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Effects of Regulation and Payment Policies on Nurse Practitioners' Clinical Practices

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Abstract

Increasing patient demand following health care reform has led to concerns about provider shortages, particularly in primary care and for Medicaid patients. Nurse practitioners (NPs) represent a potential solution to meeting demand. However, varying state scope of practice regulations and Medicaid reimbursement rates may limit efficient distribution of NPs. Using a national sample of 252,657 ambulatory practices, we examined the effect of state policies on NP employment in primary care and practice Medicaid acceptance. NPs had 13% higher odds of working in primary care in states with full scope of practice; those odds increased to 20% if the state also reimbursed NPs at 100% of the physician Medicaid fee-for-service rate. Furthermore, in states with 100% Medicaid reimbursement, practices with NPs had 23% higher odds of accepting Medicaid than practices without NPs. Removing scope of practice restrictions and increasing Medicaid reimbursement may increase NP participation in primary care and practice Medicaid acceptance.

Keywords

nurse practitioners; scope of practice; Medicaid; primary care; access to care

Introduction

Under the Patient Protection and Affordable Care Act, over 22 million Americans have gained health care coverage through private health insurance and Medicaid (Medicaid. gov, 2015; U.S. Department of Health and Human Services, 2015). This number is expected to rise, leading to an increase in demand and provider shortages (Association of American Medical Colleges [AAMC], 2012; Health Resources and Services Administration [HRSA],

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Authors' Note

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2013). However, these shortages are not expected to be uniform within or across states and are expected to be greatest in primary care and for Medicaid patients (Hofer, Abraham, & Moscovice, 2011; HRSA, 2013; Ku, Jones, Shin, Bruen, & Hayes, 2011).

Nurse practitioners (NPs) have the potential to contribute to alleviating primary care shortages and increasing access to care (American Association of Nurse Practitioners, 2015c; HRSA, 2013). In 2015, there were approximately 136,060 clinically active NPs in the United States, and it is projected that the supply of NPs will increase substantially in the coming years (Auerbach, 2012; Bureau of Labor Statistics, 2016). Almost 50% of NPs practice in primary care, and the growth of the NPs in primary care is expected to outpace growth in primary care physician supply (Biggs, Crosley, & Kozakowski, 2013; HRSA, 2014; Pohl, Barksdale, & Werner, 2015). Additionally, NPs care for Medicaid patients more frequently than physicians (Benitez, Coplan, Dehn, & Hooker, 2015; Buerhaus, DesRoches, Dittus, & Donelan, 2014).

One modifiable factor that has the potential to influence NP practice is state scope of practice (SOP) regulations. NP SOP varies across states, and a major difference between the least restrictive states and the most restrictive states is the requirement that an NP maintains a “collaborative agreement” with at least one physician to practice, prescribe medication, or both (Fairman, Rowe, Hassmiller, & Shalala, 2011). Research has found that requiring collaborative agreements has a negative impact on the number of NPs available to provide care (Reagan & Salsberry, 2013). Laws that limit specific elements of NP practice, for example, the ability to prescribe certain categories of scheduled drugs, certify disability forms, or order physical therapy (Phillips, 2016), become less effective as an NP is not able to provide any services in the absence of an collaborative agreement. For an NP practicing in a state with collaborative agreement requirements, if the physician collaborator moves or decides to end the agreement, no services are able to be rendered by that NP. In 2015, 22 states plus the District of Columbia (D.C.) allowed for full NP SOP requiring no collaborative agreements with a physician; and 28 states required some sort of agreement, often supervisory, for practice and prescribing (Phillips, 2016).

Favorable NP SOP environments also have the potential to benefit Medicaid beneficiaries. Overall, Medicaid beneficiaries experience greater difficulty in securing primary care appointments than individuals with other types of insurance (Rhodes et al., 2014). Richards and Polsky (2016) found improved access to care for Medicaid beneficiaries in practices that both employed more providers, including NPs and physician assistants (PAs), and were located in states with the least restrictive SOP. In one study, a sample of Medicare beneficiaries reported shorter wait times for appointments and less difficulty accessing care in states with more restrictive NP SOP regulations (Cross & Kelly, 2015).

A second factor that may influence NP practice and access to care is Medicaid fee-for-service reimbursement rates for NP services. Medicaid is now the largest insurer in the United States (Rosenbaum, 2014), and increasing coverage for Medicaid beneficiaries has been associated with improved patient outcomes (Sommers, Baicker, & Epstein, 2012). In a 2014 study, Buerhaus et al. found that primary care physicians who work with NPs were more likely to accept new Medicaid patients than those physicians working in practices

without an NP. However, Decker (2012) found that physicians were less likely to accept new Medicaid patients in states with lower Medicaid physician fees. In states where NPs are reimbursed less than the physician rate, varying from 75% to 100% of physician rates (Kaiser Family Foundation [KFF], 2012), practices may be discouraged from both employing NPs and accepting Medicaid.

There is limited evidence about the effect of existing SOP and reimbursement policies on NP practice patterns and their potential to undermine the goal of improving access to care. The purpose of this study was to examine how state SOP and Medicaid reimbursement policies affect NP participation in primary care and practice Medicaid acceptance. To better understand how these policies influence the outcomes, we analyzed the relationships at two levels. At the individual level, we examined the odds that an NP works in a primary care practice in states with full SOP and 100% NP Medicaid reimbursement compared with states with less favorable regulatory environments. At the practice level, we examined the odds of practice Medicaid acceptance based on the presence of an NP in the practice and whether the practice is also located in a state that allows for 100% NP Medicaid reimbursement.

Conceptual Basis for the Study

This study was based on the conceptual understanding that, examined together, both NP SOP and NP Medicaid reimbursement policies have the potential to influence NP participation in primary care and practice Medicaid acceptance. First, patients are more likely to receive primary care from NPs in states that require no collaborative agreements for practice or prescribing (Kuo, Loresto, Rounds, & Goodwin, 2013). However, we do not know if SOP regulations encourage increased participation of NPs in primary care. At the individual level, we hypothesized that states with full NP SOP (i.e., no collaborative agreement requirements for practice or prescribing) would see greater odds that individual NPs work primary care practices. This is based on the premise that states with no restrictions on practice would allow NPs greater flexibility to work in practices where their services are most needed.

Additionally, low fee-for-service reimbursement rates for NP services act as a barrier to the financial sustainability of NP practice even in states that do not require collaborative agreements (Yee, Boukus, Cross, & Samuel, 2013). Polsky et al. (2015) found an almost 8% increase in acceptance of new Medicaid patients for primary care appointments after an increase in Medicaid reimbursement rates. At the practice level, we hypothesized that reimbursing NPs at the full physician Medicaid fee-for-service rate would be associated with greater Medicaid acceptance within individual practices. We posit that more generous reimbursement rates would incentivize practices to both employ NPs and accept Medicaid. Higher reimbursement would result in less financial burden to practices employing NPs and enable these practices to see a higher proportion of patients covered under Medicaid.

New Contributions

Prior research on the NP workforce has primarily relied on administrative data, such as National Provider Identifier numbers (Kaplan, Skillman, Fordyce, McMenamin, & Doescher, 2012), Medicare billing information (DesRoches et al., 2013), or NP licensure

and certification data (Freed, Dunham, Loveland-Cherry, Martyn, & Research Advisory Committee of the American Board of Pediatrics, 2010; Kuo et al., 2013; Reagan & Salsberry, 2013). These data sources tend to underestimate the number of practicing NPs (Spetz, Fraher, Li, & Bates, 2015) because NPs may not always bill directly (Kaplan et al., 2012), and there are nurses who are licensed or certified as NPs but may not be working as an NP (e.g., they may work in a registered nurse role; HRSA, 2014).

We used a national database linking individual NPs with their employing practices in primary and specialty ambulatory care. This database does not rely on licensure or certification data, but instead provides information on clinically active NPs within ambulatory practices. This approach makes this study the first to examine NP workforce distribution with detailed information about the practices in which those NPs work. The granularity offered by these data provides a new context in which to examine the participation of NPs in primary care and practice Medicaid acceptance.

There are differing views on the extent to which provider shortages exist and whether the supply of primary care providers is adequate to meet increasing demand (AAMC, 2012; Altman & Blumenthal, 2015; Salsberg, 2015). The growing use of NPs and PAs may be reducing, to some extent, shortages in primary care created by health care reform (Salsberg, 2015). However, improvements in absolute numbers of primary care providers do not necessarily obviate the maldistribution of providers to the settings and populations of greatest need (Salsberg, 2015). The concept of NP participation in primary care is a focus of this study. The results from this study have important implications for how regulations and payment policies might be altered to improve access to primary care.

Method

Data Sources

The primary data for this cross-sectional study were extracted from the 2012 SK&A physician and NP/PA files. SK&A is a market research firm that maintains and frequently updates information on ambulatory practices in all 50 states and D.C. (SK&A, 2016). Data are collected during the previous calendar year. The NP/PA file contains data on NPs and PAs that are colocated with physicians in practices. The physician files have been used in prior research to answer questions of access to care in ambulatory settings (Polsky et al., 2015; Rhodes et al., 2014; Richards, Saloner, Kenney, Rhodes, & Polsky, 2014), but our study is the first to incorporate the NP/PA file. Using Federal Information Processing Standard codes, we merged the SK&A data with the Area Health Resources Files (AHRF; HRSA, n.d.) to obtain additional county-level characteristics for each practice. NP SOP was based on 2011 state collaborative agreement requirements (Kuo et al., 2013; Phillips, 2012), and NP Medicaid fee-for-service reimbursement rates were obtained for each state (KFF, 2012; Phillips, 2012).

Scope of Practice and Medicaid Reimbursement

NP SOP was categorized based on the requirement of a collaborative agreement with a physician for NP practice or prescriptive authority (Kuo et al., 2013). This method

categorized states as allowing for “independent practice and prescriptions” (least restrictive); “independent practice, but requiring supervision for prescriptions” (restrictive); or “requiring physician supervision for practice and prescriptions” (most restrictive). Using these categories, we derived a binary variable reflecting either full SOP (least restrictive states) or without full SOP (restrictive and most restrictive states combined). Appendix Table A1 displays how our binary variable compares with the original three categories. Next, we created a binary variable indicating whether a practice was located in a state that reimbursed NP services at 100% of the physician rate or less than 100%. Medicaid reimbursement was measured as a binary variable rather than continuous or categorical to examine the impact of an ideal reimbursement policy environment.

To examine the combined effect of NP SOP and Medicaid reimbursement, we categorized states into four groups (Figure 1). States were categorized as having a “fully enabled” policy environment if both full SOP and 100% Medicaid reimbursement were present. Seven states plus D.C. were in this category. The remaining states were categorized as full SOP only (6 states), 100% Medicaid reimbursement only (20 states), or neither (17 states). Finally, we created a binary variable to compare the “fully enabled” states with all other states.

Practices

Our final sample consisted of 252,657 ambulatory practices. We included practices that had at least one physician present in the practice whether or not the practice employed NPs. NPs were employed by 14.8% ($n = 37,393$) of the practices in the study. We created a binary variable that designated a practice as primary care or specialty based on the physician specialty provided by SK&A. Physician specialty was chosen to designate practice type because we anticipated that physician specialty would likely drive the type of care provided at each site. Primary care specialties included adolescent medicine, family practitioner, general practitioner, geriatrician, internal medicine, and pediatrician. For practices with a mix of both primary care and specialty physicians, we designated a practice as primary care if at least two thirds of physicians within the practice were primary care physicians.

Additional practice characteristics were derived from SK&A and the AHRF databases. Variables from SK&A included practice size, NP presence in a practice, and practice Medicaid acceptance. Practice size was a continuous variable calculated as the number of NPs, physicians, and PAs in each practice. NP presence and practice Medicaid acceptance were binary variables. From the AHRF, a binary variable indicating rural location was established using core-based statistical area (Office of Management and Budget), and poverty was a continuous variable that measured the percentage of the county living in poverty. High-poverty areas were defined as at least 20% of the county population living in poverty (Bishaw, 2014).

Providers

The providers studied were employed in the 252,657 practices for which data were available. Our provider sample consisted of 57,148 NPs with 47% working in primary care based on our primary care practice designation, which is consistent with the 2012 National Sample Survey of Nurse Practitioners finding of 48% of NPs working in primary care (HRSA,

2014). Additionally, 30% of the 561,799 physicians in our sample were in primary care, which compares roughly with the AAMC (2013) report that 36% of physicians are in primary care. Of note, 42,705 PAs were included in the SK&A NP/PA file and were counted in the analyses to determine the total number of providers within practices. However, our analyses did not examine PAs in relationship to our outcomes of interest because PAs work under the supervision of their employing physicians, unlike NPs whose legal SOP is defined by state regulation. Also, the national debate surrounding access to care and barriers to practice have focused on the NP and physician workforces (Gilman & Koslov, 2014; Institute of Medicine, 2010; National Governors Association, 2012). Additional provider characteristics are available in Appendix Table A2.

Data Analysis

Descriptive statistics were used to examine provider distribution and practice characteristics. We then used logistic regression models to estimate the effects of full SOP and 100% NP Medicaid reimbursement on the odds that an individual NP works in a primary care practice versus specialty practice. We considered both a main (or direct) effects model and a model that allowed these two variables to interact in their effects. Both models included controls for practice size, percentage of county population living in poverty, rural versus nonrural setting, and Medicaid acceptance. We estimated robust standard errors and significance levels that accounted for the clustering of individual NPs within practices (White, 1980; Williams, 2000).

At the practice level, we used logistic regression models to examine the main and interaction effects of NP presence in a practice and 100% NP Medicaid reimbursement on whether the practice accepts Medicaid. These models controlled for SOP, practice type, practice size, percentage of county population living in poverty, and rural versus nonrural setting. All analyses were conducted using STATA 13 (StataCorp, 2013).

Results

Scope of Practice and Medicaid Reimbursement

Just over 6% (6.3%) of practices were located in “fully enabled” states (i.e., full SOP and 100% NP Medicaid reimbursement), and 35.5% of practices were in states that had neither “fully enabled” policy in place (Appendix Table A3). The remaining 58.3% of practices were in states categorized as either full SOP or 100% Medicaid reimbursement. Within each category, we compared practices with and without NPs. In “fully enabled” states, 19.4% of practices had NPs followed closely by 18.4% in full SOP states. In states with 100% NP Medicaid reimbursement, 13.9% of practices had NPs, and 15.1% of practices in states with neither policy enabled had NPs.

As can be seen in Figure 2, in “fully enabled” states, there was a significantly higher percentage of individual NPs in primary care practices compared with specialty practices. These states also saw the highest percentage of NPs in primary care practices compared with the other three state policy categories. Additionally, across all state policy categories, a

significantly higher percentage of practices with NPs accepted Medicaid compared with practices without NPs (Figure 3).

Primary Care and Specialty Practices

Approximately one third (33.8%) of practices in our sample were designated primary care (Table 1). Greater proportions of primary care practices were in rural areas (6.6%) compared with specialty practices (2.3%), as well as areas designated as high poverty (17.9%) compared with specialty practices (15.5%). Among all practices, 21.1% of primary care practices had NPs compared with 11.6% of specialty practices. In primary care practices with NPs, significantly more practices (12.1%) were located in rural settings compared with primary care practices without NPs (5.1%), but there was not a significant difference between the specialty practices with NPs and those without NPs in rural areas. Hing and Hsiao (2015) found a similar increase in the availability of NPs/PAs in primary care practices as the practice setting became more rural. Primary care and specialty practices with NPs were located in areas of high poverty at a higher rate than both types of practices without NPs. Among both primary care and specialty practices, significantly more practices with NPs accepted Medicaid than practices without NPs.

Nurse Practitioners in Primary Care

At the individual level ($n = 57,148$), we examined the main effects (left panel of Table 2) and interaction effects (right panel of Table 2) of full SOP and 100% NP Medicaid reimbursement on the distribution of individual NPs to primary care. These models controlled for practice size, percentage of county population living in poverty, rural versus nonrural setting, and Medicaid acceptance. The main effects model indicated that NPs had 13% higher odds (odds ratio [OR] = 1.13, 95% confidence interval [CI]: 1.04, 1.23]) of practicing in primary care settings (vs. specialty care) in states with full SOP compared with states without full SOP. Also, NPs had 6% higher odds ($OR = 1.06$, 95% CI [1.003, 1.12]) of working in a primary care practice when the state allowed for 100% NP Medicaid reimbursement compared with states that reimburse for NP services at less than 100% of the physician rate. The interaction effect introduced in the model is nonsignificant, which indicates that the effect of full SOP on whether an NP works in primary care is the same regardless of whether the state allows for 100% NP Medicaid reimbursement. Moreover, the main effects model implies that in states which have both full SOP and 100% NP Medicaid reimbursement, NPs have 20% higher odds of practicing in primary care settings (i.e., odds are higher by a factor of $1.13 \times 1.06 = 1.20$).

Medicaid Acceptance

At the practice level ($N = 252,657$), we examined the main and interaction effects of NP presence in a practice and 100% NP Medicaid reimbursement on the likelihood of the practice accepting Medicaid (Table 3). These models adjusted for SOP, practice type, practice size, percentage of county population living in poverty, and rural versus nonrural setting. The main effects model suggests that practices had 17% higher odds ($OR = 1.17$, 95% CI [1.14, 1.20]) of accepting Medicaid if an NP was employed in the practice compared with practices without NPs. Also, a practice had 13% higher odds ($OR = 1.13$, 95% CI

[1.11, 1.15]) of accepting Medicaid if the state allowed for 100% NP Medicaid reimbursement.

However, these ORs would not be the preferred estimates to use to describe those effects, since the interaction introduced in the second model is highly significant (right panel of Table 3). The interaction model suggests that the direct effects of NP presence ($OR = 1.10$, 95% CI [1.06, 1.14]) and 100% Medicaid reimbursement ($OR = 1.11$, 95% CI [1.09, 1.13]) are somewhat smaller than the main effects model indicated, or (given our 0 and 1 coding of the two variables) that the effect of either is smaller when the other is absent. Because of the significant interaction, the effect of both being present is bigger than the main effects model would indicate. Thus, in states without 100% NP Medicaid reimbursement, practices with NPs had 10% higher odds of accepting Medicaid than practices without NPs. In states with 100% Medicaid reimbursement, however, practices with NPs had 23% higher odds of accepting Medicaid than practices without NPs (i.e., odds are higher by a factor of $1.10 \times 1.12 = 1.23$).

It is noteworthy that in an additional model which did not control for practice size (right column of Appendix Table A4), the main and interaction effects of NP presence and 100% NP Medicaid reimbursement on practice Medicaid acceptance remained significant and were decidedly larger. Practices with NPs had 39% higher odds ($OR = 1.39$) of accepting Medicaid compared with practices without NPs in states without 100% NP Medicaid reimbursement. In states with 100% NP Medicaid reimbursement, practices with NPs had 61% higher odds (i.e., odds are higher by a factor of $1.39 \times 1.16 = 1.61$) of accepting Medicaid compared with practices without NPs. Thus, part but not all of the effect of NP presence on Medicaid acceptance, both in states with and without 100% NP Medicaid reimbursement, is attributable to differences in the size of the practices in which NPs are present.

Finally, there were findings from our analyses that warrant a brief discussion. In the regression models, practice Medicaid acceptance was negatively associated with NP participation in primary care (Table 2), and primary care practice designation was negatively associated with practice Medicaid acceptance (Table 3). These results are interesting and unexpected, and they may be driven by practice characteristics not included in this study. For example, one study found NP/PA presence was higher in primary care practices in which Medicaid revenue accounted for a higher percentage of their total revenue (Hing & Hsiao, 2015). Actual or potential Medicaid revenue, in both primary care and specialty practices, could affect a practice's ability to accept Medicaid, as well as hire an NP. These relationships are indeed interesting, and more research is needed to explore the impact of the inclusion of NPs in primary care and specialty practices, as well as practice Medicaid acceptance on workforce and practice outcomes.

Discussion

Our findings indicate that NP participation in primary care is greatest in states that allow for both full SOP and 100% NP Medicaid reimbursement. Additionally, the presence of an NP in a practice is associated with higher odds that the practice accepts Medicaid, and the odds

of Medicaid acceptance is even higher when the state also allows for 100% NP Medicaid reimbursement. These results are striking considering only 6% of the study's practices were in states with both full SOP and 100% NP Medicaid reimbursement, and one third of practices were in states with restrictions on NP practice and low NP Medicaid reimbursement. Thus, collaborative agreement requirements and low Medicaid reimbursement rates appear to be barriers to states increasing the distribution of NPs into needed settings. In order to fully utilize the existing NP workforce to contribute to improving access to care, changes to state policies are required.

NP SOP has garnered more attention since the landmark 2010 Institute of Medicine report "The Future of Nursing: Leading Change, Advancing Health" and subsequent policy initiatives calling for the removal of NP practice restrictions (Gilman & Koslov, 2014; National Governors Association, 2012). There is growing support for revisiting regulations at the state level and advancing efforts to remove collaborative agreements. In 2015, Nebraska and Maryland have become the 20th and 21st states, respectively, to enact legislation for full NP SOP (American Association of Nurse Practitioners, 2015a, 2015b). Collaborative agreement requirements have been shown to reduce the number and slow the growth of available NPs in communities (Reagan & Salsberry, 2013), and they have been found to increase the cost of care. Independent analyses in three states found that removing restrictions and allowing for full NP SOP could provide significant economic benefits to states, as well as lower health care costs and improve access to care (Conover & Richards, 2015; Eibner, Hussey, Ridgely, & McGlynn, 2009; Weinberg & Kallerman, 2014).

There has been opposition in response to efforts to remove collaborative agreements requirement (Colombo, 2014; Pennsylvania Medical Society, n.d.). However, there is no empirical evidence that removing collaborative agreements diminishes quality of care (Fairman et al., 2011). A large body of research has found patient safety, patient satisfaction, and quality of care are not negatively affected with NP-provided care (Horrocks, Anderson, & Salisbury, 2002; Newhouse et al., 2011; Stanik-Hutt et al., 2013). Moreover, regulatory changes removing requirements for collaborative agreements between NPs and physicians have no bearing on professional norms and expectations that all health care professionals have interprofessional networks for patient referrals and consultations consistent with high standards of health care delivery. Unrestricted NP practice has the potential to improve access to primary care and to augment the health care workforce without detrimental effects to patients.

As the United States moves from a primarily fee-for-service to increasingly value-based payment model (Burwell, 2015), an opportunity arises to revisit reimbursement mechanisms for NPs in order to maximize patient access to care. This is particularly relevant in the context of emerging models of multidisciplinary, team-based care, in which NPs will have a significant role in providing care for patients with chronic and acute conditions (Goodell, Dower, & O'Neil, 2011). The willingness of practices to hire NPs and in an effort to provide the best access to care for their patients will depend on how SOP and Medicaid reimbursement policies are revised. Thus, our findings suggest that it is in the public's interest for states to grant full practice authority to NPs and reimburse NP services at 100% of the physician fee-for-service rate.

Limitations

We used a cross-sectional design, which limits our ability to determine causality. Due to the nature of cross-sectional data and the inability to determine causality, endogeneity among some of the variables is a potential issue, and in the absence of an instrumental variable and longitudinal data, endogeneity becomes a limitation of our study. Since the SK&A data are self-reported by practices, there may be errors in reporting and data entry (King, Furukawa, & Buntin, 2013; Lynch et al., 2014). Individual practices that are solely associated with NPs and without physicians (e.g., nurse-managed health centers and retail clinics) are not represented. Finally, we only had data on whether a practice accepted Medicaid; no information was available whether a practice was accepting *new* Medicaid patients.

Conclusion

The United States is experiencing shortages of primary care providers and practices that accept Medicaid, which will only increase as health care reform extends insurance coverage and the population ages and grows. NPs offer the potential to moderate these shortages, but our findings suggest that their contributions are undermined by state regulations that unnecessarily restrict practice and reduce Medicaid reimbursement rates that are already low for physicians. Removal of state regulations restricting NP SOP, as well as providing full Medicaid reimbursement for NP services, are actionable policy changes that hold significant promise for increasing access to care.

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Appendix

Table A1

Categorization of 50 States and the District of Columbia by NP Scope of Practice.

Binary scope of practice variable ^a	Three-category scope of practice ^b	State	
Full scope of practice	"Independent practice and prescriptions"	Alaska	Maine
		Arizona	Montana
		Colorado	New Hampshire
		District of Columbia	New Mexico
		Hawaii	Oregon
		Idaho	Washington
		Iowa	Wyoming

Binary scope of practice variable ^a	Three-category scope of practice ^b	State	
Without full scope of practice	“Independent practice but requiring supervision for prescriptions”	Arkansas Indiana Kentucky Maryland Michigan New Jersey	North Dakota Oklahoma Rhode Island Tennessee Utah West Virginia
	“Requiring physician supervision for practice and prescriptions”	Alabama California Connecticut Delaware Florida Georgia Illinois Kansas Louisiana Massachusetts Minnesota Mississippi	Missouri Nebraska Nevada New York North Carolina Ohio Pennsylvania South Carolina South Dakota Texas Vermont Virginia Wisconsin

Note. NP = nurse practitioner. Based on 2011 NP scope of practice collaborative agreement requirements.

^a Authors' binary categorization of NP scope of practice regulations.

^b Three-category NP scope of practice from Kuo et al. (2013).

Table A2

Provider Characteristics.

Practice characteristics	Nurse practitioners, <i>n</i> = 57,148 (8.6%)		Physicians, <i>n</i> = 561,799 (84.9%)		Physician assistants, <i>n</i> = 42,705 (6.5%)	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Practice type						
Primary care	26,877	47.0	169,479	30.2	16,771	39.3
Specialty	30,271	53.0	392,320	69.8	25,934	60.7
Practice size						
1-3	17,715	31.0	222,506	39.6	12,058	28.2
4-9	24,564	43.0	169,756	30.2	17,818	41.7
10	14,869	26.0	169,537	30.2	12,829	30.0
Medicaid acceptance	42,732	74.8	408,150	72.7	30,608	71.7
Rural location	3,585	6.3	15,951	2.8	2,358	5.5
High poverty	10,656	18.7	89,875	16.0	6,353	14.9
Full scope of practice only	2,414	4.2	20,010	3.6	2,303	5.4
100% Medicaid reimbursement only	29,560	51.7	311,444	55.4	23,211	54.4
Full scope of practice and 100% Medicaid reimbursement	4,868	8.5	43,877	7.8	4,469	10.5

Note. Primary care was established based on the presence of at least two-third primary care physicians in a practice. Primary care physicians included the following: adolescent medicine, family practice, general practitioner, geriatrician, internist, and pediatrician. Practice size was calculated as the number of physicians, nurse practitioners, and physician assistants in each practice. Rural location was established using core-based statistical area (Office of Management and Budget), and high poverty was defined as at least 20% of the county population living in poverty. Percentages may not add to 100 because of rounding.

Table A3
 Characteristics of Practices With and Without NPs Based on SOP and Medicaid Reimbursement (N = 252,657).

	Full SOP and 100% NP Medicaid reimbursement, n = 15,803 (6.3%)			Full SOP only, n = 8,282 (3.3%)			100% NP Medicaid, reimbursement only, n = 139,011 (55.0%)			Neither full SOP nor 100% NP Medicaid reimbursement, n = 89,561 (35.5%)			
	NP present, n = 3,069 (19.4%)	No NP present, n = 12,734 (80.6%)	p	NP present, n = 1,522 (18.4%)	No NP present, n = 6,760 (81.6%)	p	NP present, n = 19,274 (13.9%)	No NP present, n = 119,737 (86.1%)	p	NP present, n = 13,528 (15.1%)	No NP present, n = 76,033 (84.9%)	p	
Practice size	n	%	<.001	n	%	<.001	n	%	<.001	n	%	<.001	
1-3	1,139	37.1		623	40.9		7,985	41.4		6,443	47.6		
4-9	1,360	44.3		702	46.1		8,067	41.9		5,399	39.9		
10	570	18.6		197	12.9		3,222	16.7		1,686	12.5		
Primary care practice	1,575	51.3	<.001	729	47.9	<.001	9,091	47.2	<.001	6,638	49.1	<.001	
Medicare acceptance	2,426	79.1	.08	1,229	80.8	.89	15,580	80.8	95,659	79.9	<.01	60,893	80.1
Medicaid acceptance	2,366	77.1	<.001	1,187	78.0	<.001	14,186	73.6	76,533	63.9	<.001	9,445	69.8
Rural location	293	9.6	<.001	126	8.3	<.001	1,097	5.7	3,235	2.7	<.001	1,118	8.3
High poverty	248	8.1	.05	348	22.9	<.05	3,060	15.9	16,704	14.0	<.001	3,285	24.3

Note. NP = nurse practitioner; SOP = scope of practice. Primary care was established based on the presence of at least two-third primary care physicians in a practice. Primary care physicians included the following: adolescent medicine, family practice, general practitioner, geriatrician, internist, and pediatrician. Practice size was calculated as the number of physicians, nurse practitioners, and physician assistants in each practice. Rural location was established using core-based statistical area (Office of Management and Budget), and high poverty was defined as at least 20% of the county population living in poverty. Percentages may not add to 100 because of rounding.

Table A4

Logistic Regressions Comparing Odds That a Practice Accepts Medicaid With and Without Controlling for Practice Size ($N = 252,657$).

	Odds ratios [95% CI] that a practice accepts Medicaid	
	Original model with main and interaction effects	Model with practice size omitted
NP present in practice ^a	1.10 [1.06, 1.14] ***	1.39 [1.34, 1.45] ***
100% NP Medicaid reimbursement ^a	1.11 [1.09, 1.13] ***	1.12 [1.10, 1.14] ***
NP present in practice × 100% NP Medicaid reimbursement ^a	1.12 [1.06, 1.18] ***	1.16 [1.11, 1.22] ***

Note. CI = confidence interval; NP = nurse practitioner.

^a Additional control variables include practice type, scope of practice, percentage of county population living in poverty, and rural versus nonrural setting.

 $p < .001$.

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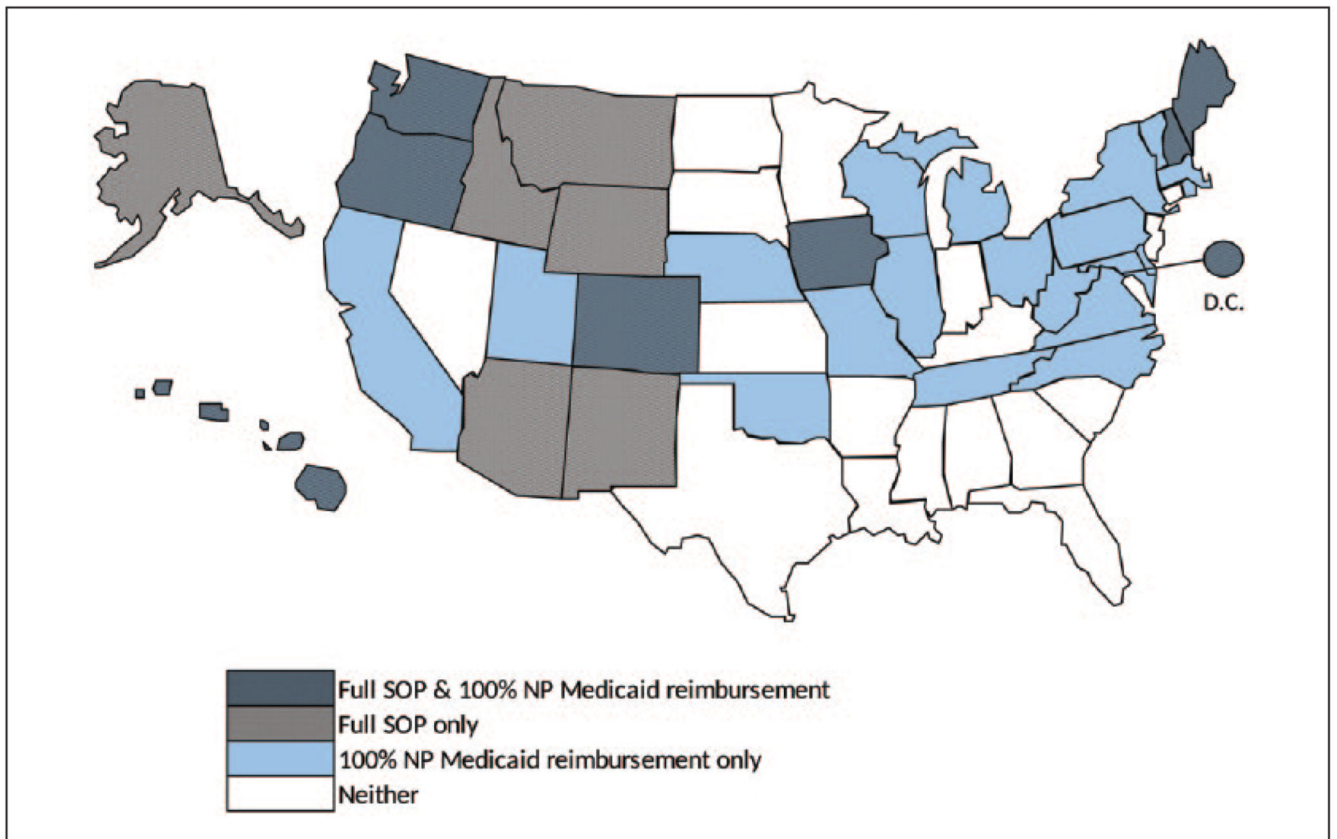


Figure 1.

NP scope of practice and NP medical reimbursement across states.

Note. NP = nurse practitioner; SOP = scope of practice; D.C. = District of Columbia. Based on 2011 NP scope of practice collaborative agreement requirements (Kuo et al., 2013) and NP Medical reimbursement (KFF, 2012).

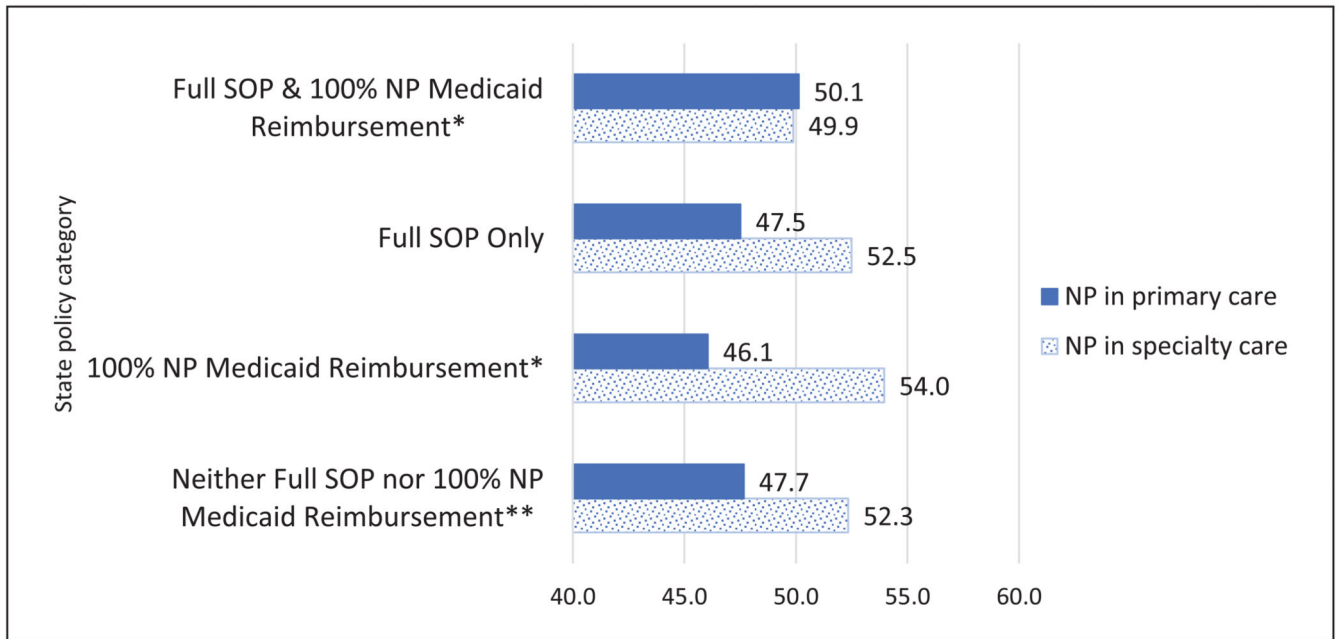


Figure 2.

Percentage of NPs working in primary care compared with specialty practices.

Note. NP = nurse practitioner; SOP = scope of practice. Differences between NPs in primary care and specialty practices across state policy categories were significant at $*p < .001$, $**p < .05$. The difference in Full SOP Only was nonsignificant. p Values generated from chi-square analyses.

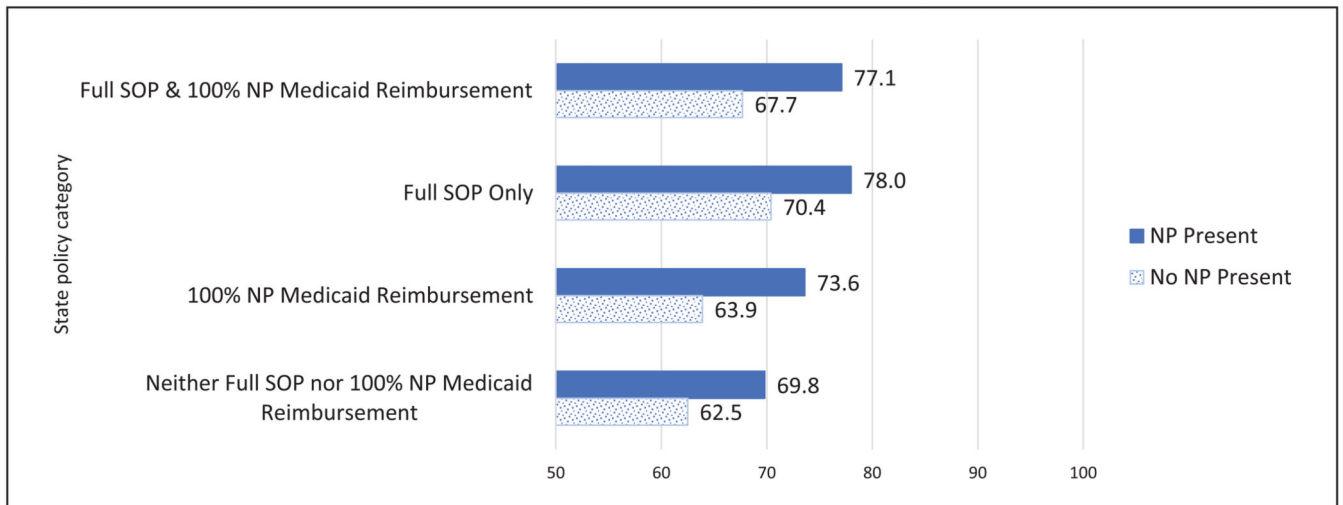


Figure 3.

Percentage of practices that accept Medicaid by practices with and without nurse practitioners.

Note. NP = nurse practitioner; SOP = scope of practice. Differences between practices with and without NPs within each state policy category were significant ($p < .001$).

Table 1
 Characteristics of Primary Care and Specialty Practices With and Without NPs (*N* = 252,657).

	Primary care, <i>n</i> = 85,446 (33.8%)			Specialty, <i>n</i> = 167,211 (66.2%)		
	<i>n</i>	%	<i>p</i>	<i>n</i>	%	<i>p</i>
	NP present, <i>n</i> = 18,033 (21.1%)			NP present, <i>n</i> = 19,360 (11.6%)		
	No NP present, <i>n</i> = 67,413 (78.9%)			No NP present, <i>n</i> = 147,851 (88.4%)		
Practice size			<.001			<.001
1-3	8,764	48.6		7,426	38.4	80.4
4-9	7,503	41.6		8,025	41.5	15.3
10	1,766	9.8		3,909	20.2	4.3
Rural location	2,182	12.1	<.001	452	2.3	.51
High poverty	3,788	21.0	<.001	3,153	16.3	15.4
Medicaid acceptance	12,551	69.6	<.001	14,633	75.6	65.6

Note. NP = nurse practitioner. Primary care was established based on the presence of at least two-third primary care physicians in a practice. Primary care physicians included the following: adolescent medicine, family practice, general practitioner, geriatrician, internist, and pediatrician. Practice size was calculated as the number of physicians, nurse practitioners, and physician assistants in each practice. Rural location was established using core-based statistical area (Office of Management and Budget), and high poverty was defined as at least 20% of the county population living in poverty. Percentages may not add to 100 because of rounding. *p* Values generated from chi-square analyses.

Table 2

Logistic Regression Models Examining the Odds That an NP Works in a Primary Care Practice Given Full SOP and 100% NP Medicaid Reimbursement.

	Full SOP and 100% NP Medicaid reimbursement main effects		Interaction model with main effects	
	Odds ratio	95% CI	Odds ratio	95% CI
Full SOP	1.13 **	[1.04, 1.23]	1.04	[0.90, 1.20]
100% NP Medicaid reimbursement	1.06 *	[1.003, 1.12]	1.04	[0.99, 1.10]
Full SOP × 100% NP Medicaid reimbursement	—	—	1.14	[0.95, 1.35]
Practice size				
1-3	2.31 ***	[2.13, 2.50]	2.31 ***	[2.13, 2.50]
4-9	2.10 ***	[1.94, 2.28]	2.10 ***	[1.94, 2.28]
10 (ref.)	1	—	1	—
% Population in poverty	1.00	[0.999, 1.01]	1.00	[0.999, 1.01]
Rural location	6.23 ***	[5.51, 7.05]	6.22 ***	[5.50, 7.03]
Medicaid acceptance	0.68 ***	[0.64, 0.72]	0.68 ***	[0.64, 0.72]
<i>N</i>	57,148		57,148	

Note. NP = nurse practitioner; SOP = scope of practice; CI = confidence interval. Primary care was established based on the presence of at least two-third primary care physicians in a practice. Primary care physicians included the following: adolescent medicine, family practice, general practitioner, geriatrician, internist, and pediatrician. Practice size was calculated as the number of physicians, nurse practitioners, and physician assistants in each practice. Rural location was established using core-based statistical area (Office of Management and Budget).

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Table 3

Logistic Regression Models Examining the Odds That a Practice Accepts Medicaid Given NP Presence in a Practice and 100% NP Medicaid Reimbursement.

	NP presence in a practice and 100% NP Medicaid reimbursement main effects		Interaction model with main effects	
	Odds ratio	95% CI	Odds ratio	95% CI
NP present in practice	1.17 ^{***}	[1.14, 1.20]	1.10 ^{***}	[1.06, 1.14]
100% NP Medicaid reimbursement	1.13 ^{***}	[1.11, 1.15]	1.11 ^{***}	[1.09, 1.13]
NP present in practice × 100% NP Medicaid reimbursement	—	—	1.12 ^{***}	[1.06, 1.18]
Full SOP	1.24 ^{***}	[1.20, 1.28]	1.24 ^{***}	[1.20, 1.28]
Primary care	0.77 ^{***}	[0.76, 0.78]	0.77 ^{***}	[0.76, 0.78]
Practice size				
1-3	0.28 ^{***}	[0.27, 0.29]	0.28 ^{***}	[0.27, 0.29]
4-9	0.45 ^{***}	[0.43, 0.48]	0.45 ^{***}	[0.43, 0.48]
10 (ref.)	1	—	1	—
% Population in poverty	1.05 ^{***}	[1.04, 1.05]	1.05 ^{***}	[1.04, 1.05]
Rural location	3.63 ^{***}	[3.42, 3.87]	3.64 ^{***}	[3.42, 3.87]
<i>N</i>	252,657		252,657	

Note. NP = nurse practitioner; CI = confidence interval; SOP = scope of practice. Primary care was established based on the presence of at least two-third primary care physicians in a practice. Primary care physicians included the following: adolescent medicine, family practice, general practitioner, geriatrician, internist, and pediatrician. Practice size was calculated as the number of physicians, nurse practitioners, and physician assistants in each practice. Rural location was established using core-based statistical area (Office of Management and Budget).

^{***}
p < .001.