Improving Access to Primary Care in Rural Virginia

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Acknowledgements

Disclaimer:

Acronyms

ACA – Affordable Care Act

ARC – Appalachian Regional Commission

ED – Emergency Department

FTE – Full Time Equivalent

HPSA – Health Professional Shortage Area

HRSA – Health Resources Services Administration

MCO – Managed Care Organization

MUA – Medically Underserved Area

NHSC – National Health Services Corp.

NP – Nurse Practitioner

PA – Physician Assistant

PCP – Primary Care Physician

PSAP – Physician Shortage Area Program

SBHC – School Based Health Center

VRHA – Virginia Rural Health Association

Table of Contents

Executive Summary

Too many rural Virginians experience non-financial barriers to accessing primary care services. Rural Virginians consistently lag behind urban Virginians in health outcomes, social determinants of health, and many other markers of health. In the coming years, this gap will continue to grow. This is often true in comparison to national rural trends, but rural Virginia's gap is particularly large.

The Virginia Rural Health Association (VRHA) must advocate for the health of rural Virginians, and they must know which policies are most effective at tackling issues of access to primary care services. Several approaches include: offering student loan forgiveness for doctors to serve in needy areas, waiving requirements of the J-1 visa program for foreign doctors to serve patients in needy areas, furthering scope of practice reform for mid-level practitioners like nurse practitioners (NPs), and utilizing school-based health centers (SBHCs).

Letting present trends continue will allow the decline in primary care physicians (PCPs) in rural areas to go unaddressed. The number of PCPs will continue to decline, but nurse practitioners (NPs) may make up for this shortage if their growth rates continue on their current trajectory. The number of NPs is set to more than double by 2030. This will cost no additional funds, but the gap between rural and urban Virginia will continue to grow for PCPs. The number of providers per person will grow in rural Virginia, but it will still lag considerably behind urban Virginia. Access to care will still be worse in rural Virginia in 2030 than it is in urban Virginia today. Many people will still lack adequate access to a consistent provider.

Primary care physicians that apply to serve in Health Professional Shortage Areas (HPSAs) can have their student loans forgiven in exchange for two years of service. Foreign physicians can get a waiver from the J-1 visa program so they can practice in an HPSA for three years instead of returning home after their education. Expanding this program could expand access to care substantially, but only in a best-case scenario. It impacts the areas with the greatest need, but not necessarily rural Virginia. It is also the least cost-effective option, has resistance from anti-immigration sentiment, and suffers from low retention rates after the program ends.

School-based health centers are highly cost-effective for the state, can service tens of thousands of Virginians, and can create consistent provider relationships for years. There is no guarantee they will be started in the rural areas of with the highest need, and they will not increase the actual number of providers. Rather, they will change the distribution of work hours.

Nurse practitioner independent practice at two years combined with prescription authority will separate the need for NPs to contract with a PCP. This will allow the growing number of NPs to care for rural patients, more than replacing the declining number of

PCPs. It will allow for truly independent providers and provide life-long providers for Virginians. This helps the entire state, but rural Virginia at a proportional rate.

NP expansion should be the focus of the VRHA. It will have a large immediate effect, and it can be paired well with funding for SBHCs if further advocacy is possible. This has no major up-front costs and is the second most cost-effective option next to SBHCs. It has strong momentum in the legislature and the Governor's office. It utilizes a drastically growing workforce that is effective in treating patients. Advocacy and education on this option should begin immediately with the Governor's office, House and Senate committees, and the past sponsor of the partial expansion. Building relationships with companion organizations can help speed up this process.

Introduction

The VRHA is a 501(c)(3) non-profit organization working and an affiliate of the National Rural Health Association. They seek to improve the health of rural Virginians through education, advocacy, and partnerships with other organizations. Their membership includes health related organizations, physicians, and students. VRHA works with elected officials to help them understand how the decisions they make affect health care for rural Virginians.

In the years since the passage of the Affordable Care Act (ACA), the VRHA has advocated for the expansion of Medicaid in Virginia and the stabilization of the Virginia insurance marketplace and hospital systems. In 2018, Medicaid was expanded by Virginia's General Assembly, going into effect on January 1, 2019. With this major policy priority completed, the VRHA must work on legacy issues to the Medicaid expansion to ensure rural Virginians can realize the benefits of health services.

Over the summer of 2018, a survey was sent to VRHA members to determine their top priorities following the Medicaid expansion. Top issues were: access to health care, the opioid epidemic, scope of practice issues, physician reimbursement, telehealth expansion, transportation, hospital funding, black lung disease, and more. Over that summer, policy papers were developed on the opioid crisis and medication assisted treatment, dental care access, black lung disease, and a legislative plan for the 2019 session was created. However, access to primary care services for rural Virginians, the most cited concern, was not addressed. This project will analyze this problem, and review a series of potential solutions.

Access to health care services is intricately tied to the number of physicians, number of nurse practitioners, transportation, telehealth, reimbursement, and other factors. By looking at several alternatives, I hope to address the primary concern of VRHA and its members by comparing the effectiveness of several complementary approaches. By the end of my analysis, I will recommend a single alternative as the most effective way to address the issue of access to primary care services for rural Virginians. This is not to say that other approaches are necessarily ineffective, nor does it imply that multiple

approaches would not be ideal. Rather, it exists to give the VRHA a single approach to focus on with its limited time and resources.

Problem Statement:

Too many rural Virginians experience non-financial barriers to accessing primary care services. Rural Virginians consistently lag behind urban Virginians in health outcomes, social determinants of health, and many other measurements of health; unfortunately, this gap is widening. This is often true in comparison to national rural trends as well, but rural Virginia has particularly poor health outcomes.

Background

Health is generally worse among rural Americans, and the gap is widening. In 2005–2009, the life expectancy for Americans in the most urbanized areas was 79.1 years compared to 76.7 years for the most rural Americans. This varied significantly by many socioeconomic factors like race, gender, and income. This ranged from a low of 67.7 years among poor black men in rural areas to a high of 89.6 for poor Asian/Pacific Islander women in large urban areas. In 1969–1971, life expectancy 70.9 years for metro areas and 70.5 for rural areas; a modest difference of only 0.4 years. This increased to 2 years by 2005-2009 at 78.8 years for metro areas and 76.8 years for non-metro areas. The rural poor and rural African Americans now can expect the longevity that the urban rich and urban whites populations experienced more than approximately 40 years prior. The largest contributors to this disparity are higher rates of heart disease, unintentional injuries, COPD, lung cancer, stroke, suicide, and diabetes in rural communities relative to urban communities. Urban regions also experienced gains in life expectancy that were larger in magnitude than rural areas (Singh & Siahpush, 2014). Put simply, both areas experience longer life expectancy, but metro areas are improving far faster and experience less incidents of chronic diseases. These diseases are both a negative outcome in themselves and reduce life expectancy.

Central to the issue of population health is real access to health care services. Virginia enacted the optional Medicaid Expansion under the ACA, and this went into effect on January 1, 2019. This will lead to increases in health coverage and health outcomes. The ACA increased health insurance coverage, overall health care access, and utilization. State Medicaid expansions were associated with a 6.1% reduction in mortality with the greatest reductions for older adults, nonwhites, and residents of poorer counties. It also increased rates of self-reported health status levels of "excellent" or "very good" by 3.4% (Sommers, Baicker, & Epstein, 2012). Coverage for adults ages 19-25 increased by 6.7 percentage points from September 2010 to September 2011. Unmarried adults, nonstudents, and men had the most significant increases with the earliest gains being largest for populations with the worst health outcomes. Large reductions in the number of young adults delaying care and avoiding care due to cost were seen, implying that access to care was improved along with financial improvements (Sommers et. al, 2013). Health care access and insurance coverage are critical compenents contributing to racial and ethnic disparities. From 2011 to 2014, the ACA is associated with significant reductions in being uninsured, delaying or forgoing any necessary care, and significant increases in the

probability of seeing a doctor. Uninsured rates decreased more substantially among African Americans and Hispanics compared with non-Hispanic whites. However, there was no significant change in emergency department (ED) visits. This implies a growth in stable primary care patient relationships (Chen et. al, 2016).

The ACA improved the healthcare landscape, but without the ability to receive care any improvement in insurance coverage or quality of healthcare is meaningless. Eighteen percent of US adults have financial barriers to healthcare, while 21% have non-financial barriers including: accommodation, availability, accessibility, and acceptability. Kullgren et. al (2012) defines accessibility as "the relationship between the location of services and the location of patients". Two-thirds of Americans with issues of affordability also have some non-financial barrier (Kullgren et. al, 2012). In other words, addressing issues of affordability through policies like Virginia's Medicaid Expansion will not solve access to care gaps as much as anticipated. As the financial barriers are resolved, many Virginians will simply run into non-financial barriers. The specifics of the access to care problem varies between rural and urban residents. Rural residents rely more on telephone access and receive other accommodations, but have fewer care options. Urban care-seekers, ironically, cite distance barriers more often. Four consequences of accessibility problems emerged across settings: being forced to restart the care-seeking process, abandoning it, using the emergency department for primary care, and negative health outcomes due to delay (Haggerty et. al, 2014).

Under current trends, the US will require more health care providers than it currently has just to maintain its ratio of physicians to patients. Total PCP visits is projected to increase 22.3% from 2008 to 2025, or from 462 million to 565 million. Post-insurance expansion by the ACA, the US will need an additional 52,000 PCPs by 2025; 33,000 from population growth, 10,000 to accommodate population aging, and 8,000 from insurance expansion. This represents a 3% increase in the current workforce (Petterson et. al, 2012). For Virginia's population of 8.2 million to the nations 325 million, that means an additional 1,312 primary care providers are needed to treat Virginian's by 2025.

Virginia has some significant differences from overall national trends in access to care. Rural Virginians are consistently worse off than urban Virginians and the national average in many conditions including rates of diabetes, obesity, HIV, and overdose deaths. This can be seen in Table 1 below.

Table 1. Metro vs. Non-Metro Health Metrics in Virginia and Nationally

Location	Classification	Diabetes (2013)	Obesity (2013)	HIV per 100k (2013)*	Overdose Deaths per 100k (2016)
	Metro	9%	26.70%	291	11.4
Virginia	Non-Metro	12.70%	30.80%	171	17.6
United States	Metro	9.70%	27%	379	16.2
	Non-Metro	11.50%	31.60%	152	15.4

Note: *People 13 and older.
Source: RHI Hub, n.d.

Regarding overall health insurance coverage, 49% of Americans were insured by their employer, 7% through non-group coverage, 19% through Medicaid, 14% through Medicare, 2% through other public insurance, and 9% were uninsured in 2016. For Virginians by contrast, these rates were 55% employer, 5% non-group, 12% Medicaid, 14% Medicare, 5% other public insurance, and 10% uninsured (Kaiser Family Foundation 1, 2018). Following the enactment of the Medicaid Expansion in Virginia, hundreds of thousands of people are gaining Medicaid, changing Virginia's insurance coverage make up significantly. However, as cited above, two-thirds of people with financial barriers have non-financial barriers as well, so access to care remains unresolved.

Table 2. Health Care Professional Staffing in Virginia and Nationally

Location	Classification	MDs/DOs per 10,000 residents	PCPs per 10,000 residents	NPs per 10,000 residents	PAs per 10,000 residents	% of MDs/DOs under 35	% of MDs/DOs over 75
Virginia	Metro	30	8	6	3	17%	1.8%
	Non-Metro	11	5	4	2	6.1%	3.5%
United States	Metro	33	8	6	4	18%	2.5%
	Non-Metro	13	5	5	3	8.1%	2.8%

Source: RHI Hub, n.d.

As seen in Table 2, Virginia had the same proportion of PCPs as the national trend in 2015. However, Virginia has less physicians, nurse practitioners (NPs), and physician assistants (PAs) overall, while Virginia's physicians tend to be older as well. This older cohort of physicians in rural Virginia with a smaller than average cohort of young professionals means that this problem will continue to grow, and staffing from mid-level professionals is lower than average and not set at present to offset this gap (RHI Hub, n.d.).

Table 3. Social Determinants of Health in Virginia and Nationally

Location	Classification	Poverty Rate	Median Household Income	18-24 years olds without HS diploma	Lack Access to Health Foods
Virginia	Metro	10.1%	$ 78,000	10.3%	44.1%
	Non-Metro	17.1%	$ 44,000	12.2%	34.5%
United States	Metro	13.6%	$ 62,000	13.4%	42.1%
	Non-Metro	16.9%	$ 46,000	16.6%	41.9%

Source: RHI Hub, n.d.

As seen in Table 3, Virginia performs somewhat better than the national average regarding social determinants of health. (RHI Hub, n.d.). However, there is a general trend that rural Virginians consistently perform worse than urban Virginians, and they even fall behind national trends in determinants like household income and poverty while urban Virginians excel. Therefore, urban Virginians are masking the problems of rural Virginians by pulling up statewide averages. Furthermore, rural Virginia, much of it residing in Appalachia, trails national rates for rural Americans. Rural Virginians have significant parts of their counties designated wholly or partially as a Health Professional Shortage Area (HPSA) for primary care by the Human Resources Services Administration (HRSA), demonstrating the need in these areas. This can be seen in Appendix A. Rural Virginia is also predominantly white, and elderly, with only 1.2 million of the state's 8.4 million population. The median age is 42.5 years of age (Virginia Department of Health, 2018). More can be seen in Appendix B. With an older, poorer, and sicker population, rural Virginians need a good network to access health care. However, they have fewer and older physicians, NPs, and PAs. Douthit et. al (2015) also found cultural, financial, transportation, and other issues. They also found a lack of trained providers led to worse health outcomes for rural Virginians. This problem of access must be alleviated to better serve rural Virginians.

Literature Review

Strategies to Increase the Number of Physicians

One strategy to address the access to care problem is by increasing the number of physicians in rural Virginia. Contrary to popular thought, research shows that increasing the number of overall physicians has a weak correlation and effect on population health. From 1979 to 1999, the supply of physicians increased 51%, but the distribution remained roughly the same with 4 physicians going to low need areas for every physician going to a high need area. Goodman and Grumbach (2008) point out that this follows the "inverse care law" that physicians are drawn to areas that have the least need. Additionally, past an initial modest increase in physicians, any further increase has little to no benefit. However, increases in PCPs decrease mortality (Goodman & Grumbach, 2008).

Goodman & Grumbach are supported by a systematic review of the research by Starfield, Shi, & Macinko (2005), which found that more primary care physicians reduced all mortality, increased overall health, and showed primary care in general is associated with better health outcomes. In these studies, primary care physician was defined as family practice, general practice, general internist, and general pediatrician. Health outcomes observed were cancer deaths, low birth weight, self-reported health, and others. These studies looked at metro and non-metro areas and controlled for income, education, race, and other characteristics. Methods included regressions and path analyses in both cross sectional and longitudinal time series data. In one study over eleven years, PCPs were associated with all cause deaths dropping and reduced differences by income inequality. Some studies found that the effects were due solely to family physicians when PCPs were disaggregated, while others found several of those physician groups decreased mortality. In Florida county level data, each family physician per 10,000 decreased mortality by 0.65

per 100,000, or 20% for cervical cancer. A study in the U.K. found for each new general practitioner mortality decreased by 6%. This specific study examined a 15%-20% increase in general practitioners, from 5 to 6 or 6 to 7 per 10,000, during their study (Starfield, Shi, & Macinko, 2005). While this benefit may only be at or near the margin, these per capita changes require relatively large increases in total physicians and represents the effect of any policy to increase physicians. On average, studies found this effect on health outcomes to be a 5.3% drop in mortality for each additional PCP per 10,000, or 127,617 applied to the US's annual rate (Starfield, Shi, & Macinko, 2005; Macinko, Starfield, & Shi, 2007). This would be roughly 3,300 deaths for Virginia.

Cooper (2009) strongly disagreed with the conclusion that increasing specialists was ineffective, arguing that the correlation was with general increases in physicians. He ran state-level analysis controlling for income and other factors, finding that family practice and general practitioner numbers were highly correlated with socioeconomic factors. This study appeared to break the United States down by region within his state-level analysis, but it does not appear that he controlled for race, instead choosing to look at correlations between physician types and socioeconomic factors. Because he did not include this in his controls, I am inclined to rely on the analyses done within the systematic review of articles mentioned above. Although some of those studies only observed the 50 states 11 times, limiting power, these studies were generally agreed with each other and appeared to follow a better methodology. Therefore, the body of evidence suggest that increasing primary care physicians, and particularly family physicians, has an outsized impact on population health. Additionally, this results in cost savings and less time spent in intensive care (Goodman & Grumbach, 2008).

One study reviewed a specific program to incentivize doctors to work in needy areas, the Jefferson Medical College initiated the Physician Shortage Area Program (PSAP) in 1974. This increased the number of family practice physicians in rural and underserved areas, for the duration of the program. Retention rates were not measured post-program, so the conclusion of this study is limited. PSAP graduates were far more likely to practice family medicine, to practice in a rural area, and to practice in underserved areas. This was 55%, 39%, and 33% for PSAP graduates compared to 13%, 11%, and 8% for non-graduates respectively. About 26% of graduates practiced family medicine in a rural area and 23% in an underserved area compared to 3% and 2% for non-graduates (Rabinowitz, 1993).

This program was followed up on in 1999. In this follow up study, PSAP graduates accounted for 12% of all family physicians in rural Pennsylvania while they were only 1% were graduates of state schools. Results were similar to the previous study. However, this time they also found program retention was also high, with the number of program graduates still practicing rural family medicine at 87% of those practicing between 5 to 10 years in the past, and 94% practicing in underserved areas (Rabinowitz et. al, 1999). The federal government also has a grant program through HRSA called the National Health Services Corp (NHSC), which grants up to $140,000 in student loan forgiveness if doctors serve in HPSAs or other needy areas. Virginia gets funding for this program and it is evenly split between the federal government and the participating practices. $50,000 is given for each of the first two years, then $20,000 for the third and fourth years each (VDH 1, n.d.). A study

by Negrusa et. al (2016) found that the retention rate for this program was far lower with only about 40% one year after the program and as low at 20% ten years later. However, these retention rates were about 80% and 70% for any HPSA. This means they moved from their initial site, but many stayed in HPSA. In all cases, it should be noted, self-selecting PCPs working in HPSAs had higher retention rates. This provides stark data that these NHSC volunteers stay to have loans forgiven, then leave.

Regardless, other studies have found that increasing the number of primary care physicians is inadequate in addressing the problem. This is due to the demand for care increasing as population growth outpaces the number of doctors being trained to meet this need. They recommend other solutions such as:

> "empowering licensed personnel, including registered nurses and pharmacists, to provide more care, creating standing orders for non-licensed health personnel, such as medical assistants, to function as panel managers and health coaches to address many preventive and chronic care needs, increasing the potential for more patient self-care, and by harnessing technology to add capacity" (Bodenheimer & Smith, 2013).

In other words, while PCPs provide quality care and more would be better, any policy being considered to increase the number of PCPs along the margins would not close the gap in health outcomes between metro and non-metro populations. Either a massive increase is needed, or policy changes in complementary areas are needed as well.

Nurse Practitioners: A Potential Supplement to Primary Care

Another way to address access to care issues is through increasing NP responsibility. The NP workforce is on track to grow 130% from 2012 to 2025 (Poghosyan et. al, 2012). In Virginia, NPs may prescribe Schedule II-VI controlled substances if authorized in a written agreement with physicians. As of July 2018, they can also operate independently after five years of practice under a supervising physician (Virginia Scope of Practice Policy, n.d.).

Because of the recent nature of this change, there is no real data on the effect of this change for Virginia. However, a study by the National Bureau of Economic Research found that states that give nurse practitioners and certified nurse midwives full practice autonomy have no difference in prescriptions, fewer labor inductions, fewer C-sections both elective and overall. There was also no difference in maternal and child health outcomes in expansion states. These states saved $85 million from the drop in C-section procedures. This study used a differences-in-differences model controlling for real income, unemployment, poverty, physicians and nurse practitioners per capita, population density, and state and county fixed effects (Markowitz et. al, 2016). This study is fairly compelling as it accounts for rolling treatment windows, utilizes millions of units of observations, and separates out restrictive states, fully independent states, and states that strike a middle ground approach. This way, they were able to assess comparative effects of slight modifications of scope of practice, which states like Virginia tend to favor, compared to more expansive changes that advocacy groups often target. In this study, the farther-reaching states gained larger benefits with no statistical increase in negative outcomes.

In a systematic review of studies, it was found that NPs "can reduce wait times for the emergency department, lead to high patient satisfaction and provide a quality of care equal to that of a mid-grade resident" (Carter & Chocinov, 2007). However, costs were increased if they could not work independently. Additionally, NPs are paid more than residents, the physicians they were compared to in this study. However, other costs of training residents were not factored into this analysis (Carter, & Chochinov, 2007). Studies in this review were all randomized, with total patient surveys being over 217. While NPs did a bit better in terms of explaining issues, dissatisfied patients were 30 percentage points more likely to say issues were unresolved with NPs than residents. Furthermore, NPs did marginally better than experienced residents and marginally worse than inexperienced residents. Therefore, I believe that NPs may be an acceptable substitute for physicians in training like residents, but not experienced attendings. However, they could be accepted by patients in areas where there is a shortage of PCPs.

NPs have also been found to be capable health care providers for patients with chronic diseases and other issues. NPs "…are better at communicating with patients and offering advice about self-managing their chronic conditions", and patients "have better outcomes when physicians partner with NPs to manage chronic conditions such as diabetes compared to patients treated only by a physician" (Poghosyan et. al, 2012). Some research also shows that patient satisfaction with care, health status, functional status, emergency department visits and hospitalizations, mortality, and more are roughly equivalent for nurse practitioners and doctors (Stanik-Hutt et. al, 2013). However, the lack of a designation as a primary care provider means they are only reimbursed as low as 75% the Medicaid or Medicare reimbursement rate compared to physicians. If they write off an action compared to working with a physician, it is only 85%. This creates disincentives to use these workers and NPs may avoid states where they do not have status as a primary care provider (Poghosyan et. al, 2012; Yee et. al, 2013). With Starfield, Shi, & Macinko (2005) finding that increases in primary care itself increase health outcomes, and these studies showing that NPs can substitute residents, it follows that increasing NPs can offer a similar result. Patel et. al (2018) conducted a systematic review of nurse practitioner scope of practice expansion and found that NPs practice primary care more, practice in more rural areas, are more likely to accept Medicaid, and improve the practice environment. This systematic review backs up that thought process. Traczynski & Udalova (2018) even found that NP independence increases checkups, improves care quality, and decreases emergency room use by patients with certain sensitive conditions.

There were an estimated 7,500 practicing NPs in Virginia in 2016, 33% grew up in a rural area, and 10% practice in rural areas. Furthermore, only 20% are 60 years of age or older, and 1,420 (19%) were licensed in the last 5 years, and only 10% plan to retire in five years. This allows for 12% growth every 5 years (Virginia Department of Health Professions, 2016). Accelerating this growth rate, or incentivizing moving to a rural area to work independently, could address to access shortage. Extending primary care provider status to NPs in Virginia is one area where action can be taken. However, experienced NPs can already practice independently, so they real question is whether they should be permitted to act as primary care providers, if new NPs should get the same benefit, or if increasing rural NPs is more desirable.

School-Based Health Centers

School-based health centers (SBHCs) "provide convenient, accessible, and comprehensive health care services" for children and teens. Some of these programs have been expanded to care for school staff, parents, and members of the local community (School-based Health Alliance 1, n.d.). For the school year 2013-2014, eighteen states spent $85.1 million on 915 School-based Health Center. Of these states, thirteen have prior authorization waivers for Medicaid to ensure payment for primary care services (School-based Health Alliance 2, n.d.). Many of the surrounding states rely on SBHCs, West Virginia with 96, Maryland with 72, and North Carolina with 73 in 2013; Virginia had 7 in 2013 without state funding. Of all SBHC programs, 55.9% served people other than students. Of these programs, 65.8% served families of the students and 35.5% served other people in the community, though this is higher in rural areas. SBHCs can be utilized to treat primary care, dental care, mental health care, vision, hearing, chronic disease management, and even substance abuse disorders (School-based Health Alliance 1, n.d.).

SBHCs have a positive impact on health care outcomes. Soleimanpour et. al (2010) found that SBHCs were the largest source of medical care (30%), family planning (63%), and mental health counseling (31%) services for clients. Significant improvements in client's mental health outcomes were reported. Medical providers and clients reported improvements in reproductive health for things like birth control were this was permitted. Students gained improved access to services to services like counselling and family planning and they reported satisfaction for convenience, confidentiality, free services, and friendly staff. This study showed high satisfaction and general improvements in a variety of health care services. While family planning may be controversial in some areas, this service is not a necessary component and need not be added on if considered unacceptable by the local serviced populations. The sites in this study could also offer both internal and external referrals, though parental consent to use SBHC services was required in many cases. Another study found mixed evidence. While Kisker & Brown (1996) found that SBHCs increased student access to care and health knowledge, the impacts on risky behaviors and health outcomes were either small or inconsistent. However, 52% of students used these services by their last year at that school with the most common number of visits at twice per year with some visiting as often as six or more times. The most common visits were to treat illness or for general physical exams. For a significant minority of students, the SBHC became their usual source of care. This study hints that SBHCs may be a method to bridge the gaps in overall health equity. Access to a physician already existed for many people, but SBHCs expanded access for a population that did not previously have access.

By having the health center in a school, this could also reduce absenteeism and travel times. This is backed up by Guo et. al (2010), which showed that SBHCs reduced hospitalization and ED visits, increased access to mental health services, increased access to prescriptions, and reduced travel and pharmacy costs. The comparison group was younger and enrolled in CHIP at higher rates, but they had less enrollment months and this study controlled for enrollment in TANF, MCOs, race, sex, and CHIP enrollment. At the end of the study, they found that SBHCs reduced Medicaid costs at $35 per patient. Many of these programs also had staffing that was part-time and a nurse practitioner and a

technician, so costs could be saved on midlevel staffing instead of a physician or specialist as well.

Ran et. al (2016) conducted a systematic review of SBHC cost-benefit analyses. Many studies only considered the costs that went into the construction and operations of these programs, but the studies that accounted for benefits and secondary costs found that benefits per SBHC ranged from $15,028 to $912,878. However, 85% of the benefits in the larger savings were from averting unintended pregnancies, while the lower end only accounted for reduced hospital visitations from asthma. In terms of Medicaid spending, SBHCs reduced costs from $30 to $969 per visit. Because the majority of monetized benefits come from averting unintended pregnancies, I would urge that something closer to the lower bound be trusted more on overall savings. Family planning can be highly controversial, and managing expectations here is key.

In terms of actual costs for planning, Nystrom & Prata (2008) looked at 42 SBHCs in Oregon from 2005-2006. They found start-up costs ranged from $49,750 to $163,750 depending on if the center was economical or faced higher costs as well as if the SBHC was an addition to the school or used a mobile build or existing space. Operations costs also ranged from $90,750 to $402,500 depending on if it was a core center, intermediate center, or expanded center with varying ranges of costs. Core centers had 10 visitation hours a week compared to an expanded center's 20 hours. Operations costs included staffing, paper work, medical supplies, and more. Costs were more expensive for a center that was open year-round instead of just during the school year. They did caution that the lower bound costs were likely more expensive than they could monetize due to unrecorded in-kind donations of furniture and other materials. However, higher end costs were likely to run into cost overruns or could be from more urban areas with greater expenses. I would say that the moderate expenses somewhere in the middle are the most prudent choice to follow. In terms of revenue, SBHCs that were not a federally qualified health center relied on 25% of funding from the state government, 5% from local government, 12% from grants, 7% from in-kind donations, 5% from billing, 1% from fundraising, and 45% from "Other." This may well be unsolicited donations. SBHCs that were federally qualified health centers received nearly half of revenue from billing and a quarter from local government. This is one of the most detailed studies found on SBHC costing and relied on federal data for supply and staffing costs. Avoiding monetizing benefits allows you to see the real costs involved of setting up these programs, and this shows they are fairly affordable.

Alternatives

Alternative 1: NP Prescription Authority and Reduce Work Hours Required for Independent Practice

The NP workforce is on track to grow 130% from 2012 to 2025 (Poghosyan et. al, 2012). In Virginia, NPs may prescribe Schedule II-VI controlled substances if authorized in a written agreement with physicians. As of July 2018, they can also operate independently after five years of practice under a supervising physician (Virginia Scope of Practice Policy, n.d.). This "five years of practice" requirement is listed explicitly as 9,000 work hours, much higher than the 3,000-work hour limit in most other states (O'Connor, 2018).

There were an estimated 7,590 practicing NPs in Virginia in 2016, 33% grew up in a rural area, and 10% practice in rural areas. Furthermore, only 20% are 60 years of age or older, 1,420 (19%) were licensed in the last 5 years, and only 10% plan to retire in five years. This workforce grew to 8,879 by 2018, a 17% growth rate in two years (Virginia Department of Health Professions, 2016; Virginia Department of Health Professions, 2018).

Reducing the work-hours requirement before independent practice from 9,000 hours to 3,000 hours (5 years to 2 years) and allowing NPs prescription authority could increase the number of primary care providers that work across Virginia, which helps HPSAs more than well-served areas. With 790 new nurse practitioners each year, lowering the work-year requirement could make another 2,370 NPs eligible for independent practice state-wide, with 237 eligible in rural areas. Allowing these NPs to prescribe medications without a physician agreement will allow their patients easier access to medical services.

Alternative 2: Increasing Physicians Through Expansion of the J-1 Visa Waiver and Rural Physician Student Loan Forgiveness

Virginia has many programs in place from federal funding to increase the number of primary care physicians in HPSAs and rural areas. These include student loan forgiveness for doctors that work in these areas and visa waivers for foreign doctors that serve in these areas as well. Expanding these programs further through additional state funding or changing administrative rules could increase the number of participating physicians.

Virginia participates in the National Health Services Corps (NHSC) with their Virginia State Loan Repayment Program. This grants student loan forgiveness in the amount of $100,000 for the two years of service in a HPSA and an additional $40,000 if the healthcare professional stays for an extra two years. The costs are split between federal dollars from a HRSA grant and the local practice. Because of limited funding, slots are limited (VDH 1, 2019). If Virginia expanded this program with state funding, this could marginally increase the number of PCPs in HPSAs by accepting physicians that were denied by the program for lack of funding. Last year, 7 PCPs were accepted and 11 were rejected because of funding issues.[1] Raising funding would have meant up to another 11 PCPs in HPSAs.

Typically, a foreign doctor is required to return to their home country for two years after training in the USA before they can apply for residence. However, this requirement can be waived for the J-1 visa if foreign PCPs commit to working in a HPSA. For the J-1 Visa

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[1] Information from Olivette Burroughs from the VDH Office of Health Equity.

waivers, Virginia is allowed 30 slots for foreign PCPs to work for three years in a HPSA. As a state within the Appalachian Regional Commission (ARC), Virginia is also allowed unlimited slots on top of this 30-physician limit. However, these applications have a $3,000 fee and require a written recommendation from the Governor, a "high-ranking" state official, or the ARC State Alternate (VDH 2, 2019; ARC, 2019). Removing the $3,000 fee and removing the recommendation requirement, or significantly loosening it, could increase applications. At present, only 1 physician slot is filled in the ARC waiver model for 2019 while all 30 slots are filled in the typical program (ARC, 2019). There are about 2,000 J-1 visa physicians each year, and 500 are not granted slots in the waiver cap. For Virginia, if J-1 visas are proportional to their population, this is a total of 12 PCPs. At most, reform could lead to an additional 11 PCPs in Virginia each year (Global Workers, Justice Alliance, n.d.).

Alternative 3: Increase Funding for School-Based Health Centers

Virginia has eight school-based health centers (SBHCs) in rural areas. These centers use existing structures to set up primary care, dental, vision, and other services for children and their families in needy areas. Granting prior authorization for SBHCs for Medicaid and funding SBHCs through Virginia's Managed Care Organizations (MCOs) could expand access to needy Virginia residents using existing infrastructure (School-based Health Alliance 1, n.d.; School-based Health Alliance 3, n.d.). Because children attend these schools throughout the week, they will have good access to these services on a day-to-day basis. Their parents and/or caretakers and the school staff will also be able to utilize these services, and they exist in areas frequented by local residents often in town centers. Because many schools are in town centers which are more likely to have broadband access, telehealth programs would also be more feasible in these locations. Locations in regular areas may also allow for consistent provider relationships for the duration of the child's or staff member's tenure at the school.

Expanded centers with 20 work hours a week could provide basic primary care services in rural Virginia for students, their families, staff, and members of the community. This could be expanded to as many schools as necessary over the next few years.

Alternative 4: Let Present Trends Continue

Many issues in health policy and access to care have been developing in Virginia. On January 1st, Medicaid was expanded. Around the same time, nurse practitioners with five or more years of experience were granted independent practice authority. Funding for broadband throughout the state is developing. Furthermore, nurse practitioners increase statewide at about 790 every year with 10% practicing in rural areas.[2]

With the financial barriers removed, partial expansion of nurse practitioners, a rapidly growing number of nurse practitioners, and programs to incentivize rural physician practice, action may not be required. This alternative may be plausible in this case considering the effects of several implementations have yet to be measured.[3]

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[2] Specifics are in Appendix F.
[3] Specifics on two discarded alternatives can be found in Appendix C and Appendix D.

Criteria

Cost-effectiveness: This criterion involves comparing the estimated change in rural residents' ability to see a primary care professional per dollar spent by the state. There exists a large body of literature reviewing the change in "ease in getting an appointment when desired" or "ability to get an appointment when sick" that can be compared to an estimated dollar cost for the Commonwealth of Virginia on each alternative. For my analysis, I reviewed the estimated costs of each alternative per additional patient visit. Details of my methodology for cost-effectiveness can be found in Appendix F.

Political Feasibility: This involves looking at the current political climate and how it may develop this year and next. To quantify this, I will assess my alternatives by what bills have become law in the last few years, which have failed, and where they failed in the process. If they failed, I will also look at if they failed completely, or along party-line votes. Additionally, I consider how local advocacy groups, like the Medical Society of Virginia, view these alternatives. They often have a large impact in the state. Some of these alternatives, like the J-1 visa waiver program, are administrative and may not require legislation. Details of my methodology for political feasibility can be found in Appendix E.

Scalability: Options may be cost-effective, but they must be scalable to meet a large magnitude of the problem to be recommended. For example, if Virginia is only able to increase the number of physicians or nurse practitioners by a small amount, then it will not do well on this criterion even if the marginal benefit per physician/nurse practitioner/SBHC is high. At present, Virginia has a shortage of 243 FTEs statewide (HRSA, n.d.). With a growing and aging population, Virginia will need more providers just to maintain its current capacity, let alone decrease this shortage. This shortage affects rural Virginia disproportionately, as seen in Appendix A, but the specifics are difficult to quantify.

Directedness: Do these alternatives help this specific problem directly, or is it a spillover effect? For example, if more NPs are trained, do they stay in rural areas, or will they move out-of-state or to urban areas that have enough practitioners? For SBHCs, will these help areas of need first? For physicians, will they be in rural areas or will they bunch in urban HPSAs?

Consistent Provider Relationships: Do these alternatives create long-term relationships between residents and a primary care provider? Residents should be able to visit the same provider for years and establish a trusting relationship. Visiting a new provider and transferring medical records in onerous and wasteful for visits. The more the alternatives set up these relationships, the better.

In terms of weighing, I will focus primarily on cost-effectiveness (30%), political feasibility (20%), scalability (20%), directedness (15%), and consistent relationships (15%). All criteria will be scored from 1 to 5 with 1 being the lowest score and 5 being the highest.

Analysis

Alternative 1: Nurse Practitioner Prescription Authority and Independent Practice After 2 years

Cost Effectiveness: 3

This option will expand access to rural Virginians at a rate of $88.20 per patient visit from 2021 to 2030. There is no up-front cost to this alternative, but the effect of occupational licensing reform will result in statewide increases in primary care visits from Medicaid recipients, increasing costs. Additionally, hiring administrative staff to review NP independent practice applications will also be necessary, and changes in tax revenue from increases in NP salaries and decreases in PCP salaries will occur. It should be noted that this option is the most cost-effective if applied to the statewide population of nurse practitioners, which is 10 times the rural population of nurse practitioners. Costs per patient visit is this high because all costs are divided along the Non-Metro Primary Care Nurse Practitioners in independent practice rather than the full state population of primary care nurse practitioners.

Political Feasibility: 4.8

Based on the past two legislative sessions, this alternative is highly politically feasible. Nurse practitioner independent practice was expanded for NPs with about five years of experience during the 2018 legislative session, and it passed with near universal support and no veto by the Governor. It passed the Senate Education and Health Committee universally and the companion House committee 12-5. This year, bills were passed to ease restrictions on physician assistants, create reimbursement parity for NPs, and more. With a history of support from both parties in both houses of the legislature and the support of the Governor, this plan is feasible. Although there could be advocacy opposition from physician societies, this has not become an issue with the recent bills. This suggests that the political conversation has shifted in favor of this occupational licensing reform.

Scalability: 4

This option would result in an additional 251,266 patient visits in rural Virginia each year from about 55 NPs working independently as primary care providers in rural areas. Because each patient visits their primary care provider four times a year on average, this results in about 62,816 additional people (5% of Virginia's rural population) gaining access to primary care services.

Directedness: 2

This policy will change scope of practice state-wide rather than just rural Virginia; however, the effect of the policy will be roughly proportional to the population distribution between urban and rural areas. In other words, this policy will be equitable rather than targeted, but this means this policy has a larger scalability than just rural areas. Still, this policy affects many areas outside the scope of the project, so urban areas with a surplus of primary care providers may have an even greater surplus after this policy.

Consistent Provider Relationships: 5

Nurse practitioners that self-select into rural areas are very likely to stay in those areas. Based on Virginia workforce data, 10% of nurse practitioners work in rural areas, and this remains constant every year. Primary care providers that work in an HPSA by choice have 1-year retention of 90% and 10-year retention of 70% (Negrusa et. al, 2016). Nurse practitioner expansion will allow for long lasting relationships between patients and their providers. This being an average, many people will have provider relationships that could last decades, while some natural turn over will exist. This is as optimal as any policy could be.

Alternative 2: Increasing Physicians Through Expansion of the J-1 Visa Waiver and Rural Physician Student Loan Forgiveness

Cost Effectiveness: 1

Visa waiver reform and student loan forgiveness for physicians that work in HPSAs cost $310 per patient visit. This alternative is by far the most expensive policy option. Additionally, the state bears the cost of this program in full. Costs come from loan forgiveness, the waiving of state application fees, staff time to review applications, and additional Medicaid spending from patient visits in these areas.

Political Feasibility: 2.75

There is little support for further immigration in the general assembly. There have been many bills passed along party lines in the legislature that try to ban "sanctuary cities", deny in-state tuition for residents, and more. The only reason many of these have not passed is because of a veto by the Governor. There is some promise regarding funding for training programs in rural areas, like IT grant funding, but none specifically for rural physicians past current levels. It seems that the state is willing to have the current grant funding from the federal government, but state funding has no major political backing in the state legislature.

Scalability: 4

This will result in an additional 132 PCPs in HPSAs by 2030 with an additional 701,744 patient visits a year for 175,436 Virginians. If these PCPs go to rural and urban areas evenly, heavily disproportionately to their populations, this would be an additional 66 PCPs in rural areas, 350,872 patient visits, for 87,718 patients by 2030. The annual patient visits rise each year from some physician retention.

However, this alterative was analyzed under the assumption that the applications for the Virginia loan forgiveness program would all be accepted with new funding and the high number of applications in the last few years would hold. Additionally, this assumes that all J-1 visa holders would apply for the waiver if the restrictions were loosened, and this assumption is strong. Without this, it would likely have a lower scalability.

Directedness: 4

This alternative is direct in that it only focuses on primary care HPSAs, but it does not directly target rural areas. HPSAs are more concentrated in rural areas, so it is assumed

that this will disproportionately aid rural areas. Under the assumption that half of PCPs go to rural HPSAs, this a direct alternative. For the distribution of HPSAs in Virginia, see Appendix A.

Consistent Provider Relationships: 2

One-year retention after the loan forgiveness program is only 40% and 10-year retention is only 20%. This is similar for the J-1 visa waiver program. The largest drop off comes in the first year. More than half of these physicians stay to reap the rewards of the loan forgiveness program or to stay in the United States while they gain resident status, then leave. This is harmful to their patients as they need to get new providers after this short period of 2-3 years. Relationships cannot develop in this time period and patients will need to explain health issues to new physicians every few years and transfer files between offices after these physicians leave.

Alternative 3: Increase Funding for School-Based Health Centers

Cost Effectiveness: 4

SBHCs only cost $22.55 per patient visit to the state. With costs considered as a whole, it is closer to the cost of nurse practitioners. Within a budget, this policy gives rural Virginia the cheapest way to address the problem possible. This accounts for staffing, supplies, and upfront building costs. The rest of the costs are shared among the local and federal government, in-kind donations, grants, and more.

Political Feasibility: 3.8

As mentioned above, all the surrounding states utilize state funding for SBHCs regardless of their political situations. This year, Virginia passed a study and a few companion bills regarding the feasibility of SBHCs with a report due in December. This hints that the General Assembly is considering this method to address access to care issues statewide and this could develop further for the next session. Up to this point, nothing has passed. This option is promising, but unrealized.

Scalability: 3

Fifty state-funded expanded SBHCs could result in 130,000 patient visits every year for 32,500 Virginians. This is in line with the number of state funded SBHCs in surrounding states, but this has the lowest scalability between the options. This could be increased or hours could be expanded to require a full-time staff. But this would be more expensive, and partnerships with existing organizations would be harder to achieve due to the time commitment.

Directedness: 3

Directedness is unclear. The state could mandate the locations be in HPSAs or only in rural areas, but this is unlikely. The most likely outcome is that areas that would opt into this on their own with state funding to cover the costs. The hope is rural areas with lack of access to care would opt into these programs, but there is no guarantee. About a third of SBHCs were in rural areas in 2014, but this is descriptive of how it has been implemented nation-

wide rather than how it would be implemented in Virginia (School-based Health Alliance 1, n.d.).

Consistent Provider Relationships: 4

With immobile locations and granting treatment to people in the area, this could provide consistent provider relationships for years. There will be turnover when children and parents move to other schools, but people in the area and staff could have the same provider for as long as the staff remain in these SBHCs. For parents and students, this allows them to have consistent providers through these SBHCs if they choose them as their primary care providers for 3-5 years. For children, this is a good portion of the time they could have a pediatrician.

Alternative 4: Let Present Trends Continue

Cost Effectiveness: N/A

This option does not cost anything as no additional patient visits or staffing occurs past the present growth. Everything will maintain present trends in Medicaid spending, staffing, and more. This makes this option the least costly, but with zero new patients seen past what would be seen anyway.

Political Feasibility: 5

This alternative requires no further action, just a continuation of current policies already passed and in effect by the state legislature and implemented by the Governor. For this reason, this option is highly feasible.

Scalability: 1

Nurse practitioners have independent practice authority after five years and are growing rapidly. Under this policy, there will be a decline in PCPs from 500 in rural areas now to 482 in 2030 and an increase in independent primary care NPs from 147 to 348. This is less than under any other alternative, but it is still a major increase from 2019. The number of NPs are expected to more than double. However, this is relatively in line with the amount of residents to primary care providers state wide, and lack of access still exists in urban areas.

Directedness: 1

There is no policy change, so there is no real targeting involved. Under this policy, PCPs will continue to congregate in urban areas and neglect rural areas. Nurse practitioners will continue to move to rural areas at a roughly proportional rate, but they will need to work with a shrinking and aging physician workforce to write prescriptions for an aging population.

Consistent Provider Relationships: 1

Patients that have physicians will be able to have a consistent relationship, but residents without access to care will continue to not have a provider relationship at all.

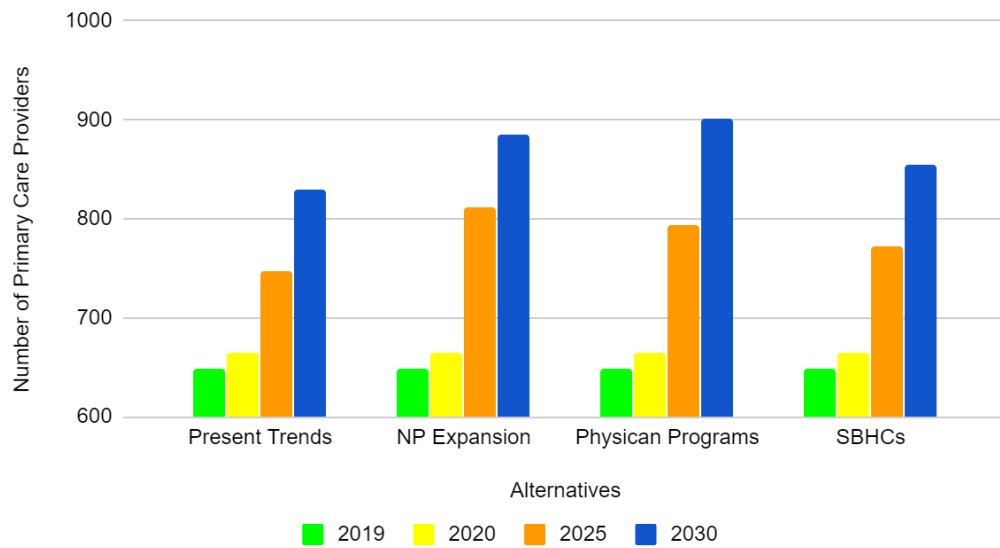# Figure 1. Total Rural Providers in Each Alternative

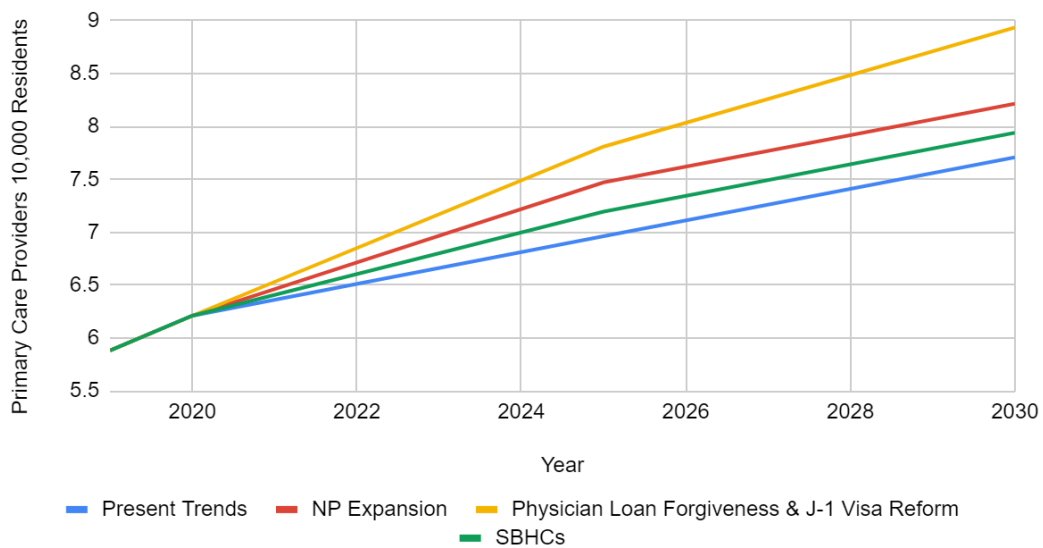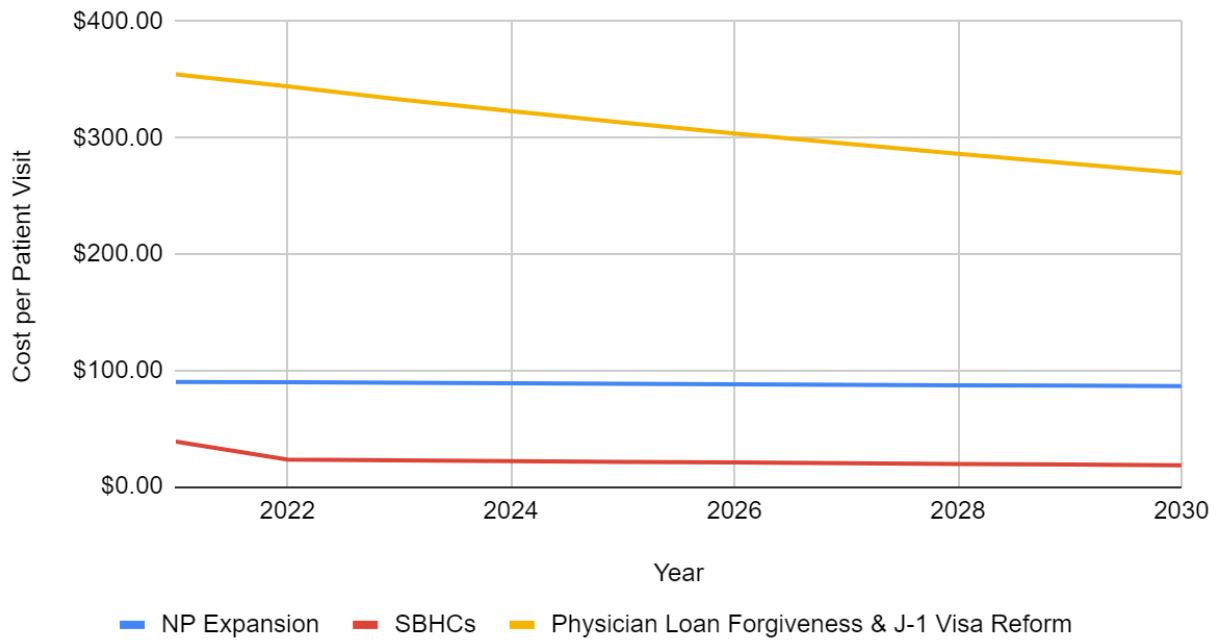# Figure 2. Rural Primary Care Providers by Alternative

Figure 3. Cost Effectiveness Analysis for Each Alternative

Legend: NP Expansion, SBHCs, Physician Loan Forgiveness & J-1 Visa Reform

Outcomes Matrix

Outcomes are rated on a scale of one to five: 1=very low, 2=low, 3=medium, 4=high, 5=very high. Each criterion is weighed relative to their overall importance.

Criteria	Alt 1: Nurse Practitioner SOP Expansion	Alt 2: Visa Reform & Loan Forgiveness Expansion	Alt 3: School-based Health Centers	Alt 4: Let Present Trends Continue
Cost Effectiveness (.30)	3. $88.20/per patient visit.	1. $310/per patient visit.	4. $22.55/per patient visit	N/A. Rural PCPs decline from 500 to 482. Rural NPs in primary care increase from 147 to 348.
Political Feasibility (.20)	4.8. Similar laws pass. Governor supportive.	2.75. Little support for immigration. Some support for grant funding.	3.8. Virginia has several studies and some similar bills passing.	5. Requires no action.
Scalability (.20)	4. 62,816 rural patients a year provided by 55 additional independent nurse practitioners in primary care.	4. 87.718 rural patients a year as an upper bound. This will result in 66 additional rural PCPs by 2030.	3. 32,500 rural patients a year with 50 SBHCs (similar to MD and NC state funding).	2. PCPs continue to decline and NPs cannot prescribe alone, but more than double in number.
Directedness (.15)	2. Statewide, but with consistent increases every year that area proportionally higher than at present.	4. Only needy areas, but not necessarily rural areas. Assumption is a disproportionate amount here.	3. As long as they are approved as needed in the targeted area.	1. No targeting
Consistent Provider Relationships (.15)	5. Life-long primary care providers	2. 40% Retention 1 year after, but only 20% 10 years after.	4. Primary care providers for a family for years.	1. No solution and people lack access
Totals	3.71	2.55	3.61	2.43

Recommendation

The VRHA should focus its efforts on expanding prescription authority to nurse practitioners and reducing the work hours required for independent practice to 3,000 hours instead of 9,000 hours post-training. Based on my analysis, this will create an increase in the number of independent practice eligible primary care nurse practitioners in rural Virginia by about 110 annually, and I estimate about 55 will opt into independent practice (1,110 and 550 statewide). These NPs will also be able to prescribe medications on their own, rather than relying on physicians to partner with them. This will empower a rapidly growing workforce to provide care for rural Virginians rather than relying on an aging PCP workforce that is declining year after year. Furthermore, as these PCPs decline and retire, finding physicians to partner with may become more difficult, so utilizing NPs now is vital. The number of primary care nurse practitioners eligible for independent practice will increase by 136% by 2030 without this expansion, but they will be unable to prescribe medications without a partnering physician. This policy will raise the growth rate to 173% instead, and allow flexibility. It will also increase NPs fast enough to replace the retiring PCP workforce and improve provider choice. With a growing workforce, the number of nurse practitioners per 10,000 is set to more than double as the population remains flat. This results in more patient visits than SBHCs, but my estimates placed physician visas and loan forgiveness as being more scalable. However, this was under the assumption that the visa waiver is extended to every J-1 visa physician in Virginia, and this seems unlikely from lack of interest in previous years. For loan forgiveness, this assumes that the higher number of applicants from the last two years is maintained and there is enough funding to accept the rejected applicants to double the enrolled members of the Virginia loan forgiveness program.

Nurse practitioner scope of practice changes also allows for major increases in non-rural areas as well, enabling partnerships with advocacy organizations not specifically concerned with rural areas. The growth rate of NPs in non-metro areas is also roughly proportional to the state population that lives in these areas. These NPs move into rural areas by choice, so their retention rates will be far higher than PCPs that are incentivized to more into a rural area for visa status or student loan forgiveness. This will ensure retention and long-term patient-provider relationships.

This policy also requires a one-time law change in the Virginia General Assembly when the legislature and Governor have been receptive to scope of practice expansions and occupational licensing reforms in recent years, including reimbursement parity. Visa waivers and immigration have generally seen a backlash against them in the legislature, statewide. Regarding loan forgiveness, this has a high up-front cost and bills like these rarely come up in the legislature. SBHCs are being studied, but do not have major political backing yet.

SBHCs were more cost-effective than NP expansion, but this is because state governments only fund 25% of the cost of SBHCs. When all costs are accounted for among several groups, SBHCs are about as cost-effective as NP expansion. Additionally, the outcome only accounts for costs per rural primary care independent NP. If the outcome was statewide, it would be considered a tenth the cost per patient visit, making it more cost-effective than SBHCs. On a separate non-quantified note, SBHC funding does not actually increase the number of providers in Virginia state-wide. Instead, it redistributes the time they spend in rural areas. NP expansion does increase the number of primary care providers statewide and in rural areas.

Finally, NP expansion should be priority number one, but SBHCs can be a good complementary policy. If it is feasible to advocate for both, the VRHA should do so. This will both expand providers and target equity directly. With these issues being debated in the last legislative session, these policies can be realistically achieved in the next few years.

Implementation

As a 501 c (3), the VRHA cannot change state policies itself, but it can advocate for these policies. The VRHA should partner with: The Virginia Council of Nurse Practitioners, the Virginia Nurse Association, the American Association of Nurse Practitioners (AANP), and VRHA's own association members (individual and organizational). The AANP has both a regional and a state representative in Virginia, Dr. Lori Martin-Plank and Mary Duggan, respectively. These two individuals should be contacted to form a partnership. By combining resources, the VRHA and other advocacy organizations can effectively educate both the executive and legislative branches on these issues.

Regarding the executive, Governor Ralph Northam has been generally supportive of nurse practitioner and physician assistant expansion up to this point. The VRHA should continue a dialogue with both the Office of the Governor and the Office of the Secretary of Health and Human Resources on the viability of full nurse practitioner independence after two years of experience. Aside from inviting them or a representative to speak at your annual meeting or other rural health summits, the VRHA should continue to attend the Virginia Chamber of Commerce's Health Care Conference and other conferences on an annual basis. This provides an invaluable opportunity to meet representatives of the executive and stress the importance of further expansion of scope of practice laws.

The initial nurse practitioner scope of practice bill was sponsored by Delegate Roxann Robinson, a Republican from Chesterfield. Remaining in contact with her office, and pressing her on the need for further expansion is a good first step. After thanking her for the initial expansion, educating her on the need for prescription authority and loosening of work hour requirements is a way for her to help her constituents again, while building on her past success. This bill will likely go through the Senate Education and Health Committee as well as the House Health, Welfare, and Institutions Committee. Senator Dick Saslaw, the top Democrat in the Senate, is on this committee. Advocacy efforts should be

focused on him, as well as Senator Newman. The last bill passed universally, but educating them on further expansion should not be neglected. The House committee had five no votes, 4 Democrats and 1 Republican. Therefore, getting support from Democratic leadership may be more pressing here to avoid a failure. Republican support should not be neglected, but there seems to be more hesitation among Democratic members.

By remaining visible, partnering with other state advocacy organizations, and focusing on support within the relevant committees and party leadership, nurse practitioner expansion can be passed. Once achieved, this implementation should be fairly seamless as it is merely an expansion of existing regulatory policy. Patients will begin to reap the benefits of this policy as soon as it is implemented, and the health of rural Virginians will improve in the years to come.

Appendix

Appendix A. Virginia Primary Care HPSA Status by County. Non-Metro vs. Metro. (2017)

Health Professional Shortage Areas: Primary Care, by County - Virginia Nonmetropolitan 2017
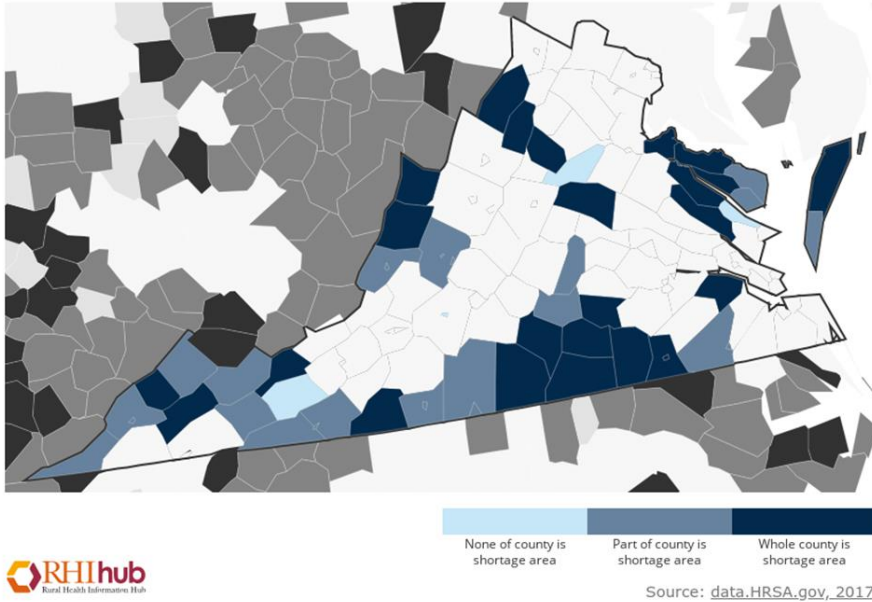
Source: RHI Hub (n.d.)

Health Professional Shortage Areas: Primary Care, by County - Virginia Metropolitan 2017
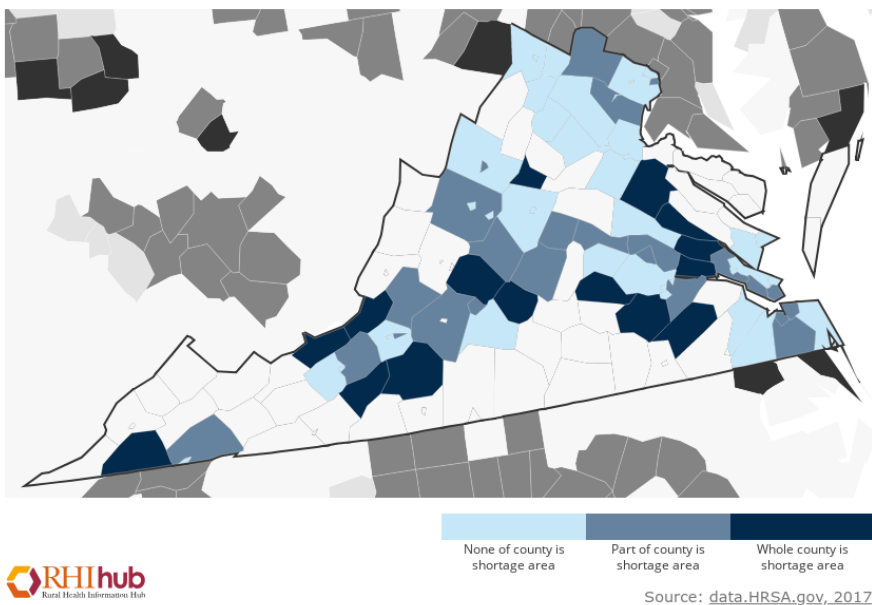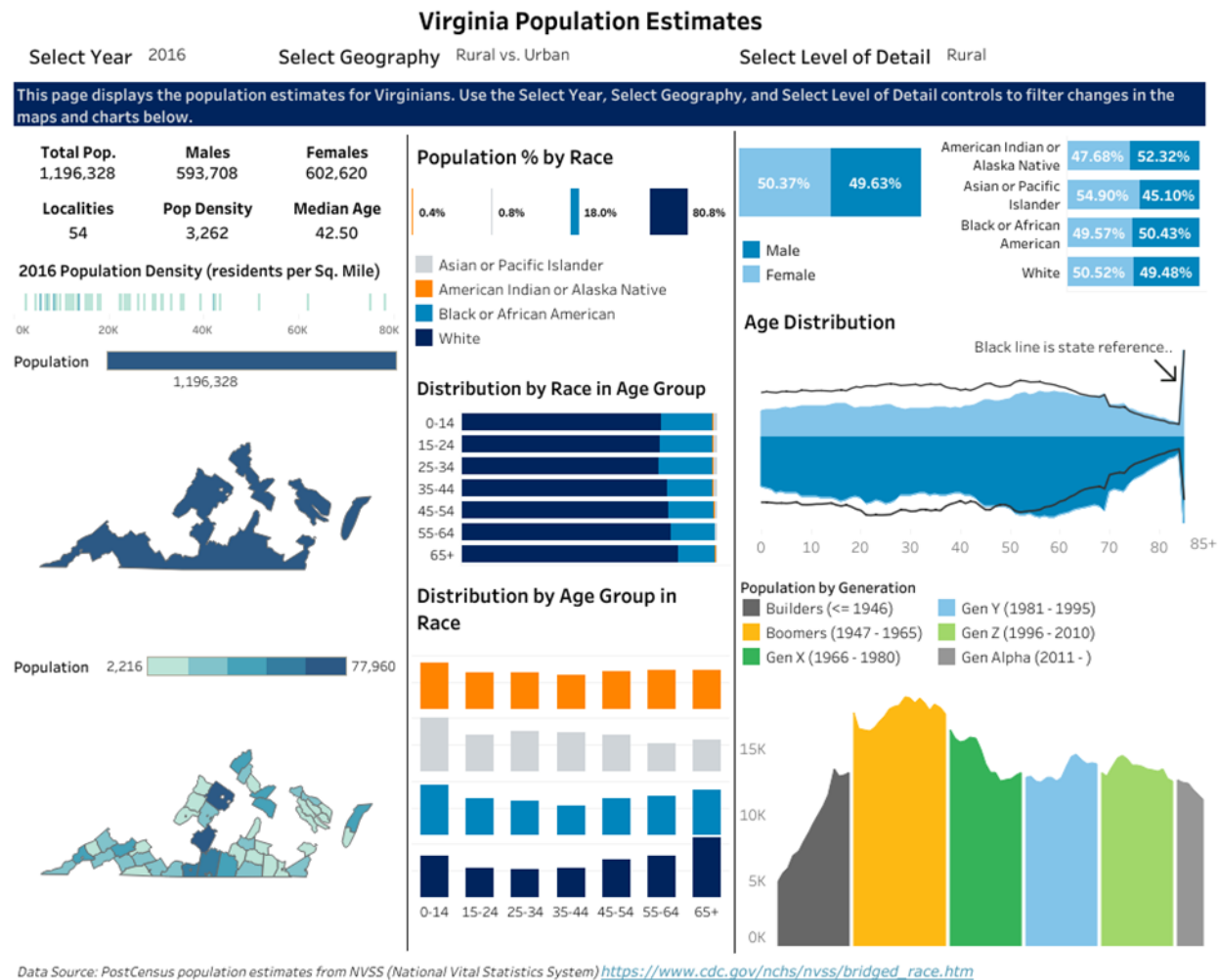

Source: RHI Hub (n.d.)

Appendix B. Virginia Department of Health, Virginia Population Characteristics in 2016

Virginia Population Estimates

Select Year 2016   Select Geography Rural vs. Urban   Select Level of Detail Rural

This page displays the population estimates for Virginians. Use the Select Year, Select Geography, and Select Level of Detail controls to filter changes in the maps and charts below.

Total Pop.	Males	Females
1,196,328	593,708	602,620

Localities	Pop Density	Median Age
54	3,262	42.50

2016 Population Density (residents per Sq. Mile)

0K   20K   40K   60K   80K

Population   1,196,328

Population % by Race

0.4%   0.8%   18.0%   80.8%

- Asian or Pacific Islander
- American Indian or Alaska Native
- Black or African American
- White

Distribution by Race in Age Group

0-14
15-24
25-34
35-44
45-54
55-64
65+

Distribution by Age Group in Race

Population   2,216 — 77,960

0-14 15-24 25-34 35-44 45-54 55-64 65+

	Male	Female
	50.37%	49.63%
American Indian or Alaska Native	47.68%	52.32%
Asian or Pacific Islander	54.90%	45.10%
Black or African American	49.57%	50.43%
White	50.52%	49.48%

Age Distribution

Black line is state reference..

0   10   20   30   40   50   60   70   80   85+

Population by Generation

- Builders (<= 1946)
- Boomers (1947 - 1965)
- Gen X (1966 - 1980)
- Gen Y (1981 - 1995)
- Gen Z (1996 - 2010)
- Gen Alpha (2011 -)

15K
10K
5K
0K

Data Source: PostCensus population estimates from NVSS (National Vital Statistics System) https://www.cdc.gov/nchs/nvss/bridged_race.htm

Source: Virginia Department of Health (2018)

Appendix C. Center for Geospatial Information Technology, Map of Broadband Coverage in Virginia and Telehealth

In the early stages of this project, I considered grants for telehealth programs. However, many areas of the state lack access to broadband services and they are disproportionately in rural areas. This is likely to remain this way for the foreseeable future regardless of funding. Because of this, I removed this alternative from consideration. Below is a map of this as well as my literature review on this alternative.

The map below shows areas without broadband coverage issues in green, those with incomplete coverage in yellow, and those without coverage in red.
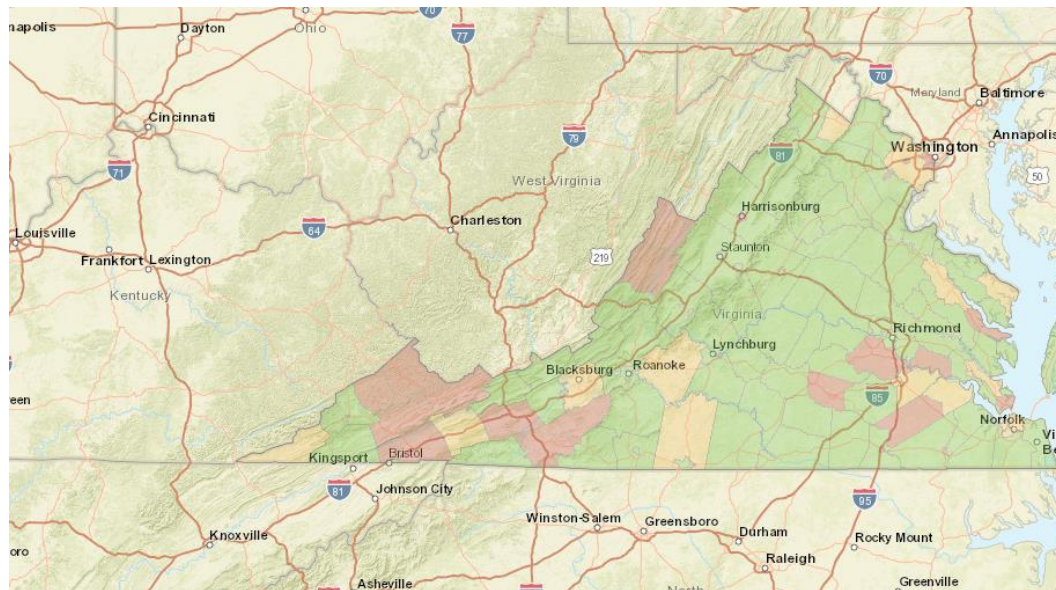
Source: (Center for Geospatial Information Technology, n.d.)

Telehealth: Access Through Technology

An approach many people point to is the utilization of telehealth. Telemedicine is defined as "the use of medical information exchange from one site to another via electronic communications to improve a patient's clinical health status." This includes electronic communications and information technology used to provide health assessments, diagnoses, interventions, and consultations (Kvedar, Coye, & Everett, 2014). One review of 20 studies found telemedicine has positive effects. These include therapeutic effects and increased efficiency in delivery of services. Successful interventions using telehealth included psychological interventions, treatment of chronic heart failure, home telemonitoring of lung conditions, smoking reduction programs, heart disease prevention, psychiatry, and more. Telehealth programs also reduce waiting times, unnecessary referrals, improve patient and provider satisfaction, and diagnostic accuracy was either unchanged or improved (Ekeland, Bowes, & Flottorp, 2010). Effects were more marginal with telemonitoring of conditions like heart failure and diabetes, and I am inclined to trust telehealth at least for expanding access to care for consultation of specialists,

transferring of medical records, and more. This study removed non-reviews, low quality reviews, reviews using different measurements, and reviews with serious limitation. Furthermore, the questionable or "promising" cases centered around things like active monitoring at home. Telemedicine as it would help increase access to care is more so for electronic communications and video conferences. These results were clear. This study lacks quality information on the cost-effectiveness of telemedicine though, and that must be considered. Specific information on transportation, viability in Southwest and Southside Virginia, and more should be considered. Telehealth requires reliable access to broadband and many high upfront costs, and progress here is hard to ascertain.

Significant barriers to telehealth exist. As of 2016, Twenty-nine states required that private insurers cover telehealth services equivalent to regular primary care, and 48 state Medicaid programs cover telehealth. Medicare, however, reimburses for telehealth services only in HPSAs with only $5 million on telehealth services in 2012. The unspoken concern may be that telehealth availability will lead to overuse compared to in-person primary care. However, some studies suggest that telehealth visits can reduce costs via lower rates of diagnostic testing. State licensing laws and social barriers also exist. The social aspect is considered a significant barrier, or the hesitance of the elderly to use technological solutions (Dorsey & Topol, 2016; Rogove, 2011). For example, rural Americans correspond with doctors via online portals and email less (Greenberg et. al, 2017). Interstate regulations and reimbursement can also be a major issue. Telehealth requires having approval in all states involved (Weinstein et, al, 2014; Rogove, 2011). For example, someone in southwest Virginia getting a telehealth appointment with a specialist in Kentucky via a small clinic in Virginia requires the clinics to have clearance in both states involved. Reimbursement may not be at parity or split between doctors, so they would be disincentivized to use telehealth to help their patient.

To utilize telehealth, broadband services are needed. Urban Americans are three times for likely to have access to broadband compared to rural America, fueling a large disparity in access (FCC, 2014). In December 2018, Governor Northam announced a plan for $50 million in FY 2020 funding for telecommunications companies to expand in underserved areas. At present, funding is set for $4 million annually, and he considers this part of a plan for $250 million in overall funding over several years. The aim of this proposal in to increase access to internet speeds faster than 10 megabits per second, far faster than the 56 kilobits offered by dial-up speed internet (Commonwealth of Virginia, 2018). However, only $15 million was allocated in the biannual budget in the most recent legislative session. If this passes in the in a future session, this could open up high speed internet to the rest of the state, allowing telemedicine to be utilized in some areas for the first time. As seen in the map above, areas in red have no broadband policies, while areas in yellow have incomplete coverage. This overlaps with rural areas of the state and HPSAs, preventing telemedicine (Center for Geospatial Information Technology, n.d.). Because of this, hundreds of thousands of rural Virginians would not benefit from a telehealth program because they live in areas with limited or no broadband access. Therefore, this alternative is not applicable for these residents until universal broadband is closer to reality.

Appendix D. Increasing the Primary Care Reimbursement for Medicaid to match Medicare rates

During this course of this project, I considered increasing the Medicaid reimbursement rate to match Medicare for primary care services. The thought process behind this was increasing the reimbursement rate could convince PCPs in shortage areas to take Medicaid patients, accept more patients, or to move into these areas and accept Medicaid patients. However, researching this made it clear that physicians would not move to an area for additional Medicaid reimbursement, and physicians' preferences for Medicaid patients was not receptive to this policy change. The most likely result would be that physicians that accept Medicaid patients would accept a few more patients, and get additional funds for patients they were already treating. This would be prohibitively expensive for a small increase of patients on the margin. Below is my literature review on the policy.

Increasing the Medicaid Reimbursement Rate for Primary Care

The United States has a collection of 51 separate Medicaid programs that set different reimbursement rates for primary care, obstetric care, and more. These rates change by year, and several of these services can be seen below.

Table 4. Medicaid-to-Medicare Fee Index in 2016

Location	All Services	Primary Care	Obstetric Care	Other Services
United States	0.72	0.66	0.81	0.82
District of Columbia	0.79	0.8	0.79	0.78
Maryland	0.88	0.92	0.86	0.81
Virginia	0.92	0.84	1.03	0.97
West Virginia	0.81	0.74	1.04	0.71

Source: The Kaiser Family Foundation 2

Periodically, these state Medicaid agencies will change reimbursement rates based on their budget constraints, economic factors, and more. In 2013 and 2014, the federal government gave state Medicaid programs additional funding so their reimbursement rates would match the Medicare rates (Kaiser Family Foundation 2, n.d.). Taken from the perspective of supply and demand, some scholars reason that increasing the reimbursement rates for Medicaid could increase the number of healthcare providers that accept Medicaid for things like primary care services.

Cunningham and Nichols (2005) found a strong relationship between state Medicaid reimbursement rates and the rate at which doctors accept Medicaid patients, but this did not translate into a sizeable effect on access for patients themselves. This study looked at measures of access to care like foregoing necessary medical care in the last year, having a regular place of medical care, and more in the Community Tracking Survey controlling for variables like demographics, reimbursement rates, practice type, managed care penetration, and more. They found that a 20-percentage point increase in Medicaid to Medicare reimbursement would increase the acceptance rate of new patients by 10.6 percentage points, or about 0.53 percentage points for every percentage point increase in the Medicaid to Medicare ratio. However, this varied to as much as 16.3 percentage points in Little Rock Arkansas to 0.4 in Phoenix. At first glance, this seems to be correlated with areas that had higher acceptance rates from Medicaid already, somewhere in the range of 60-80%. On outcomes, having a usual place of care only increased by 4%, while emergency room visits dropped by 9% and unmet medical needs dropped by 21% (down 1.7 percentage points from 8.1 percentage points). They believed this was a relatively small effect for the first two because Medicaid patients mostly had usual places of care. Therefore, the benefits here are mostly indirect. Furthermore, they explained that managed care settings are associated with less of a change for patients with reimbursements rather than more. This is likely because groups are given a pool of funding rather than fees for each patient, which disconnects marginal patient visits with funding somewhat.

Buchmueller, Orzol, & Shore-Sheppard, L (2013) did a similar examination with Medicaid reimbursement rates using a state fixed effects model from 1999 to 2009. They found that this increased the proportion of dentists that accept public insurance and have public insurance patients by about 0.47 percentage points per percentage point increase in the Medicaid to Medicare fee ratio, or roughly the same as Cunningham and Nichols (2005) while controlling for many demographic characteristics. In this case, about 38% of dentists accepted Medicaid, showing a similar effect in lower acceptance rates for dentists as physicians with higher acceptance rates. This study also has the benefit of analyzing all 50 states rather than 12 cities like in Cunningham and Nichols (2005). However, this study found an increase of about 0.3 percentage points per percentage point increase in the fee index for dentists having any Medicaid patients, but no statistical increase in the ratio of their patients. Therefore, the amount of Medicaid patients accepted was small per practice. They also found that the elasticity of demand for these patients was very low, so large changes in reimbursement were needed for a measurable effect. However, these are not actual examinations of reimbursement changes, but are instead attempts to use controls to determine what the association is between reimbursement and access.

Alexander & Schnell (2018) conducted just such analysis with a difference-in-difference study using the full Medicaid to Medicare matching rates in 2013 and 2014 to see the real effects of reimbursement increases on access to care. This study controlled on state effects, county effects, HPSA status, and many demographic controls. It found a 0.55 percentage point drop in difficulty accessing care and 0.37 percentage point drop in lack of a regular place of medical care compared to the previous rates of 2.12% and 1.57% respectively with no detectable difference between HPSAs and non-HPSAs. This was after a $10 increase in average Medicaid reimbursement to PCPs. Additionally, this increased

the odds of seeing a doctor in the last 2 weeks by 1.5%, decreased chronic absenteeism by 2%–8%, decreased reports of no new patients by 14%, decreased insurance refusals by 11%, and decreased reports of trouble finding a doctor by 26%. Prior to this, Medicaid matched at 66% of Medicare rates and this $10 increase represented parity with Medicare. Therefore, an increase in Medicaid rates in Virginia now to Medicare level for primary care would represent half of the benefits of this study. This seems to show a relatively more modest effect than the studies cited above, but I am more inclined to believe it. First, this study uses a full spread of all US states, and is more recent than either study above. Second, it is more recent than the first study, taking place after the passage of the ACA. Third, this study dealt with real changes in the primary care reimbursement rate rather than a prediction. While the changes were fairly large in terms of percentage, the absolute changes to establish care for the last few patients only appeared to be modestly successful. This is in keeping with previous studies.

Appendix E. Political Feasibility Criterion Methodology

Political feasibility was measured by looking at the bills discussed during the 2019 Virginia General Assembly Legislative Session (Virginia's Legislative Information System, n.d.). Bills were scored from 1 to 5 with five being the most feasibility and one being the least feasible. A five was when a bill was passed by both houses of the legislature and signed by the Governor into law. A four either died on the floor or was passed, but a less comprehensive bill than what would be considered a full passage of a specific policy. Threes were bills that were passed as "studies" or bills that died in committee in a close vote. A two died in committee through tabling debate, promising a "study", or something similar. A one was rejected by a committee in an overwhelming vote.

Scores were compiled for bills similar to the alternative in question. For example, occupational licensing reform bills for nurse practitioners, healthcare workers, or more were considered for nurse practitioner expansion. Grant funding for loan forgiveness for rural area jobs and immigration reform bills were considered for physician loan forgiveness and the J-1 Visa waiver. Bills on SBHCs, school counselor staffing requirements, care for government staff, and more were considered for SBHCs.

Once compiled, these scores were averaged to find the overall political feasibility for each option. The results from the 2019 session can be seen below. For Nurse practitioner expansion, the partial expansion from 2018 was included because it was passed into law.

NP EXPANSION

5s	HB 2169 (2019)	HB 1640 Signed by Governor.	HB 1849 Signed by	HB 1914 Signed by	

	Signed by Governor. Makes PA license easier to obtain in VA.	NP reimbursement parity to MDs.	Governor. Dental hygienists can be supervised remotely in behavioral health units.	Governor. Loosened antibiotic prescription authority without a previous patient relationship.	
4s	HB 1952 Patient care teams; podiatrists and physician assistants. – Signed by Governor.	2018: Nurse Independent Practice after 5 years, but no prescription authority.			Score: 4.8

Physician Loan Forgiveness and J-1 Visa Reform

5s	HB 2185 (2019) Virginia Rural Information Technology Apprenticeship Grant Fund and Program; established. – Signed by Governor				
2s	SB 1640 (2019) – In-state tuition for permanent resident applicants	HB 2270 (2019) Notify ICE of incarcerated aliens–passed along party	SB 1156 (2019) Sanctuary City Ban– Vetoed by Governor after a party line	Score: 2.75

	passed by indefinitely	lines and vetoed by Governor.	passage in both houses. Anti–immigrant bill.

SBHCS

5s	SB 1358 (2019) Signed by Governor. Clinics to care for staff and dependents	SB 1406 (2019) Signed. Ratio requirements: school counselors.	
4s	HB 1735 (2019) – faculty ratios on mental health. Passed unanimously, but no agreement.		
3s	SB 1195 (2019) Study Signed on feasibility of SBHCs in VA.		
2s	HB 2006 (2019) – Create Taskforce on SBHCs under Sec of Health		Score: 3.8

Appendix F. Cost-Effectiveness Criterion Methodology

The cost-effectiveness analysis used for this assignment compiled information from several papers and government workforce data surveys to come to its conclusion. This required different methods for each alternative, and this will be explained in what follows.

Because the scope of this problem is measured in decades, I decided that my cost-effectiveness analysis would take place from the years 2019 through 2030. The benefits of access to care are well documented and cited throughout this document, but monetizing the collection of downstream health effects was not feasible. Therefore, I opted for a cost-effectiveness analysis. For sensitivity analysis, I compared all of my alternatives using a 3% and a 7% discount rate. All amounts stated in the actual project are using the 3% discount rate. Because all alternatives are implemented in 2021 and have constant benefits, this did not have any measurable effect on the optimal alternative. One limitation of my analysis is that they do not account for a substitution effect of uncompensated care costs being reduced as primary care costs increased. This is because these are often caused by people going to the emergency room for untreated medical issues, and general lack of insurance. This was difficult to separate with the benefits of access to care. This means my alternatives are more expensive per patient than they would be in reality. This applies on a per patient basis for all alternatives, however, so this would not change the outcome in any circumstance for the cost-effectiveness analysis. All costs were in 2019 US dollars. Only the costs of SBHCs from Nystrom & Prata (2008) had to be adjusted, which were originally in 2005 US dollars. This analysis is statewide data from Oregon, rather than just a rural area, so costs may be different than they would be in reality.

The measured outcome was additional patient visits in rural communities. I also calculated the estimated number of patients on an annual basis, with the assumption that the average patient sees a primary care provider four times per year.[4] To determine number of additional patient visits per year, I divided the number of new providers by the "workers per FTE" number given by the Virginia Department of Health Professions. I then assumed that offices would be open 5 days a week for 260 days a year, multiplied this by the number of additional providers, and assumed that a full-time provider could see 20 patients a day.[5]

$$Patient\ Visits = \frac{Health\ Workers}{FTE\ Units} \times 260\ Days \times 20\ patients\ daily$$

Let Present Trends Continue

This alternative was a baseline, costs from present trends were developed to be used against the other alternatives. This means present trends shows up as zero additional costs and zero benefit even though there will be more providers, patients, and spending. Under all of my alternatives, these policies were assumed to be passed during the 2020 Virginia General Assembly session with implementation occurring in the 2021 calendar

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[4] Health Status: https://www.healthstatus.com/health_blog/wellness/doctor/
[5] Statistica: https://www.statista.com/statistics/613959/us-physicans-patients-seen-per-day/

year. Because of this, each alternative has no difference from "Let Present Trends Continue" for the years 2019 and 2020.

Having access to care is dependent on how many providers there are in an area per resident. To project population growth statewide and in rural Virginia, I used the analysis from the Weldon Cooper Center, which included 2016 ACS data as well as their 2020 and 2030 projections. I annualized the projected population change from 2016–2020 and from 2020–2030 to estimate the populations in these regions for any given year.[6]

To project the number of physicians and nurse practitioners statewide and in rural areas, I used Virginia workforce surveys from the Virginia Department of Health Professions. For Nurse practitioners, I used the surveys from 2015–2018. For physicians, I used the surveys from 2014, 2016, and 2018[7]. These surveys had information on their places of origin, places of practice, full time equivalency units, changes in the number of licensees and the strict Virginia workforce, and specialty. I created average trends from these years to determine the annual change in total professionals, specialty, and the proportion of rural providers. I then assumed that the proportion of primary care providers were equal to the state total to find the number of providers. For the number of new primary care providers each year, I assumed that the proportion of primary care certified professional would not change as it has not in the last several years.

$$\text{Total Rural PCP or NP PCPs FTEs} = \frac{VA\ Workers\ \times\ \%\ Primary\ Care\ Specialty\ \times\ \%\ Rural}{FTE\ Units}$$

The number of J–1 visa waivers and number of physicians participating in the Virginia Loan Forgiveness Program is represented in these numbers, so I only needed to look at the rejected applicants that would be accepted for my alternatives based on information given to me by the representative for the Virginia Department of Health and the Appalachian Regional Commission representatives, Olivette Burroughs.[8] The information she provided was the number of rejected applications due to funding issues for the Virginia Loan Forgiveness Program for primary care physicians. Information on the ARC J–1 Visa program can be found on their website.[9] To determine nurse practitioner application rates, I assumed scenarios in which 30% and 50% of eligible nurse practitioners applied, respectively. In my final analysis, I assumed that 50% of eligible nurse practitioners applied.

The application for the J–1 visa waiver for flex slots involves a $3,000 fee each[10], and the application for independent practice for a nurse practitioner costs $100 each.[11] These were

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[6] University of Virginia Weldon Cooper Center, Demographics Research Group (2017): https://demographics.coopercenter.org/virginia-population-projections

[7] Virginia Department of Health Professions: https://www.dhp.virginia.gov/hwdc/findings.htm#NP
[8] Olivette Burroughs can be contacted at olivette.burroughs@vdh.virginia.gov
[9] VDH J–1 Visa Slots: http://www.vdh.virginia.gov/health-equity/conrad-30-waiver-program-overview/
[10] ARC J–1 Visa Waiver FAQ: https://www.arc.gov/program_areas/ARCARCFederalCoChairsJ1VisaWaiverPolicy.asp
[11] Nurse Practitioner Independent Practice Application: https://www.dhp.virginia.gov/Forms/nursing/NURSE%20PRAC/NP_AutonomousPractice,.pdf

calculated to account for the revenue the state generated for each additional application. To calculate the cost of review time, I assumed that an administrative assistant could review 3 applications an hour, and they were paid the state average hourly pay for administrative assistants.[12] In my analysis, I assumed that Virginia would meet their 30 allotted J-1 visa waiver slots every year and any additional slots would be flex slots from the ARC program. For the Virginia Loan Forgiveness program, I assumed applications would remain at the rate of 18 from the last two years and that the status quo rejection rate was an average of the last five years.

$$Cost\ of\ Application\ Review = \frac{\#\ Apps}{3\ per\ hour} \times Hourly\ Wage\ Admin.Assist.$$

$$Application\ Revenue = \#Apps \times Application\ fee$$

$$Net\ App\ cost = Cost\ of\ App\ Review - Application\ Revenue$$

School-based health centers currently have no funding in Virginia and there are no plans to do so. Therefore, the baseline costs here are $0 as are any benefits. The SBHC alternative could simply be an addition to present trends in both benefits and costs. For this analysis, I made the assumption that any hours worked would not have occurs in another area if the SBHC did not exist.

Nurse Practitioner Scope of Practice Expansion and Reform

This alternative lowers the requirement for independent practice status from 5 years to 2 years. To find the number of newly eligible nurse practitioners in 2021, the number of nurse practitioners from 2016-2018 were combined for the initial influx of applications after accounting for the primary care certified nurse practitioners and the rate at which nurse practitioners work in rural areas. For every year after this, the average growth rate in absolute terms from 2015-2018 was used. Each additional nurse practitioner increased costs and revenues for the application process.

2019 Independent Rural NP PCPs

$$\begin{aligned}\#\ of\ Rural\ Independent\ NP\ PCPs \\ = (NPs \\ - New\ NPs\ 2014\ through\ 2018) \times \%\ Primary\ Care\ \times\ \%\ Rural \\ \times\ Application\ rate\end{aligned}$$

First year of Expansion

$$\begin{aligned}\#\ of\ New\ Rural\ Independent\ NP\ PCPs \\ = (Avg.New\ NPs\ per\ year\ \times 3) \times \%\ Primary\ Care\ \times\ \%\ Rural \\ \times\ Application\ rate\end{aligned}$$

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[12] Zip Recruiter, VA Administrative Assistant: https://www.ziprecruiter.com/Salaries/What-Is-the-Average-Administrative-Assistant-Salary-by-State

After (in "Present trends" as well)

$$\text{\# of New Rural Independent NP PCPs} = Avg.\,New\,NPs\,per\,year \times \%\,Primary\,Care \times \%\,Rural \times Application\,rate$$

According to Kleiner et. al (2016), full scope of practice expansion decreases the wages of primary care providers by 2.8 percentage points and increases the wages of nurse practitioners by 4.5 percentage points. To calculate the costs of this to the state of Virginia, the wages of nurse practitioners[13] and primary care physicians[14] in Virginia were calculated to account for this change and Virginia income tax rates were used to determine gains and losses to state tax revenue from this change.[15] To account for additional sensitivity other than the application rates, I calculated costs under the assumption that this would not occur as well, but my stated analysis in the text assumes salary changes occur.

$$\text{Tax Revenue Change PCPs} = (Average\,VA\,PCP\,Salary \times (1 - Salary\,Reduction)) \times VA\,Income\,Tax\,Rate \times \#\,PCPs$$

$$\text{Tax Revenue Change NPs} = (Average\,VA\,NP\,Salary \times (1 + Salary\,Increase)) \times VA\,Income\,Tax\,Rate \times \#\,PCPs$$

$$Net\,Tax\,Revenue\,Change = NP\,Tax\,Revenue\,Change + PCP\,Tax\,Revenue\,Change$$

Additional patients lead to increased medical spending each year. While the state government does not pay for the majority of health insurance, it does contribute to the Virginia Medicaid program. To find a per capita cost for Medicaid, I multiplied the 2018 Medicaid spending by the proportion of acute care and managed care and divided this by total Medicaid enrollees.[16] I then multiplied by the state proportion of the spending.[17] To account for the Medicaid expansion, I multiplied the new 200,000 enrollees[18] by the per capita Medicaid spending and added this to overall enrollment numbers from 2018, assuming that the state would only pay 10% of the overall costs. I also added this population to the proportion of the population on Medicaid as cited by the Kaiser Family Foundation (2018) to project how many new patients seen would be Medicaid enrollees. I multiplied by

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[13] Zip Recruiter, VA NP Salary: https://www.ziprecruiter.com/Salaries/What-Is-the-Average-Nurse-Practitioner-Salary-by-State

[14] Zip Recruiter, VA PCP Salary: https://www.ziprecruiter.com/Salaries/What-Is-the-Average-Primary-Care-Physician-Salary-by-State

[15] Virginia Income Tax: https://www.individual.tax.virginia.gov/calculators/income-tax-calculator.cfm

[16] Virginia Medicaid Spending, KFF 2018: http://files.kff.org/attachment/fact-sheet-medicaid-state-VA

[17] MACPAC: https://www.macpac.gov/wp-content/uploads/2015/01/EXHIBIT-16.-Medicaid-Spending-by-State-Category-and-Source-of-Funds-FY-2017.pdf

[18] Office of the Governor: https://www.governor.virginia.gov/newsroom/all-releases/2018/december/headline-837430-en.html

per capita spending rate by the proportion of new patients seen that I estimated to be on Medicaid to get this cost.

$$Per\ capita\ Medicaid\ Spending\ Primary\ Care\ pre-Expansion$$
$$= \frac{Total\ Spending \times \%\ State\ Spending \times (\%\ Acute\ care\ or\ Managed\ Care)}{Medicaid\ Population\ 2018}$$

$$Per\ capita\ Medicaid\ Spending\ Expansion\ Pop.$$
$$= \frac{Total\ Spending \times 10\%\ State\ Funding \times (\%\ Acute\ care\ or\ Managed\ Care)}{Medicaid\ Expansion\ Population\ (200,000)}$$

$$Per\ Capita\ Medicaid\ Spending\ Primary\ Care\ post\ Expansion$$
$$= (Per\ Capita\ Before\ Expansion \times Proportion\ Before\ Expansion\ Pop.)$$
$$+ (Per\ Capita\ Expansion\ Pop. \times Proportion\ Expansion\ Population)$$

$$Cost\ of\ Program$$
$$= (Per\ Capita\ Medicaid\ Spending \times \#\ New\ Patients)$$
$$+ Net\ Application\ Costs + Net\ Tax\ Revenue\ Change$$

Figure 4. Nurse Practitioner Cost Effectiveness Sensitivity Analysis
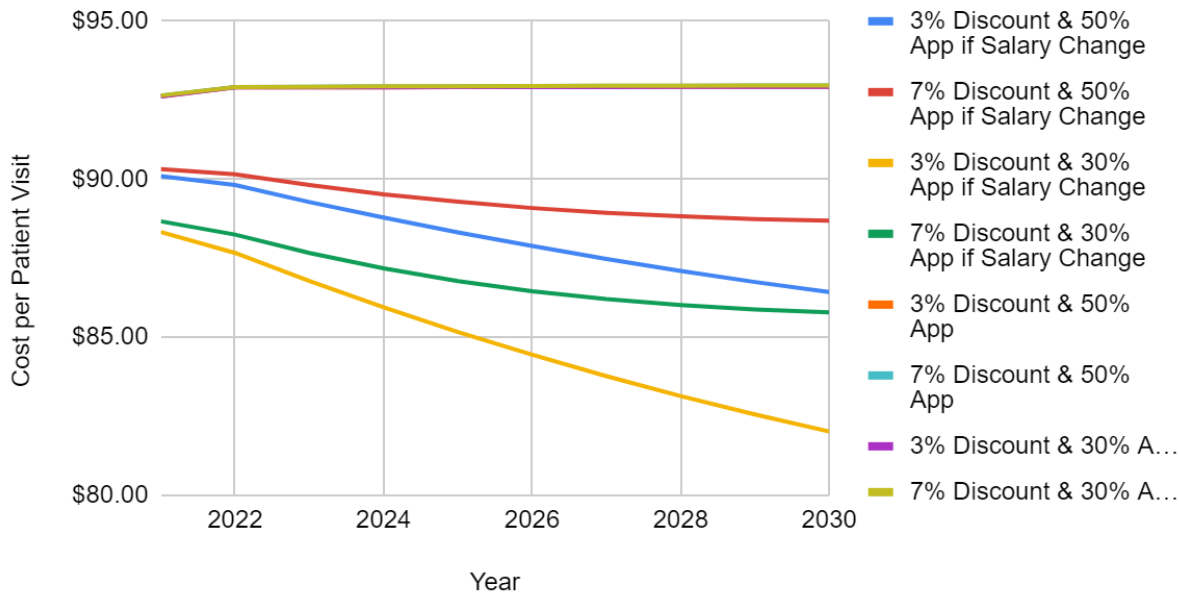
Virginia Physician Student Loan Forgiveness and J-1 Visa Waiver Reform

For this alternative, I assumed that all rejected applicants for the Virginia Loan Forgiveness program would be accepted at the rate of $50,000 a year for two years. For the additional J-1 visa waivers, I calculated the cost of losing the $3,000 application fee each

year and that the program would run for the required three years. The review period costs were calculated the same as "Let Present Trends Continue."

To calculate the additional costs to the state from Medicaid, I used the same method described above. To calculate the number of additional patient visits, I did the same as described above.

Costs of Program
$$= Net\ Application\ cost + (Per\ capita\ Medicaid\ spending\ \times\ \#\ Patients)$$
$$+ (Loan\ forgiveness\ \times\ \#\ Additional\ PCPs\ in\ Service\ Corp)$$

To calculate the effect of this alternative, I used the method described above for the Virginia Loan Forgiveness Program applicants. For the J-1 visa waiver, I needed to know how many additional doctors were eligible. The Global Worker's Justice Alliance (n.d.) found there are about 2,000 J-1 visa physicians each year. Each state has 30 slots, so only 500 physicians are not eligible each year. Multiplying this number of the proportion of Virginia's population to the national population results in 12 J-1 visa physicians in this category. Therefore, a reformed program with 100% compliance could result in an additional 11 physicians in HPSAs each year. After the program ends, retention rates are necessary to know the end result. A study by Negrusa et. al (2016) found that only 80% of applicants stay in "Any HPSA" after 1 year and only 70% after 10 years. There is a significant drop from year 1 to year 2, so all years after the first used the 70% retention rate. While the retention rate was much lower for their specific HPSA, this was used in case they moved within the state.

Figure 5. Physician Loan Forgiveness & J-1 Visa Reform Cost Effectiveness Sensitivity Analysis
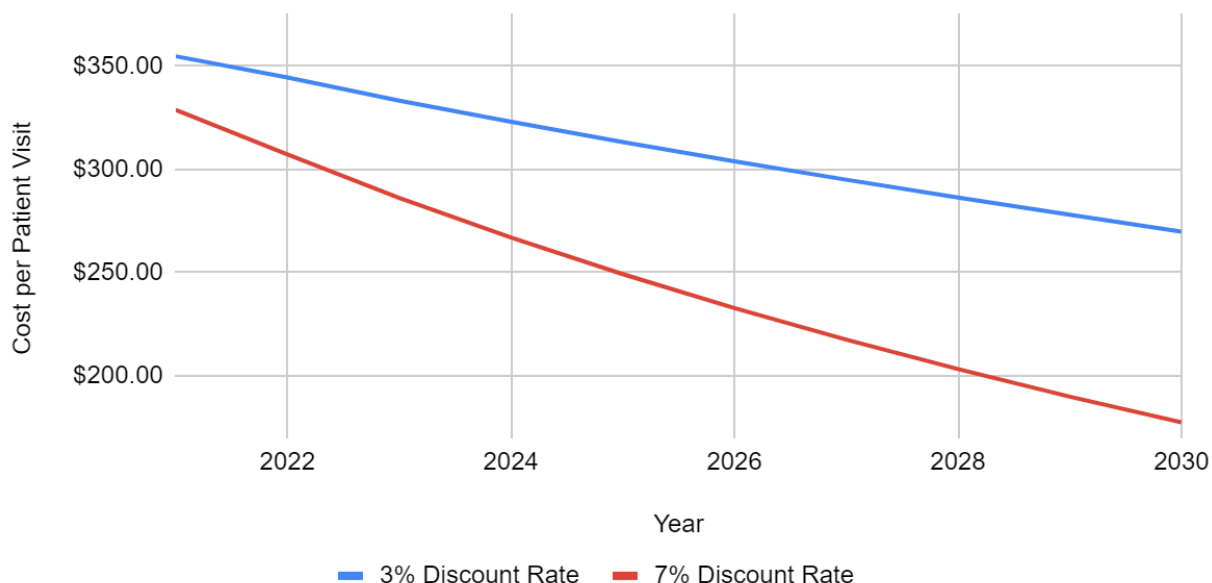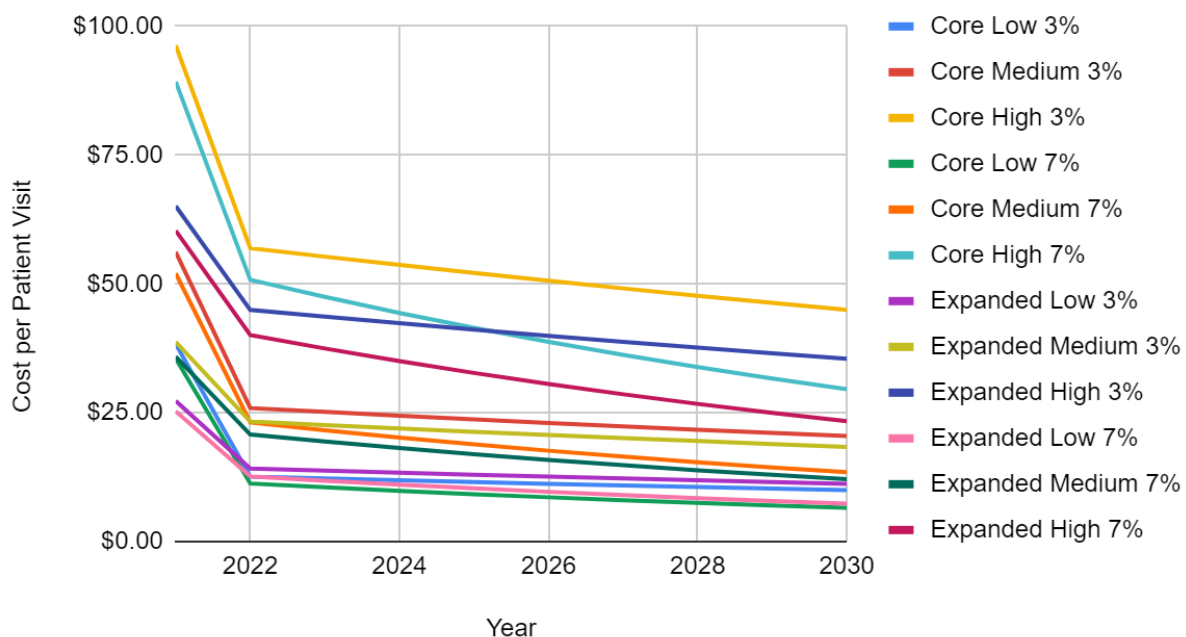
School-based Health Centers

This alternative used estimates from Nystrom & Prata (2008) adjusted for 2019 US dollars. Costs considered were both start up costs and annual operational costs for "Core Centers" with only 10 patient hours per week versus "Expanded Centers" at 20 hours per week. The spaces considered were both additions to the schools versus existing space. For the purpose of this analysis, I used the Expanded Centers with an addition to the school in the mid-range of cost estimates. Expanded centers were the more cost-effective option per hour and had greater scalability. This gave a "per SBHC" number, so I scaled the funding up to 50 state funded SBHCs, which is in line with many surrounding states. I did not account for additional Medicaid funding, because operational costs accounted for supplies, staffing, and administrative costs. This would result in double counting.

$$Costs\ per\ Expanded\ Center$$
$$= Mid-range\ Expanded\ Center\ Operations\ Costs +\ Mid$$
$$-\ Range\ Start\ up\ Costs$$

Figure 6. SBHC Cost Effectiveness Sensitivity Analysis

List of Costs Considered

Nurse Practitioner Scope of Practice Expansion	J-1 Visa Waiver Reform & Virginia Physician Loan Forgiveness Expansion	School Based Health Center Funding	Let Present Trends Continue
Cost to review independent practice applications	Cost to forego J-1 Visa Waiver fee	Startup costs of building the facility	Cost to review independent practice applications
$100 Revenue from each additional application	Cost to Review J-1 Visa and Health Corp Applications	Annual Operational costs (staff, medical supplies, billing, etc.)	$100 Revenue from each additional application
Additional Tax Revenue from Nurse Practitioner salary increases following independent practice authority	Additional Medicaid Patient Spending from new patients		
Reduced Tax Revenue from Primary Care Physicians following independent practice authority			
Additional Medicaid Patient Spending from new patients			

Tabulated Costs over Time

Alt 1: Nurse Practitioner Scope of Practice Expansion

Costs & Benefit	Priced 2021-2030
Review of Applications	$3,652.37
Application Fees	($74,590.75)
Tax Revenue Changes	($12,106,902.44)
Additional Medicaid Spending	$233,783,185.31
Total	$221,605,344.49
Patient Visits	2,512,658

Alt 2: J-1 Visa Waiver Reform & Virginia Loan Forgiveness Program Expansion

Costs & Benefit	Priced 2021-2030
Review of Applications	$ 791.85
Loan Payments	$ 6,659,438.34
Additional Medicaid Spending	$ 1,309,985,755.22
Total	$1,316,645,985.40
Patient Visits	4,677,031

Alt 3: School Based Health Centers (At 50 Centers)

Costs & Benefit	Priced 2021-2030
Start Up Costs per SBHC	$1,777,314
Operational Costs per SBHC	$27,396,967
Total	$29,174,281
Patient Visits	1,300,000

Alt 4: Status Quo:

All of the above were compared to "Let Present Trends" continue, so this is $0 at present with 0 benefit.

Cost-Effectiveness Analysis

Alternative	Cost per Patient Visit
Visas and Health Corp	$88.20
Nurse Practitioner Scope of Practice Liberalization	$310
School Based Health Centers	$22.55
Status Quo	$0 for 0 additional patients

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