

Limited Economic Benefits Expected by Relaxing Nursing Scope of Practice Regulations in North Carolina

TECHNICAL APPENDIX

AMERICAN SOCIETY OF ANESTHESIOLOGISTS – DEPARTMENT OF HEALTH POLICY RESEARCH

This Technical Appendix contains additional details about the findings and flaws of **Economic Benefits of Less Restrictive Regulation of Advanced Practice Registered Nurses in North Carolina: An Analysis of Local and Statewide Effects on Business Activity** (“Duke Study”)¹, an analysis published in February 2015 by the Duke University Center for Health Policy and Inequalities Research.

Duke Study Outcome Measures

The Duke Study used the following indicators to assess the impact of less restrictive Advanced Practice Registered Nurse (APRN) regulations in North Carolina.

Total Economic Output	The total dollar value of all transactions in the economy.
Jobs	The number of jobs supported – APRN jobs and other positions needed to support APRNs
Wages and Benefits	The dollar value of job-related wages and benefits – APRN jobs and other supportive positions
Tax Revenues	The dollar value of taxes that are paid by APRNs and the positions that they create
Shortage Reduction	The percent of physician shortages eliminated

Total Economic Output, Jobs, Wages and Benefits, and Tax Revenues were calculated using economic impact multipliers from IMPLAN data.² IMPLAN data include information about local economies across the U.S. such as economic output, employment statistics, income and compensation, demographics, and economic demand. IMPLAN is an economic data provider that specializes in modeling economic impact across industries.

Direct vs. Indirect Effects

Direct effects are economic impacts produced from APRNs (e.g., medical revenues).

Indirect effects are economic impacts generated by the industries that are supported by APRNs. They are classified in two different ways – business-to-business effects, and induced effects. Business-to-business effects may include supplies and equipment purchasing, practice administrative services, property maintenance services, and laboratory services. Induced effects occur when employees of APRNs pay taxes and spend their earnings to support local businesses.

Duke Study Findings

The Duke Study estimates annual benefits that apply only to North Carolina, include direct and indirect effects, and are presented as lower- and upper-bound estimates. The lower-bound estimates are based only on effects from the increase in full-time equivalent APRNs, while the upper-bound estimates also include effects from additional ancillary medical services and personnel that each APRN would support.

Total Economic Output: \$477M to \$883M

Number of Jobs: 3,848 to 7,128

Wages and Benefits: \$244M to \$452M

Tax Revenues: \$20.7M to \$38.3M

The Duke Study also estimates the percent shortage reduction for three physician specialties. These calculations are static (i.e., not per year):

Specialty	Shortage reduction of at least:
Primary care physicians (excludes OB/GYN)	92%
OB/GYN physicians	17%
Physician anesthesiologists	85%
All nonfederal physicians (overall shortage reduction)	41%

RAND 2014 Report Findings

The Duke Study uses information from a 2010 report by the RAND Corporation (“RAND”) to calculate a current shortage of physician anesthesiologists. The 2010 RAND report estimated a physician anesthesiologist shortage in North Carolina of 8.2 percent in 2007. However, RAND released an updated report in 2014 that reverses RAND’s prior estimate.³

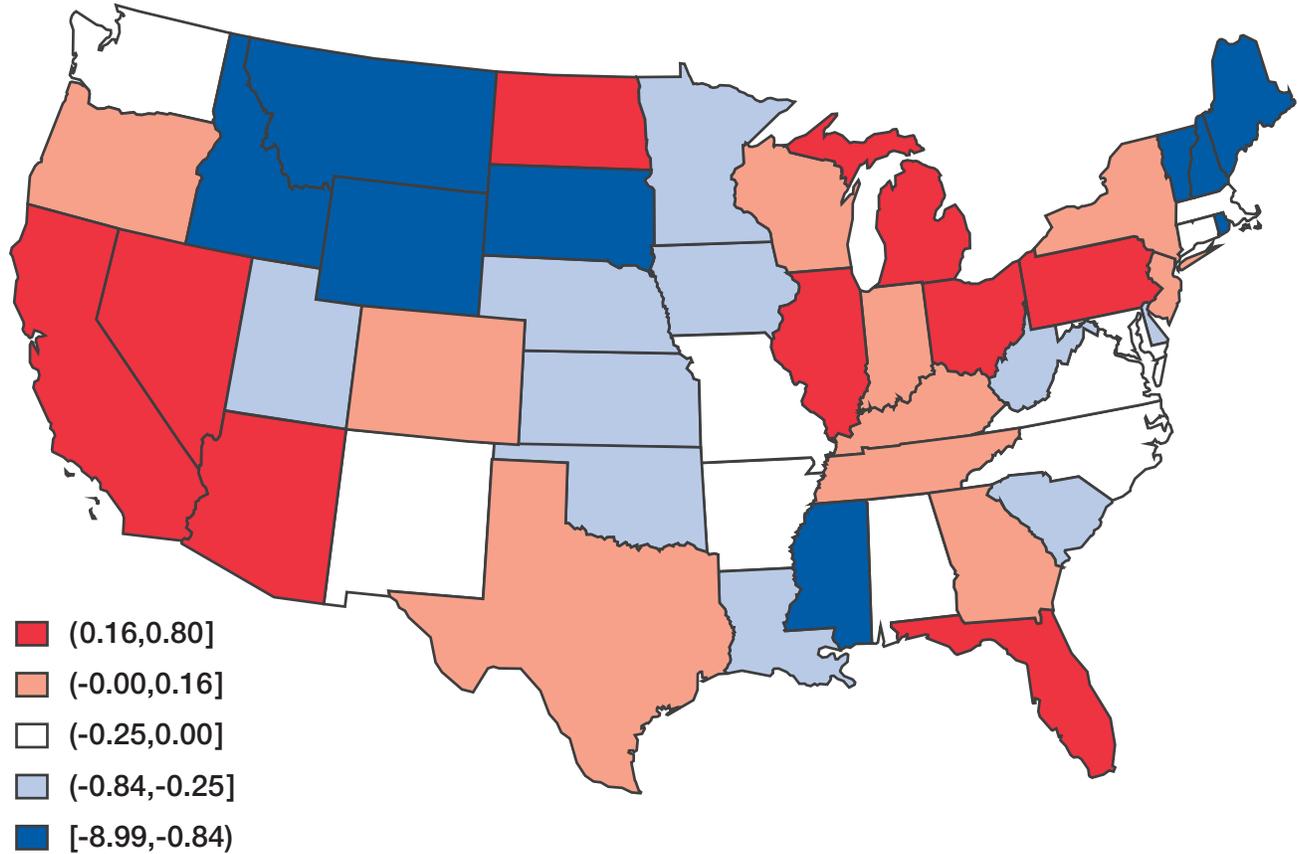
RAND aggregated multiple shortage indicators into one shortage variable to estimate the level of 2013 anesthesiologist shortage in each of the 50 states. RAND did not list which shortage indicators they used to create their shortage variable, however the five shortage indicators discussed in the RAND report are:

- Facility preference for more anesthesiologists,
- Number of anesthesiologist openings at a facility,
- Elasticity of labor supply,
- Ability of facilities to handle more cases if given more anesthesiologists, and
- Change in real wages of anesthesiologists.

Figure 1 presents a map of RAND’s physician shortage/surplus estimates by state.

FIGURE 1: Shortage of Anesthesiologists by State

Adapted from the 2014 RAND Research Report: *The Anesthesiologist Workforce in 2013*



NOTES: Based on results from a survey conducted by RAND in April and May of 2013. Dark red states have a shortage, while darker blue states have a greater surplus. In the legend, square brackets indicate that the endpoint number is included in the range; parentheses indicate that the endpoint is not included in the range.

Source: The RAND Corporation. *The Anesthesiologist Workforce in 2013*. RAND Research Report 2014. [http://www.rand.org/pubs/research_reports/RR650.html]

If the methodology used in the Duke Study to calculate the physician anesthesiologist shortage was correct, the updated RAND analysis would have found a 14.8 percent shortage in 2013 in North Carolina (8.2 percent shortage in 2007 plus a 0.94 percent shortage increase per year). Instead, as seen in Figure 1, RAND found that there was either an exact equilibrium or a slight surplus of anesthesiologists in North Carolina in 2013.

Reagan and Salsberry 2013⁴ (R&S)

The Duke Study used evidence from R&S to calculate the effect of less restrictive APRN regulations on the supply of APRNs. There are several methodological flaws in R&S[†]:

1. **Omitted Variable Bias:** There are variables not included in the R&S statistical model that are standard in econometrics, and their omission will affect the study's results. Specifically:
 - a. Per capita income. Shown in other research to correlate with measures of physician supply and demand.⁵
 - b. Measures of price and wages. Labor shortages are generally viewed as a short-run issue because economic theory suggests that prices or wages would rise in response to the shortage. However, the wages of physicians are relatively fixed due to fee schedules and reimbursement rates, so some other measure of price and wage could be used. Employers may offer additional non-financial benefits that act as a proxy for market wages. Prices and wages have been shown in other research to correlate with measures of physician supply and demand.⁶⁻⁷
 - c. Quality and outcomes. Differences in care quality and access between the geographic areas studied may affect the health care market by influencing the hiring choices of health care employers.
2. **Multicollinearity:** There are independent variables included in the R&S statistical model that may correlate with each other, and the authors did not test for this. Examples include per-capita counts of primary care and specialist physicians, percent poverty and percent uninsured, which likely correlate with each other. As a result, the R&S statistical model cannot precisely assess the contribution of the correlated variables.
3. **Model Structure:** The R&S statistical model uses time-invariant variables to predict time-variant outcomes. There are a variety of data sources that would have enabled the authors to obtain time-series data for each of the chosen independent variables, which would have resulted in a stronger statistical model.
4. **Dummy Variables:** The main variables of interest in the R&S models are the dummy variables indicating the strength of state-level scope of practice regulations. However, the authors fail to acknowledge the difficulty in interpreting dummy variable coefficients when the dummy variable takes a non-zero (usually unit) value for a finite and fixed number of observations. According to Giles 2011, the coefficients associated with these variables “will be very unreliable even with an infinitely large sample size [and] we should also be really careful about constructing confidence intervals or tests relating to this coefficient, because the non-normality of the sampling distribution for this particular OLS estimator, even asymptotically.”⁸

The methodological flaws in the R&S statistical model are evidenced by the model's sensitivity and R-squared values seen in the R&S article. Tables 4 and 5 in R&S show that the addition of more variables significantly changes the results, therefore the statistical model is likely weak. Additionally, the R-squared values in the dynamic models are significantly lower than in the static models. The static models (Table 4, Models 1 and 2) have R-squared values of 0.68 and 0.72, respectively, whereas the dynamic models (Table 5, Models 3 and 4) have R-squared values of 0.25 and 0.19, respectively. The latter R-squared values are quite low, and indicated that only 25 and 19 percent of the variance in nurse workforce changes are explained by the R&S model, respectively.

[†] Based on analysis by Avalon Health Economics.

IMS Health 2014 Physician Economic Impact Analysis⁹

The Duke Study fails to acknowledge the results from another economic impact analysis published in 2014 which examined the impact of hiring physicians. The physician impact study was conducted by IMS Health for the American Medical Association and, similar to the Duke study, used IMPLAN multipliers to examine the benefits of physician employment measured by total economic output, jobs, wages and benefits, and tax revenue. Those benefits were also calculated by state, allowing a direct comparison of the economic impacts of physicians and APRNs in North Carolina (Table 1).

TABLE 1: Economic Impact of Physicians and Nurses in North Carolina

	Output (\$)	Jobs	Wages & Benefits (\$)	Taxes (\$)
Physicians (n=20,247*)				
Total*	29,400.0M	210,311	16,770.6M	1,189.9M
Per Physician†	1,452,000	10.39	828,000	58,800
APRNs				
Per APRN (Upper Bound)‡	506,000	4.00	140,000	11,800
Per APRN (Lower Bound)‡	273,000	2.20	259,000	22,000

* Obtained from IMS Health physician impact study, Table 2 pages 12-13.

† Impact per physician calculated by dividing total impacts by total number of physicians. Calculations by ASA Health Policy Research.

‡ Impacts per APRN obtained from the Duke Study (Executive Summary, page v).

Sources: IMS Health (2014). The National Economic Impact of Physicians.

Retrieved from <http://www.ama-assn.org/ama/pub/advocacy/state-advocacy-arc/economic-impact-study> on May 7, 2015

Conover CJ, Richards R. *Economics Benefits of Less Restrictive Regulation of Advanced Practice Registered Nurses in North Carolina: An Analysis of Local and Statewide Effects on Business Activity*. Duke University 2015.

References:

1. Conover CJ, Richards R. Economics Benefits of Less Restrictive Regulation of Advanced Practice Registered Nurses in North Carolina: An Analysis of Local and Statewide Effects on Business Activity. Duke University February 2015.
2. IMPLAN Group, LLC, IMPLAN System (data and software), 16740 Birkdale Commons Parkway, Suite 206, Huntersville, NC 28078. [www.IMPLAN.com]
3. The RAND Corporation. The Anesthesiologist Workforce in 2013. RAND Research Report 2014. [http://www.rand.org/pubs/research_reports/RR650.html]
4. Reagan PB, Salsberry PJ. The effects of state-level scope-of-practice regulations on the number and growth of nurse practitioners. *Nursing Outlook*. 2013;61:392-9.
5. Cooper RA, Getzen TE, Laud P. Economic expansion is a major determinant of physician supply and utilization. *Health Services Research*. 2003;38(2):675-96.
6. McRae I, Butler JRG. Supply and demand in physician markets: A panel data analysis of GP services in Australia. *Int J Health Care Finance Econ*. 2014;14:269-87.
7. McCurdy TE. An empirical model of labor supply in a life cycle setting. National Bureau of Economic Research 1980; Working Paper No. 421.
8. Giles DE. On the inconsistency of instrumental variables estimators for the coefficients of certain dummy variables. 2011. University of Victoria, Department of Economics: Victoria, B.C., Canada V8W 2Y2.
9. IMS Health (2014). The National Economic Impact of Physicians. [https://download.ama-assn.org/resources/doc/economic-impact/us-study.pdf]