

# Primary Care Practice Structural Capabilities in Health Professional Shortage Areas

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Providing high-quality primary care has proved to be challenging as the United States faces a national shortage of primary care physicians compounded by growing rates of an aging and chronically ill population.<sup>1,2</sup> Currently, 80 million Americans reside in geographic areas known as health professional shortage areas (HPSAs), which are disproportionately affected by a lack of supply of primary care physicians relative to the general population.<sup>3</sup> Improving primary care access in HPSAs is critical because maldistribution of the health care workforce is linked to poor health outcomes including disease severity, quality of life, and life expectancy.<sup>4,5</sup> Indeed, patient populations residing in HPSAs have higher prevalence of diabetes, hypertension, obesity, and smoking compared with patients not living in these areas. Provider shortages in HPSAs can also exacerbate existing socioeconomic barriers to obtaining care, such as education, housing, or transportation needs.<sup>6</sup>

Deploying the nurse practitioner (NP) workforce has been identified as an optimal strategy by policy makers and administrators to meet the growing demands in primary care. NPs are the fastest-growing primary care workforce in the United States,<sup>7</sup> and approximately 89% of NPs are equipped to deliver primary care.<sup>8</sup> NPs demonstrate equivalent patient outcomes to physicians, including disease-specific physiologic measures, symptom reduction, and acute care utilization.<sup>9-12</sup>

NPs are specifically equipped to expand primary care in HPSAs for patients with high rates of multimorbidity and complex social needs because NPs are trained in comprehensive and holistic care emphasizing a patient's broad health needs and their social and emotional well-being.<sup>13</sup> Indeed, NPs are significantly more likely to care for patients with 3 or more chronic conditions compared with physicians (25.9% vs 20.8%)<sup>14</sup> and to deliver chronic disease services such as disease education and counseling.<sup>15,16</sup> Further, in US states with full scope-of-practice regulation—meaning NPs can independently evaluate, diagnose, interpret tests, and treat patients—NPs are more likely to practice and reside in HPSAs compared with physicians.<sup>17,18</sup> Full scope-of-practice regulation for NPs is also associated with an approximate 30% increase in yearly checkups in HPSAs.<sup>19</sup>

## ABSTRACT

**OBJECTIVES:** To evaluate structural capabilities in primary care practices employing nurse practitioners (NPs) and test whether they differ across health professional shortage areas (HPSAs) and non-HPSAs.

**STUDY DESIGN:** Secondary analysis of cross-sectional survey data and health care workforce data from 2018-2019.

**METHODS:** We computed bivariate analyses and multivariable adjusted regression models to evaluate differences in NP characteristics and practice characteristics and to determine the odds of having particular structural capabilities in HPSA practices compared with non-HPSA practice.

**RESULTS:** The majority of NPs worked in HPSA practices (61%). We found statistically significant differences in NP educational degrees, practice certifications, and structural capabilities between HPSAs and non-HPSAs. Care coordination was 77% more likely to be delivered in HPSA practices compared with non-HPSA practices (odds ratio, 1.77;  $P < .05$ ).

**CONCLUSIONS:** Expanding care coordination may be beneficial for HPSA populations with high rates of morbidity and socioeconomic needs. Future research is needed to understand how the NP workforce may be optimized to meet the growing primary care demands in underserved areas.

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However, little is known about the practice infrastructure or integrated features (ie, structural capabilities) used by NPs to enhance primary care delivery in HPSAs. Previous research demonstrates that practice structural capabilities can improve primary care access through extended practice hours and delivery of chronic care through reminders for provider workflows, or care coordination.<sup>20,21</sup> Care coordination, for example, consists of the integration of personnel or activities used to manage patient care across the health care spectrum and has been shown to be associated with lower medical expenditures, inpatient hospitalizations, emergency department (ED) visits, and 30-day readmission rates.<sup>22,23</sup> Other structural capabilities such as availability of chronic disease registries—designed to support providers in managing patients with chronic illness through tracking systems, clinician reminders, and checklists<sup>21</sup>—have been shown to improve patient outcomes and to support practices in achieving the standard of care for ongoing chronic care.<sup>24,25</sup>

Despite such findings, it is unclear whether HPSA practices that are employing the growing NP workforce implement specific structural capabilities to meet the needs of their complex and chronically ill patient populations. Such evidence is needed to understand how the NP workforce may be optimized to expand access to primary care in underserved areas. To fill this gap, our study assessed primary care practice structural capabilities in practices employing NPs and tested whether they differ across HPSAs and non-HPSAs.

## METHODS

### Data Sources and Collection

This study was a secondary analysis of cross-sectional data from 2 sources: (1) survey data collected from primary care NPs in 2018-2019 (principal investigator: Poghosyan; RO1MD011514) on NP characteristics, practice setting, and structural capabilities; and (2) publicly available data from the Health Resources and Services Administration (HRSA) from 2018-2019 on HPSA designation.

Survey data were collected from primary care NPs as part of a large study focused on racial and ethnic disparities in chronic disease outcomes and NP practice. Researchers sent surveys to 10,237 NPs in primary care settings across 6 geographically diverse states. NPs were identified through the OneKey database from IQVIA, which includes the most complete information on office-based providers in the United States.<sup>26</sup> Using a modified Dillman method, 3 rounds of mail and online surveys were sent out to eligible NPs with reminder postcards and phone calls to nonresponders.<sup>27</sup> Overall, 1244 NPs in 1109 practices completed and returned the surveys, with a response rate of 31.2%. A nonresponse analysis was conducted and determined to have low bias.<sup>28</sup>

Data on HPSA designation were collected by researchers for the large study. HPSA designation was obtained from the Primary Care

## TAKEAWAY POINTS

Nurse practitioners (NPs) are more likely to deliver care coordination in health professional shortage areas (HPSAs) compared with non-HPSAs and are meeting the growing demand for primary care in underserved areas.

- ▶ NPs deliver specific structural capabilities (ie, practice features or infrastructure) related to chronic care to support the complex and chronically ill populations in HPSAs.
- ▶ Without expansion of scope-of-practice laws, workforce shortages will remain a perennial challenge.
- ▶ HPSA criteria do not include the availability of additional providers such as NPs, which may complicate the accuracy of identifying and evaluating care in shortage areas.

Service Area files, which contain data on primary care availability in communities and are maintained by the Dartmouth Institute. Data on HPSA designation are updated regularly and made publicly available by HRSA.

### Data Merging

Survey data on NP practices were merged with data on HPSA designation using zip code information available both in the NP survey and in the Primary Care Service Area files. The NP survey provided either 5-digit or 4-digit zip codes on NP practice location, and the Primary Care Service Area files provided 9-digit zip codes to identify HPSA geographic areas. Crosswalk files from the US Department of Housing and Urban Development were used to link differing zip code levels using an incident fraction for each 9-digit and 5-digit zip code to account for differences in geographic scales.<sup>29</sup>

### Sample

We extracted data from the parent study from Arizona and Washington because these states have full scope-of-practice regulation. NPs are more likely to practice and reside in HPSAs in states with full scope-of-practice regulation.<sup>17,18</sup> We sampled surveys from 366 NPs across 269 unique practices in Arizona (46%) and Washington (54%).

### Measures

**HPSA.** Our independent variable of interest was HPSA designation calculated on a range from 0 to 25. Criteria for designation are (1) the population to provider ratio (10-point maximum), (2) percentage of the population below 100% of the federal poverty level (5-point maximum), (3) travel time to the nearest source of care outside the HPSA (5-point maximum), and (4) infant health index (5-point maximum).<sup>3</sup> Practices without any HPSA score (HPSA score 0 or not applicable) were coded as “non-HPSA,” and practices with any score (HPSA score 1-25) were coded as “HPSA,” indicating geographic areas or populations with inadequate access to primary care.

**Structural capabilities.** Structural capabilities were obtained from the Structural Capability Index (SCI) contained within NP survey data. The SCI is a validated measure used to evaluate primary care practice attributes linked with high-quality care delivery.<sup>21,30</sup> Previous research has used the SCI to explore structural capabilities

**TABLE 1.** Structural Capability Index and Corresponding Survey Items

Structural capability	Survey item
After-hours care (weekend)	Is your practice setting regularly open to provide care on Saturdays or Sundays?
After-hours care (weekday)	How many nights per week is your practice open for patient visits during extended evening hours?
Care coordination	<p>Does your practice have designated staff for care management services and/or care coordination? If yes, which of the following are provided:</p> <ul style="list-style-type: none"> <li>• Creating and managing patient problem lists</li> <li>• Providing resources to assist self-management of symptoms, conditions, and medications</li> <li>• Medication management and reconciliation</li> <li>• Helping patients access community and social services</li> <li>• Helping patients schedule appointments</li> <li>• Coordinating care among clinicians, hospitals, pharmacists, laboratories, insurance companies, and imaging services</li> </ul>
Shared communication systems	<p>Do clinicians at your practice use a shared communication system to contact patients:</p> <ul style="list-style-type: none"> <li>• Who are due for guidelines recommended for chronic conditions?</li> <li>• After a hospitalization?</li> <li>• Who have not had an appointment for an extended period?</li> </ul>
Chronic disease registry	Does your practice have a registry that creates a list of patients who are overdue for their chronic disease services (eg, glycated hemoglobin A <sub>1c</sub> in diabetes, cholesterol in coronary artery disease)?

in medical homes and the impact of various structural capabilities on patient outcomes, patient satisfaction, and quality of care.<sup>20,21,30,31</sup>

We selected 4 subscales on the SCI that have been shown to expand access to care and improve ongoing disease management: (1) *shared systems for communication* (3 items), shown to improve patient satisfaction and enhance timely communication between patients and providers<sup>32,33</sup>; (2) *care coordination* (7 items), associated with lower medical expenditures, hospitalizations, ED visits, and readmission rates<sup>22,23</sup>; (3) *chronic disease registries* (1 item), shown to improve patient outcomes and support practices to achieve the standard for chronic care in diabetes and hypertension<sup>24,25,34</sup>; and (4) *after-hours care* (2 items), which is associated with reduced ED utilization, lower expenditures, and lower rates of unmet medical needs.<sup>35,36</sup>

The majority of structural capabilities were measured on subscales with binary (yes/no) responses in which NPs reported on the presence or absence of each structural capability. We dichotomized subscales with multiple items by operationalizing the entire subscale as present if more than 50% of items were reported as present. This method of standardization is consistent with prior research.<sup>21</sup> **Table 1** provides the corresponding survey items for each capability evaluated.

**Covariates.** To isolate the relationship between HPSA and practice capabilities, we controlled for NP demographics and characteristics including age, gender, race, education (ie, highest educational degree received), time employed (ie, time working at current practice), and certification. Practice characteristics included practice type (eg, physician practice, community health center, hospital-based clinic) and practice size (eg, number of NPs, physicians, or physician assistants).

## Data Analysis

Descriptive statistics were computed to describe the characteristics of NP respondents and their practices. Bivariate  $\chi^2$  analyses were computed to evaluate differences in NP and practice characteristics across HPSAs and non-HPSAs. We built multivariate logistic regression models to evaluate the odds of having a structural capability in a HPSA practice compared with a non-HPSA practice. Multicollinearity was assessed between covariates by calculating the variance inflation factor and were determined to be acceptable. Final models adjusted for NP demographics and practice characteristics. We also adjusted for the clustering of NPs within practices to ensure that the sample variance was not underestimated and to decrease the potential for type 1 error. Analyses were performed using RStudio version 1.3.

## RESULTS

### Sample Characteristics

**Table 2** presents the characteristics of NPs and primary care practices in our sample in HPSAs and non-HPSAs. Overall, 366 NPs responded in 269 distinct practices. The majority of NPs (61%) practiced in areas designated as HPSAs. Demographic characteristics of NPs in HPSA practices were generally similar to those in non-HPSAs. The mean age of NPs in our sample was 50 years. In both HPSA and non-HPSA practices, the plurality of NPs were female (85%-87%), aged between 31 and 44 years, and had worked at their current primary care practice for 5 years or fewer. HPSAs had similar racial composition to non-HPSAs; in both HPSAs and non-HPSAs, the largest percentage of NPs was White or Caucasian (87% in HPSAs vs 84% in non-HPSAs) and the second largest was Asian (6.8% in HPSAs vs 10% in non-HPSAs).

There were statistically significant differences in educational degrees and practice certifications between NPs in HPSAs and those in non-HPSAs. NPs in HPSAs were significantly more likely to have a greater distribution of specialties such as hospice, midwifery, wound care, or HIV medicine compared with NPs in non-HPSAs (6.7% vs 2.8%;  $P < .05$ ). In HPSAs, NPs were less likely to have only an adult certification (11% vs 18%;  $P < .05$ ). In HPSA practices, a lower percentage of NPs had a doctorate degree (18% vs 22%;  $P < .05$ ). All NPs in non-HPSAs had graduate degrees at either the master's or doctoral level. Practice size was similar in HPSAs and non-HPSAs. The plurality of practices in both HPSAs and non-HPSAs (37%) were run by more than 7 primary providers including NPs, physicians, and physician assistants.

## Structural Capabilities

The prevalence of structural capabilities across all primary care practices in our sample is demonstrated in **Table 3** and calculated based on the percentage of NP respondents. The most prevalent structural capability across practices was chronic disease registries (65%). The least prevalent practice capability was access to after-hours care during the week (24%) and on the weekends (30%). Only 43% of practices offered care coordination.

Results from our regression models show significant differences in structural capabilities across HPSAs and non-HPSAs (**Table 4**). NPs who practiced in HPSAs were 68% more likely to have care coordination (odds ratio [OR], 1.68;  $P < .05$ ), even after controlling for differences in individual NP and practice characteristics (OR, 1.77;  $P < .05$ ). Although the difference was not significant, NPs who practiced in HPSAs were also more likely to report implementing chronic disease registries. Both unadjusted and adjusted regressions demonstrated that NPs in HPSA practices were 26% more likely to implement chronic disease registries (OR, 1.26;  $P = .33$ ).

There was no significant difference in shared communication systems or after-hours care across HPSA and non-HPSA practices, but NPs who practiced in HPSAs were slightly less likely to have shared communication compared with NPs in non-HPSAs (unadjusted OR, 0.99;  $P = .95$ ). On the other hand, NPs in HPSA practices were slightly more likely to offer after-hours care even after accounting for differences in practice size and NP demographics (OR, 1.07;  $P = .81$ ). However, neither of these relationships were statistically significant.

## DISCUSSION

Using cross-sectional survey data from 2 states, this study explored the association between primary care practice structural capabilities and HPSA designation. We found that NPs were significantly more likely to deliver care coordination in practices located in HPSAs compared with non-HPSAs. Delivering care coordination has been shown to improve disease management and reduce ED utilization specifically for patients with complex needs and multimorbidity,<sup>22,37</sup> and care coordination may be used more frequently in HPSA practices to support their complex and chronically ill populations. Further, care coordination is also more likely to be primarily delivered by NPs, underscoring the key role of NPs in enhancing primary care delivery.

Although the difference was not statistically significant, our study also demonstrated that NPs in HPSA practices are more likely to implement disease registries. Disease registries and reminders for chronic care are associated with improved patient outcomes including reaching target adherence measures for diabetes and achieving clinical practice guidelines for care,<sup>25,34</sup> as well as lower per-beneficiary spending.<sup>24</sup> Additionally, disease registries may be used on paper rather than implementing new software or electronic health records.<sup>38</sup> Thus, disease registries show promise in improving chronic care at low cost to practices.

**TABLE 2.** Characteristics of NPs and Primary Care Practices in HPSAs Compared With Non-HPSAs<sup>a</sup>

	Overall (n = 366)	HPSA (n = 224)	Non-HPSA (n = 142)	P
<b>NP characteristics</b>				
Age group in years				.88
≤30	10 (2%)	6 (2%)	4 (3%)	
31-44	129 (36%)	79 (36%)	50 (36%)	
45-54	79 (22%)	50 (23%)	29 (21%)	
55-64	96 (27%)	55 (25%)	41 (29%)	
≥65	47 (13%)	31 (14%)	16 (11%)	
Gender				.56
Female	315 (86%)	195 (87%)	120 (85%)	
Male	51 (14%)	29 (13%)	22 (15%)	
Education				<.05
Bachelor's, associate's, other	8 (2%)	8 (4%)	0 (0%)	
Master's	280 (78%)	172 (78%)	108 (78%)	
Doctorate (DNP or PhD)	71 (20%)	40 (18%)	31 (22%)	
Race				.22
White or Caucasian	312 (86%)	194 (87%)	118 (84%)	
Black or African American	7 (2%)	4 (2%)	3 (2%)	
Asian	29 (8%)	15 (7%)	14 (10%)	
Other	7 (2%)	4 (2%)	3 (2%)	
Certification				<.05
Adult	50 (14%)	24 (11%)	26 (18%)	
Gerontology	32 (9%)	17 (8%)	15 (11%)	
Family	282 (77%)	176 (79%)	106 (75%)	
Psychiatry/mental health	11 (3%)	7 (3%)	4 (3%)	
Other (eg, hospice, midwifery, HIV medicine)	19 (5%)	15 (7%)	4 (3%)	
Time employed by current practice				.64
< 1 year	73 (21%)	45 (21%)	28 (21%)	
1-5 years	140 (40%)	91 (43%)	49 (37%)	
6-10 years	67 (19%)	39 (18%)	28 (21%)	
11-20 years	48 (14%)	27 (13%)	21 (16%)	
> 20 years	18 (5%)	10 (5%)	8 (6%)	
<b>Practice characteristics</b>				
State				.43
Arizona	168 (46%)	97 (43%)	71 (50%)	
Washington	198 (54%)	127 (57%)	71 (50%)	
Practice size				.53
Solo NP provider	30 (8%)	16 (7%)	14 (9%)	
2-3 providers	106 (29%)	64 (29%)	42 (30%)	
4-6 providers	96 (26%)	62 (28%)	34 (24%)	
≥7 providers	134 (37%)	82 (37%)	52 (37%)	

DNP, doctor of nursing practice; HPSA, health professional shortage area; NP, nurse practitioner; PhD, doctor of philosophy.

<sup>a</sup>Data are presented as n (%). Percentages account for missing responses and do not sum to 100% for certification as NPs can report more than 1 certification.

**TABLE 3.** Prevalence of Structural Capabilities in Primary Care Practices\*

Structural capability	Prevalence (%)
After-hours care (weekend)	30
After-hours care (weekday)	24
Care coordination	43
Shared communication systems	58
Chronic disease registry	65

\*Structural capability prevalence was calculated based on percentage of nurse practitioner respondents. A structural capability was determined as present if nurse practitioners reported more than 50% of items as present.

**TABLE 4.** Relationship Between HPSA Designation and Practice Structural Capabilities\*

Practice capability	Unadjusted			Adjusted		
	OR	95% CI	P	OR	95% CI	P
After-hours care (weekend)	0.94	0.54-1.63	.83	1.07	0.59-1.96	.81
After-hours care (weekday)	0.80	0.46-1.39	.44	0.87	0.49-1.59	.67
Care coordination	1.68	1.05-2.69	.03*	1.77	1.03-3.02	.04*
Shared communication systems	0.99	0.63-1.56	.97	0.91	0.53-1.52	.71
Chronic disease registry	1.26	0.79-2.01	.33	1.23	0.73-2.10	.43

HPSA, health professional shortage area; OR, odds ratio.

\*P < .05.

\*ORs represent the estimated odds for presence of a practice capability in HPSA vs non-HPSA. Reference group: non-HPSA. The multivariable analyses were adjusted for practice size, as well as nurse practitioner demographics including age, gender, race, time employed, education level, and certification, and weighted by a HPSA incident ratio.

We evaluated states with full scope-of-practice laws to assess how to optimize NPs in underserved areas when they are able to practice as independent providers. Consistent with research that found that NPs are more likely to practice in HPSAs in states with full scope-of-practice regulations,<sup>17,18</sup> we found that the majority of NPs in our sample (61%) were working in HPSA practices. However, the formula used to designate primary care HPSAs does not take into account the availability of additional primary care providers such as NPs or physicians, which may complicate the accuracy of evaluating differences across HPSA designations.<sup>3</sup>

Consequently, in this study the extent of differences across HPSA designation in NP characteristics and structural capabilities was largely insignificant. Existing research similarly demonstrates small and insignificant differences in patient health status and access to care across HPSAs and non-HPSAs.<sup>39</sup> We recommend that future research continues to evaluate patient and provider outcomes across HPSA designation to test the sensitivity of HPSA criteria and designation status. Further, refining the HPSA criteria to include availability of the NP workforce would be an important contribution to inform policy and demonstrate more accurately how NPs are meeting the primary care needs of underserved areas.

## Implications for Practice and Policy

Substantial evidence exists demonstrating the positive impact of care coordination on a variety of indicators including improved quality of life, decreased medical expenditures, and lower rates of inpatient hospitalizations.<sup>23,40</sup> Yet only 43% of NPs in our sample reported delivering care coordination at their practices. Two strategies may be used to support care coordination implementation: First, enhancing practice infrastructure through dedicated personnel, electronic medical records, or psychosocial resources can be useful to facilitate effective care coordination delivery.<sup>41</sup> Second, emphasizing the use of chronic care management codes from CMS can incentivize practices by reimbursing for care management or coordination for Medicare beneficiaries.<sup>42</sup>

This study was conducted in states with full scope-of-practice regulations for NPs, and many of the structural capabilities that we studied (ie, care coordination and disease management) are primarily delivered by NPs.<sup>15,16</sup> We chose full scope-of-practice states to control for regulatory differences. Consequentially, we were unable to assess whether variation in scope-of-practice regulation (ie, full vs reduced vs restricted practice laws) modifies the relationship between HPSA designation and the presence of structural capabilities. Thus, it is unclear whether the extent of regulation impacts the presence or delivery of structural capabilities. Future research should consider how restrictive scope-of-practice regulation may affect implementation of structural capabilities in order to make actionable policy recommendations for optimizing NP care delivery and improving primary care access in underserved areas.

## Limitations

We sampled NPs from 2 states, limiting the extent to which these findings can be generalized to other states. Self-reported survey data are subject to self-report bias. To control biases, validated tools were used with rigorous methodology throughout survey development and data collection. We were unable to assess whether there were differences in the quality of structural capabilities that may exist among practices. For example, NPs reported only on the presence of structural capabilities within their practices, rather than their actual or perceived efficacy. We also did not include whether NPs were practicing in teams or independently and how the presence of teams may affect the implementation of structural capabilities within a practice. Lastly, the use of cross-sectional data limits our ability to infer causation.

## CONCLUSIONS

We found statistically significant differences in NP educational degrees, practice certifications, and structural capabilities between HPSA and non-HPSAs. NPs in HPSA-designated primary care practices were significantly more likely to have care coordination compared with those in practices that are located in areas with adequate access to primary care. Expanding care coordination may be beneficial for complex and chronically ill patients residing in HPSAs. Future

research is needed to understand how to optimize the NP workforce and implementation of structural capabilities to meet the growing demands for primary care in underserved areas. ■

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