The Economic Cost and Impacts of Scope of Practice Restrictions on Nurse Practitioners

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Eliminating nurse practitioners' (NPs') scope-of-practice restrictions in states has been the focus in care delivery because of its cost-saving potential. Pooling 2 years of county-level data from all counties in the United States, a multivariate regression model linking Medicare cost to the status of NPs' scope-of-practice restrictions is estimated. Empirical results show that eliminating restrictions significantly reduces Medicare costs statistically, suggesting the need for increased participation of NPs in primary care to ensure access, patient safety, and quality of care at reduced cost. At the national level, eliminating restrictions is shown to result in annual Medicare cost savings of $44.5 billion.

The literature provides evidence that expansion of states' scope of practice (SOP) to allow nurse practitioners (NP) full independence in healthcare delivery can improve access, patient safety, and quality of care (Adams & Markowitz, 2018; Buerhaus, 2018; Buerhaus et al., 2018; Dower, Moore, & Langelier, 2013; Hooker & Muchow, 2015; Institute of Medicine [IOM], 2010; Martsolf et al., 2016; Oelke et al., 2008; Perloff, Clarke, DesRoches, O'Reilly-Jacob, & Buerhaus, 2017; Traczynski & Udalova, 2018). Evidence of its effect on cost savings to society at large is scant. Thus, it is important its cost implications be assessed carefully and rigorously.

Nurse practitioners (NPs) and physician assistants (PAs) provide care in various health-care settings. According to the American Association of Nurse Practitioners (AANP, 2019a), there are approximately 248,000 NPs, with 87% prepared to practice in primary care settings. NPs provide care to more than 1.06 billion patients per year (AANP, 2019b). The NP is prepared at the master's or doctoral level to assess, diagnose, and interpret diagnostic tests; develop treatment plans; and prescribe medications. NPs are certified to provide care to specific populations (e.g., adults, geriatrics, pediatrics, family care, women's health, psychiatry, to name a few) and provide most of the same services as physicians. In 22 states plus the District of Columbia, NPs practice and prescribe medications independently without having a collaborative agreement with a physician.

In contrast, the PA is prepared at the master's level and takes a generalist examination for certification. There are approximately 131,000 certified PAs who assess, diagnose, treat, and prescribe medications to approximately 473 million patients per year under the supervision of a physician (National Commission on Certification of Physician Assistants [NCCPA], 2019). The majority of PAs practice in a hospital-based setting rather than in an office or community-based setting (NCCPA, 2019).

The pace at which states are expanding NPs' SOP is tardy (Dower et al., 2013). This, according to many authors, may

put a strain on healthcare resources as the nation faces an increasingly aging population and a rise in the demand for primary care (Auerbach, 2012; Hofer, Abraham, & Moscovice, 2011; Ortiz et al., 2018). The growing shortage of primary care services is expected to be further aggravated by the projected shortage of primary care physicians, specifically in the rural and medically underserved areas in the United States, and due to an uneven distribution of the clinician workforce across states (Graves et al., 2016; Xue et al., 2018).

An empirical model of the county-level Medicare cost as a function of multiple determinants of such cost was developed to analyze and estimate potential future cost savings associated with SOP expansion in states that are facing resistance to NPs' independent practice authority. Using data from all 3,143 counties across the United States for 2010 and 2012 on Medicare costs, related information on healthcare services, and other county-level factors affecting cost and access to health care, several variants of multivariate regression models of cost functions were estimated. The estimated cost functions enable (a) analysis of the role of NPs in cost-efficient delivery of overall care services; (b) estimation of the potential cost savings associated with expanded SOP in counties/states that are lagging behind in lifting such restrictions; and (c) assessing the total national level benefits (cost avoidance) that would accrue if all the remaining states lifted the existing SOP restrictions to allow full independence of NP practice.

Practice Environment In States

State regulations that govern NPs SOP include entry-to-practice qualifications, physician involvement in diagnosis and treatment, and prescriptive authority (Buerhaus, 2018; Gadbois, Miller, Tyler, & Intrator, 2015). There has been a growing receptivity among state legislatures over the past 25 years to NPs' expanded SOP (Adams & Markowitz, 2018; IOM, 2010; Wing, Salsberg & Continelli, 2002). Currently, state practice and licensure laws in 22 states, District of Columbia, and two territories permit full independence. The AANP (2018) classifies the "full independent practice" environment as one where under the licensure authority of the state, the NP has the permission to practice independently. This includes prescribing medications and controlled substances, as well as ordering medical devices, durable goods, and other equipment and supplies in any setting where the NP is providing care.

The AANP classifies states where full practice is not permitted as either "reduced practice" or "restricted practice" states. Reduced-practice states, according to AANP (2018), are those in which *state law requires a career-long regulated collaborative agreement with another health provider for the NP to provide patient care or it limits the setting of one or more elements of NP practice;* Restricted-practice *states are those in which state law requires career-long supervision, delegation, or team-management by another health provider for the NP to provide patient care.* See AANP (2018) for details of the practice environment for states based on the above definitions.

Literature Review

Cost-effectiveness of patient care is the major force driving the trend toward expanded SOP in states. Kleiner, Marier, Park, and Wing (2016) investigated the impact of independent practice authority of advanced practice registered nurses (APRNs) on prices of well-child medical exams; Stange (2014) looked at its impact on the price of office visits for checkups or diagnostic/treatment visits; Oliver, Pennington, Revelle, and Rantz (2014) and Ortiz and colleagues (2018) investigated its impact on cost of preventable hospitalizations and readmissions; Markowitz, Adams, Lewitt, and Dunlop (2017) examined the competitive effects of SOP restrictions for certified nurse midwives (CNMs) and evaluated the effects of changes in states' SOP laws on markets for CNMs and on maternal and infant outcomes.

Studies on the impact of practice environment on cost of health care are limited. Using a retrospective cohort design for a large sample of individual

Medicare beneficiaries and a propensity score regression modeling approach, Perloff, DesRoches, and Buerhaus (2015) determined average beneficiary payments in the case of NP visits were 11% less for inpatient services and 18% less for office visits compared with those for primary care physicians.

Xue, Zhiqiu, Brewer, and Spetz (2015) surveyed two papers investigating NPs' SOP impact on healthcare cost. The first, by Stange (2014), used county-level data for the years 1990 to 2008 and a fixed effect unbalanced panel model to analyze the impact of practice environment on access, costs, and utilization. After accounting for the effect of increased supply of nonphysician clinicians, Stange (2014) found that greater supply of NPs and PAs had only minimal impact on cost of healthcare services. The second paper, by Spetz, Parente, Town, and Bazarko (2013), examined the impact of SOP regulation on the cost of clinic visits. The authors found the cost per clinic visit in restricted-practice states was, on average, the highest ($543), followed by full-practice states ($509) and reduced-practice states ($484).

Baicker and Chandra (2004) studied the broader impact of provider mix on healthcare cost at the population level, using Medicare claims data for 2 successive years 1998-1999 and 2000-2001. They examined the impact of a change in the mix of physician workforce (generalists vs. specialists) on Medicare cost at the state level by applying the first-difference generalized least squares regression technique. The authors found that increasing the number of general practitioners by 1 per 10,000 population (while decreasing the number of specialists holding constant the total number of physicians in a state) was associated with a reduction in that state's overall spending of $684 per beneficiary in 2004 dollars. It would therefore be interesting to explore the magnitude of benefits that can possibly accrue to the nation if states' ability to substitute one type of provider with another could be facilitated through the elimination of the SOP barriers to full practice in the United States. This is the focus of the present research.

Sources of Economic Benefits of Expanded SOP

In the IOM (2010) report, the committee discussed at length the legal barriers that prohibited APRNs from practicing to their full education and training. The committee recommended legal limits to the SOP be removed to ensure better access to care, improved quality of care delivery, and cost efficiency. Economic benefit (cost avoidance) of expanded SOP at the population level may be observed as occurring from the following sources:

- *Wage gap.* It is reasonable to expect the significant difference in salaries/wages between physician and nonphysician providers would result in overall reduction in cost of care if the primary care provider mix is tilted in favor of the NPs and other APRNs. Isaacs and Jellinek (2012) reported median salaries of various categories of clinicians as of 2012. The impact of the marked differences in wages is also revealed in the recent labor markets for providers. For example, Isaacs and Jellinek reported that about half of all office-based physicians employ nonphysicians (with lower wages) to cut costs.
- *Differences in Medicare reimbursement.* Currently, Medicare reimburses independent NPs at 85% of the rate of physicians for services performed, while private insurance payment for NPs can be as low as 50% of what physicians are paid for comparable services (Isaacs & Jellinek, 2012; Traczynsky & Udalova, 2018). Thus, there is currently an incentive to bill most NP and PA-provided care through a physician's national provider identification, which may result in higher cost of care. Expanding SOP for NPs, which can promote nurse-managed health centers and retail clinics, can reduce such practices and thereby reduce cost.
- *Labor market competition for efficiency.* Expanded SOP in states can instill competition among physicians and NPs in the primary care market, where a significant proportion of the care

provisions is substitutable (Auerbach, 2012). This, in turn, will promote establishments of nurse-managed health centers and retail clinics. The long-run effect of such labor market competition is a widespread reduction in cost of primary care services.

The present study attempts to measure the combined impact of the above factors in assessing potential benefits of relaxing NPs' scope of practice in states.

Data and Methods

Data

Data for this study come from Area Health Resources Files (AHRF) compiled by the Health Resources and Services Administration (HRSA). AHRF is HRSA's publicly available data product that compiles data from over 60 different sources, including the American Medical Association, American Hospital Association, Centers for Medicare & Medicaid Services (CMS), Bureau of Labor Statistics, National Center for Health Statistics, and Bureau of Census. Data relating to healthcare agencies, county-level information on Medicare costs, provider population, and aggregate population, demographic, and socioeconomic characteristics are available in the AHRF for the entire United States and territories. Complete data on all study variables from 3,143 counties in the United States (excluding the territories) were available only for two years (2010 and 2012), and thus, utilized for the study. Comparable data pertaining to later years are inadequately available due to definitional changes and unavailability of information relating to certain variables. Data descriptions of all variables utilized in the multivariate regression analysis, including Medicare costs as dependent variable, and the set of all explanatory variables, such as healthcare services variables, practice environment variables, and a list of socioeconomic and demographic variables, are provided in Table 1.

All variables representing dollar amounts are Consumer Price Index-adjusted and are reported in 2013 dollars. Also, Medicare costs are standardized and risk adjusted. CMS standardizes Medicare cost to remove geographic differences in payment rates for individual services as a source of variation. CMS also risk adjusts Medicare costs to account for differences in beneficiary-level risk factors that could affect quality outcomes or medical costs, regardless of the care provided.

Estimation Method

The multivariate regression models of county-level Medicare cost function in the present study relate cost of service provided at the county level to three types of services, namely (a) inpatient services (*totinpatdays*); (b) outpatient visits for primary care services (*totoutpatvisits*); and (c) services associated with emergency department visits (*totedvisits*). Two specifications of the cost function were estimated: one with cost, level of service provided, and its square, measured in logarithm (log-quadratic); and the other with cost, level of service provided, and its square, measured in the level form (linear-quadratic). In the log-quadratic model, all the explanatory variables, except those in percentages or dummy variables, were transformed to natural logarithm.

Economy-wide impact of SOP regulations often triggers policymakers to selectively change SOP regulations and update the status of state practice environments. This makes the practice environment in states endogenously determined. In other words, the two included practice environment dummies (*sopreduced* and *soprestricted*) in equations (3a) and (3b) are endogenous. To effectively address this endogeneity issue, the regression models in the present study were estimated in a structural model framework, commonly known as three-stage least squares (3SLS). This involved first predicting the two practice environment dummy variables (*sopreduced* and *soprestricted*) by applying ordinary least squares (OLS) regression technique to each, separately, using a set of predictors, namely total numbers of primary care physicians, nurse practitioners, and physician assistants in each county as well as the state dummy variable representing the state in which the county is

Table 1.
Variable Descriptions and Summary Statistics

Name	Description	Mean	Stand Dev
Dependent Variable			
totsrmcarecost	Total standardized, risk-adjusted Medicare cost (2013 $)	10,400,000	250,000,000
Explanatory Variables (related to healthcare services)			
totinpatdays	Total hospital inpatient days including nursing home (thousands)	73.09	253.50
totoutpatvisits	Total number of outpatient visits in short-term general hospitals (thousands)	229.16	689.90
totedvisits	Total number of emergency department visits in short-term general hospitals (thousands)	41.90	118.09
expperfacility	Expenses per facility (2013 $)	0.0913	0.1262
avgwagerate	Average payroll expenses per facility personnel (2013 $)	53.12	14.97
tothospbeds	Total number of hospital beds in the county	304.36	994.23
totftefacpers	Total number of facility personnel FTE in short-term general hospitals and nursing homes	527.25	5,257.36
rationppabypcp	Number of (NP + PA) per one primary care physician (ratio)	1.09	1.13
Explanatory Variables (demographic and socioeconomic)			
pcinpoverty	Percentage of county population below federal poverty level	16.98	6.41
pc65wohealthins	Percentage of county population under 65 without health insurance	18.06	5.52
pc25plus4college	Percentage of county population age 25+ with 4-year college education	20.63	8.03
medhhinc	Median household income in the county (2013 thousand $)	45.792	11.594
medhomevalue	Median county home value (2013 thousand $)	133.33	69.88
pcfoodstamp	Percentage of county population who are food stamp recipients	15.74	7.95
pc1564	Percentage of county population in the age group 15 to 64	58.33	3.95
pc65plus	Percentage of county population aged 65 and above	16.31	4.28
Name	**Description**	**Mean[1]**	**Stand Dev[1]**
Explanatory Variables (practice environment)			
sopfull	= 1 if the county in a state with “full” scope of practice (dummy variable)		
sopreduced	= 1 if the county in a state with “reduced” scope of practice (dummy variable)		
soprestricted	= 1 if the county in a state with “restricted” scope of practice (dummy variable)		
Explanatory Variables (county population distribution)			
countypop10k	= 1 if county population ≤ 10,000 (dummy variable)		
countypop10to25k	= 1 if county population > 10,000 but ≤ 25,000 (dummy variable)		
countypop25to50k	= 1 if county population > 25,000 but ≤ 50,000 (dummy variable)		
countypop50to100k	= 1 if county population > 50,000 but ≤ 100,000 (dummy variable)		
countypop100k	= 1 if county population > 100,000 (dummy variable)		

[1]Mean and standard deviation of the dummy variables are not reported.
FTE = full-time equivalent, NP = nurse practitioner, PA = physician’s assistant

Table 2.
Parameter Estimates of the County Level Cost Function (Linear-Quadratic)
Dependent variable: Standardized risk adjusted Medicare cost (2013 $)

Explanatory Variables[#]	Coefficient Estimates (OLS) (Standard Errors)[a]	Coefficient Estimates (3SLS) (Standard Errors)
totinpatdays	308,311 (77,934)***	306,182 (23063) ***
$(totinpatdays)^2$	-97.16 (33.78)***	-96.98 (6.56) ***
totoutpatvisits	-88,123 (25,530)***	-89,198 (7,047) ***
$(totoutpatvisits)^2$	8.98 (4.07)**	9.01 (0.76) ***
totedvisits	1,338,845 (206,461)***	1,344,742 (60,238) ***
$(totedvisits)^2$	478.72 (248.37)*	478.68 (46.71) ***
rationppabypcp	-2,240,805 (1,172,062)*	-2,277,942 (1,528,081)
sopreduced	1.53E+07 (4,627,775) ***	1.73E+07 (3,532,618) ***
soprestricted	1.59E+07 (4,787,964)***	1.80E+07 (3,720,509) ***
R^2	0.91	0.91

[a] Standard errors are robust to county-level clustering
[#] The variables *totinpatdays*, its squares; *totoutpatvisits*, it squares; *totedvisits*, its squares; *medhhinc*; *medhomevalue* are expressed in thousands; *expperfacility* is expressed in million dollars.
***Significant at 1% level; **significant at 5% level; *significant at 10% level
OLS = ordinary least squares, 3SLS = three-stage least squares

located. Second, original values of the practice environment dummy variables were replaced by their respective predicted values before carrying out multivariate regression estimation of the cost function.

Results

Estimation Results

The regression estimates obtained for the 3SLS model are reported in Table 2 in the case of the linear-quadratic cost function and in Table 3 in the case of the log-quadratic cost function. Estimates are reported only for a subset of explanatory, policy-relevant variables. For robustness check of the 3SLS model, results of the multivariate regression estimation using the standard OLS technique were also carried out and reported in Tables 2 and 3. All results were obtained using the STATA software.

Negative and highly significant coefficient on the dummy variable *soprestricted* suggests a significant cost savings could be realized in counties in a restricted-practice state, if the state in question relaxed all its existing SOP regulations to join the ranks of full-practice states. For example, the parameter estimate of *soprestricted* in the 3SLS, log-quadratic specification shows a potential average cost saving of 21% (= $e^{0.19}$ -1). The average risk-adjusted, standardized Medicare cost for the present sample being $104 million, this amounts to an annual average cost saving of $21.84 million per county in a restricted-practice state.

Similarly, negative and highly significant coefficient on the dummy variable *sopreduced* suggests a significant cost saving of 15% (=$e^{0.14}$ -1) in the 3SLS log-quadratic model. This amounts to an average annual cost savings of $15.6 million per county in a reduced-practice state.

The coefficient on the third key policy variable *rationppabypcp* is negative in all four models and highly significant in the two log-quadratic models. In the case of the 3SLS log-quadratic model, this implies that controlling for all factors, doubling (100% increase) the total number of NPs and PAs per primary care physician would result in cost saving of 4% on average. Given that the average risk-adjusted, standardized Medicare cost for the present sample is $104 million, a 4% cost saving would be about $4.16 million, with a

Table 3.
Parameter Estimates of the County-Level Cost Function (Log-quadratic)
Dependent variable: log (standardized risk adjusted Medicare cost) (2013 $)

Explanatory Variables[#]	Coefficient Estimates (OLS) (Standard Errors)[a]	Coefficient Estimates (3SLS) (Standard Errors)[a]
log(totinpatdays)	0.05 (0.02)***	-0.05 (0.01) ***
$(\log(totinpatdays))^2$	0.02 (0.003)***	0.02 (0.002) ***
log(totoutpatvisits)	0.04 (0.04)	0.04 (0.03)
$(\log(totoutpatvisits))^2$	-0.01 (0.005)**	-0.01(0.003) ***
log(totedvisits)	0.10 (0.03)***	0.10 (0.02) ***
$(\log(totedvisits))^2$	0.05 (0.006)***	0.05 (0.004) ***
log(rationppabypcp)	-0.03 (0.01)***	-0.04 (0.01)***
sopreduced	0.11 (0.02) ***	0.14 (0.01) ***
soprestricted	0.16 (0.02)***	0.19 (0.02) ***
R^2	0.92	0.92

[a]Standard errors are in parenthesis and, in the case of OLS, are robust to county-level clustering.
The variables *totinpatdays,* its squares; *totoutpatvisits,* it squares; *totedvisits,* its squares; *medhhinc; medhomevalue* are expressed in thousands; *expperfacility* is expressed in million dollars.
***Significant at 1% level; **significant at 5% level; *significant at 10% level
OLS = ordinary least squares, 3SLS = three-stage least squares

95% confidence bound ($3.91 million, $4.41 million). In other words, regardless of whether or not SOP restrictions were reduced or eliminated in states and consequent cost savings were realized, there would still be room for further cost saving by tilting the provider mix in favor of NPs and PAs in primary care.

Discussion and Implications

Results of the 3SLS log-quadratic model suggest counties in 12 restricted-practice states could save $21.84 million and counties in 17 reduced-practice states could save $15.6 million per year, per county, in 2013 dollars, on average. Based on the most recent definition of the practice environment, in 2012 (the second year of the county-level data set) there were 1,202 counties in the 12 restricted-practice states and 1,170 counties in the 17 reduced-practice states. This implies aggregate annual national savings on Medicare cost, if the SOP restrictions in all of these 29 states were lifted completely, would be $44.5 billion (=1,202 x $21.84 million + 1,170 x $15.6 million) in 2013 dollars with a 95% confidence interval ($36.6 billion, $53.6 billion).

According to the CMS (2014), the 2014 aggregate Medicare cost at the national level was $618.7 billion. Based on this figure, the annual savings would be about 7.2% of the aggregate Medicare cost. An estimate of the average, state-level annual benefit per state for the 12 restricted-practice states would be approximately $2.19 billion (=1,202 x $21.84/12), and that for the 17 reduced-practice states would be about $1.07 billion (=1,170 x $15.6/17).

All relevant estimates presented in the previous section are summarized in Table 4. Estimates in all four models are fairly comparable, although the 3SLS-based estimates are slightly higher than their respective OLS counterparts for the obvious reason 3SLS is able to effectively address endogeneity associated with the two key policy variables *soprestricted* and *sopreduced*.

The estimated national benefit of $44.5 billion through Medicare cost reduction is roughly in the same ballpark as that of Baicker and Chandra (2004). According to their estimate, increasing the number

Table 4.
Annual Cost Savings Under Full Practice Environment*

Annual Cost-Saving Potential under Various Scenarios	OLS: Linear-Quadratic	3SLS: Linear-Quadratic	OLS: Log-Quadratic	3SLS: Log-Quadratic
Doubling (NP + PA) per PCP (per county)	$2.45 million [-6.37, 4.97]	$2.49 million [-0.78, 5.77]	$3.54 million [3.33, 3.74]	$4.16 million [3.91, 4.41]
Restricted-practice state (per county)	$15.9 million	$18.0 million	$17.7 million	$21.84 million
Reduced-practice state (per county)	$15.3 million	$17.3 million	$12.5 million	$15.6 million
Restricted-practice state (per state)	$1.59 billion	$1.80 billion	$1.77 billion	$2.19 billion
Reduced-practice state (per state)	$1.06 billion	$1.19 billion	$0.86 billion	$1.07 billion
At the national level	$37.0 billion [15.2, 59.0]	$41.9 billion [25.0, 58.8]	$35.9 billion [24.7, 42.9]	$44.5 billion [36.6, 53.6]
Cost saving as a percentage of aggregate national Medicare cost	5.98%	6.77%	5.79%	7.19%

* 95% confidence bounds are reported underneath in third bracket.
NP = nurse practitioner, OLS = ordinary least squares, PA = physician's assistant, PCP = primary care provider, 3SLS = three-stage least squares

of general practitioners (by replacing with specialists) in the nation by 1 per 10,000 population in 2013 would result in an aggregate Medicare benefit of $35.8 billion at the national level, in 2004 dollars. With inflation adjustment of 3% per year, this value would be equivalent to $46.7 billion in 2013 dollars. However, our focus is on SOP regulations, which can impact the ratio of NPs to primary care physicians, whereas Baicker and Chandra focused on the ratio of general practitioners to specialists.

In addition to the potential cost reduction associated with expanded SOP, results based on the 3SLS, log-quadratic model indicate additional potential cost reduction of $4.16 million in 2013 dollars, on average, per county, if the total number of NPs and PAs per primary care physician is doubled, signifying that tilting the provider mix in favor of NPs and PAs can result in substantial benefits. Innovative state-level policies on healthcare delivery, such as the Patient-Centered Medical Home (PCMH) model or a team-based approach to care coordination, can be good strategies to explore to achieve these gains in Medicare cost savings (Nielsen, Olayiwola, Grundy, & Grumbach, 2014).

As discussed earlier, states' practice environments have evolved over a long period of time and thus the county-level cost function estimated in the previous section is the result of a long-run adjustment process of the labor markets for providers across states. The wide-ranging policy implications this estimated cost function projected should be viewed in that light. For example, as these models suggest, the impact of the transition from restricted-practice state to full-practice state can be far and wide both in terms of provision of services as well as in terms of cost, since it will involve changes in a large number of existing SOP bills in restricted-practice states. The same is true for the reduced-practice states. Moreover, the SOP bills will affect not only NPs and PAs, but also a large number of other categories of providers, implying the effect of the change can be widespread across provider submarkets. Additionally, the widespread labor market impact will also have spillover effects on the broader economy, and the effects of the spillover can be quite sizable.

Findings from this study demonstrate the cost-effective care being provided by NPs across the United States. These findings support views of the American Association of Colleges of Nursing (AACN), National Council of State Boards of Nursing, American Hospital Association, Robert Wood Johnson Foundation, Federal

Trade Commission, and others that state practice barriers should be removed, and NPs should be allowed to practice independently to the full extent of their education (AACN, 2017). The AACN identified several benefits to allowing NPs to practice independently, including (a) reduced hospitalization rates and length of stay (Landspeger, Semler, Wang, Byrne, & Wheeler, 2016; Oliver et al., 2014), (b) expanded health utilization and access (Xue, Ye, Brewer, & Spetz, 2015), (c) lower cost of care as compared to physicians (Perloff et al., 2015), and (d) fewer prescriptions for medications commonly associated with death from overdoses (Schirle & McCabe, 2016). State boards of nursing should seriously consider removing practice barriers from NPs and allow NPs to practice at the full scope of their license to achieve significant gain associated with full practice authority as this study and others have demonstrated.

Schools of nursing should consider incorporating findings and discussion from this study and others surrounding SOP issues into policy courses. The implementation of these types of studies into a policy course would allow students to learn how their practice is going to effect change in the healthcare delivery system. Additionally, these types of discussions will encourage students to be advocates for change in nursing practice and motivate future NPs to get involved in policy change and in professional organizations to support improved outcomes in practice.

With the increasing shortage of primary care physicians in the United States (Association of American Medical Colleges, 2019), the need for NPs to obtain full-practice authority in all states is critical. NPs primarily practice in rural areas, and with increasing shortage of primary care physicians, access to care in rural areas is decreasing, thereby negatively impacting health outcomes. The number of NPs is continuing to increase in the United States, but research has shown that fewer primary care NPs are providing care in states with reduced or restricted practice authority (Buerhaus, 2018; Graves et al., 2016; Martsolf et al., 2016; Poghosyan & Carthon, 2017; Ritter, Bowles, O'Sullivan, Carthon, & Fairman, 2018). Expanding the NP's SOP to full practice may bring even more NPs to rural areas resulting in increased access to care, reduced costs, and improved health outcomes.

More research is needed to determine if reduced and/or restricted practice authority in states results in decreased access to care, decreased supply of NPs in rural areas, increased hospitalization rates, and the effect these have on vulnerable populations and population health outcomes in a state or community. Many medically underserved communities and rural areas are dependent on NPs for care, but if NPs have a reduced or restricted practice agreement, they are unlikely to go to these needed areas and provide health care. Researchers should consider conducting a systematic review to identify best practices in states that moved from reduced or restricted practice to full practice to determine if patient access and health outcomes have improved.

Due to definitional changes and lack of comparability of county-level data across multiple years, the present study sample is restricted to only 2010 and 2012. Multiple years of comparable data at the county as well as state levels covering more recent years could provide more insight to economic benefits of the full-practice environment in states.

Summary and Conclusion

This research estimates Medicare cost savings associated with lifting states' scope-of-practice regulations at the county, state, and national levels. Combining county-level data on Medicare costs, information relating to county-level healthcare resources and services, and other pertinent demographic and socioeconomic factors at the county and state levels, a county-level cost function for Medicare services was estimated. The estimated cost function model of healthcare service delivery revealed interesting insights into the broad-based impact of SOP regulations at the population level.

First, lifting SOP restrictions in restricted-practice states is expected to result in an average annual Medicare cost saving of $2.19 billion, whereas in

reduced-practice states the equivalent estimated cost saving would be $1.07 billion, per state. Second, aggregate annual Medicare cost savings associated with full expansion of NPs' SOP is expected to be $44.5 billion at the national level, which is about 7.2% of the total Medicare cost in 2013. Finally, additional cost reduction of $4.16 million in 2013 dollars, on average, per county can be achieved by doubling the number of NPs and PAs per primary care physician. This indicates that beyond lifting SOP restrictions in states to achieve substantial cost savings, state and federal policies should continue focusing on innovative models of primary care that emphasize the need to change the provider mix in favor of NPs and PAs for basic primary healthcare services, such as the PCMH model or a team-based approach to care coordination to achieve further reduction in Medicare costs. $

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Note: The views expressed in this article are solely the opinions of the authors and do not necessarily reflect the official policies of the U.S. Department of Health and Human Services (HHS) or the Health Resources and Services Administration (HRSA) nor does mention of the names of HHS or HRSA imply endorsement by the U.S. Government.

Acknowledgment: The authors would like to thank the editor and the reviewers of the journal for valuable feedbacks on an earlier version of the manuscript. The authors would also like to thank the seminar participants at Johns Hopkins University School of Nursing, especially Patricia Davidson, for valuable comments on a preliminary version of the paper. The corresponding author acknowledges with thanks the Fellowship support jointly by the Oak Ridge Associated Universities and Health Resources and Services Administration (HRSA). Data-related support provided by the National Center for Health Workforce Analysis and the Data Resources Center, Bureau of Health Workforce, HRSA, is acknowledged.

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