Primary Care Clinicians in Low-Access Counties

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Advanced practice providers comprise an increasing percentage of the health care and primary care workforce. This paper evaluates the weighted contribution of advanced practice providers to the primary care workforce in well-served and underserved counties across North Carolina using age- and sex-adjusted population measures of access.

Background

Primary care is foundational to a high-functioning, efficient, effective, and high-value health system. Patients who report a usual source of health care are more likely to have timely preventive care [1], lower rates of emergency department use [2], and fewer unmet medical needs [3]. Primary care clinicians (PCCs) typically have a relationship with patients and families over time. That relationship leads to trust, which can improve shared decision-making and adherence, leading to improved health [4]. A recent National Academy of Science, Engineering, and Medicine report on implementing high-quality primary care defines it as care that is continuous, person-centered, relationship-based, and considers the needs and preferences of individuals, families, and communities [5]. The report notes that absence of primary care can lead to delay in care, uncoordinated care, increased emergency department use, less preventive care, and soaring costs [5]. Lower access to primary care services and primary care clinicians may have a detrimental impact on health outcomes in rural communities [6].

Primary care can be provided by physicians or advanced practice providers (APPs). PCCs include those who practice family medicine, general internal medicine, general pediatrics, combined general medicine and pediatrics, and obstetrics and gynecology. APPs include physician assistants (PAs) and advanced practice nurses (APNs). Physician assistants may work across a range of settings, including primary care and specialty care. Advanced practice nurses who practice primary care include nurse practitioners (NPs) and certified nurse-midwives (CNMs). Certification and practice setting can be used to determine primary care practice. Not all family nurse practitioners practice primary care [7]. Length of training, path of training, opportunities for practice, and salary vary widely by provider type. Skills and practice preferences may vary by provider type, but they also vary by individual. PCCs all conduct exams, make diagnoses, and prescribe treatments.

Historically, shortages of primary care services have been studied, reported, and intervened on primarily by addressing the physician workforce. However, in North Carolina and across the United States there has been rapid growth in the number of schools educating both physician assistants and nurse practitioners. Since 2011, North Carolina has added seven new physician assistant programs to the previous five (one is now closed) and is home to nine nurse practitioner programs, one of which has been added since 2011 [8]. The number of physician assistants and nurse practitioners working in the United States has swelled in recent years to 149,000 physician assistants [9] and 325,000 nurse practitioners [10]. At the same time, the number of physicians trained each year has increased only slightly and the number practicing primary care has remained stable [11]. There are 1.02 million physicians licensed to practice in the United States [12]. However, counting the number of physicians and APPs in primary care practice is more complicated.

Inadequate primary care access remains a challenge across much of North Carolina and the United States. For example, North Carolina has 82 geographic or population-specific primary care health professional shortage areas [13]. As part of a process of setting population health goals, North Carolina set a target that all counties should have a PCC-to-population ratio of 1:1500 or fewer, a target met by only 61 counties [14]. This included primary care physicians who report practicing primary care, physician assistants practicing with a supervising primary care physician, and nurse practitioners with a primary care certification and practicing in a primary care setting. This paper documents the relative role of physicians, nurse practitioners, certified nurse-midwives, and physician assistants in primary care in North Carolina counties based on PCC-to-population ratio.

Methods

To calculate the supply of primary care clinicians for 2017–2019, we used data from the North Carolina Health Professions Data System (HPDS), which are derived from annual licensure files received from the North Carolina Board

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DATA & TRENDS – *McCartha* SIDEBAR

of Nursing and the North Carolina Medical Board. The data includes NPs, PAs, CNMs, and physicians who are licensed and actively practicing in North Carolina as of October 31 of each year.

We also obtained estimates of population and county demographics for 2017–2019 from the North Carolina Office of State Budget and Management, accessible at https://www.osbm.nc.gov/facts-figures/population-demographics. Population estimates are necessary to calculate the population-to-PCC ratio, the metric of interest.

Primary care physicians and physician assistants share common data elements in the licensure data. In both cases, we used self-reported primary area of practice to define clinicians as practicing primary care if they reported one of the following practice areas: family medicine, general practice, internal medicine, internal medicine-pediatrics, pediatrics, adolescent medicine, or obstetrics and gynecology. We excluded resident physicians and clinicians of both types who indicated that they work for the federal government.

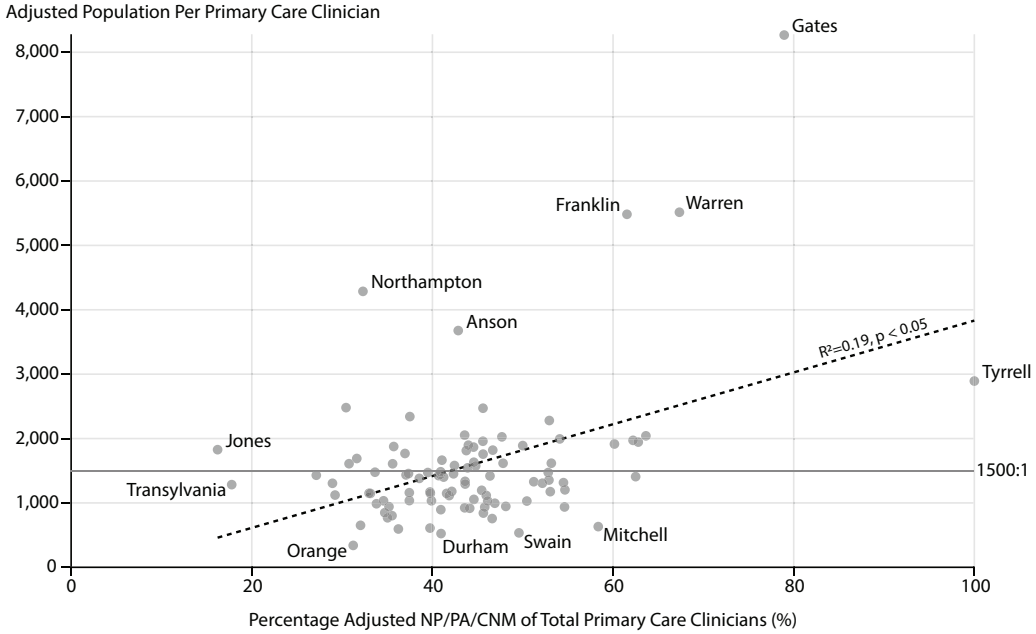
Camden County was an outlier in the HPDS data with

no clinicians of any type in 2017 and 2018 and one internal medicine physician in 2019. The population-to-PCC ratio was unstable. As a result, Camden County was excluded from our analysis.

Nurse practitioners do not select an area of practice during the licensure process. However, they do select certifications and practice settings. Using a combination of these variables, we can estimate the number of nurse practitioners practicing primary care. As an example, a certified family nurse practitioner (FNP) working in a group medical practice setting would be classified as a PCC, while an FNP working in a hospital inpatient setting would not. The same methodology has been used previously and described elsewhere [7, 8].

All CNMs were assumed to be working in primary care. This assumption may overestimate the number of CNMs in primary care but licensure data do not contain enough detail to determine the practice characteristics for CNMs. The total number of CNMs in the state is relatively small (~ 300) compared to NPs and physicians, so this assumption

FIGURE 1.
Population Per Primary Care Clinician versus Percentage NP/PA/CNM of Primary Care Workforce by County, North Carolina, 2017–2019



Note. *Camden County excluded as an outlier, see methods. NP = Nurse Practitioner, PA = Physician Assistant, CNM = Certified Nurse-Midwife. A ratio of 1500:1 is highlighted. The Negotiated Rulemaking Committee on the Designation of Medically Underserved Populations and Health Professional Shortage Areas15 recommended 1500:1 as the low threshold under which geographic areas would not be eligible for HPSA designation.

is unlikely to significantly affect the overall findings.

Because physician and physician assistant data exclude clinicians employed in federal facilities, we removed all NPs and CNMs who appeared to work for the federal government (e.g., Veterans Administration Medical Centers, military hospitals). To do this, we compiled a list of federal government facilities in North Carolina and matched the geocoded locations to the geocoded practice addresses of NPs and CNMs. We used the ArcGIS World Geocoder in ArcMap 10.5 for geocoding, and PostgreSQL/PostGIS for spatial matching.

We assigned weights to each clinician type to reflect potential differences in primary care full-time equivalents (FTE) between clinician types. Following the recommendations of the Negotiated Rulemaking Committee on the Designation of Medically Underserved Populations and Health Professional Shortage Areas [15], we weighted all primary physicians except those practicing obstetrics and gynecology as one primary care FTE. Physicians and physician assistants practicing obstetrics and gynecology were assigned .25 of a primary care FTE. All other PAs, NPs, and CNMs were assigned .75 of a primary care FTE. We refer to this as the adjusted primary care workforce. This reflects approximate differences in productivity based on national data and the recommendations of a federal rule-making committee for the designation of health professional shortage areas [15].

We also followed the recommendations from the same report to adjust for differential rates of use of primary care services by age and sex of the population in each county using the report's estimates of national age/gender-specific primary care visit rates derived from the Medical Expenditure Panel Survey. This adjustment means that, for example, a county with an older population than average (and a greater primary care visit rate) will have a larger adjusted population to serve based on national data for primary care use by age and gender; this too follows the recommendations of a federal rule-making committee for the designation of health professional shortage areas [15].

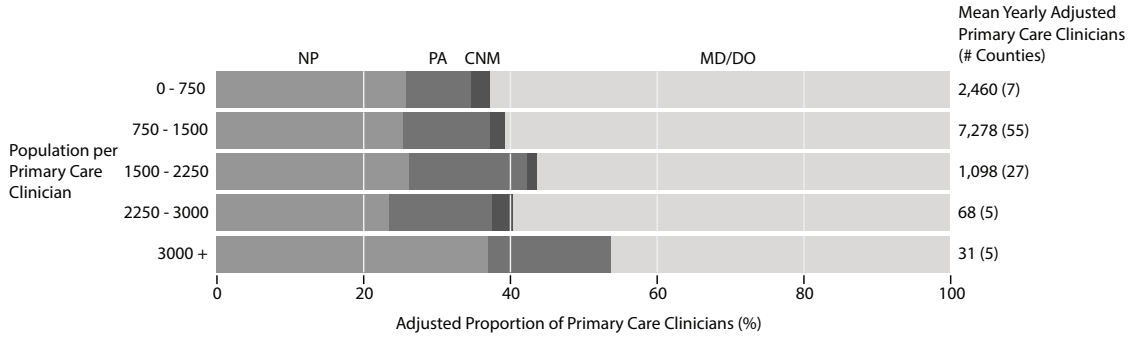
Finally, we calculated an estimate of spatial primary care access by dividing the adjusted population in each county by the adjusted primary care workforce in each county. For each county, we also calculated the percentage of the adjusted primary care workforce who are physicians, NPs, PAs, and CNMs. We averaged the data over the three-year period to smooth out variations in counties with relatively few clinicians.

Except in the instances noted above, all analyses were completed in Stata 14. Maps and charts were generated using Observable Plot [16] and D3 [17].

Results

North Carolina had an average population-to-PCC ratio of 984:1 from 2017 to 2019, ranging from 340:1 (Orange County) to 8267:1 (Gates County). Based on adjusted FTEs, APPs comprised 39% of the primary care workforce. The

FIGURE 2.
The Composition of the Primary Care Workforce Stratified by Population per Primary Care Clinician, North Carolina, 2017–2019



Note. Camden County excluded, see methods. NP = Nurse Practitioner, PA = Physician Assistant, CNM = Certified Nurse Midwife, MD = Doctor of Medicine, DO = Doctor of Osteopathic Medicine.

adjusted primary care workforce consisted of 60.6% physicians, 25.7% nurse practitioners, 11.6% physician assistants, and 2.1% certified nurse-midwives. Between 2017 and 2019, the adjusted APP primary care workforce grew by 18.6% while the primary care physician workforce grew by 3.8%.

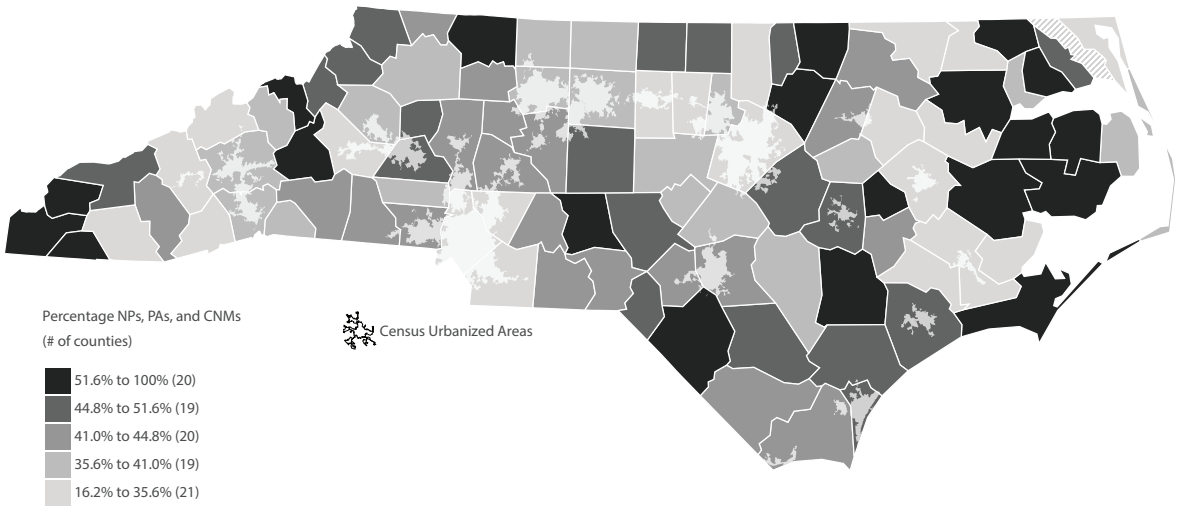
We performed a simple bivariate regression of the percentage of primary care APPs versus the primary care clinician ratio. With a P value < .05 and an r^2 of 0.19, we find evidence of positive association between the two variables, suggesting that as the ratio of population to primary care clinicians increases so does the proportion of the primary care workforce comprised of APPs. These results are presented in the scatter plot in Figure 1. Figure 2 shows the contribution to primary care by APPs and by type of APP in counties grouped by population-to-PCC ratio.

In general, the counties where APPs comprise a larger share of the primary care workforce are more rural. Figure 3 displays a map of North Carolina counties where the shading indicates the percentage of the primary care workforce who are APPs broken into quintiles. The darkest shading indicates the top quintile, i.e., the places where APPs are a higher percentage of the primary care workforce. Overlaid on this map are Census urbanized areas indicating denser metropolitan areas, as well as outlying linked areas (e.g., suburbs) [18]. Areas outside of these boundaries are typically rural areas or small towns not linked to a metropolitan area. Notably, none of the top quintile counties overlap significantly with urbanized areas.

Discussion

APPs make up a growing and important part of our primary care workforce. As such, they should be included in analysis and policy-making around access to primary care. This analysis in North Carolina shows that APPs make up 39% of the primary care workforce in the state. APPs in North Carolina make up a larger proportion of the primary

FIGURE 3.
Percentage Adjusted NPs, PAs, CNMs of Primary Care Workforce, North Carolina, 2017–2019



Note. Camden County excluded, see methods. NP = Nurse Practitioner, PA = Physician Assistant, CNM = Certified Nurse Midwife. Urbanized Areas are areas defined by the US Census Bureau containing 50,000 or more people, along with adjacent outlying areas linked to the metropolitan core.

care workforce in the most under-resourced counties. Even those counties have more nurse practitioners than physician assistants (and more physicians than nurse practitioners). However, the rapid growth of PA workforces in the last 11 years and the disproportionate deployment in under-resourced communities may suggest opportunities for future workforce planning. The relative lack of certified nurse-midwives in the most under-resourced communities is likely related to a lack of birthing facilities and a lack of potential collaborating physicians.

This analysis has several potential limitations. It is based entirely on licensure data. We are unable to tell what kind of service health care providers offer based on licensure data. Licensure data report primary site of practice. Many providers have multiple sites of practice that may take place across county lines. Also, we are unable to account for part-time providers.

This analysis has important implications for policy makers. In the most under-resourced counties, APPs make up a higher percent of the primary care workforce. Loan repayment programs, pathway programs, school admissions committees, and recruitment programs should invest in a range of primary care providers [19]. It is possible that these programs will have differential success with different provider types. Supervision requirements may impact location of practice for APPs [20]. In the case of certified nurse-midwives, current practice environment has resulted in no midwives in the least-resourced communities. This could be due to a variety of factors, including recruitment, location of facilities, and availability of collaborating physicians.

Adequate primary care in all of North Carolina's counties will require a robust investment across provider types. Students from rural communities should be introduced to the range of career opportunities, recruited into health professions schools, and trained and mentored for—and eventually recruited into—rural practice. Special attention should be paid to our most under-resourced communities. NCMJ

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