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State variation in use of physician assistants and nurse practitioners among primary care physician offices, United States 2012

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Introduction

According to the 2010 Council on Graduate Medical Education report, “there is a shortage of primary care physician (PCPs) in this country and that shortage is likely to worsen” (1). The current shortage is attributed to a low supply of physicians in rural areas and underserved areas with high proportions of low-income and minority residents, as well as low interest in primary care by new physicians. The shortage also may be associated with the aging of the physician workforce, the heavy workload, and administrative burden faced by PCPs (2,3). This situation will worsen as the U.S. population ages, particularly as 80 million baby boomers become Medicare-eligible, and as provisions of the Affordable Care Act expand health insurance coverage (4).

Increased use of non-physician clinicians, such as physician assistants (PAs) and nurse practitioners (NPs) has been proposed to offset declining numbers of PCPs (5,6). PAs are health professionals licensed to practice medicine under the supervision of a physician. NPs are registered nurses with advance training. Between the mid-1990s to mid-2000s, the per capita number of NPs increased by more than 9% annually, while PAs increased 4% annually. During the same time period, the per capita number of PCPs increased about 1% (7). NP and PA scope of practice and levels of autonomy are regulated by state medical statues. Over the past 20 years, the increased supply of PAs and NPs, increased reimbursement levels for services provided by PAs and NPs, and state laws expanding the scope of PA and NP practice have resulted in expanded roles for both types of clinicians in primary care (5,6,8).

Greater utilization of PAs and NPs in primary care practices, as well as new models of primary care, such as Accountable Care Organizations and Patient-Centered Medical Homes (5), requires overcoming several barriers. There is wide variation in NP scope-of-practice laws; states with more restrictive laws limit the practice and access to these professionals (9). Lack of reimbursement for certain NP or PA services, such as patient education and outreach for preventive care, as well as lack of physician training in team-oriented care, may also reduce fuller utilization of PAs and NPs (10). Previous studies found that states identified as “favorable” for PA practice had higher PA supply relative to other states (11–13). Other studies found that NPs serving rural populations practiced more often in states with the most practice autonomy than in states with less autonomy (14,15).

Although 43% of PAs and 52% of NPs practice in primary care settings (3,16), much is unknown about PAs and NPs working in the ambulatory, office-based primary care setting. In this study, we identify states where PCPs are more likely to have PAs or NPs working in their offices. We also examine the association between PCPs (those in the specialties of general or family practice, internal medicine, geriatrics, pediatrics) with PAs or NPs in their practices and selected practice characteristics, including practice location and the effect of state scope of practice laws using multivariate analysis. Although selected national estimates on availability of PAs or NPs among office-based PCPs have been published (17,18), results of a multivariate analysis may be informative to policy makers at the state level.

Methods

Data for this study were based on the 2012 National Ambulatory Medical Care Survey (NAMCS) - Electronic Health Record (EHR) Survey, a nationally representative mail survey monitoring physician adoption of electronic health record systems (19). NAMCS is an annual probability survey of non-federal, office-based physicians providing direct patient care, excluding radiologists, anesthesiologists, and pathologists, conducted by the Centers for Disease Control and Prevention's National Center for Health Statistics. The sample of physicians was taken from the master files of the American Medical Association and the American Osteopathic Association. The NAMCS two-stage sample design includes 112 geographic primary sampling units (PSUs). Within each PSU, physicians were stratified by specialty, and then a sample of physicians was selected according to each stratified specialty. The NAMCS - EHR survey was designed as a supplemental mail survey to the in-person NAMCS. The 2008–2009 NAMCS - EHR surveys employed the same sample design as NAMCS; combined estimates from both surveys have been published (19). For more information about NAMCS and the NAMCS - EHR surveys see the website: http://www.cdc.gov/nchs/ahcd.htm.

Starting in 2010, the NAMCS - EHR survey sample size was increased fivefold to allow for state-level estimates. The 2012 NAMCS - EHR survey included a sample of 10,302 physicians selected from the 50 states and the District of Columbia. Non respondents to the mail survey received follow-up telephone calls. The NAMCS - EHR survey collected information on physician and practice characteristics (e.g., specialty, practice size), as well as adoption of EHR systems (e.g., availability of selected computerized capabilities, electronic exchange of clinical data). In 2012, 4,545 physicians responded to the survey, for a weighted response rate of 65 percent.

The 2012 NAMCS - EHR survey study population consisted of PCPs in the specialties of general or family practice, internal medicine, geriatrics, or pediatrics with information on non-physician clinicians in their practice (n=1,951). Estimates of PAs or NPs in primary care physician practices are based on the question: "How many mid-level providers (i.e., nurse practitioners, physician assistants, and nurse midwives) are associated with you at this reporting location?" Reporting location is the site where most ambulatory patients were seen.

In this study, we examine state variability of the percentage of PCPs with PAs or NPs in their practice after controlling for physician practice characteristics previously found to be associated with the presence of non-physician clinicians in physician practices (17–18). These characteristics include: practice size as measured by the number of physicians in the office where the physician saw the most ambulatory care patients (1–2 physicians, 3–10 physicians, 11 or more physicians); multi-specialty practice status; percent Medicaid revenue (above median of 7%, equal or below median, unknown) and urban-rural classification of the practice location (large central metropolitan, large fringe metropolitan, medium metropolitan, small metropolitan or nonmetropolitan).

We also examined the association between state scope of practice laws and use of PAs or NPs in PCP practices. NP autonomy was classified by the extent to which physician oversight of NPs is required by state law or regulation. As classified by the 2012 Pearson Report, (20), NP scope of practice laws were categorized as “Physician oversight to diagnose, treat, and prescribe” (least independent), “Physician oversight to prescribe”, and “No physician oversight required” (most independent). We used the PA state practice characterization scheme published by Sutton, Ramos, Lucado (11) to classify PA scope of practice. This scheme includes six elements (licensure, scope of practice determined at the practice level vs. by state regulation, adaptable physician supervision, full prescriptive authority, no requirement for chart co-signature, physician-to-PA ratio determined at practice level vs. state regulation) in state laws that enable physician-PA teams to treat patients. In general, the higher the number of elements that are present, the more favorable the state law is for PA scope of practice. Using Sutton, Ramos, and Lucado’s PA classification, 1–2 elements were least favorable for PA practice, 3–4 elements were moderately favorable, and 5–6 elements were most favorable for PA practice.

Since the NAMCS EHR survey was based on a complex sample survey of physicians, compound sampling weights were applied to make national estimates of non-physician clinician use and corresponding estimates of sampling error. The statistical analysis software SUDAAN was used to account for the sample design when calculating the standard errors (21). All estimates presented were reliable (relative standard error less than 30%) due to the large sample size. We conducted bivariate analysis using t-tests ($p=0.05$) to examine whether physician practice, location, and scope of practice categories were associated with availability of PAs or NPs in PCP practices. We used multivariate logit models to examine availability of PAs or NPs in PCP practices (dependent variable) while controlling for physician practice, location, and scope of practice characteristics.

Two analytic questions were addressed: in multivariate logistic models: whether PA or NP employment among PCP practices varied by state, , and whether PA or NP employment among PCP practices varied by PA and NP scope of practice laws. For the first analysis, a logistic regression model for percent of PCPs with PAs or NPs in their practice was computed controlling for practice characteristics and state using Texas as the reference state. Texas was chosen because employment of PAs or NPS in this large state (47%) was roughly similar to the national percentage (53%). The second question investigated the availability of PAs or NPs in PCP practices controlling for practice characteristics, PA scope of practice

and NP scope practice indicators. State was omitted from this model because both scope of practice variables were defined by state.

Because effect size cannot be directly inferred from coefficients of logit models, we estimated marginal effects as the change in the predicted probability of a one-unit change in the independent variable, holding all other covariates at observed values. For comparability, differences with reference categories based on bivariate estimates (unadjusted) are also presented.

Results

In 2012, employment of PAs and NPs in PCP offices varied by state and the District of Columbia, ranging from 33.4% in Washington, D.C. to 89.1% in Montana (Figure 1). In unadjusted analysis, the percentage of PCPs with PAs or NPs in their practice was greater than the national average of 53.0% in 19 states (Alaska, Arizona, Idaho, Iowa, Kansas, Maine, Massachusetts, Minnesota, Montana, Nebraska, New Hampshire, New Mexico, North Carolina, North Dakota, South Dakota, Tennessee, Vermont, Wisconsin, and Wyoming) and lower than the national average in Georgia (34.8%) (Figure 1).

Table 1 indicates practice characteristics associated with PCP employment of PAs or NPs. In unadjusted analysis, the percent of PCPs working with PAs or NPs (column 2) increased with practice size (from 36.3% among solo and partner practices to 80.0% among practices with 11 or more physicians). Availability of PAs or NPs was higher among PCPs in multi-specialty practices (74.9%) than in single-specialty practices (45.3%), and was higher among PCPs in practices with more than 7% Medicaid revenue (54.5%) than physicians in practices with less than 7% Medicaid revenue (44.7%). The unadjusted percentage of PCPs working with PAs or NPs increased as practice location became less urban; from 41.9% in practices located in large central metropolitan areas to 65.7% in non-metropolitan areas.

The multivariate model produced similar patterns of results as the bivariate analysis. After controlling for practice characteristics, the percent of PCPs working with PAs or NPs increased as practice size increased. The marginal effect of PA or NP use in PCP practices with 3–10 physicians was 16.5 percentage points higher relative to solo and partner practices. Among PCP practices with 11 or more physicians, PA or NP use was 33.2 percentage points higher than among solo and partner PCP practices. Multi-specialty practices were also associated with higher use of PAs or NPs; the marginal effect for multi-specialty practices was 14.7 percentage points higher than in single-service practices. As PCP office locations became more rural, use of PAs and NPs increased. Relative to PCPs located in large central metropolitan areas, use of PAs or NPs in offices located in medium or small metropolitan areas was 11.1 percentage points higher, and increased to 18.0 percentage points higher in offices located in non-metropolitan areas.

In the same model, higher availability of PAs or NPs in PCP offices persisted in only 4 states (Alaska, Minnesota, Montana, South Dakota) relative to PCPs in Texas, after adjusting for physician practice size, multi-specialty status, percent Medicaid revenue, and urbancity of

office location, all else constant (Table 2). No state had significantly lower availability of non-physician clinicians relative to Texas, all else remaining constant.

In unadjusted analysis, employment of PAs or NPs in PCP offices varied by NP and PA scope of practice laws (Table 3). The percentage of PCPs with PAs or NPs in their practice was higher in states where no physician oversight for NPs was required (63.2%) compared with states that required physician oversight to diagnose, treat, and prescribe (50.0%). The percentage of PCPs with PAs or NPs in their practice was higher in states with laws favorable to PA practice (70.0%) compared to states in the least favorable environment for PA practice (49.8%).

In a separate model adjusting for the same physician practice characteristics as in Table 1, the percentage of PCPs with PAs or NPs in their practice was unrelated to NP scope of practice laws, all else remaining constant. Availability of PAs or NPs in PCP offices, however, was 9.6 percentage points higher in states with favorable PA scope of practice laws relative to least favorable environment for PA practice, all else remaining constant. These results were based on a logistic regression model that excluded the state location of physician offices since both NP and PA scope of practice variables were defined by state.

Discussion

In 2012, availability of PAs or NPs in PCP practices varied by state. The percentage of PCPs working with a PA or NP was greater than the national average in 19 states (Alaska, Arizona, Idaho, Iowa, Kansas, Maine, Massachusetts, Minnesota, Montana, Nebraska, New Hampshire, New Mexico, North Carolina, North Dakota, South Dakota, Tennessee, Vermont, Wisconsin, and Wyoming) and lower than the national average in Georgia.

Based on unadjusted bivariate analysis, higher use of PAs or NPs was associated with PCP practice characteristics such as increased practice size (3 or more physicians), multi-specialty practice, and office location outside of large central metropolitan areas. These associations remained significant in multivariate analysis. Higher PCP employment of PAs or NPs was associated with practice size, multispecialty status, and urban status of the office location. The largest marginal effects occurred among PCPs in practices with 11 or more physicians relative to solo and partner practices, and among PCPs in nonmetropolitan locations relative to PCPs in large central metropolitan areas.

The association between multi-specialty practices and higher PA or NP use may reflect the greater resources of large multi-specialty practices. On average, the practice size (17.9 physicians) among PCPs in multi-specialty practices was larger than the average (4.2 physicians) among PCPs in single-specialty practices (data not shown). In addition, previous studies have documented increased use of NPs and PAs as primary care providers in managed care organizations such as HMOs and multispecialty clinics since the l990s (22).

After controlling for practice characteristics, use of PAs or NPs in PCP offices was significantly higher in four states (Alaska, Minnesota, Montana, South Dakota) relative to Texas (reference state), all else remaining constant. This suggests that characteristics other than practice size, multi-specialty status, percent Medicaid revenue and urbanicity of office

location may be associated with higher use of PAs or NPs in PCP practices in these states. In our next model, we explore effects of state PA and NP scope of practice laws on availability of NPs and PAs in PCP offices.

In bi-variate analysis, higher use of PAs or NPs in PCP offices (70%) occurred in states with favorable PA scope of practice laws compared with states with least favorable laws for PA practice (49.8%). Higher PA or NP use by PCPs was also found in states where no physician oversight for NPs was required (63.2%) compared with states requiring physician oversight for NPs to diagnose, treat, or prescribe (50%). In adjusted analysis, higher use of PAs or NPs by PCPs was associated with states having favorable PA scope of practice laws, controlling for practice size, multi-specialty status, percent Medicaid revenue and urbanicity of office location, all else remaining constant. This finding may be related to a higher supply of PAs in states with favorable PA practice laws relative to other states (11). A previous study also suggested that the geographic distribution of PAs was associated with mean PA state wages, as well as with the location of state PA education programs (23).

On the other hand, we found no association between state scope of practice laws for NPs and availability of PAs or NPs in PCP offices after adjusting for practice characteristics in the same model. However, it is possible that the wording of the question whereby NPs and PAs were combined made it difficult to interpret the effect of NP scope of practice laws. Previous research (13) using the same NP scope of practice variable but a more direct NP outcome measures (patients with NPs as their primary care provider) found a strong association between the percentage of patients with NPs as primary care provider and the degree of state restriction. Public and private payment policies recognizing NPs as primary care providers affects use of NP in office practices because their recognition as primary care providers permits NPs to bill claims directly for their patients (24–26). Further research is needed to investigate the association between physician employment of NPs and state scope of practice laws taking NP recognition as primary care provider into account, as well as other factors noted in the literature, such as reimbursement rates (10), and the effect of local supply of PCPs and/or PAs on the availability of NPs (13). Finally, it is possible that physicians may underreport NPs in their practices if NPs are employed as administrators rather than as care providers. The 2008 National Sample Survey of Registered Nurses found that 14.6 percent of NPs in ambulatory or primary care reported principally working in management (27).

The findings are subject to certain limitations. First, since our findings are based on a cross-sectional study, causation should not be inferred. Second, our conclusions about PCPs reporting PA and NP in their office practice may not be generalizable to other healthcare settings. Third, the study was unable to specify type of non-physician clinician associated with PCPs due to question wording that grouped non-physician clinician use (NPs, PAs, or nurse midwives). Reporting the joint availability of NPs and PAs may have influenced the inability to detect associations between NP scope of practice laws and availability of PAs or NPs in PCP practices. This limitation also made comparisons with other state-based studies of PA or NP availability problematic. Fourth, findings may vary if NP and PA scope of practice variables were defined differently (i.e., included public and private reimbursement policies, or supply of PCPs and PAs at the local level). Finally, it is possible that estimates

for practice characteristics (practice size, multispecialty status) as defined by the reporting location may be inaccurate if the sampled location is different from other locations.

Conclusion

Our study found that most state variation in use of non-physician clinicians by PCPs can be explained by higher use as office location became less urban, as well as in larger practices, and multi-specialty practices. After controlling the same practice characteristics, we found higher use of PAs or NPs among PCPs in states with favorable PA scope of practice laws, but no association between NP state scope of practice laws and use of PAs or NPs among PCPs.

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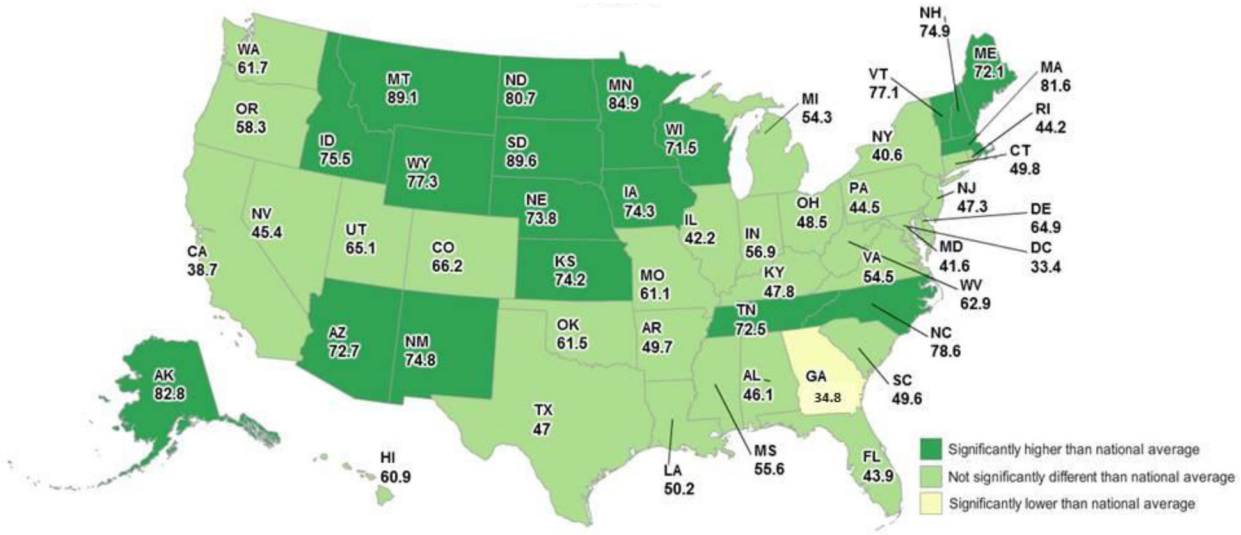

Figure 1.

Percentage of office-based primary care physicians with physician assistants (PAs) or nurse practitioners (NPs) in their practice: United States,2012

NOTES: Primary care physicians include family/general practitioners, internists, geriatricians, and pediatricians. Estimates exclude physicians missing information on availability of PAs or NPs. SOURCE: NAMCS - EHR Survey.

Table 1.

Percent of distribution of primary care physicians, unadjusted and adjusted percent of physicians with PAs or NPs in practice, and marginal effects: United States, 2012

		Percent of physicians with PAs or NPs in practice		
		Unadjusted		Adjusted[1]
Characteristic	Percent distribution	Percent	Difference[2]	Differences[2]
All primary care physicians	100.0	53.0	…	…
Practice size[3]				
1–2 physicians	41.4	36.3	Reference	Reference
3–10 physicians	42.2	59.0	[4]22.7	[5]16.5
11+ or more physicians	16.4	80.0	[4]43.7	[5]33.2
Multi-specialty status[3]				
Single specialty	73.8	45.3	Reference	Reference
Group multi-specialty	26.2	74.9	[4]29.6	[5]14.7
Percent of Medicaid revenue				
Above 7%	47.8	54.5	[4]9.8	3.6
Below or equal 7%	39.0	44.7	Reference	Reference
Unknown	13.2	72.6	[4]27.9	[5]16.5
Urban status of practice location[3]				
Large central metropolitan	33.0	41.9	Reference	Reference
Large fringe metropolitan	24.5	52.3	10.4	6.2
Medium or small metropolitan	29.1	60.4	[4]18.5	[5]11.1
Non-metropolitan	13.4	65.7	[4]16.1	[5]18.5

NOTES: PA is physician assistant. NP is nurse practitioner.

[1]Adjusted for practice size, multi-specialty status, unban status of practice location, and state.

[2]Percentage points.

[3]Characteristics refers to practice location where most patients are seen.

[4]Significant difference relative to reference category based on a t-test ($p<0.05$).

[5]Significant marginal effect.

SOURCE: MAMCS -EHR survey.

Table 2.

Adjusted percent of primary care physicians with PAs or NPs in their practice by state, 2012.

State	Adjusted percent of primary care physicians with PA or NPs[1]	State	Adjusted percent of primary care physicians with PA or NPs[1]
United states	53.0	Missouri	61.6
Alabama	44.6	Montana	80.8[#]
Alaska	73.9	Nebraska	63.9
Arizona	71.8	Nevada	53.1
Arkansas	46.6	New Hampshire	66.0
California	39.7	New Jersey	54.4
Colorado	64.7	New Mexico	61.6
Connecticut	51.7	New York	49.1
Delaware	60.2	North Carolina	72.6
District of Columbia	39.1	North Dakota	67.4
Florida	55.8	Ohio	51.0
Georgia	43.8	Oklahoma	58.0
Hawaii	57.8	Oregon	48.6
Idaho	66.5	Pennsylvania	48.6
Illinois	41.9	Rhode island	50.1
Indiana	56.0	South Carolina	45.5
Iowa	59.9	South Dakota	78.1[#]
Kansas	69.0	Tennessee	69.6
Kentucky	48.1	Texas	51.7
Louisiana	48.9	Utah	46.5
Maine	58.8	Vermont	68.5
Maryland	45.4	Virginia	57.9
Massachusetts	73.7	Washington	50.4
Michigan	52.4	West Virginia	57.0
Minnesota	77.0[#]	Wisconsin	53.6
Mississippi	54.1	Wyoming	67.1

NOTES: PA is physician assistant. NP is nurse practitioner.

[#]Odds ratio significantly higher than reference state (Texas).

[1]Adjusted for practice size, multi-specialty status, percent Medicaid revenue, and urban status of practice location. Excludes physicians missing information on non-physician clinicians, and multi-specialty status.

SOURCE: National Ambulatory Medical Cane Survey-Electronic Hearth Records Survey.

Table 3.

Percent distribution of primary care physicians, unadjusted and adjusted percent with PAs or NPs in practice, and marginal effects: United States, 2012

		Percent of physicians with PAs or NPs in practice		
		Unadjusted		Adjusted[1]
Characteristic	Percent distribution	Percent	Difference[2]	Difference[2]
All primary care physicians	100.0	53.0	…	…
Independence level n nurse practitioner (NP) State scope of practice laws[3]				
Physician oversight to diagnose, treat, and prescribe	69.7	50.0	Reference	Reference
Physician oversight to prescribe	13.6	56.3	6.3	1.9
No Physician oversight required	16.6	63.2	[5]13.2	4.3
Number of elements in state physician assistant (PA) practice laws[4]				
Least favorable	43.8	49.8	Reference	Reference
Moderately favorable	45.7	52.3	2.5	−0.7
Favorable	10.5	70.0	[5]20.2	[6]9.6

NOTES PA is physician assistant NP is nurse practitoner.

[1]Adjusted for practice size, multi-specialty status, urban status of practice location, NP scope of practice and PA scope of practice laws.

[2]Percentage points.

[3]Categories based on NP Practice Autonomy categories in The 2012 Pearson Report.

[4]Categories based on favorability of state laws toward PA practice in Sutton, Ramos, Lucado, 2010.

[5]Significant difference relative to reference category based on a t-test ($p<0.05$).

[6]Significant marginal effect.

SOURCE: NAMCS-EHR Survey.