non-pcHPSA counties (comparison)	Difference (percentage points) and statistical significance
Unemployment rate	6.1%	5.9%	0.002*
Uninsurance rate (18- to 64-year-olds)	17.4%	15.7%	1.7***
Poverty rate	15.9%	13.2%	2.7***
Rural counties	13.3%	5.0%	8.3***
Percent urban counties	59.4%	48.6%	10.8***
Metropolitan counties	34.4%	59.7%	-25.3***
Black population	7.7%	7.4%	0.3
Hispanic population	9.7%	8.4%	1.3***
White, non-Hispanic population	82.6%	84.2%	-1.7***
Female population	50.0%	50.6%	-0.6***
Population 65 and older	17.5%	16.4%	1.1***

Notes. Percentage of county population under the poverty level, percentage of county population uninsured, percentage of county population female, percentage of rural counties, uninsured rate, and racial composition in full pcHPSA counties are based on 128 counties. Percentage of county population under the poverty level, percentage of county population uninsured, percentage of county population female, percentage of rural counties, uninsured rate, and racial composition in non-pcHPSA counties are based on 398 counties. * $0.05 \leq p < 0.10$. ** $0.01 \leq p < 0.05$. *** $0 \leq p < 0.01$.
Adapted from Area Health Resource File, USDA Rural Urban Continuum Codes, Small Area Health Insurance Estimates, and U.S. Census Bureau Annual County Resident Population Estimates (April 2010 to July 1, 2019).

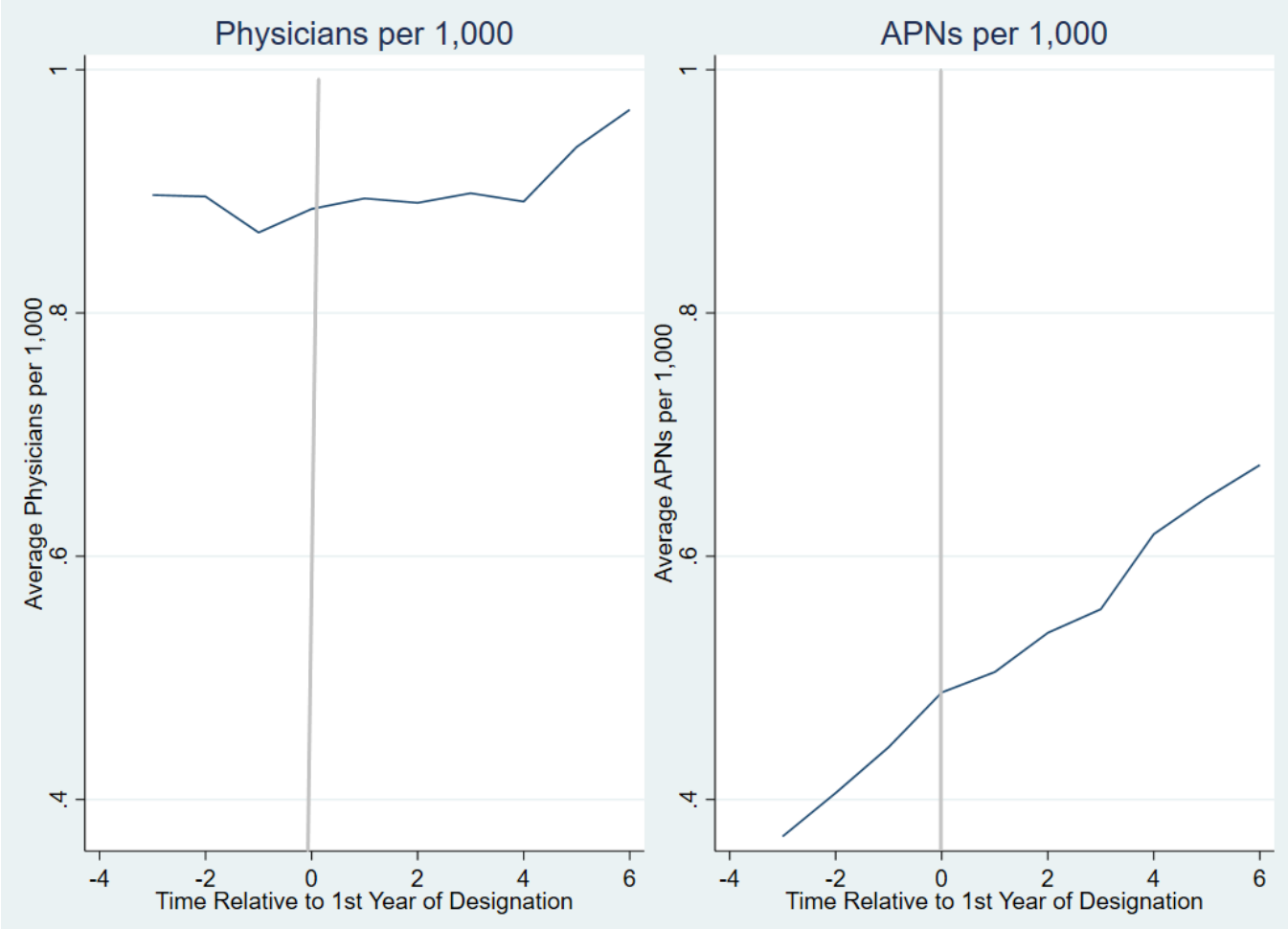
Exhibit 4. Trends in County Population-Adjusted Primary Care Physicians and APNs per 1,000, by pcHPSA Status



Note. APN = advanced practice nurse. Full pcHPSA counties consisted of 128 total counties that were designated as full pcHPSA at any time between 2012 and 2018. Non-pcHPSA counties consisted of 398 total counties. Physicians included doctors of medicine (MDs) and doctors of osteopathic medicine (DOs) for general practice, family medicine, general internal medicine, general pediatrics, and obstetrics/gynecology. From Area Health Resource File.

Within the treatment group, not all counties are designated as pcHPSAs in the same year. Therefore, in Exhibit 5, we present population-adjusted provider rates for pcHPSAs in relation to the year after being designated (relative time set to 0). Relative to the physician rate in pcHPSAs in the first year of designation, the population-adjusted physician rate in pcHPSAs has increased, especially after 4 to 5 years after designation (from 0.89 per 1,000 in the year after pcHPSA designation to 0.97 per 1,000 six years later). In contrast, APN rates have consistently increased prior to and after the first year of designation at almost the same trajectory, suggesting that the designation policy may not have played a substantial role.

Exhibit 5. Trends in County-Level Primary Care Physicians and APNs per 1,000 in Full pcHPSA Counties



Note. APN = advanced practice nurse or nurse practitioner. Full pcHPSA counties were 128 total counties that were designated as full pcHPSAs at some point between 2012 and 2018. Non-pcHPSA counties consisted of 398 total counties. Physicians included doctors of medicine (MDs) and doctors of osteopathic Medicine (DOs) for general practice, family medicine, general internal medicine, general pediatrics, and obstetrics/gynecology. Relative time to Year 1 of designation is set to 0 for the first year after full pcHPSA designation for the county. From Area Health Resource File.

Event Study Research Design

The increasing trends in the county population-adjusted physician counts does not account for differences in observable and unobservable county characteristics. Therefore, using a quasi-experimental research design, we tested the impact of full pcHPSA designation. In particular, in an event study analysis, we empirically tested whether differences in population-adjusted primary care physician and APN rates were large in magnitude and statistically significant after accounting for observable county-level characteristics and unobservable county-specific differences that did not vary over time.

Since counties were designated full pcHPSA at different points in time between 2012 and 2018, we used relative period index instead of calendar years to identify years since pcHPSA designation for different cohorts, as recommended in the literature.[16,17] This allows us to hold exposure to the treatment (pcHPSA designation) constant for different cohorts and compare cohorts. For each cohort, the first year of treatment (year after being designated pcHPSA) is the index period and is assigned a relative time value of 0.[vi] The year prior to the index period is assigned a value of -1 (year of pcHPSA designation), the year two years prior to the index period is assigned a value of -2 (1 year prior to pcHPSA designation), and so forth. Likewise, the year after the index period is assigned a value of 1 (second year after designation), the year two years after index period is assigned a value of 2 (third year after designation), and so forth. To estimate the event study regression, for each cohort we assigned the year of pcHPSA designation (i.e., relative time set to -1) as the reference period. Reference periods for non-pcHPSAs are based on the corresponding pcHPSA cohort's reference year. Therefore, for pcHPSAs in Cohort 1, if the index period (relative time set to 0) is 2013, observations from non-pcHPSAs in 2013 are used as the counterfactual. For pcHPSAs in Cohort 2, if the index period is 2014, observations from non-pcHPSAs in 2014 are used as the counterfactual.

The coefficient estimates in an event study design (estimated using ordinary least squares) measure the difference in outcomes of interest between pcHPSAs and non-pcHPSAs in the given time period relative to the difference observed in the reference period. To assess whether the research design was appropriate and whether there was a substantial impact of the full pcHPSA designation, coefficients in relative time periods -2 and -3 should be close to 0 and not statistically significant, while coefficients since designation (relative time periods 1 to 6) should be larger than 0 and statistically significant. Coefficients are not statistically significant if the confidence intervals (vertical bar lines) cross the x-axis in the event study graphs.

Results

Coefficient estimates from an event study design for all 128 pcHPSAs compared with those for the 398 non-pcHPSAs did not show evidence that the designation process had a significant impact on population-adjusted primary care physician rates after full pcHPSA designation. Prior to designation, population-adjusted physician rates in full pcHPSA counties were not significantly different from those in non-pcHPSAs. After full pcHPSA designation, differences in population-adjusted physician rates between pcHPSAs and non-pcHPSAs were not statistically significant even after a 6-year lag.

However, both the pcHPSA and non-pcHPSA samples contained a mixture of rural and nonrural counties, and results could differ according to the county type. Therefore, we conducted a subgroup analysis by separately estimating event studies for rural counties and nonrural counties.

[vi] We assign the index period 0 to the first year after pcHPSA designation.

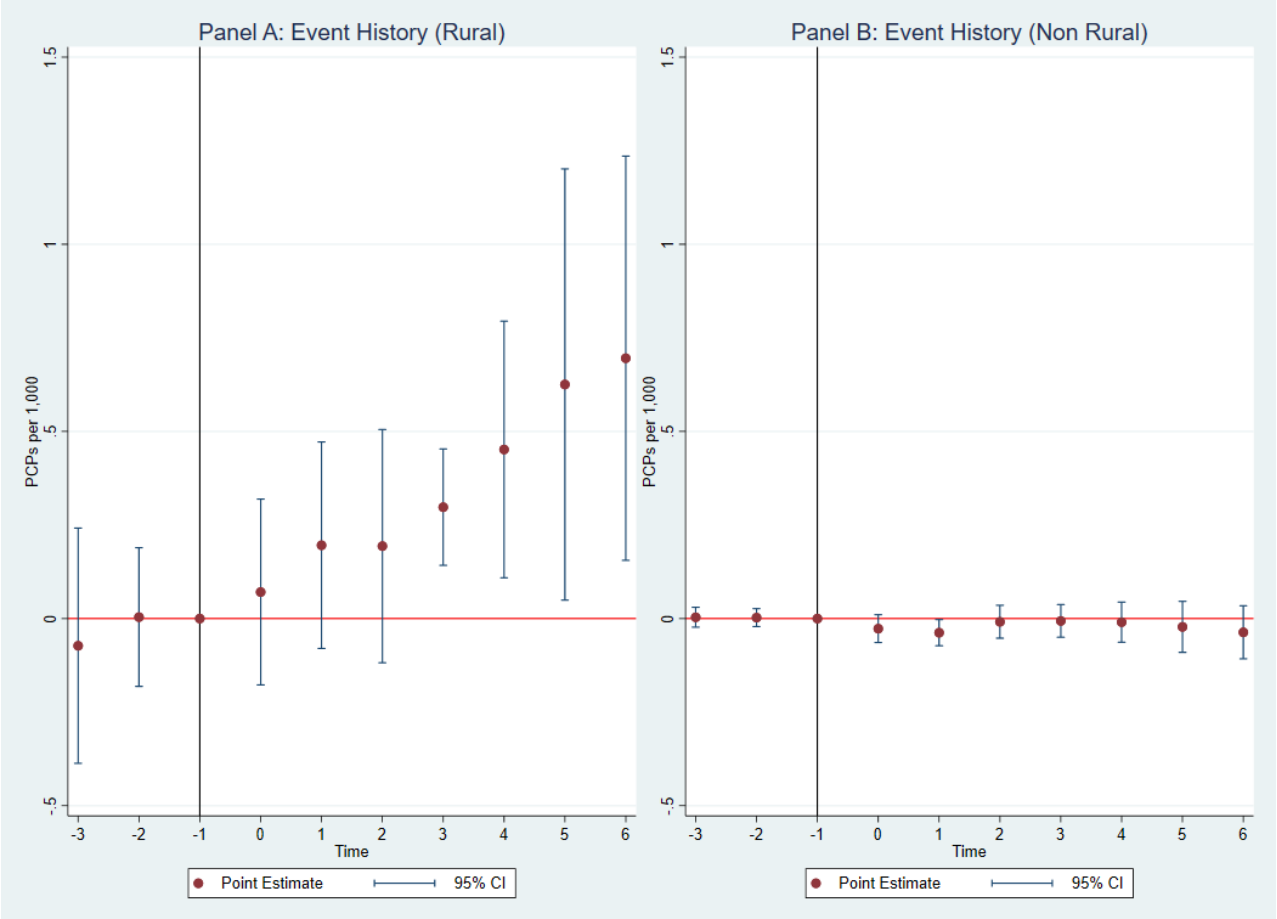
In Exhibit 6, Panel A, we present results of the event study analysis for 17 rural pcHPSAs (designated between 2012 and 2018) in comparison with 20 rural non-pcHPSAs during the same time period. In Exhibit 6, Panel B, we also present separate event study results for 111 nonrural pcHPSAs (designated between 2012 and 2018) in comparison with 378 nonrural non-pcHPSAs.

First, in the years prior to designation, the differences in primary care physician rates between pcHPSAs and non-pcHPSAs (both rural and nonrural counties) are close to 0 and not statistically significant. Second, as shown in Exhibit 6, Panel A (for rural counties only), we find that primary care physician rates significantly increased in rural pcHPSAs in comparison with those in rural non-pcHPSAs 4 years after receiving designation status; the differences were statistically significant ($p \leq 0.05$). Seven years after being designated rural pcHPSAs, these counties had, on average, significantly higher population-adjusted primary care physician rates (0.7 per 1,000). Therefore, on average, for a county population of approximately 7,700 residents, pcHPSA designation is associated with 5.4 additional primary care physicians in the county as compared to rural non-pcHPSAs.[vii]

As Exhibit 6, Panel B, shows, nonrural pcHPSAs did not experience substantial gains in primary care physician counts when compared with nonrural non-pcHPSAs.

[vii] The difference in differences (DID) estimate at relative time = 6 was 0.70. We multiplied the DID estimate by the population in rural counties the year they were designated (relative time = -1), which was 7,670. We then divided the amount by 1,000, as our DID estimate was 0.7 per 1,000.

Exhibit 6. Event Study of Primary Care Physicians per 1,000, by Rural and Nonrural Separately (Comparing pcHPSAs With Non-pcHPSAs)



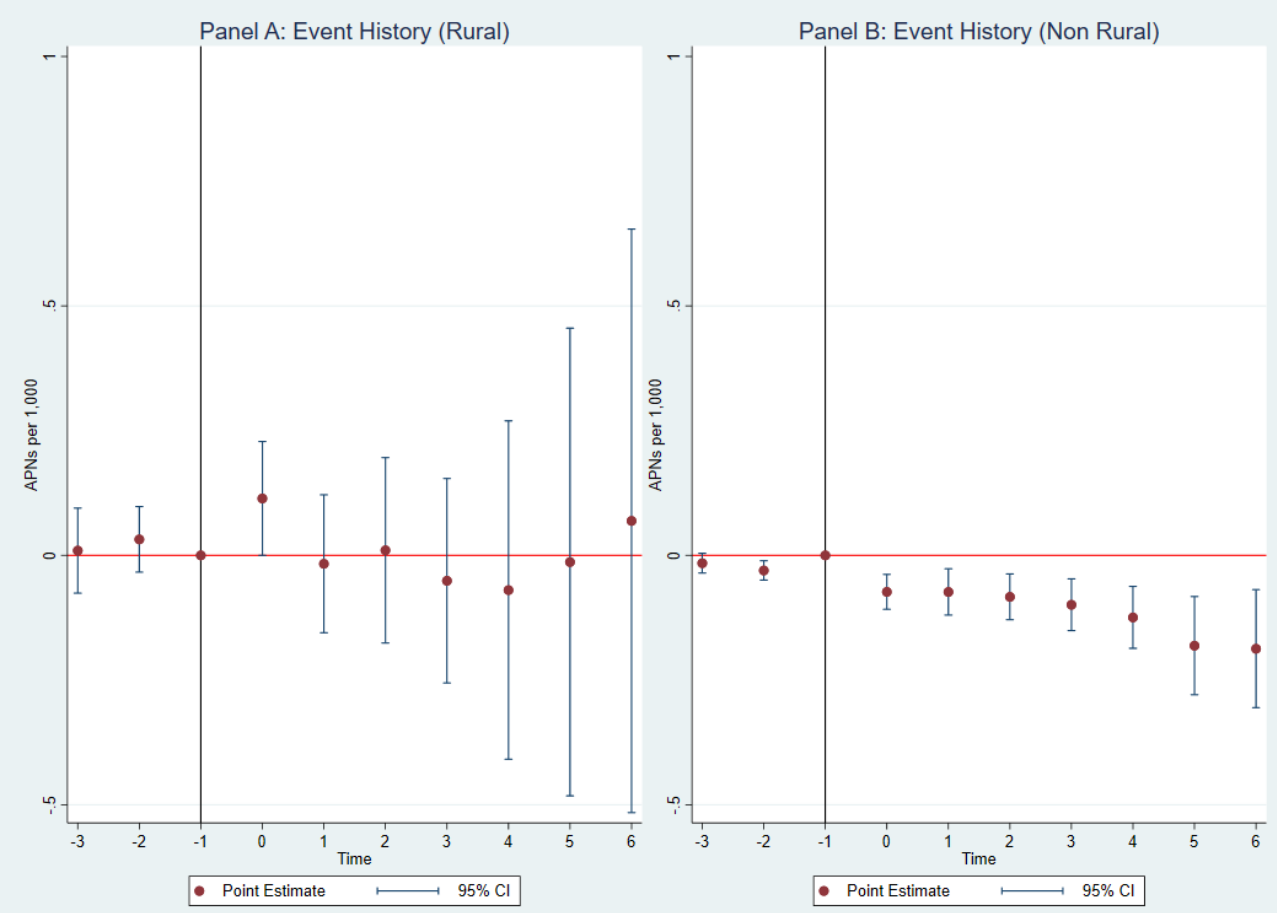
Note. PCP = primary care physician; CI = confidence interval. (a) The Panel A sample size for rural counties consisted of 262 county-by-year observations (17 counties are full pcHPSAs and 20 are non-pcHPSAs). (b) The Panel B sample size for nonrural counties consisted of 3,666 county-by-year observations (111 counties are full pcHPSAs and 378 are non-pcHPSAs). (c) Covariates in both Panels A and B included the percentage of females in the county, county unemployment rate, county uninsured rates for 18- to 64-year-olds, percentage of county population living in poverty, percentage Hispanic in the county, percentage Black in the county, percentage other race/ethnicity in the county, percentage of county population below age 20, and percentage of county population older than 65. (d) Models in Panels A and B also included county fixed effects and year fixed effects. (e) Standard errors in models in Panels A and B were clustered at the county level. (f) The reference period is the year of pcHPSA designation (time = -1). (g) Coefficient results from Times 3 to 6 are all statistically significant at the 1% significance level ($p < 0.01$) for the event study graph for rural counties (Panel A). (h) Coefficient results for Times -3 and 2 are not statistically significant ($p > 0.10$) for the event study graph for rural counties (Panel A). (i) Coefficient results from Times -3 to 6 are not statistically significant ($p > 0.10$) for the event study graph for nonrural counties (Panel B). Adapted from Area Health Resource File, USDA Rural Urban Continuum Codes, Small Area Health Insurance Estimates, U.S. Census Bureau Annual County Resident Population Estimates (April 2010 to July 1, 2019), Small Area Income and Poverty Estimates (2010–2019), and Local Area Unemployment Statistics (LAUS, 2010–2019) from the Bureau of Labor Statistics.

We also tested whether the pcHPSA designation program increased population-adjusted APN rates. While APNs are health care providers, the designation may or may not have an impact. First, HPSA program

incentives such as the J-1 visa waiver and Medicare bonus repayment programs are only for physicians. Second, even though APNs can be eligible for NHSC education loan repayment benefits as part of the HPSA program, the incentives are more substantial for physicians because of the sheer number of years they have spent in medical school and residency after obtaining an undergraduate degree.

Exhibit 7, Panel A, shows that for rural pcHPSAs, in comparison with non-pcHPSAs, the population-adjusted APN rates increased significantly (at the 5% level, with $p = 0.05$) the first year after designation (relative time set to 0). However, population-adjusted APN rates were not significantly different ($p > 0.10$) from the second year after designation (relative time set to 1–6). Also, Exhibit 7, Panel B, shows that the population-adjusted APN rates in nonrural pcHPSAs were significantly lower than in non-pcHPSAs beyond the first year after designation (relative time set to 0) and that the difference continued to widen over the years after designation (relative time set to 1–6). Note that the difference in population-adjusted APN rates between pcHPSAs and non-pcHPSAs was also significantly lower in the year before designation (relative time set to -2), signaling that parallel trend assumptions were violated.

Exhibit 7. Event Study of APNs per 1,000, by Rural and Nonrural Separately (Comparing pcHPSAs vs. Non-pcHPSAs)



Note. APN = advanced practice nurse; CI = confidence interval. (a) Panel A sample size for rural counties consisted of 262 county-by-year observations (17 counties are full pcHPSAs and 20 are non-pcHPSAs). (b) Panel B sample size for rural counties consisted of 3,666 county-by-year observations (111 counties are full pcHPSAs and 378 are non-pcHPSAs). (c) Covariates in Panels A and B included the percentage of females in the county, county unemployment rate, county uninsured rates for 18- to 64-year-olds, percentage of county population living in poverty, percentage of Hispanics in the county, percentage of Blacks in the county, percentage of other races/ethnicities in the county, percentage of county population below the age of 20, and percentage of county population older than 65. (d) Models in Panels A and B also included county fixed effects and year fixed effects. (e) Standard errors in Panels A and B were clustered at the county level. (f) The reference period is the year of pcHPSA designation (time = -1). (g) Coefficient results from Times -3, -2, and 1–6 are not statistically significant for the event study graph for rural counties (Panel A). (h) Coefficient results for Times -3 and 0–6 are statistically significant ($p \leq 0.01$) for the event study graph for nonrural counties (Panel B). From Area Health Resource File, USDA Rural Urban Continuum Codes, Small Area Health Insurance Estimates, U.S. Census Bureau Annual County Resident Population Estimates (April 2010 to July 1, 2019), Small Area Income and Poverty Estimates (2010–2019), and Local Area Unemployment Statistics (LAUS, 2010–2019) from the Bureau of Labor Statistics.

Policy Implications

Our analysis finds suggestive evidence that the incentives associated with the pcHPSA designation are effective in increasing the number of primary care physicians in underserved rural counties. We do not find evidence that the designation program increased primary care physician counts in nonrural counties, nor did we find evidence that the observed increase in population-adjusted APN rates in rural and nonrural counties could be attributed to the designation. For rural counties, our models suggest a larger lagged effect of pcHPSA designation for more than 5 years.

There are currently not enough primary care physicians to meet the demand for primary care in the United States even if they were redistributed, which means that solving the shortage is going to require an increased supply of providers.[2,18] Becoming a physician is a long process in the United States (becoming a primary care physician generally requires 4 years of undergraduate school, 4 years of medical school, and 3 to 4 years of residency).[19] Immigrants with prior medical education still have to repeat a residency (at least 3 years) to practice in the United States.[20] Therefore, any interventions aimed at substantially increasing the supply of primary care physicians will need a longer time frame. While APNs have increased during our study period (of 2010–2019), we did not find evidence that the pcHPSA designation program was associated with the increased count of APNs.

Our results suggest that pcHPSA designation is not equally effective in increasing the supply of all eligible types of providers in all types of pcHPSAs, and incentives may need to be restructured in order to address lack of access to primary care in nonrural areas. Further study is needed to understand how to improve the pcHPSA incentive structure, but it is unlikely that insufficient and unequal access to primary care physicians can be effectively solved without also taking steps to increase the number of individuals in training to provide primary care.

Limitations and Next Steps

A limitation that may be driving results, especially for population-adjusted physician rates in nonrural pcHPSAs relative to the non-pcHPSAs, is that there are differences in underlying characteristics between nonrural pcHPSAs and non-pcHPSAs. This is supported by the differences in county characteristics observed in **Exhibit 3.** A potential method to mitigate this risk is to match the full pcHPSAs to non-pcHPSAs on observable characteristics and only use a subset of full pcHPSAs and non-pcHPSAs that seem to overlap in observable characteristics. If matching is not a feasible option because only a few full pcHPSAs and non-pcHPSAs match on observable characteristics, a potential work-around would be to create a synthetic control group by assigning weights to non-pcHPSA counties so that their observable characteristics are the same as the characteristics of the full pcHPSA counties during the pre-designation period. Finally, the lack of robust results in nonrural pcHPSAs may be due to a lack of statistical power. Because of a higher population in nonrural counties, additional physicians added by the pcHPSA program may not result in significant increases in population-adjusted physician rates. Black et al. (2022) provide a potential strategy for conducting a power analysis for quasi-experimental study designs, and this strategy could help confirm whether the study is underpowered, especially when considering nonrural counties.[viii]

[viii] Black, B., Hollingsworth, A., Nunes, L., & Simon, K. (2022). Simulated power analyses for observational studies: An application to the Affordable Care Act Medicaid expansion. *Journal of Public Economics, 213*, 104713. https://doi.org/10.1016/j.jpubeco.2022.104713

METHODS

Our outcome variable is the number of population-adjusted primary care physicians and advanced nurse practitioners per 1,000 residents at the county-year level. The AMA Physician Masterfile provides annual county-level physician counts by specialty. HRSA's guideline for counting physicians in an HPSA is to include doctors who provide care in one of the following five specialties: general medicine, family medicine, general internal medicine, general pediatrics, and obstetrics/gynecology.

Since our AHRF data span 2010 to 2019, we consider the impact of full pcHPSA designation between 2012 and 2018 on 128 counties. We do not consider any counties that received a full pcHPSA designation (802 counties) in 2011 or earlier because we want to have at least 3 years of pre-trend data prior to a pcHPSA designation. To avoid potential noise from counties with a full pcHPSA designation prior to 2012, we exclude the 802 counties from our analysis. In addition, we allow for a 1-year time lag for health practitioners to be informed about the recent full pcHPSA designation status of a county. Therefore, counties that receive a pcHPSA designation in year t are assigned to the treatment status in year $t + 1$. As a result, counties that were designated full pcHPSAs in 2019 would not be assigned to treatment status until 2020. We exclude all partial pcHPSA counties from the analysis and only include 398 non-pcHPSA counties as a comparison group.

Our sample treatment counties (pcHPSA designation) received pcHPSA designation at different points in time. Therefore, even though some counties could have multiple years of having a pcHPSA designation, others may have received the designation a year or less ago. We are also interested in evaluating the way the treatment effect varies over the time since a county received a pcHPSA designation.

A number of recent papers suggest the use of a panel event study design in which we can obtain cohort-specific average treatment effects.[15] As recent literature recommend, we will use a relative period index instead of calendar years[14,15] to identify the period since the beginning of the treatment for different cohorts. This allows us to hold exposure to the treatment constant for different cohorts and compare cohorts.

To retrieve unbiased cohort-specific average treatment effects, we will ensure that three identifying assumptions are met[21]—first, that the parallel trends assumption is met; second, that there is no evidence of anticipation of treatment in the pretreatment period; and third, that cohorts share the same path of treatment effects.[16] Therefore, if one cohort experiences an increasing intensity of the treatment effect over time, other cohorts should not experience decreases in the treatment intensity over time.

EVENT STUDY SPECIFICATION

$$(1)\ Y_{it} = X'_{it}\beta + \sum_{t=T_i^{min}}^{T_i^*-2} \alpha_{t-T_i^*} \cdot \mathbf{1}(t - T_i^* < 0) + \sum_{t=T_i^*}^{T_i^{max}} \alpha_{t-T_i^*} \cdot \mathbf{1}(t - T_i^* > 0) + \gamma_i + \tau_t + \epsilon_{it}$$

Note that this specification should be restricted to two kinds of counties: (a) counties that gained full pcHPSA status during the period of our study and (b) counties that are comparable to those counties but were not designated as full or partial pcHPSA status during the period of our study. In Specification (1), T_i^* denotes the year that county i gained HPSA status; T_i^{min} and T_i^{max} denote the first year and last year that we observe county i in our data set; and $\mathbf{1}(\cdot)$ denotes the indicator function. All other notations follow Specification (1).

Notes

[1] Chetty R., et al. The association between income and life expectancy in the United States, 2001-2014. *JAMA.* 2016; **315**(16): 1750-1766.

[2] Bureau of Health Workforce. Primary care workforce projections. 2022. Available from: https://bhw.hrsa.gov/data-research/projecting-health-workforce-supply-demand/primary-health

[3] Health Resources and Services Administration. Designated Health Professional Shortage Areas statistics in fourth quarter of fiscal year 2021: Designated HPSA quarterly summary. 2021.

[4] Streeter RA, et al. The geographic alignment of primary care Health Professional Shortage Areas with markers for social determinants of health. *PLoS One.* 2020; **15**(4): e0231443.

[5] Emery JD, et al. The role of primary care in early detection and follow-up of cancer. *Nat Rev Clin Oncol.* 2014; **11**(1): 38-48.

[6] Friedberg MW, Hussey PS, Schneider EC. Primary care: A critical review of the evidence on quality and costs of health care. *Health Aff (Millwood).* 2010; **29**(5): 766-772.

[7] Goodfellow A, et al. Predictors of primary care physician practice location in underserved urban or rural areas in the United States: a systematic literature review. *Acad Med.* 2016; **1**(9): 1313-1321.

[8] Shi L, et al. Primary care, self-rated health, and reductions in social disparities in health. *Health Serv Res.* 2002; **37**(3): 529-550.

[9] Starfield B, Shi L, Macinko J. Contribution of primary care to health systems and health. *Milbank Q.* 2005; **83**(3): 457-502.

[10] Health Resources and Services Administration. National and regional projections of supply and demand for primary care practitioners: 2013-2025. 2016.

[11] Bureau of Health Workforce. Scoring shortage designations. Available from: https://bhw.hrsa.gov/workforce-shortage-areas/shortage-designation/scoring#:~:text=Three%20scoring%20criteria%20are%20common,outside%20the%20HPSA%20designation%20area

[12] Laughery SP. Do health professional shortage areas improve primary care for Medicare beneficiaries? Working paper. 2015.

[13] Health Professional Shortage Areas (HPSAs) and Medically Underserved Areas Populations (MUA/P) application review process. 2019. Available from: https://www.hhs.gov/guidance/document/hpsa-and-muap-application-review-process#:~:text=State%20Primary%20Care%20Offices%20(PCO,%2C%20dental%2C%20and%20mental%20health

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[14] Scannell CA, et al. Primary Care Health Professional Shortage Area designations before and after the Affordable Care Act's shortage designation modernization project. *JAMA Network Open*. 2021; **4**(7): e2118836-e2118836.

[15] Auerbach DI, Buerhaus PI, Staiger DO. Implications of the rapid growth of the nurse practitioner workforce in the US. *Health Aff (Millwood).* 2020; **39**(2): 273-279.

[16] de Chaisemartin C, D'Haultfœuille X. Two-way fixed effects estimators with heterogeneous treatment effects. *Am Econ Rev.* 2020; **110**(9): 2964-2996.

[17] Callaway B, Sant'Anna PHC. Difference-in-differences with multiple time periods. *J Econom.* 2021; **225**(2): 200-230.

[18] Health Resources and Services Administration (HRSA). *National and regional projections of supply and demand for primary care practitioners: 2013-2025.* 2016.

[19] FREIDA™ residency and fellowship program listing. Available from: https://freida.ama-assn.org/specialty

[20] American Medical Association. Practicing medicine in the U.S. as an international medical graduate. Available from: https://www.ama-assn.org/education/international-medical-education/practicing-medicine-us-international-medical-graduate#:~:text=The%20physician%20will%20have%20to,or%20she%20has%20received%20overseas.&text=IMGs%20who%20seek%20entry%20into,training%20to%20provide%20medical%20services

[21] Sun L, Abraham S. Estimating dynamic treatment effects in event studies with heterogeneous treatment effects. J Econom. 2021; 225(2): 175-199.

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