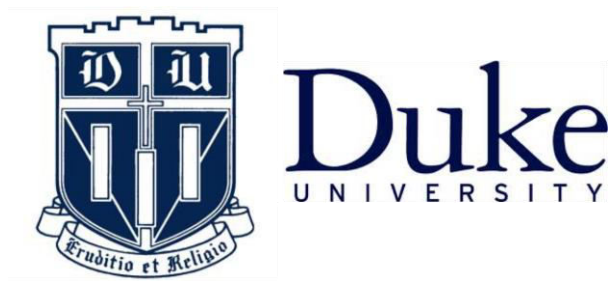# Economic Benefits of Less Restrictive Regulation of Advanced Practice Registered Nurses in North Carolina:

An Analysis of Local and Statewide Effects on Business Activity

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Robert Richards

February 2015

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Preface

This report presents findings from several interrelated analyses of data designed to assess the economic impact of removing barriers to independent practice of Advanced Practice Registered Nurses (APRNs) in North Carolina. The project began in May, 2014 with a research grant from the North Carolina Nurses Association.

This work builds on the Principal Investigator's work on the benefits and costs of health services regulation in the U.S. This work has been supported for more than a decade through various grants and contracts, including the Cato Institute, the Office of the Assistant Secretary for Planning and Evaluation, U.S. Department of Health and Human Services, and the Searle Freedom Trust.

The economic impact assessment parallels similar work that has been conducted by The Lewin Group (*The State-Level Economic Impact of Office-Based Physicians*) and The Perryman Group (*The Economic Benefits of More Fully Utilizing Advanced Practice Registered Nurses in the Provision of Health Care in Texas: An Analysis of Local and Statewide Effects on Business Activity*).

A summary version of the present report is available as a separate document (*Economic Benefits of Less Restrictive Regulation of Advanced Practice Registered Nurses in North Carolina: Key Findings*). Due to their length, the appendices are available in a separate volume (*Economic Benefits of Less Restrictive Regulation of Advanced Practice Registered Nurses in North Carolina: Technical Appendices*). These contain all details of sources and methods as well as complete tabulations of findings at the county level. All publications are available for download at the Center for Health Policy and Inequalities Research website: http://chpir.org/_homepage-content/completed-projects/economic-benefits-of-less-restrictive-regulation-of-advanced-practice-registered-nurses-in-north-carolina/.

These reports and related data should be of interest to policymakers, legislators and thought leaders in healthcare as well as others concerned with issues of regulation of health professionals, the supply and demand of various types of health professionals, and health financing more generally.

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Executive Summary

Advanced practice registered nurses (APRNs) are a critical component of North Carolina's healthcare system, giving its citizens improved access to care that is both cost-effective and of high quality in the communities in which they practice. Advanced Practice Registered Nurses (APRNs) include nurse practitioners (NPs), certified registered nurse anesthetists (CRNAs), certified nurse midwives (CNMs), and clinical nurse specialists (CNSs). Such practitioners offer patient care in a broad range of settings, including private or group practices in offices and clinics as well as hospital inpatient and outpatient settings.

While APRNs are primarily focused on providing care to their patients, they also play a vital role in the state and local economy by creating jobs, purchasing goods and services, and supporting state and community public programs though the tax revenues they create. A variety of local and national studies have projected a shortage of both primary and specialist physicians by the year 2020. These shortages are being aggravated by the expansion of coverage under the Affordable Care Act (ACA). One of the fastest, surest and most cost-effective paths to alleviating these shortages would be to remove regulatory barriers that currently prevent APRNs from fully utilizing their training. States with fewer APRN practice restrictions (including Arizona, Montana, New Mexico and Utah) have a demonstrably larger supply of APRNs than if they had retained rules as restrictive as North Carolina's.

Especially in the context of the sweeping changes in the health care industry occurring under the Affordable Care Act (ACA), it is important to understand the economic benefits of reducing the looming shortage of primary care and selected specialist physicians in North Carolina by greater reliance on APRNs through less restrictive regulation.

This report provides data that can be used by policymakers, legislators and thought leaders in medicine. It shows how more fully utilizing APRNs in the provision of health care in North Carolina will not only ensure the health and well-being of communities, but also help support local economies and produce jobs, growth and prosperity.

We begin by examining the empirical evidence regarding the impact of APRNs on health quality and health costs. A large number of studies have examined the safety and quality of care for APRNs. Even though these studies vary in their methodological rigor, each has concluded that APRN practice outcomes are equivalent or better to those of physicians. All other things equal, APRN-provided care is less expensive to society than the equivalent physician-provided care because a) training costs are much lower; b) compensation levels are much lower; and c) resource use often is lower (e.g., hospitalization, procedure rates). Overall, various studies have indicated that expanded use of APRNs under less restrictive regulation could produce health system savings ranging from 0.63 percent to 6.2 percent.

We then examine changes in the demand and supply for APRNs between 2012 and 2019. Such changes will occur at an uneven pace during this period. However, to simplify understanding of how such changes will affect long-run demand and supply relative to the 2012 baseline (the latest year for which data were available), all estimates are expressed as if they had been fully

realized in 2012. This allows all increases in demand and supply to be expressed as percentage increases relative to 2012.

We first show that the level of overall health care utilization (demand) observed in 2012 will increase by 14.4 percent by the year 2019 due to population growth and demographic change. Had the Affordable Care Act been fully implemented in 2012, this would have increased baseline 2012 utilization by 3.1 percent assuming no Medicaid expansion. Alternatively, if Medicaid were expanded (or its equivalent, such as letting all persons below poverty purchase subsidized coverage through the health Exchanges), baseline demand would increase by 5.7 percent.

Based on empirical studies that have looked at what happened in other states, we then examine the potential increase in APRN supply that would occur during the same time period if North Carolina would adopt less restrictive APRN regulations of the sort already in place in states such Arizona, Montana, New Mexico and Utah. Once again, because it will take time to train new APRNs or attract additional APRNs from outside of North Carolina, the actual effects of such policy changes would actually play out over a number of years. However, we present our results as if these effects had been fully realized in 2012. This allows us to more easily compare such projected changes in supply to the changes in demand earlier described.

According to the most reliable information available, there were 4,244 NPs, 258 CNMs, 2035 CRNAs and 951 CNSs active in North Carolina in 2012. To improve the precision of our estimates, we have converted these to full-time-equivalent employees. We estimate that full-time-equivalent APRNs would increase by 24.4 percent as a result of removing unnecessary regulations. We then detail the economic impact of this increase in APRNs measured across four variables: output, jobs, wages and benefits, and tax revenue.

Economic impact includes both a direct component and an indirect component. The direct impact is the value of output, jobs, wages and benefits and taxes that are produced from patient care activities provided by APRNs. The indirect impact includes the output, jobs, wages and benefits, and taxes generated in the industries that are supported by the organizations in which APRNs practice. But indirect effects also include induced effects on household spending. That is, as APRNs (and employees of businesses that provide supporting services to the practices in which APRNs work), spend their earnings to support local businesses, such businesses pay their employees who, in turn, purchase goods and services and pay taxes, in a continuing "ripple" across the economy.

"Total" effects are the sum of the direct and indirect effects. This report examines these effects for the State of North Carolina as a whole and also for a variety of regional breakdowns ranging from counties to Metropolitan Statistical Areas to larger regions. Indirect effects within the state or region are limited to effects within the geographic borders of whatever region is being examined. Thus, they exclude economic effects that spill over into neighboring states (or regions). For that reason, the statewide economic impacts are larger than the sum of the total regional economic impacts.

We estimated these impacts in two ways. Our lower-bound estimates are conservatively based exclusively on the increase in APRN compensation (salary and benefits) that would result from the increase in FTE APRNs following less restrictive regulation. Our upper-bound estimates take into account the ancillary medical services (e.g., lab tests, medications) and personnel (e.g., non-medical and medical support staff) that each APRN would support. These impacts (expressed in 2014 dollars) would be as follows:

- **Total Output**: Statewide, APRN regulatory reform would result in an annual increase in total output of at least $477 million, and potentially as high as $883 million. On average, each new FTE APRN attracted to the state would support a minimum of $273,000 in output across the state, and up to $506,000.
- **Jobs**: Even leaving aside support staff whose livelihood may rely on APRN-provided services, the direct and indirect effects of these additional APRNs would support at least 3,848 jobs a year, and up to 7,128 jobs per year. On average, each FTE APRN conservatively supports 2.2 jobs statewide, and up to 4.0 jobs.
- **Wages and Benefits**: APRNs significantly contribute to wages and other employer-provided fringe benefits in their communities. In North Carolina, payroll would have increased by at least $244 million in 2012 had APRNs been subject to less restrictive regulation (potentially reaching $452 million). The average APRN conservatively supports $140,000 in payroll compensation to North Carolina residents (a figure that could be as high as $259,000).
- **Tax Revenues**: The revenues and earnings generated by APRNs contribute to state and local taxes, which in turn support public works and community development. We estimate that removal of unnecessary restrictions on APRN practice would have resulted in an increase of at least $20.7 million in total state and local tax revenues in 2012, possibly as high as $38.3 million. On average, each full-time APRN generates between $11,800 and $22,000 annually in state and local tax revenue across the state.

We also examined the potential annual health cost savings that would accompany this projected expanded use of APRNs. These range from $433 million to $4.3 billion - $44 to $437 per North Carolina resident. These savings themselves would not increase net economic output since they would represent the diversion of dollars otherwise spent on health care—e.g., hospital services--into other types of consumer spending. However, since such savings can be achieved without reducing the quality of health care—some literature suggests quality of care and/or patient satisfaction may actually increase somewhat—they represent substantial resources that could be potentially redeployed to alternative uses that would increase the welfare of the state's citizens.

Less restrictive regulation of APRNs would result in a net increase of 1,744 FTE APRNs relative to the 2012 supply. We examined the extent to which APRNs can reduce the need for physicians either directly (by substituting for doctors to the extent that their training allows) or indirectly (e.g., by reducing the need for hospitalization and the companion physician care that otherwise would have been provided). The combined increases for NPs and CNSs would reduce the projected shortage of primary care physicians (exclusive of OB/GYNs) by at least 92 percent. The expected increase in CNMs would reduce the expected shortage of OB/GYNs by at least 17 percent. However, since NPs and CNSs also can reduce the demand for OB/GYNs, it is feasible for the expanded use of APRNs under less restrictive regulation to entirely eliminate the shortage

of OB/GYNs while still reducing the shortage of non-OB/GYN primary care doctors by 83 percent. Similarly, the expected increase in CRNAs could eliminate at least 85 percent of the expected shortage of anesthesiologists and possibly eliminate that shortage entirely. Less restrictive APRN regulation has the potential to decrease the overall shortage of nonfederal physicians by at least 41 percent and possibly eliminate the shortage altogether.

We have been conservative in selecting analytic assumptions. Consequently, we have confidence that all of our lower-bound estimates represent a true floor compared with what is likely to happen. We have less confidence that our upper-bound estimates represent a true ceiling. It is possible (though unlikely) that various outcomes (e.g., increased output, jobs, and taxes) might be even larger than reported.

We also have carefully examined the extent to which our projected increase in APRN supply resulting from less restrictive regulations might be financed with federal funds. We believe it is appropriate to view the entire potential increase in APRN utilization resulting from less restrictive regulation as being financed through an injection of federal funds from outside the state's borders. Hence, the economic impact assessment provided in this report is a valid means of assessing the impact of that supply increase on the overall economy in North Carolina.

Less restrictive regulation of APRNs can be expected to make sizable inroads on the anticipated shortage of physicians in 2020. In the best case, such a policy change offers the promise of entirely eradicating shortages of primary care physicians, OB/GYNs and anesthesiologists. North Carolina residents consequently would enjoy better access to care of equivalent or better quality even as the health system sheds some avoidable costs (e.g., hospitalizations) in the process. It is rare that a health policy change offers such gains across all three dimensions of health system performance.

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Table of Contents

Technical Appendices (separate report)

I.   Overview

Advanced practice registered nurses (APRNs) are a critical component of the healthcare system, making a vital contribution to the health of the community in which they practice. Advanced Practice Registered Nurses (APRNs) include nurse practitioners (NPs), certified registered nurse anesthetists (CRNAs), certified nurse midwives (CNMs), and clinical nurse specialists (CNSs). These practitioners provide patient care in a broad range of settings, including private or group practices in offices and clinics as well as hospital inpatient and outpatient settings. For brevity, these acronyms will be used throughout this report.

According to the most reliable information available, there were 4,244 NPs, 258 CNMs, 2035 CRNAs and 951 CNSs active in North Carolina in 2012 (Table C-1).

The Policy Problem

While APRNs are primarily focused on providing care to their patients, they also play a vital role in the state and local economy by creating jobs, purchasing goods and services, and supporting state and community public programs though the tax revenues they create. But both local and national studies have projected a shortage of primary and specialist physicians as well as APRNs—a shortage that is being aggravated by the expansion of coverage under the Affordable Care Act (ACA). One of the fastest and surest paths to alleviating these shortages would be to remove regulatory barriers that currently prevent APRNs from fully utilizing training. States with fewer APRN practice restrictions (including Arizona, Montana, New Mexico and Utah) have a demonstrably larger supply of APRNs than if they had retained rules as restrictive as North Carolina's.

Purpose of this Report

Especially in the context of the sweeping changes in the health care industry due to the Affordable Care Act (ACA), it is important to understand the economic benefits of reducing the looming shortage of primary care and selected specialist physicians in NC by greater reliance on APRNs through more reasonable regulation.

This report provides data that can be used by policymakers, legislators and thought leaders in medicine. It shows how more fully utilizing APRNs in the provision of health care in North Carolina will not only ensure the health and well-being of communities, but also help support local economies and enable jobs, growth and prosperity.

This report estimates the economic impact of APRNs across four variables: output, jobs, wages and benefits, and tax revenue. Economic impact includes both a direct component and indirect component. The direct impact is the value of output, jobs, wages and benefits and taxes that are produced from patient care activities provided by APRNs. The indirect impact includes the output, jobs, wages and benefits, and taxes generated in the industries that are supported by the organizations in which APRNs practice. But indirect effects also include the induced effects on household spending. As APRNs (and employees of businesses that provide supporting services to the practices in which APRNs work) spend their earnings to support local businesses, which in

turn pay their own employees and pay taxes, there is a continuing "ripple" of growth across the economy.

"Total" effects are the sum of the direct and indirect effects. This report examines these effects for the State of North Carolina as a whole and also for a variety of regional breakdowns ranging from counties to Metropolitan Statistical Areas to even larger regions. The economic impact of office-based APRNs varies across counties and depends on the number of APRNs in each county as well as the characteristics of the county's economy. Indirect effects within the state or region are limited to effects within the geographic borders of whatever region is being examined. This analysis excludes economic effects that spill over into neighboring states (or regions). For that reason the statewide economic impacts are larger than the sum of the regional economic impacts.

Main Conclusions

The analysis includes estimated changes in the demand for APRNs between 2012 and 2019 based on projected county-level changes in population size and demographics as well as the anticipated impact of the health insurance exchange established by the ACA. In actuality, these changes in demand will occur gradually, not instantaneously. But for simplicity, the results are expressed as if all the aforesaid changes in demand had occurred in 2012 (although results are monetized in 2014 dollars). These estimates show that the level of demand observed in 2012 will increase by 14.4 percent as a result of demographic changes in demand driven by population growth and aging (but excluding the impact of the health insurance exchange).

In a parallel fashion, we calculated the incremental increase in current APRN usage that would have been observed in 2012 had the ACA counterfactually been fully implemented – including the Medicaid expansion where relevant – in that year. APRN demand is estimated to grow 3.1 percent even without Medicaid expansion. If Medicaid were expanded (or its equivalent, such as letting people below poverty purchase subsidized coverage through Exchanges), demand will increase by 5.7 percent. These estimates are extremely conservative since they are based on current practice patterns and presuppose no substitution of APRN services for physician services.

The model then calculates a parallel figure showing the potential increase in APRN supply through 2019 that would result from less restrictive APRN practice regulations (note such less stringent APRN regulations already are in place in other states). Again, even though the results of such regulation, i.e., an expanded supply of APRNs, would actually occur over 7 years, the model reports the results as if these policy changes had been in place for that period of time by 2012. Specifically, the removal of unnecessary regulations ultimately would increase the count of full-time-equivalent APRNs by 24.4%. The economic impacts of this change would be as follows:

- **Total Output**: Statewide, APRN regulatory reform would result in an annual increase in total output of at least $477 million and up to $883 million. On average, each new FTE APRN resulting from more reasonable regulations would support a minimum of $273,000 in output across the state (possibly as high as $506,000).
- **Jobs**: Even leaving aside support staff whose livelihood may rely on APRN-provided services, the direct and indirect effects of these additional APRNs would support 3,848

jobs a year (upper bound=7,128). On average, each APRN supports at least 2.2 jobs statewide (upper bound=4.0).

- **Wages and Benefits**: APRNs significantly contribute to wages and other employer-provided fringe benefits in their communities. In North Carolina, payroll would have been increased by $244 million in 2012 had APRNs been subject to less restrictive regulation (this payroll increase may be as high as $452 million). The average APRN supports at least $140,000 in payroll compensation to North Carolina residents – and the figure could be as high as $259,000.
- **Tax Revenues**: The revenues and earnings generated by APRNs contribute to state and local taxes, which in turn support public works and community development. We estimate that removal of unnecessary restrictions on APRN practice would have resulted in an increase of at least $20.7 million in total state and local tax revenues in 2012, and up to $38.3 million. On average, each full-time APRN generates between $11,800 and $22,000 annually in state and local tax revenue across the state.

The potential amount of annual health cost savings that might result from expanded use of APRNs ranges from $433 million to $4.3 billion, or $44 to $437 per North Carolina resident. Such savings themselves would not increase net economic output in the state, since they would merely represent the diversion of dollars otherwise spent on health care into other types of consumer spending, the details of which would depend on how such savings are shared between households, employers and various components of the health sector, such as health insurers. Nevertheless, since such savings can be achieved without reducing the quality of health care - indeed, it may actually increase somewhat - they represent substantial resources that can be redeployed to alternative uses that potentially will increase the welfare of North Carolina's citizens.

Finally, less restrictive regulation would result in a net increase 1,744 FTE APRNs in North Carolina. The combined increases for NPs and CNSs would reduce the estimated shortage of primary care physicians (excluding OB-GYNs) by 843 - this is equivalent to reducing the expected 2020 shortage of such PCPs by at least 92 percent. The increase for CNMs would reduce the shortage of OB-GYNs by 50, equivalent to a decrease in the projected OB-GYN shortage of at least 17 percent. Finally, the increase for CRNAs would reduce the shortage of anesthesiologists by 365 - equivalent to at least an 85 percent decrease increase in that shortage.

Report Roadmap

Section II details the policy problem in greater depth. It summarizes the literature that shows that APRNs provide a level of quality that is at least equivalent to that of their physician counterparts; this includes patient satisfaction. It then reviews what is known about the impact of APRNs on health costs, including a) the considerably lower costs of their training relative to physicians; b) compensation differentials; and c) lower resource use (e.g., shorter lengths of stay). After reviewing the evidence of a looming shortage of physicians in North Carolina, there is an examination of the potential of APRNs to alleviate that shortage. The section concludes with a discussion of current regulatory barriers to greater use of APRNs in North Carolina and a

summary of the empirical literature on the extent to which removing such barriers might expand the supply of APRNs in a highly regulated state such as North Carolina.

Section III focuses on quantifying the economic benefits of more fully utilizing APRNs within North Carolina. It starts with a brief introduction to economic impact analysis. There follows an analysis of projected changes in demand for APRNs between 2012 and 2020 based on expected demographic changes (population increase and changes in the distribution of the population by age and gender). A separate calculation shows the expected increase in demand that would be financed with federal dollars under the Affordable Care Act under two scenarios: a lower-bound scenario that assumes no Medicaid expansion and an upper-bound scenario that assumes Medicaid expansion (or its equivalent) is adopted. This is followed by detailed findings—broken down by region—of the estimated economic impact of less restrictive APRN regulation. Subsequently, there is a brief discussion of the potential amount of health cost savings that might result from expanded use of APRNs. The section concludes with an examination of the extent to which expanded use of APRNs resulting from less restrictive regulation will redress the looming shortages of physicians of selected types.

Section IV provides a discussion of these results starting with an examination of evidence supporting the lower-bound figures. A parallel discussion of evidence supporting the upper-bound figures is then followed by conclusions.

The Appendices offer a detailed description of methodology as well as detailed findings broken down by various regional categories as well as counties.

II. The Policy Problem: The Untapped Potential of APRNs

A large body of empirical evidence has demonstrated that greater utilization of APRNs can both improve patient outcomes and reduce overall health care costs. Many areas in North Carolina will face shortages of both primary care and specialty physicians; APRNs offer a very cost-effective solution that could considerably alleviate that problem.

APRNs and Health Quality

There is a sizable number of scientific studies that have examined the safety and quality of care provided by APRNs. While these studies vary greatly in methodological rigor, each has concluded that APRN practice outcomes are equivalent or better to those of physicians.

- **NPs**. Reagan and Salsberry (2013) cite 7 studies that demonstrate NP outcomes are equivalent to those of physicians, including 2 systematic reviews[1] (Horrocks et al., 2002; Newhouse et al., 2011), a literature summary (Naylor & Kurtzman, 2010) and four randomized controlled trials (Dierick-van Daele et al., 2009; Laurant et al. 2004; Mundinger et al., 2000; Spitzer et al., 1974). The most recent and thorough of the systematic review (Newhouse et al., 2011) examined 37 studies, concluding that when comparing NP and MD care, there is a high level of evidence to support equivalent levels of a) patient satisfaction; b) self-reported health status; c) functional status outcomes; d) glucose control; e) blood pressure control; and f) mortality rates. There also is a high level of evidence to support better management of patient serum lipid levels by NPs. Several recent studies have reinforced this general picture. Oliver et al. (2014a) found that 2012 state health rankings reported by the United Health Foundation were higher in states where full independent practice of NPs is permitted than in states without full practice. This finding was re-confirmed in Oliver et al. (2014b), which further showed that states with full practice had better health outcomes on several other statewide measures of health, including a) potentially avoidable hospitalizations for Medicare-Medicaid beneficiaries; b) hospital readmission within 30 days discharge from

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[1] A systematic literature review is performed in a transparent and rigorous manner, with very explicit rules about which studies to include and exclude, as well as the criteria by which studies will be assessed. For example, evidence from randomized controlled trials (RCTs) generally is accorded a higher weight than evidence from case studies or less rigorous cohort studies in which part of any observed outcome difference may be the result of patients with more favorable characteristics self-selecting into one of the comparison groups. For example, if healthier patients tend to see APRNs, this would make outcomes for APRN patients better than for doctors even if both groups were actually being treated identically. By grading the quality of the scientific evidence supporting a given conclusion, those conducting a systematic review can make states about whether each of its conclusions is supported by a high, moderate or low level of evidence. A group that examined the quality of the Newhouse et al. review concluded: "This review concluded that advanced practice registered nurses provided safe, effective and quality care in a variety of settings and in partnership with physicians and other providers had a significant role in the promotion of health. There were questions about data quality and some of the review methods, but the relatively conservative conclusions appear reasonable" (CRD, 2012).

rehabilitation and c) annual hospitalizations of nursing home patients. Kleiner et al., (2014) find no impact on infant mortality of loosening restrictions on NP prescribing authority. The Bay Area Council Economic Institute reported "In years following increased NP authority, adults report a 13-15 percent increase in visit quality, while children report gains of 17-27 percent" (BACEI, 2014).

- **CNMs**. The most recent and thorough systematic review (Newhouse et al., 2011; also reported in Johantgen et al. 2012) examined 21 studies, concluding that when CNM and MD care is compared, there is a high level of evidence to support that CNMs have a) similar infant APGAR scores; and b) equivalent levels of low birthweight infants; c) comparable or lower rate of NICU admissions; and d) lower likelihood of perineal lacerations. There is moderate to high evidence that CNMs, when compared to MDs. have similar or better outcomes using fewer interventions including epidural, episiotomy, and induction of labor. There is a moderate level of evidence to support higher rates of breastfeeding initiation in the CNM group.

- **CRNAs**. The most recent and thorough systematic review (Newhouse et al., 2011) found that no studies of CRNAs met the criteria for inclusion in the review. The authors further noted that although numerous studies have reported on CRNA clinical interventions, very few studies have compared the outcomes of care involving CRNAs with other providers. Sparse data from single observational studies of low quality suggest equivalent complication rates and mortality when comparing care involving CRNAs with care involving only physicians. Hogan et al. (2010) note that anesthesia-related mortality rates are only 1.1 per million population (8.2 per million hospital surgical discharges). Likewise, the rate of adverse outcomes totally attributable to anesthesia is only 1.25 per 10,000 procedures. This makes it cost-prohibitive to conduct a study of sufficient size to detect any difference between CRNAs and anesthesiologists in either adverse outcomes or mortality. While the observational studies alluded to in Newhouse are not listed, Hogan et al. list 4 such studies (Hoffman et al., 2002; Needleman and Minnick, 2008; Pine et al., 2003; Simonson et al., 2007).

- **CNSs**. The most recent and thorough systematic review (Newhouse et al., 2011) examined 11 studies, concluding that when comparing CNS and non-CNS providers, a high level of evidence supports equivalent group satisfaction scores. There is a moderate level of evidence to support that the CNS decreases complication rates associated with stroke, surgical and maternity patients. NACNS (2013) has summarized the results of at least 4 additional recent studies showing that various CNS interventions have reduced hospital-acquired infections by as much as 80 percent, resulting in lives saved in one study.

APRNs and Health Costs

APRNs and Training Costs

For all four types of APRNs discussed in this report, the cost of education/training is less than that of training for physicians. For example, a recent Lewin Group analysis (Hogan et al., 2010) showed that the total social cost of pre-anesthesia and anesthesia graduate education amounted to $1.1 million for anesthesiologists, which was nearly 7 times as large as the cost for CRNAs ($162,000; all figures in 2008 dollars). These figures include both the direct costs of undergraduate/graduate education and clinical experience before entry into an anesthesia program, and the direct costs and opportunity costs (foregone earnings) of graduate education. Similarly, NP training costs reportedly are 20-25% of the amount required to train physicians (AANP, 2010).

Although the cost differential may not be as large for other types of APRNs, it is reasonable to suppose that a parallel training cost difference exists for CNMs and CNSs, with the amount of the difference depending on which category of physician to use as the comparison group.

APRN Compensation

According to the Bureau of Labor Statistics (2014a), in May 2013 the annual average wages (excluding fringe benefits) for practitioners in North Carolina were:

- **NPs**. NPs earned $94,910, which is half the equivalent figure reported for physicians in family or general practice ($192,140) or pediatricians ($192,330).
- **CNMs**. The annual average wage for nurse midwives was $85,460, which is 40 percent of the amount for OB-GYNs ($213,250).
- **CRNAs**. Nurse anesthetists earned $158,840. No equivalent figure is reported by BLS for anesthesiologists, but a recent Lewin study on the cost-effectiveness of anesthesia providers (Hogan 2010) showed that anesthesiologists are paid roughly twice as much as nurse anesthetists ($336,000 vs. $170,000).
- **CNSs**. BLS did not report separate figures for CNSs, but data from Salary.com shows that CNSs not in home care earn about the same as CNMs, which would be less than two-fifths the annual wage of general internists ($233,720).[2]

APRN Reimbursement Rates. There is no uniformity in how APRNs are paid by third party payers.

- **NPs**. Since January 1, 1998, NPs have been able to be reimbursed directly by Medicare Part B at the rate of 80 percent of the lesser of the actual charge or 85 percent of the fee schedule amount for physicians (AANP, 2010).[3]

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[2] This does not imply that nurse specialists necessarily substitute directly for services of various physician specialists.

- **CRNAs**. CRNAs are Medicare Part B providers and since 1989, have been allowed to bill Medicare directly for 100 percent of the physician fee schedule amount for services (Bless, 2014).
- **CNMs**. Since January 1, 2011, CNMs have billed Medicare directly for 100 percent of the physician fee schedule amount for services, although there are 22 states—including North Carolina—in which Medicaid still pays CNMs less than physicians (ACNM, 2011).

Some other third party payers can and do pay APRNs less than physicians for the equivalent services. However, the payment rates vary considerably across payers. For anesthesia providers, for example, the Medicare payment rate is 58 percent lower than the amount paid by private insurers (Hogan et al., 2010), while that for Medicaid is 70 percent lower. Thus, from a social point of view, there unequivocally is a savings whenever an APRN substitutes for a physician. But whether that savings ultimately is borne by consumers, payers, or providers depends heavily on the mix of payers and their choices about how APRNs are paid relative to physicians.

APRNs and Resource Use

There is companion evidence that the practice style used by APRNs results in equivalent or in some cases less use of other medical care resources such as emergency departments (EDs), hospital days, or various medical procedures (e.g. C-sections), resulting in attendant savings. The most recent and thorough systematic review (Newhouse et al., 2011; CNM results also reported in Johantgen et al. 2012) found the following:

- **NPs.** When comparing NP and MD care, there is a high level of evidence to support equivalent levels of a) ED visits; and b) hospitalization rates. There is a moderate level of evidence to support equivalent hospital length of stay and there is a low level of evidence to support equivalent duration of mechanical ventilation for adults and low birthweight neonates. Other studies not included in the Newhouse et al. review have confirmed and expanded this evidence. One study found that time lost from work was lower for injured workers managed by NPs than for workers compensation claimants managed by physicians (Sears et al., 2007). Konetzka et al. (2008) reviewed the evidence from 55 peer-reviewed articles on interventions that potentially reduce hospitalizations from formal long-term care settings. The interventions showing the strongest potential are those that increase skilled staffing, especially through physician assistants and nurse practitioners. Oliver et al. (2014b), found that states that permitted full independent practice for NPs had lower resource use than states with more restrictive regulations; this was consistent across several statewide measures of use including a) potentially

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[3] However, as noted by Stange (2013), "Alternatively, if NP or PA care is provided as part of an episode of care provided by a physician, the services can be reimbursed at 100%through the physician's NPI, which is referred to as reimbursement for NP or PA care provided "incident-to" physician care. In this case, the physician must both be on-site when the service is performed and must treat the patient on the patient's first visit." Yet even with such a seemingly hard and fast rule, "different payers and states interpret these requirements quite differently."

avoidable hospitalizations for Medicare-Medicaid beneficiaries; b) hospital readmission within 30 days discharge from rehabilitation and c) annual hospitalizations of nursing home patients.

- **CNMs**. When comparing CNM and MD care, there is a high level of evidence CNM groups have lower rates of a) cesarean sections; b) epidural use; c) episiotomy; and d) labor analgesia. There is a high level of evidence to support comparable levels or lower levels in the CNM group of vaginal operative delivery (forceps, vacuum, or both). There is a moderate level of evidence to support a) equivalent or lower levels of labor induction of CNM the group; b) comparable levels or higher rates of vaginal births after cesarean sections in the CNM group; and c) comparable levels or lower rates of infant NICU admission in the CNM group. There is a high level of evidence of equivalent levels of labor augmentation.

- **CRNAs**. For studies of CRNAs, no outcomes met the criteria for aggregation. However, the Lewin Group recently conducted a cost-effectiveness analysis of various models of anesthesia delivery, concluding that "the most cost-effective delivery model is CRNAs practicing independently" (Hogan et al., 2013: 165). The cost per procedure ($170) is half that of an anesthesiologist practicing independently ($336) and 36 percent lower than the standard Medicare model in which 1 anesthesiologist medically directs 4 nurse anesthetists ($267) or 25% less than alternative model in which 1 anesthesiologist supervises 6 CRNAs ($226).

- **CNSs**. There is a high level of evidence to support a) equivalent or lower hospital length of stay for patients cared for in the CNS group; and b) that the CNS group has lower cost of care. Another RCT excluded from the Newhouse review (since it did not compare CNSs with MDs) showed that early discharge of low birthweight infants to home care by a CNS was safe and cost-effective, saving more than $18,000 per infant (Brooten et al., 1986). Another RCT excluded for the same reason showed that a model of prenatal care for women at high risk of delivering low-birth-weight infants in which half of the prenatal care was provided in women's homes by nurse specialists likewise found savings of nearly $31,000 per infant due to fewer infant hospitalizations before and after birth (Brooten et al., 2001). Finally, one RCT of a comprehensive discharge planning protocol, designed specifically for the elderly and implemented by nurse specialists, showed that patients in the medical intervention group had fewer readmissions, fewer total days rehospitalized, lower readmission charges, and lower charges for health care services after discharge (Naylor et al., 1994).

Likewise, NACNS (2013) has summarized the results of 7 other studies (all published in 2011 or later) demonstrating various arrangements in which CNSs have reduced hospital lengths of stay. The same report summarizes the results of at least 4 additional recent studies showing how various CNS interventions have reduced hospital-acquired infections by as much as 80 percent, resulting in additional cost savings.

Net Assessments of APRN Costs

- Based on an extensive review of the literature, the Office of Technology Assessment (1981) concluded that NPs have the potential to decrease the cost per patient visit by up to one third.

- Jenkins and Torris (1995) compared a physician-managed family practice to an NP-managed practice within the same managed care organization, finding that the annualized per member per month monthly cost of the NP practice was 50% lower than that of the physician practice (cited in AANP, 2013).

- A comparison of physician-only to physician-NP teams in a long-term care facility showed that costs for the physician-NP team were 42 percent lower for patients needing intermediate or skilled care and 26 percent lower for patients having long-term stays (Hummel and Pirzada, 1994, cited in AANP, 2013).

- The RAND Corporation calculated that expanded use of NPs and physician assistants in Massachusetts (whether through removing regulatory restrictions or other means) had the potential to save the state $4.2 to $8.4 billion between 2010-2020, representing savings in overall health expenditures of 0.63 to 1.25 percent during that period (Eibner et al., 2009).

- The Perryman Group (2012) conducted an extensive literature search on NPs, utilizing academic studies which quantified savings from the use of APRNs on a conservative basis. These amounts were then subjected to an acuity adjustment to account for the types of treatment which require the use of a physician. They were further reduced to reflect the probable lack of efficiency in implementing a broad utilization program. This process suggested that a net savings of about 6.2% was attainable through expanded use of NPs.

- Kleiner et al. (2014) analyzed insurance claims data, finding that regulations on NP prescribing increase the price of a well- child medical exam by 3 to 16 percent.

The Looming Shortage of Physicians in North Carolina

A North Carolina Institute of Medicine study done in 2007 projects a shortage ranging from 1 to 8 percent in the number of providers needed to care for the population in 2020 (NCIOM, 2007). Unfortunately, this study did not break down this figure in terms of either primary care vs. specialty physicians or in terms of specific specialties for which APRNs are known substitutes. Other studies help to fill this knowledge gap:

- **Primary Care Physicians**. Recent studies have estimated that coverage expansions under the Affordable Care Act will increase demand for primary care by about 2 to 3 percent (Hofer et al., 2011; Huang and Finegold, 2013); unpublished estimates by Parente et al. suggest the increase may even be higher than this. Consequently, the looming shortages are likely to be even larger than those projected by NCIOM in 2007. Based on comparing actual primary care provider capacity (including APRNs and PAs) to the expected increase in primary care demand if all states pursued Medicaid expansion under

the Affordable Care Act, Ku et al. (2013) found that North Carolina would be the seventh most challenged state in the nation in terms of the difference between actual supply and demand for primary care.

- **OB-GYNs.** The national shortage of OB-GYNs by 2020 is projected to be 27 percent (Satiani, 2011), although ACOG (2014) predicts it will be 18 percent by 2030 and 25 percent by 2050. But the same ACOG report shows there is no good reason to suppose that the picture in North Carolina differs appreciably from these national trends. First, 31 of North Carolina's 100 counties currently do not have any OB-GYNs. Second, while the state has only a slightly higher supply of OB-GYNs relative to population, the number of females in North Carolina will grow nearly twice as fast as the rest of the nation between now and 2030.
- **Anesthesiologists**. The RAND Corporation (Daugherty et al., 2010) documented a shortage of anesthesiologists in North Carolina of 8.2 percent in the year 2007 (Table 4.8) and projects nationally that this shortage will get even more severe by 2020 (state-specific projections not available).

While the situation in North Carolina may be somewhat worse, it largely mirrors the rest of the nation. According to the federal Health Resources and Services Administration: "Without changes to how primary care is delivered, the growth in primary care physician supply will not be adequate to meet demand in 2020, with a projected shortage of 20,400 physicians. While this deficit is not as large as has been found in prior studies, the projected shortage of primary care physicians is still significant" (HRSA, 2013). The American Association of Medical Colleges has likewise documented virtually an identical shortage of primary care physicians (PCPs), while also projecting a shortage of specialists that is equivalent in magnitude to the shortage of PCPs (AAMC, 2010). In short, North Carolina cannot hope to alleviate this shortage by looking to in-migration of physicians from other states to fill the gap.

The Potential of APRNs to Alleviate the Physician Shortage

Ironically, with the possible exception of CRNAs, a national surplus of APRNs appears to be emerging in tandem with the growing shortage of physicians.

- **Nurse Practitioners**. For example, HRSA projects that the national supply of NPs in 2020 will exceed demand at current utilization levels by 11.4 percent (HRSA, 2013: Exhibit 8). Put a different way, of the 30 percent projected increase in NPs between 2010 and 2020, over two-fifths will become "surplus" NPs, unable to be used if practice patterns remain unchanged. There is no reason to believe this situation is any different in North Carolina. A recent analysis shows that from 1990-2010, the NP workforce in North Carolina grew more than 10 times as fast as the state's physician workforce (Spero and Fraher, 2014).
- **Nurse Midwives**. Between 2012 and 2022, CNMs are projected to grow even faster than CRNAs according to Bureau of Labor Statistics (BLS, 2014b). Again, there is no good

reason to suppose that the picture in North Carolina differs appreciably from these national trends.

- **Nurse Anesthetists**. The RAND Corporation (Daugherty et al., 2010) shows a 2007 shortage of CRNAs of 18.5 percent in North Carolina, in contrast to a national shortage of only 3.0 percent (Table 4.9). The same report projects a national *surplus* of CRNAs by 2020, but it is unclear whether North Carolina would be in the same position since North Carolina-specific CRNA projections were not reported by RAND or elsewhere. It seems unlikely that this faster growth would have entirely eliminated the state's relatively larger CRNA shortage. Figures in Dyson et al. (2004) show that the annual growth in the number of CRNAs per 100,000 population was 2.2 percent in North Carolina between 1980 and 2000 compared to 1.3 percent for the nation overall. But that implies that North Carolina's relative shortage of 15.5 percentage points in 2007 is only being eroded by less than 1 percentage point a year. Consequently, it seems likely North Carolina would continue to experience a future shortage of CRNAs in 2020 (albeit smaller) even if the nation as a whole faces a CRNA surplus by that year.

- **Nurse Specialists**. Although there are no North Carolina-specific projections for CNSs, a national study from 1998 showed their supply would grow at roughly the same pace as CNMs through the year 2015 (Cooper et al. 1998).

The previously-cited HRSA report estimated that "*Under a scenario in which the rapidly growing NP and PA supply can effectively be integrated*, the shortage of 20,400 physicians in 2020 could be reduced to 6,400 PCPs" (HRSA, 2013: emphasis added). A very similar point was made by the Federal Trade Commission this past March in a report arguing that restrictions on APRNs exacerbate well-documented provider shortages (both aggregate and geographic) (FTC, 2014).

In short, these divergent trends—a shortage of physicians coupled with a surplus of APRNs— offers the prospect of greater reliance on APRNs as "helping hands" who could help alleviate critical shortages of various types of physicians.

- **NPs**. Every additional 100 NPs would reduce the shortage of primary care physicians by 75 doctors.[4]

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[4] A recent HRSA report (2013: p.28) employs a 0.75 weighting to NPs and PAs relative to primary care physicians. This weighting reflects the consensus of the Negotiated Rulemaking Committee on the Designation of Medically Underserved Populations and Health Professional Shortage Areas. The ratio reflects differences in both the demographic make-up of each profession and practice styles. That is, a higher fraction of NPs are female, who in turn, tend to work fewer hours than their counterparts who are male; for example, in 2005 the average number of work hours per week reported by female physicians in North Carolina was about 91% of the average hours reported by males (NCIOM, 2007:16). NPs typically spend more time per visit with patients, doing more patient education, for example. As HRSA cautioned in reporting this ratio, "It is important to note that the Committee did not intend for this weighting to represent the general relative cost or value of NP and PA services compared with physician services. The Committee also acknowledged that these providers often deliver a different set of services than a physician, and that weighting them at 1.0 would overstate the assessment of primary care capacity."

- **CRNAs**. A RAND Corporation study showed that CRNAs spend 37 hours weekly on procedures while the parallel figure for anesthesiologists (MDAs) is 49 hours (Daugherty et al., 2010). Thus, even though productivity of CRNAs and MDAs are equivalent in terms of productivity per case (as reflected by Medicare payment rules[5]), one FTE CRNA only can substitute for 75 percent of an MDA due to the latter's longer clinical workweek.

- **CNMs**. Current Medicare payment rules imply that CNMs have the equivalent productivity as physicians who deliver the identical services.[6] However, AMA survey data show that average weekly hours of patient care were nearly identical for OB-GYNs and anesthesiologists in 1998.[7] Assuming weekly work hours declined at the same rate in both professions, the equivalent figure currently would be 50 hours. In North Carolina, we infer the typical workweek for CNMs is 40 hours,[8] implying one FTE CNM would substitute for about 80 percent of an OB-GYN.

- **CNSs**. There is no commonly accepted equivalency standard for CNSs. "CNSs are engaged in direct clinical practice; function as consultants in their area of expertise; provide expert coaching and guidance; interpret, evaluate, and participate in research; provide clinical and professional leadership; collaborate; and employ ethical decisionmaking [sic]" (O'Grady, 2010: 2-604). In light of the solid evidence that CNSs reduce the need for inpatient care, as one example, the reduction in patient needs for various medical services may have at least as important in alleviating physician shortages as any direct substitution of CNS for MD services. Thus, depending on their training, the services CNSs perform can reduce the need for a variety of specialists ranging from OB-GYN physicians to general internists. But in light of the lack of solid evidence regarding how many fewer physicians might be required for every 100 CNSs, we conservatively use a weighting of .5, which is the ratio HRSA formerly applied to NPs when determining the number of FTE primary care providers for purposes of designating Health Professional Shortage Areas (NCIOM, 2007: 117).

In short, for the most part, there are ample APRNs coming out of the pipeline: the issue is whether they can be effectively utilized to help offset the looming shortages of primary care

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[5] This is reflected in Medicare billing rules. A CRNA practicing alone is paid the identical amount (Base units + Time units) x conversion factor) as an anesthesiologist alone (Hogan et al. 2010).

[6] For services on or after January 1, 1992, through December 31, 2010, Medicare payment had been made at 80 percent of the lesser of the actual charge or 65 percent of the Medicare Physician Fee Schedule amount that would be paid for the same service furnished by a physician. However, for services rendered after January 1, 2011, Medicare will pay CNMs for their services and services furnished incident to their professional services at 80 percent of the lesser of the actual charge or 100 percent of the physician fee schedule amount that would be paid to a physician for the same service (CMS, 2010).

[7] These 1998 figures are from an annual survey conducted by the AMA annually (but which ceased in 1999), as reported in HRSA, 2008 (Exhibit 10). Average weekly hours have unquestionably declined in the interim (anesthesiologists reported 57 patient care hours weekly in 1998 compared to 49 hours reported in in Daughtery (2010), while OB-GYNs reported 58 patient care hours. For purposes of analysis, it was assumed that current OB-GYN hours = 58 x 49/57, implying OB-GYN hours declined at the identical rate as for MDAs.

[8] The data and logic supporting this conclusion are detailed in Appendix A.

doctors and specialists. However, to the extent there is (or will be) a surplus of APRNs, an important reason is that practice restrictions in North Carolina prevent such professionals from being able to practice to the full extent of their training and thus limit their employment opportunities.

Regulatory Barriers to Greater Use of APRNs in North Carolina

Current Regulatory Barriers in North Carolina

While there is no single summary number to quantify it, as the following illustrations show, North Carolina generally has a more restrictive regulatory climate regarding APRNs than most other states.

- **NPs**. NPs are jointly regulated by the North Carolina Board of Nursing and the North Carolina Medical Board and require physician supervision (Kugler et al. 2011). Currently, 22 states (including District of Columbia) allow for autonomous practice of NPs, meaning that neither physician supervision nor collaboration are required for diagnosis, treatment or prescribing medicines. Another 8 states allow for autonomous practice for diagnosis and treatment, but not prescribing. Thus, North Carolina is one of only 21 states that impose the highest level of restriction on NPs, requiring a collaborative practice agreement with a physician both for diagnosis and treatment as well as prescribing medications (Barton Associates, 2014). Note that NP educational and certification requirements have been standardized since the 1990s; hence differences in training/competency cannot account for differences in the need for physician oversight.

- **CNMs**. North Carolina CNMs are regulated by the Midwifery Joint Committee, with independent statutory authority (Kugler et al. 2011). However, like NPs, CNMs also are required to have physician supervision; that is, without entering into a physician supervisory agreement, CNMs are unable to practice, even if they have completed training. According to the American College of Nurse-Midwives, only five other states require such supervisory agreements (CA, NE, FL, SC, VA) (Hoban, 2014). North Carolina also is one of 30 states in which CNMs lack independent prescriptive authority (NCSBN, 2014c).

- **CRNAs**. CRNAs are regulated by the board of nursing, with no requirement for physician supervision (Kugler et al. 2011); that is, there is no requirement for a written collaborative agreement, no supervision, and no conditions for practice (NCSBN, 2014a). This allows CRNAs to work either "in collaboration with" or "under supervision of" doctors. However, for purposes of Medicare reimbursement, physician supervision of CRNAs is required. Specifically, "for Medicare Part B to pay an anesthesiologist a claim for providing medical direction services, the anesthesiologist must attest that he or she completed the following in each case: (1) performed a pre-anesthetic examination and evaluation; (2) prescribed the anesthesia plan; (3) personally participated in the most demanding procedures in the anesthesia plan, including induction and emergence; (4)

ensured that any procedures in the anesthesia plan that he or she did not perform were performed by a qualified anesthetist; (5) monitored the course of anesthesia administration at frequent intervals; (6) remained physically present and available for immediate diagnosis and treatment of emergencies; and (7) provided indicated post-anesthesia care." Anesthesiologists are not permitted to supervise more than four CRNAs (AANA, 2010). However, since 2001, the federal government has given states leeway to opt out of physician supervision requirements for nurse anesthetists without sacrificing payments from Medicare.[9] To date, 17 states have done so, but North Carolina is not one of these (AANA, 2012). North Carolina also is one of 11 states in which CRNAs have no prescribing authority (NCSBN, 2014b).

- **CNSs**. CNSs are not regulated in North Carolina, making the state among the 25 that allow for independent practice of CNSs (NCSBN, 2014d). However, CNSs also do not have title protection (Kugler et al. 2011); lack of title protection in a state results in use of the title by those without formal preparation as CNSs, which hypothetically poses a risk both to patient safety as well as patient acceptance of CNSs. North Carolina is among 11 states that do not give prescribing authority to CNSs (NCSBN, 2014e).

Impact of Regulatory Barriers on APRN Supply

Theoretically, it makes sense that regulatory barriers will reduce the supply of APRNs. Collaborative practice agreements (CPAs), for example, increase the cost of APRN practice since they or the organizations that employ them must pay physicians to enter into such arrangements. This shifts the supply curve backwards (it costs more to provide any given number of APRNs), so fewer APRNs are demanded at equilibrium (where supply and demand curves intersect). As well, APRNs who cannot find a physician willing to enter into a CPA are barred from entering the market altogether (Reagan and Salsberry, 2013).

Empirical evidence on the impact of APRN regulatory barriers on supply and use of APRNS lends credence to these theoretical predictions. This literature supports the hypothesis that removing various restrictions on APRNs to give them as much freedom to practice as already exists in many other states would increase the overall number of APRNs available to help reduce the shortage of physicians:

- Sekscenski et al. (1994) provides cross-sectional evidence that states with more favorable nurse practice environments (e.g. full prescriptive authority) and reimbursement policies have a greater number of NP and CNM practitioners per capita;
- Shi and Samuels (1997), using 1991 data on regulatory requirements, found that the number of NPs and PAs employed by community health centers was significantly associated with the regulatory practice environment for these practitioners;

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[9] It is worth noting the the VA health system, Army, Navy, Air Force, Indian Health Services, and Combat Support Hospitals all allow for CRNAs to practice without physician supervision (VHA, 2014).

- Declerq et al. (1998) found a positive correlation between the supply of CNMs and a measure indicating how much the state regulatory environment supports such providers (including rights to be reimbursed, authority to write prescriptions, and hospital admitting privileges, among others).
- Adams et al. (2003) likewise found a positive correlation between the supply of CNMs and the regulatory environment for CNMs.
- Kalist and Spurr (2004), using data from 1989-1995, showed that enrollments in APRN programs are 30 percent higher in states where APRNs have a high level of professional independence (i.e., where the Board of Nursing has sole authority over the scope of nursing practice) than in States where either the Board of Medicine has some authority over scope of practice, or there is a requirement of physician supervision;
- Reagan and Salisbury (2013) examined trends in the number of NPs per 100,000 between 2001 and 2008, finding that states with the most restrictive NP scope of practice regulations reduced the number of NPs by about 10 per 100,000 and reduced the growth rate by 25.7%.[10] No difference was found between states with the most restriction and those with some restrictions. The authors conclude from their results that changes to practice regulations should not be incremental but should follow the current practices in the least restrictive states;
- Kuo et al. (2013) assessed the impact of state regulations on the increase in care provided by NPs in the United States, using a 5 percent national sample of Medicare beneficiaries. They found that between 1998 and 2010 the number of Medicare patients receiving care from NPs increased fifteen-fold. By 2010 states with the least restrictive regulations of NP practice had a 2.5-fold greater likelihood of patients' receiving their primary care from NPs than did the most restrictive states.[11] As well, the increase in the number of NPs per 100,000 residents between 2006 and 2010 was greatest in states with the least restrictive regulations. All told, when a number of other demographic, socioeconomic and medical system factors were taken into account, states' degree of regulation explained 16.8 percent of the variation in NP care at the state level.
- Kleiner et al. (2014) found that regulations that require NPs to be supervised by physicians when prescribing controlled substances lead to a reduction in hours worked by NPs of between 6 to 14 percent per year.

Ancillary Impacts of Removing Regulatory Barriers on APRN Supply

Impact on Supply of Physicians. The literature is mixed on whether removing restrictions on APRNs is associated with a reduction in the supply of physicians.

- Sekscenski et al. (1994) have shown that states with more favorable practice environments for advanced practice providers do not have a smaller supply of generalist

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[10] Note that North Carolina fell into the "most restrictive" of the three categories used to characterize NP regulation.
[11] Note that North Carolina fell into the "most restrictive" of the five categories used to characterize NP regulation.

physicians relative to states with less permissive environments. On the contrary, supplies of generalist physicians, PAs and NPs within states are positively associated. However, states with documented shortages of primary care physicians that had environments favorable to PAs and NPs had relatively more such practitioners than the national average. This implies that expanding the supply of APRNs through less restrictive regulations would have the intended effect of alleviating physician shortages rather than merely encouraging doctors to move elsewhere leaving the overall shortage picture unchanged.

- Declerq et al. (1998) found a positive correlation between the supply of physicians and a measure indicating how much the state regulatory environment supports CNMs (including rights to be reimbursed, authority to write prescriptions, and hospital admitting privileges, among others).

- Kleiner et al. (2014) found that, depending on the empirical model used in the estimation, regulations that require NPs to be supervised by physicians when prescribing controlled substances were associated with increases in physician hours worked of between 6 to 9 percent.

- Traczynski and Udalova (2014) performed an analysis similar to Kleiner et al.'s but using a much longer time-frame: 1970-2011. They too found that NP independence was associated with an increase in physician time spent with patients of 8% in the long run. Since this effect size is so close to the 10% statutory requirement for time spent supervising NPs, the authors conclude "these results suggest that physicians substitute additional patient care hours for time spent supervising" (p. 29).

Impact on APRN Earnings. Theoretically, removal of restrictions should increase APRN earnings because the demand for APRN services would increase. Nevertheless, there also is mixed evidence on the impact of APRN regulations on APRN earnings:

- Dueker et al. (2005) used Current Population Survey (CPS) data on earnings from 1988 to 2002 to show that the earnings of APRNs were 21 percent lower in states where they have greater professional autonomy. This finding is consistent with the idea that the supply of APRNs increases when a state adopts regulations that encourage professional independence. However, earnings of PAs also were substantially higher (36%) in those same states. Consequently, the authors speculated there may be another reason for the decline in earnings: physicians may respond to such regulation by hiring physician assistants instead of APRNs. Unlike APRNs, physician assistants PAs are usually salaried employees who by law must be employed by a supervising physician (Perry, 2009), hence do not pose the same competitive threat to physicians. It is worth noting that the CPS does not identify APRNs specifically, so the authors had to infer this from the

data.[12] It is not clear how much this imprecise measurement contributed to their somewhat counterintuitive results.

- Perry (2009) found that increased prescriptive autonomy for NPs was associated with an increase in NP earnings of 1.6% per year after which authority was first granted.
- In an unpublished master's thesis, Kasprisin (2010) examined county-level data from 2001-2005 finding that areas with high NP growth were associated with reimbursement rates that were 4.42% higher for NPs. This analysis did not examine scope of practice regulations directly, but to the degree that removing practice restrictions increases NP supply, the findings are consistent with the view that fewer restrictions would increase NP earnings.
- Kleiner et al. (2014) find that occupational regulations that require NPs to be supervised by physicians when prescribing controlled substances reduce NP wages by about 14 percent. This implies that NP wages are 16 percent higher in states without such restrictions.

Impact on Physician Earnings. There also is mixed evidence regarding the impact of less restrictive practice environment on physician earnings.

- Dueker et al. (2005) using CPS earnings data (1988 to 2002), found a reduction in physician earnings in states with less restrictive regulation of NPs and CNMs, but this effect was significant at a .07 level, making it not statistically significant in conventional usage.
- Perry (2009) using physician earnings data from the CPS (1996-2005) and proprietary survey data on PAs (1996-2004), found that increased prescriptive autonomy for NPs was associated with a decrease in earnings a year (per year after which authority was first granted) for both PAs (-1.4%) and physicians (7.6%).
- In an unpublished master's thesis, Kasprisin (2010) examined county-level data from 2001-2005 finding that areas with high NP growth were associated with reimbursement rates that were 3.1% lower for primary care physicians. This analysis did not examine scope of practice regulations directly, but to the degree that removing practice restrictions increases NP supply, the findings are consistent with the view that fewer restrictions would lower primary care physician earnings.
- Pittman and Williams (2012) used 2009 BLS data on hourly earnings to examine trends in earnings for family and general physicians, pediatricians and surgeons (the latter were used as a control group). There were no significant differences in earnings for any of the physician groups in states with the most liberal NP scope of practice regulations and those with restrictive laws.

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[12] The authors explain: "To analyze advanced practice nurses, we selected the records of all those in the RN occupation who had a master's or "professional school" degree (but not a Ph.D.) or alternatively, at least 5 years of higher education."

- Kleiner et al. (2014) find that occupational regulations that require NPs to be supervised by physicians when prescribing controlled substances increase physician wages by about 7 percent. This implies that physician wages are 7 percent lower in states without such restrictions.

Impact on Utilization, Costs and Prices. There also is mixed evidence regarding the impact of less restrictive practice environment on utilization of health services, costs or prices in the markets for APRN services.

- Kleiner et al. (2014) examined occupational regulations that require NPs to be supervised by physicians when prescribing controlled substances. Their analysis of insurance claims data showed that the more rigid regulations increase the price of a well-child medical exam by 6% in states with intermediate levels of regulation (supervised/delegated prescriptive authority) and 16 % in states with the strongest level of regulation (limited prescriptive authority).[13]
- Stange (2014) used the variation in regulation of NPs and PAs to assess the effects of increased supply of such providers on access, costs, and patterns of utilization for a broad population-based sample, using a time series of cross-sections for the period 1990-2008 and county-level data on supply of NPs and PAs. He found that in states that expanded prescriptive authority for NPs, there were modest increases in access to care, as measured by utilization and expenditures (3% more visits among those having at least 1 visit). However, he also found no evidence that increases in non-physician provider supply decreases prices, even for visits most likely to be affected by NPs and PAs: primary care visits in states with a favorable regulatory environment for NP and PAs. When he directly measured the impact of giving NPs prescriptive authority, he found no significant difference in the amount paid per visit for either check-ups or diagnostic/treatment visits.
- Traczynski and Udalova (2014) performed an analysis similar to Kleiner et al.'s but using a much longer time-frame: 1970-2011.
  - The authors found that in states where NPs were given more independence, the frequency of routine check-ups rose for adults (3.1 percentage points in the short-term, 7.4 percentage points in the long term), but not for children.
  - Based on their analysis of various strands of evidence, the authors concluded that checkup frequency increased predominantly because NP independence resulted in lower travel times or more convenient appointment scheduling. The authors observe: "Lower travel times are consistent with geographic spread of medical providers in response to NP independence, while better availability of

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[13] There are several mechanisms by which this could happen. First, this study showed that in states with the most restrictions on prescribing, annual hours of work for NPs declined while those for physicians rose. Thus, higher prices could be due simply to substitution of higher-priced doctors for lower-priced NPs. Another possible explanation is that the supervisory requirements themselves increase the cost of production, hence must be reflected in higher prices both for physicians and NPs.

appointments is consistent with less time spent on supervision and consultations between physicians and NPs" (p. 15).

o The increase in yearly check-ups was higher in states with a higher share of the population living in medically underserved areas. The authors conclude "NP full independence is an effective policy for alleviating primary care provider shortages" (p. 30).

o The authors also found that NP independence was associated with a 21.7% reduction in emergency room visits for ambulatory-care-sensitive (ACS) conditions, while there was no parallel effect on non-ACS conditions.

Impact on Health Outcomes. Several studies have examined the impact of changes in APRN regulations on health outcomes.

• Kleiner et al.'s (2014) analysis of occupational regulations that require NPs to be supervised by physicians when prescribing controlled substances found no evidence that changes in NP regulatory policy over the 2002-2007 period were reflected in outcomes such as infant mortality rates or malpractice premiums. These results suggest that less restrictive NP regulations would not adversely affect health care quality.

• The Bay Area Council Economic Institute reported "In years following increased NP authority, adults report a 13-15 percent increase in visit quality, while children report gains of 17-27 percent" (BACEI, 2014).

• Traczynski and Udalova (2014) performed an analysis similar to Kleiner et al.'s but using a much longer time-frame: 1970-2011. In states where NPs were given more independence, the percentage of adults reporting excellent health rose by 11% in the long run.

Summary

Solid scientific evidence shows that APRNs provide care that is equivalent or better than that provided by physicians. This finding is robust to how quality of care is measured and extends to patient satisfaction as well. Moreover, APRNs lower the cost of care both because their own care is less expensive and because in some cases it also results in lower use of other medical care resources such as days spent in the hospital, tests, procedures and medications. Thus, expanded use of APRNs offers the potential to deliver care more cost-effectively. Moreover, many areas in North Carolina now or in the future will face shortages of both primary care and specialty physicians; APRNs offer a very cost-effective solution that could considerably alleviate that problem. North Carolina could lessen these shortages to a considerable extent were the state to adopt less restrictive APRN regulations that have worked successfully for years in other states.

III.   Economic Benefits of More Fully Utilizing APRNs

This section presents the results from a series of interrelated analyses designed to calculate the economic benefits of the expanded use of APRNs that would accompany removing unnecessary practice restrictions. These economic benefits include the economic impact of expanded use as well as potential reductions in health expenditures that would arise due to expanded use. The section concludes with a discussion of the potential impact of expanded APRN use on the projected shortage of various types of physicians.

Economic Impact Analysis

Overview

Economic impact analysis is designed to track the flow of revenues generated by an activity, codifying the jobs created as these revenues flow through the local economy, cataloguing the component of spending that supports local businesses and the companion tax revenues that are generated. EIAs includes both direct and indirect effects.

Direct Effects. The *direct* impact of an APRN practice can be quantified in various ways: a) the value of output, which is measured in terms of revenues since these represent the value that the market places on the services provided; b) the wages, benefits and taxes that are produced from patient care activities provided by the APRN and which are paid both to the APRN as well as to employees who help support delivery of care; c) the number of jobs created within that APRN practice; and d) taxes paid by the practice (e.g., property taxes), its owner and employees.

Indirect Effects. The *indirect* impact includes the output, jobs, wages and benefits, and taxes generated in the industries that are supported by the organizations in which APRNs practice. In this analysis, indirect impacts are measured by including only such business-to-business spending that is related directly to the services provided by APRNs—as opposed to all B-to-B spending that might occur in such organizations. Indirect effects also include *induced* effects on household spending. As APRNs (and employees of vendors) spend their earnings to support local businesses, which pay their employees and pay taxes, job and revenue growth continue in a "ripple" across the economy.

Figure 1: Economic Multipliers
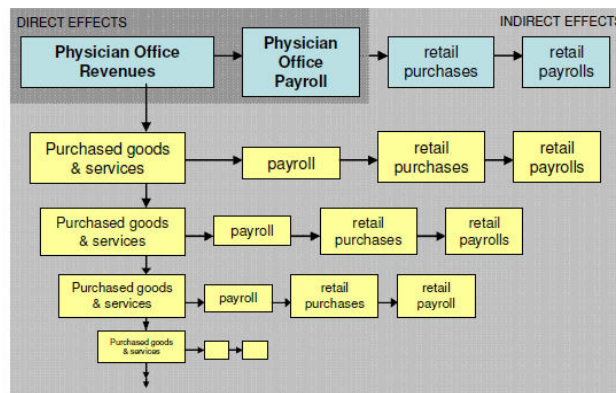
Source: Lewin Group (2011)

Figure 1 illustrates this "ripple effect" for physician offices, but the identical concept would apply to APRNs whether they own and manage their own freestanding practice or (much more commonly) if they are employed by some other organization, be it a physician practice, hospital, retail clinic or similar organization.

Note that in each "round" of spending, there is some "leakage" of new spending outside the community (however that might be defined). This means it no longer generates any additional local value. Thus, every EIA is designed to measure impacts within a defined geographic area, which in this context may be as small as a county or as large as the State of North Carolina.

Multipliers

The indirect and direct effects make up the "multipliers" that underlie an EIA. That is, the total impact in a community is a multiple of whatever economic benefit is generated directly from patient care provided by APRNs. In the current context, the multiplier reflects the number of times that each dollar generated by an APRN circulates through the local economy, supporting local jobs and spending.

Put another way: multipliers measure the response of the economy to a change in demand or (in this case) production. Multiplier analysis generally focuses on the effects of exogenous changes on: a) output of all sectors of the economy, b) income earned because of the new outputs, and c) employment (jobs) that is expected to be generated because of the new outputs. The key here is "exogenous" changes. If $1 million in demand or production merely shifts from one sector of the economy to another within a county, for example, that does not create increase output in that county. While this shift in demand may change who is employed or how much any given worker earns, it does not generally result in a net increase in output, jobs or taxes. It merely shuffles around existing resources without boosting the size of that county's economy. In contrast, if an outside entity—be it a private investor or the federal government—added $1 million in new spending – such as to pay for hospital construction or purchase health services - this would represent an exogenous change in demand that would trigger a stream of economic impacts that could be measured using EIA.

Each of the three types of direct benefits mentioned earlier has its own multiplier: output, jobs, and payroll (wages and benefits). The *output* multiplier is the number of dollars of total economic activity (direct, indirect and induced) that are created by one new dollar of business revenue in a given geographic area. Similarly, the *payroll* (labor income) multiplier calculates the total value of supported wages and benefits (excluding Social Security and Medicare taxes since these are counted as taxes rather than fringe benefits) for every dollar in direct output. The *employment* (jobs) multiplier computes the total number of full-time-equivalent jobs supported for every $1 million in direct output created by an industry.

Multipliers Vary by Geography

Multipliers vary by both geography and industry. A multiplier of 1.0 shows that the total economic value of the industry is the same as the direct economic value. That is, a dollar of revenue in the industry immediately leaves the community so that there is no cycling through the community for additional economic benefit. Conversely, a multiplier will take on a value greater than 1.0 when a dollar earned by a business, e.g., an APRN practice, is spent in the community, supporting jobs and other local businesses, which in turn pay their employees who, in turn buy more goods and services in the local community.

The multiplier for APRNs practicing in a county adjacent to a large metropolitan county may be much lower than the multiplier for an APRN practicing in a remote rural county. For example, many of the employees of the first practice may travel from the more urbanized county to get to their job. Likewise, even if the APRN lives in the same county where s/he practices, s/he may do a considerable amount of household purchases (food out, clothing, entertainment) in the urban county. Thus, there may be a lot more "leakage" of whatever is paid in wages and salaries in a remote rural county where people have to travel long distances to shop or access other services.

For any given industry, a county's multiplier will be smaller than a state's multiplier since, on average, there will be considerably more leakage across county lines than state lines. Because "health care is local," health care industry multipliers typically are higher than those for many other industries precisely because health care providers such as APRNs and their office staff tend to live in the community and their services support the local community.

Projected Changes in Demand for APRNs

A 2012 baseline was used for analysis since this is the latest year for which actual counts of APRNs by county were available through the North Carolina Health Professions Database System (HPDS).

Changes in Health Spending Due to Demographic Factors

The first step in the analysis was to estimate the expected change in health expenditures between 2012 and 2020 that would result from population growth and aging. Official state forecasts of changes in county populations over that 8 year period inclusive of changes in the distribution by sex and age (10 age categories) were used to estimate county-specific changes in health spending. These projections should be viewed as the change in demand for "real" health services, not taking into account what might happen to either medical prices or general inflation in the interim. That is, if a given county's population uses 100,000 APRN visits in 2012 and grows 10 percent by 2020 without any changes whatsoever in the age or sex mix, it would be expected to use 110,000 visits in 2020. Simply comparing the total population in 2020 to the total population in 2012 shows how much spending will rise purely due to the effects of population growth. Statewide, that increase is 8.2 percent, but it ranges from negative growth in at least 20 counties to growth as high as 21.9 percent in Brunswick County (Table B-1).

A national age curve was used to determine relative spending by age and gender (Yamamoto 2013). This curve is normalized so that an index value of 1.0 represents average spending for members of an employer group PPO (the most common form of health insurance coverage for most Americans). This curve shows that males age 75-84 have an index value of 4.19 meaning their total annual health spending (inclusive of amounts paid out-of-pocket and by third party payers) is 4.19 times as large as the group average. Thus, it is straightforward to calculate for each county a weighted average spending index value based on the distribution of the population by age and sex. As the population ages, this index value will rise, so the ratio of the 2020 index to the 2012 index provides a method of estimating the percent increase in spending due to aging. Statewide, this increase is 6.2 percent (i.e., the effects of aging nearly double the increase in spending predicted from population alone), ranging from a low of 2.6 percent in Swain County to a high of 11.1 percent in Camden County (Table B-1).

Thus, the combined effects of population growth and aging will result in a 14.4 percent increase in health expenditures independent of any other factors. This means that--assuming zero change in current practice patterns--the "need"/demand for APRNs (and other health providers) will rise by 14.4 percent over the 8 year period examined.

Changes in Health Spending Due to the Affordable Care Act

The next step was to determine the extent to which new federal spending under the Affordable Care Act (ACA) will change the need for APRNs in the years ahead. The rationale for focusing on federal spending is that this represents new demand for health services into the local economy. This new flow of federal dollars will result in greater economic activity that can be measured using EIA, such as new jobs, higher output and additional tax collections. In contrast, while the ACA also will result in higher spending by North Carolina residents on their own health care than would have occurred otherwise, this new demand for health services will not provide a net benefit to the economy since every new dollar spent out of the pockets of North Carolinians due to the ACA will be diverted from spending within the state that would have instead gone to the purchase of other goods and services.[1]

Determining the impact of the ACA required two calculations. The first estimated the net increase in federal spending related to subsidies provided on the ACA exchange (Table B-2). The second calculated the increase in new federal Medicaid spending (Table B-3). Because it is uncertain if or when North Carolina will adopt the Medicaid expansion allowed under the ACA, both sets of calculations include a lower-bound estimate that assumes no Medicaid expansion and an upper-bound estimate assuming that Medicaid expansion (or its equivalent) is adopted sometime before 2020.

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[1] North Carolina accounts for 2.3 percent of federal tax collections (IRS, 2013). Thus, strictly speaking a small fraction of new federal spending likewise essentially will be pulled out of North Carolina households and hence likewise would otherwise have been spent on other goods and services. Thus, explicitly accounting for this would only change the estimated amount of new demand arising from federal dollars under the ACA only a small fraction. For simplicity, it was therefore ignored.

Although in reality the ACA is being phased in over time, all estimates were calculated using the assumption that the ACA was fully implemented in 2012. This approach provides a picture of the long run permanent increase in baseline demand that will result under the ACA. These calculations show that without Medicaid expansion, the new federal dollars flowing into North Carolina as a consequence of the ACA will boost health spending by 3.1 percent. With Medicaid expansion, the increase would be 5.7 percent. Put another way, the new federal dollars under the ACA are equivalent to increasing the expected baseline growth in health spending due to demographics by an additional one fifth (21.3%)--if Medicaid is not expanded—to two fifths (39.2%) if Medicaid is expanded (Table B-4).

These estimates are extremely conservative since they presuppose no substitution of APRN services for physician services. That is, they are based on current practice patterns and show what the increase in demand will be given those practice patterns. To the degree that APRNs began filling in physician shortages—i.e., providing ACA-funded services that otherwise would remain unmet due to lack of physicians to provide them, the hypothetical expansion in demand for APRNs could be considerably greater.

Economic Impact of Less Restrictive Regulation of APRNs

Current Size of the APRN Market in North Carolina

To perform an EIA of expanded use of APRNs after the adoption of less restrictive scope-of-practice regulations, a baseline estimate of the current size of the APRN market (in dollar terms) was needed.

Total Number of APRNs. The North Carolina Health Professions Data System (HPDS) provided information from which to calculate the total number of FTE NPs, CNMs, CRNAs and CNSs by county (Table C-1). Analysis of these data showed there were 4,244 NPs (4,006 FTE), 258 CNMs (238 FTE), 2,035 CRNAs (1,981 FTE) and 951 CNSs (909) active in North Carolina in 2012.[2]

APRN Compensation. Information from Salary.com provided information, by county, on the average compensation for each category of APRNs.[3] Compensation figures include salary and bonus and fringe benefits (inclusive of employer payroll tax contributions on behalf of workers for Social Security and Medicare). In terms of their own direct compensation, APRNs represent a $1 billion industry in North Carolina (Table C-4).

APRN Practice Expenses. APRN compensation is merely one component of this industry. Each APRN implicitly supports other clinical and non-clinical personnel whose livelihoods depend on

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[2] These counts are based on data from the North Carolina Health Professions Data System (HPDS). Using survey results also reported by HPDS on hours of work, we converted these estimates raw counts into FTEs: 4,006 NPs, 238 CNMs, 1,981 CRNAs and 909 CNSs. For further detail on methods, see Appendix A.

[3] Salary.com reports separate figures for different types of NPs (Table C-2) and CNSs (Table C-3), so APRN gross compensation was calculated using the number of nurses reported in each sub-category times the average compensation for that sub-category (Table C-4).

the revenues generated by the APRN. This is obviously true in the case of APRNs who have their own private practice. But it is equally true of APRNs hired by other organizations such as hospitals or community health centers since these organizations likewise must hire additional personnel (lab technicians, billing clerks) to support whatever services are provided by the APRN. These practice expenses - which include clinical and clerical personnel as well as office expenses, medical equipment, medical supplies and drugs - were imputed for each category of APRN based on calculating the ratio of such practice expenses (PE) to physician compensation for similar categories of physicians.[4] When such practice expenses are included along with total APRN compensation, the total size of the APRN industry rises to just under $2 billion (Table C-6).

Potential Changes in APRN Supply Due to Less Restrictive Regulation of APRNs

The next step was to calculate a parallel figure showing the potential increase in APRN supply through 2019 that would result from less restrictive APRN practice regulations. As explained in Section II, less stringent regulations already have been adopted in other states. Thus, what has been modeled is moving from a regime of restrictive regulations to a regime of fewer scope-of-practice restrictions, not the elimination of all regulations related to APRNs.

Once again, even though the results of such regulatory reform, i.e., an expanded supply of APRNs, would actually occur over a period of years, the results are expressed as if these policy changes already had been in place for 7 years by 2012. A recent study by Reagan and Salsberry (2013) compared states with the most NP restrictions in 2001—defined to mean requirements for a collaborative practice agreement to diagnose, treat and prescribe—to states without any such restrictions. The analysis showed that controlling for a variety of other state characteristics (such as the supply of primary care and specialty physicians), the increase in the number of NPs per 100,000 population by the year 2008 was 10.91 per 100,000 population higher than in states with no such restrictions. Assuming an equivalent increase were to occur in North Carolina in 2012, such an absolute gain in NPs per 100,000 would have expanded the supply of NPs by 24.4 percent since there were 43.5 NPs per 100,000 that year.[5]

As shown in Section II, of the half dozen studies that have examined the relationship between APRN regulation and APRN supply, five focused on NPs and only one focused on CNMs (DeClerq et al. 1998). However, the latter study a) used much older data (from 1991 and 1995);

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[4] NPs were assumed to have PE similar to those of MDs in Family Medicine, CNM PEs were imputed from those of OB/GYNs, CRNA PEs were imputed from anesthesiologists, and CNS PEs were imputed from those of MDs in Internal Medicine (Table C-5).

[5] It is worth noting that the 10.91/100,000 gain reported by Reagan and Salsberry represented a 40 percent increase in the baseline supply of NPs/100,000 in states with no restrictions. Thus, use of the 24.4 percent figure is arguably conservative, but since the baseline supply of NPs grew by 73 percent between 2001 and 2008 even in states with the most restrictions, one could also argue that it is not reasonable to expect that less restrictive regulation could produce an additional 40 percent expansion of the much higher 2008 supply level. It is worth noting that North Carolina's 2012 supply was nearly identical to the level (43.62/100,000) reported for the most restrictive states in 2008.

b) only examined the cross-sectional correlation between regulation and supply rather than how regulation may have affected rates of growth in APRN supply; and c) did not control for other important state characteristics that may have influenced CNM supply such as the number of OB/GYNs. This study confirmed that the level of CNM supply per 100,000 females age 15-44 was 3.3 times as high in states with a high level of regulatory support (i.e., less restrictive regulation) compared to states in the "low support" category. This is certainly consistent with the view that regulation affects CNMs by a considerable amount, but does not provide a very solid basis for quantifying the magnitude of that effect.

Consequently, lacking good empirical evidence on how regulation might affect the supply of CNMs, CRNAs and CNSs, we elected to use the conservative figure of 24.4 percent derived from the Reagan and Salsberry study as the basis for predicting how less restrictive APRN regulation would increase the supply for all four categories of APRNs studied here.

Thus, applying this 24.4 percent increase to the baseline estimates of the size of the APRN industry implies that less restrictive APRN regulation would expand the size of that industry by $260 million (using APRN compensation) to $481 million (inclusive of APRN practice expenses).

Economic Impact of Expanded APRN Use Following Less Restrictive Regulation

Below is a summary of projections of how increased APRN activity will affect overall economic output, state product, payroll, and employment, as well as the increased tax revenue the state and its local governments will receive as a result. Appendix A fully explains the methodology while Appendix provides more detailed results down to the county level. The major economic impacts of the aforementioned expansion are summarized in Fig. 1.

Fig. 1--Annual Economic Impact of Less Restrictive Regulation of APRNs in North Carolina

Total expenditures (output): Upper-bound $883, Lower-bound $477

Value-added (gross product): Upper-bound $495, Lower-bound $314

Wages & benefits: Upper-bound $452, Lower-bound $244

State & local taxes: Upper-bound $38, Lower-bound $21

3,848 to 7,128 Permanent Jobs

■ Upper-bound
■ Lower-bound
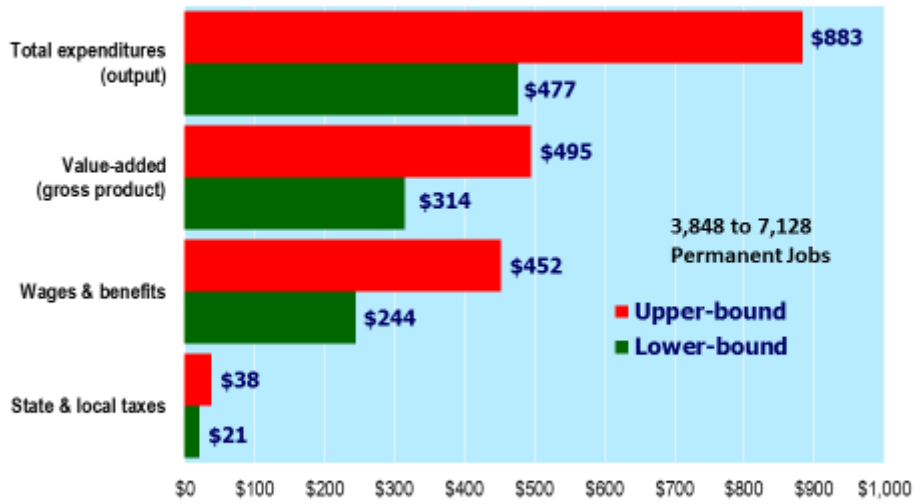
Source: Duke University, Center for Health Policy and Inequalities Research

Total Expenditures (Output). Economic output, sometimes called total expenditures, is the total value of all transactions in the economy. This measure incorporates every dollar that changes hands in any transaction. For example, suppose a farmer sells wheat to a miller for $0.50; the miller then sells flour to a baker for $0.75; the baker, in turn, sells bread to a customer for $1.25. The total expenditures recorded in this instance would be $2.50, that is, $0.50 + $0.75 + $1.25.

Statewide, modernization of APRN regulations would result in an annual increase in total output of at least $477 million (potentially as high as $883 million). On average, each new FTE APRN resulting from more reasonable regulations would support a minimum of $273,000 in output across the state (possibly as high as $506,000). Note there is double-counting in this measure. That is, a dollar of output in one industry (e.g., medical supplies) can become an input into another industry, such as an APRN practice. The output (i.e., revenues) from that APRN practice are used in part to purchase those same medical supplies. Since the output measure counts the output from the APRN practice as well as the output from the medical supplier, the value of such supplies is counted twice. The total expenditures measure provides a picture of the total economic activity that is triggered by a given change in APRN production, but the net value to the economy of this added production is better measured using value-added (also called gross product).

The map below shows that the lower-bound estimate of this annual added economic activity would amount to less than one quarter million dollars in relatively remote counties, but in other counties would amount to tens of millions of dollars.

Increased Output (Lower Bound) by County

Magnitude of Increase
(in thousands of $)

- 0 - 244
- 244 - 699
- 699 - 1,234
- 1,234 - 3,304
- 3,304 - 55,764
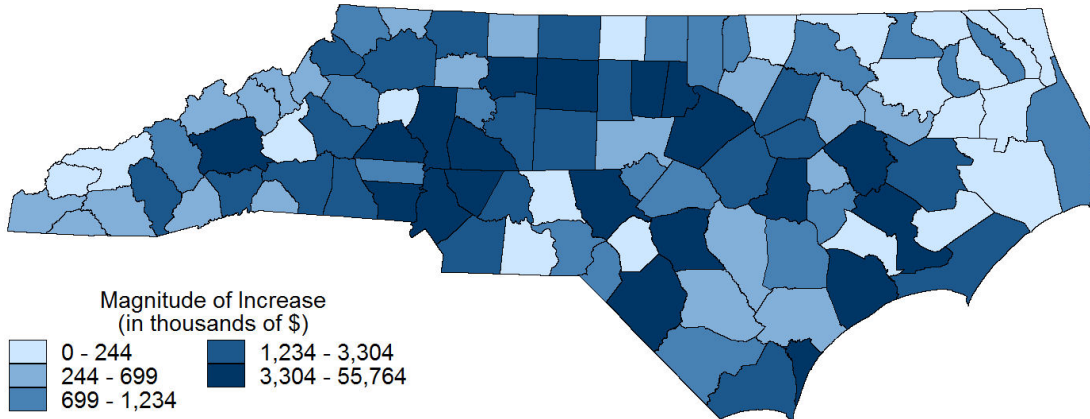
Value-Added (Gross Product). Gross product, the state-level version of the familiar Gross Domestic Product (GDP), is the standard measure by which the size of the U.S. economy is assessed. Gross product is defined as the value of all final goods produced in a given region. Stated differently, it captures the amount of value-added over intermediate goods and services at each stage of the production process, that is, it eliminates the double counting in the Total Expenditures concept. Using the wheat example above, the gross product is $1.25 (the value of the bread) rather than $2.50. Alternatively, it may be viewed as the sum of the value-added by the farmer, $0.50; the miller, $0.25 ($0.75 - $0.50); and the baker, $0.50 ($1.25 - $0.75). The total value-added is, therefore, $1.25, which is equivalent to the final value of the bread, i.e., the amount paid by a retail customer (which in turn equals revenue to the bakery).

Statewide, less restrictive APRN regulations would result in an annual increase in gross product of at least $314 million (potentially as high as $495 million). As noted above, this measure eliminates all the double-counting of production and provides a summary of the net value added to the economy in terms of final users. The average FTE APRN generates a minimum of $180,000 in value-added within North Carolina (possibly as high as $334,000). The map below shows how this would be distributed by Health Service Area.

Increased Value Added (Lower Bound) by HSA

Magnitude of Increase
(in thousands of $)

- 0 - 769
- 769 - 1,811
- 1,811 - 7,002
- 7,002 - 12,525
- 12,525 - 43,424
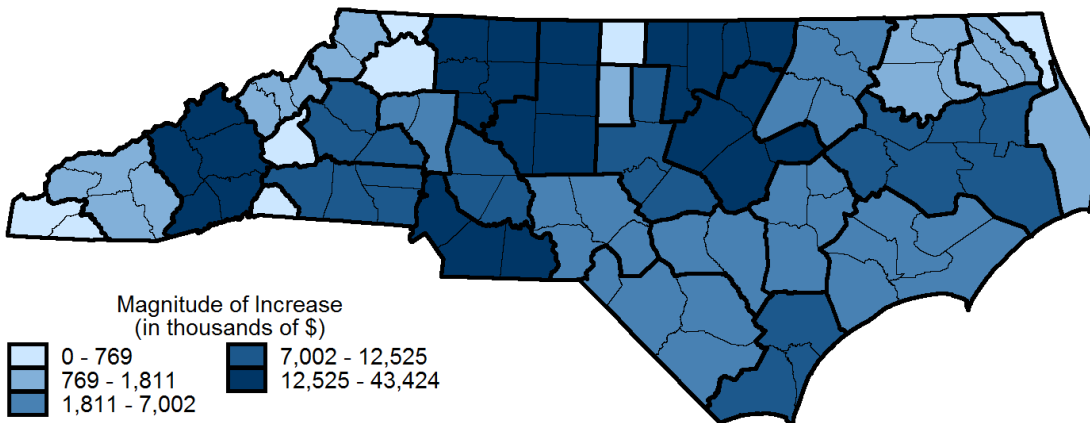
Wages and Benefits: A substantial portion of the gains from APRN activity will flow directly to North Carolina citizens in the form of payroll (wages, salaries, and other employment benefits). As with output and state product, the gains will vary by region. In North Carolina, payroll would have been increase by $244 million in 2012 had APRNs been subject to less restrictive regulation (this payroll increase may be as high as $452 million). The average APRN conservatively supports $140,000 in payroll compensation to North Carolina residents (a figure that could be as high as $259,000).

Not surprisingly, this added payroll would be most concentrated in the urban areas of the state that include the Triangle and Charlotte, but every major Health Service Area as defined by the Sheps Center at UNC-Chapel Hill would see an increase in payroll of at least $20 million.

Increased Payroll (Lower Bound) by Sheps HSA
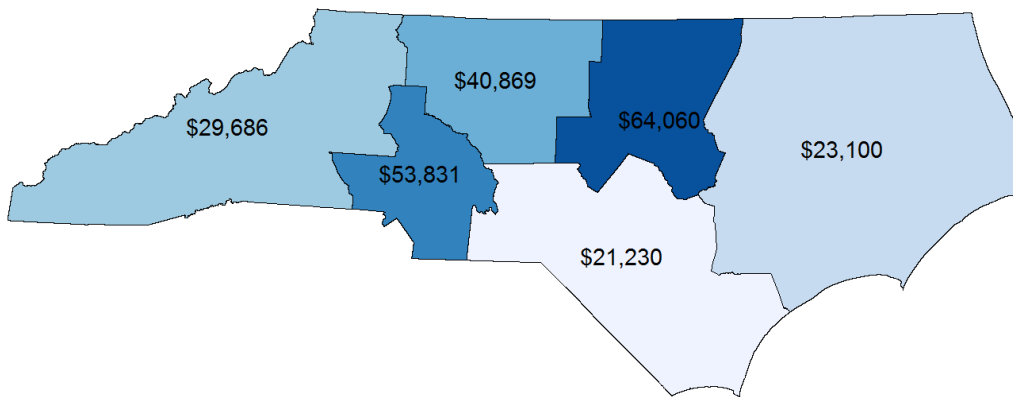
Labels are in thousands of $.

Tax Revenues: The revenues and earnings generated by APRNs contribute to state and local taxes, which in turn support public works and community development. Removal of unnecessary restrictions on APRN practice would have resulted in an increase of at least $20.7 million in total state and local tax revenues in 2012 (possibly as much as $38.3 million). On average, each full-time APRN generates between $11,800 and $22,000 annually in state and local tax revenue across the state. This entirely excludes their contribution to federal tax coffers. Table 1 provides a breakdown by type of tax.

Table 1. Increased Annual State and Local Taxes Due to Impact of Less Restrictive Regulation of APRNs (thousands of 2014 dollars)

	Lower-bound estimate	Upper-bound estimate
NORTH CAROLINA TOTAL	$ 20,679	$ 38,305
Dividends	17	31
Social Insurance Taxes: Total	397	736
Social Ins Tax- Employee Contribution	134	248
Social Ins Tax- Employer Contribution	263	488
Tax on Production and Imports: Total	12,962	24,011
Tax on Production and Imports: Sales Tax	7,217	13,369
Tax on Production and Imports: Property Tax	4,866	9,014
Tax on Production and Imports: Motor Vehicle Lic	160	297
Tax on Production and Imports: Severance Tax	1	2
Tax on Production and Imports: Other Taxes	622	1,152
Tax on Production and Imports: S/L Non taxes	96	177
Corporate Profits Tax	318	589
Personal Tax: Total	6,985	12,938
Personal Tax: Income Tax	5,702	10,562
Personal Tax: NonTaxes (Fines- Fees	902	1,670
Personal Tax: Motor Vehicle License	267	494
Personal Tax: Property Taxes	76	141
Personal Tax: Other Tax (Fish/Hunt)	38	71
Memorandum: Taxes per New FTE APRN	$ 11,853.61	$ 21,957

Source: Author estimates using IMPLAN.

Jobs. The increased economic activity described above will also lead to employment gains for the state. Again, these gains will be both direct gains in employment of APRNs and their support staff, as well as indirect gains realized in the broader economy. The direct and indirect effects of these additional APRNs would support 3,848 permanent jobs a year (upper-bound=7,128). On average, each APRN conservatively supports 2.2 jobs statewide (upper-bound=4.0). Table 2 shows how these would be distributed by Metropolitan Statistical Area (MSA).

Table 2. Permanent Job Gains Due to Impact of Less Restrictive Regulation of APRNs, by MSA

MSA Name	Lower-bound estimate	Upper-bound estimate
NORTH CAROLINA TOTAL	**3,848**	**7,128**
Metropolitan Statistical Areas	2,948	5,373
Asheville	179	313
Charlotte	663	1,217
Fayetteville	95	168
Goldsboro	30	55
Greensboro	597	1,068
Greenville	130	241
Hickory	126	214
Jacksonville	36	67
Raleigh	935	1,753
Rocky Mount	28	47
Wilmington	128	229
Non-MSAs	901	1,756
Memorandum: Jobs per New FTE APRN	2.2	4.1

Source: Author estimates using IMPLAN.

Projected Impact of Expanded APRN Use on Health Expenditures

Section II reviewed a large body of literature demonstrating the potential of APRNs to reduce health expenditures. Total health expenditures in North Carolina in 2012 amounted to $68.8 billion (Table B-4). Estimates of net overall health system savings resulting from expanded use of APRNs range from 0.63 percent--based on the RAND Corporation's assessment for the State of Massachusetts (Eibner et al., 2009)—to 6.2 percent—based on the Perryman Group's assessment for the State of Texas (2012). Assuming equivalent savings in North Carolina, the potential amount of annual health cost savings that might result from expanded use of APRNs ranges from $433 million to $4.3 billion. This translates into $44 to $437 per North Carolina resident.

Such savings themselves would not increase net economic output in the state, since they would merely represent the diversion of dollars otherwise spent on health care into other types of consumer spending, the details of which would depend on how such savings are shared between households, employers and various components of the health sector, such as health insurers. Nevertheless, such savings can be achieved without reducing the quality of health care - indeed, the evidence reported in Section II suggests both health outcomes and patient satisfaction may actually increase somewhat. Consequently, they represent substantial resources that can be redeployed to alternative uses that potentially will increase the welfare of North Carolina's citizens. Indeed, from a value-for-money perspective, it is difficult to argue that North Carolinians would be better served by a health care system that spends more to achieve the same (or slightly worse) outcomes when a lower cost alternative is readily available.

Projected Impact of Expanded APRN Use on Physician Shortages

As demonstrated in Section II, the supply of regular physicians in North Carolina is expected to fall short of that demand by the year 2020, with the exact size of the shortage depending on specialty. APRNs are not trained to do everything MDs and DOs can do. Nevertheless, the Office of Technology Assessment (1981) determined that NPs were capable of managing 80 percent of adult primary care and 90 percent of pediatric primary care. As was documented in Section II, a single new FTE APRN can alleviate the need for anywhere from 50 percent to 80 percent of a physician. Consequently, the increased supply of APRNs resulting from less restrictive regulation can dramatically reduce the shortage of medical care in the state.

Depending on whether low or high estimates of the expected size of North Carolina's physician shortage are used, the expanded supply of APRNs that would result from regulatory reform have the potential to alleviate a minimum of 92 percent of the expected shortage of primary care doctors (excluding OB/GYNs), 85 percent of the expected shortage of anesthesiologists, and 41 percent of the overall shortage of nonfederal physicians.

Fig. 2—Potential Impact on Physician Shortages of Less Restrictive Regulation of APRNs in North Carolina
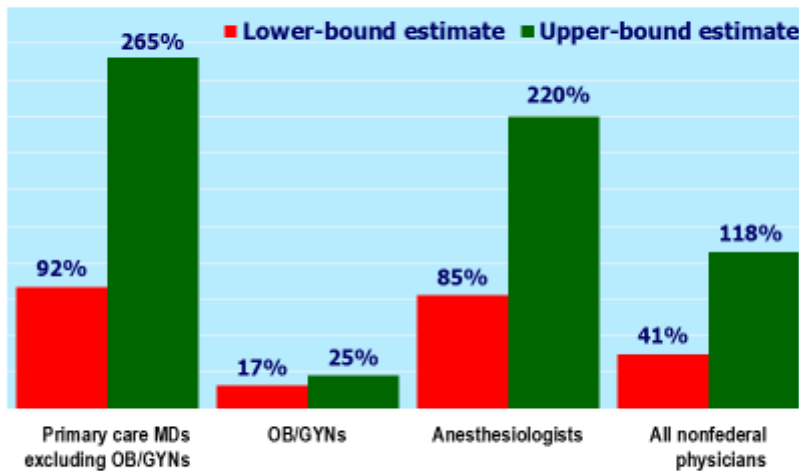
Source: Duke University, Center for Health Policy and Inequalities Research

The impact on the OB/GYN supply appears much more modest, but that is only because the figure shown is based solely on the expanded supply of CNMs resulting from less restrictive regulations. In reality, NPs and CNSs also can contribute to reducing the OB/GYN shortage (but if that assumption is made, it would mean a corresponding diminution of the extent to which such providers would reduce the shortage of all other primary care doctors).

It also is worth keeping in mind that the figures for anesthesiologists do not account for the current 18.5 percent shortage of CRNAs. If the expanded supply of CRNAs first were used to fill that gap, it would reduce the number available to redress the MDA shortage by approximately three quarters. This means that even if the physician shortage figures underlying the upper-bound estimates above are correct, the expected reduction in the shortage would be close to 55 percent rather than 220 percent.

Summary

This section has demonstrated that if North Carolina were to adopt less restrictive regulation of APRNs, citizens would benefit from greater economic activity (income, jobs etc.) as well as lower health expenditures. But of at least equal importance, they would obtain better access to care insofar as the expanded APRN supply could go a long way towards eliminating the shortages of many different types of physicians. The final section will summarize the extent to which empirical evidence supports the lower-bound and upper-bound estimates provided throughout this section.

IV. Discussion

The preceding analysis includes several important findings.

- First, federal spending will increase demand for health care—including APRN services—by anywhere from 3.1 percent (if Medicaid is not expanded) to 5.7 percent (if Medicaid expansion or its equivalent is adopted before 2019).
- Second, if there were less restrictive regulation of APRNs, the potential economic benefits would include new jobs (ranging from 4,053 to 7,507), more payroll (from $257 to 476 million) and higher taxes (from $21.8 to 40.3 million).
- Third, this expansion in APRN supply would provide health system savings that would amount to $433 to $4.3 billion.
- Finally, greater availability of APRNs resulting from less restrictive regulation offers the potential to substantially reduce the expected shortage of physicians in North Carolina in the year 2020, shrinking those shortages by a minimum of 92 percent for primary care physicians other than OB-GYNs; 85 percent for anesthesiologists, 17 percent for OB-GYNs and 41 percent for all physicians. But our upper-bound estimates show that the shortages would be entirely eliminated for all four categories of physicians.

Prediction obviously is never perfect, but what follows is intended to help readers better understand the strengths and limitations of these analyses. It will help inform whether reality is more likely to correspond to the lower-bound or upper-bound estimates that permeate this report.

Findings That Support the Lower-Bound Estimates

As a general proposition, we were conservative in selecting analytic assumptions. Consequently we have much greater confidence that all of our lower-bound estimates represent a true floor on what is likely to happen. We have less confidence that our upper-bound estimates represent a true ceiling: it is conceivable, albeit unlikely, that outcomes could be even better than the upper-bound estimates indicate.

Potential Increase in Demand Due to the Affordable Care Act

We have no way of gauging the likelihood of political events. We have relied on Urban Institute estimates of how much federal spending will increase in the ACA Exchange. While we have used reasonable assumptions to allocate this statewide amount to the county level, there is no question that the amounts we have predicted for any given county may be higher or lower, but statewide any such errors should balance each other out.

There is one contingency we did not model. On November 7, 2014, the Supreme Court agreed to hear the case of King v. Burwell which will determine whether federal subsidies are legally permitted in Exchanges (such as North Carolina's) that are federally-run. We have no way of predicting how the Court will rule in this case (expected next June). More importantly, we have no way of predicting what either the State of North Carolina or federal government will do should the Court decide such subsidies are illegal.

At some level, the economic impact of APRNs is inextricably tied to North Carolina's decision regarding Medicaid expansion. That is, our estimates show that if Medicaid expansion (or its equivalent) were approved, federal funding would increase 84 percent above the lower-bound levels that assume only Exchange coverage is put into place. Thus, if federal funding for Exchange coverage actually disappeared, this would result in our lower-bound estimates dropping by 100 percent if Medicaid were not expanded, but only 16 percent if it was. Readers can decide for themselves which of these various contingencies is most probable.

Potential Impact of Less Restrictive Regulation of APRNs

There are three components to the estimated value of less restrictive regulations for APRNs. The first relates to the relative increase in supply that might occur following less restrictive regulation of APRNs. The second relates to the economic impact of such a supply increase per newly added APRN. The third relates to how much of the expanded use of APRNs could plausibly be financed with federal dollars, i.e., representing an exogenous increase in demand that would generate added jobs and economic activity into the North Carolina economy.

How Much Will APRN Regulatory Reform Change Supply? First, we assume that the supply of APRNs across the board will increase by 24.4 percent. As we pointed out in Section III, this is actually a conservative assumption in the case of NPs. The study we relied upon (Reagan and Salsberry, 2013) showed that all other things equal, the absolute growth in NP supply between 2001-2007 in states with the least restrictive NP regulations was 10.91/100,000. Relative to the 2001 NP supply in those least restrictive states, that added increase represented a 40.5 percent increase over the 7 year follow-up period examined. But in the most restrictive states, the added increase in 2001 was even higher: 43.3 percent. That said, if one conceptualizes the problem as how much additional supply would have been observed in 2008 (relative to what actually happened in the most restrictive states), then the hypothetical increase in supply would have been 25.0 percent. Our lower-bound figure is less than any of these percentages and we see no good reason the supply response should be substantially different in North Carolina than elsewhere.

Unfortunately there is no good parallel literature for CNMs, CRNAs or CNSs related to the impact of less restrictive regulation on APRN supply.[1] But as documented in Section II, the nature of restrictions facing these professionals (i.e., lack of prescribing authority and physician supervision requirements[2]) are quite similar to those facing NPs. So again, conceptually, it is difficult to see why the supply response should be appreciably different for these APRNs compared to NPs. If anything, one could argue that the current shortage of both CRNAs and

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[1] DeClerq et al.'s (1998) correlational study demonstrated a relationship between the degree of CNM regulation and CNM supply, but did provide quantitative estimates of either the absolute or relative increase in CNM supply that could be expected under less restrictive regulations.

[2] Technically, CRNAs have no requirement for physician supervision under North Carolina law. But because North Carolina has elected not to opt out of physician supervision requirements under Medicare (even though Medicare rules give the state leeway to do so), as a practical matter, hospital policies get driven by these restrictive Medicare policies. That is, a hospital cannot know in advance which patients will be Medicare-eligible, hence it must staff operating rooms on the presumption that such supervisory requirements are in place.

MDAs might induce an even stronger response following regulatory reform. As detailed in Table C-8, more than half (56 percent) of the predicted increase in APRNs comes from NPs and another 28 percent comes from CRNAs (which, if anything, may be underestimated in our model for reasons just described). In contrast, one could cut our estimate of the increase in CNMs by half and this would shrink our overall estimate of the increase in FTE APRNs by less than 2 percent. For all these reasons, we believe our prediction of the increase in APRN supply resulting from modernized APRN regulation is a reasonable one.

Economic Impact of Less Restrictive APRN Regulation per Added APRN. Our lower-bound estimate of economic impact is based purely on APRN compensation rather than practice revenues (which would be the standard way of conducting an economic impact analysis). The salary and benefits figures we obtained from Salary.com provide us with a very accurate way of measuring APRN compensation down to the county level. This is especially true when one considers that we used compensation by sub-types of NPs and CNSs in conjunction with the actual distribution of NPs by sub-type to arrive at these county estimates.[3]

But a corresponding figure on revenues per APRN is not readily available at the county, region or state level. What we know from the very detailed data collected to calculate the Medicare Economic Index used for Medicare physician payments is that less than half of Medicare revenues to physicians are paid as compensation to the physician, with the balance going to various sorts of practice expenses. Even if we subtract all compensation going to clinical staff (which includes APRNs as well as nurses/technicians who would provide care even in a practice without any APRNs), physician compensation would amount to only 53 percent of Medicare payments to physicians. In short, APRN compensation is likely to be approximately only half of the conceptually correct measure to use for an EIA. This implies that even if our estimate of the projected increase in APRN supply is twice as high as reality, it is unlikely that the true economic impact would fall below the lower-bound amount.

How Much Expanded APRN Use Could be Financed Using Federal Dollars? Recall from Section III that EIAs make sense only in the context of an external increase in demand, i.e., financed outside the state's borders. The lower-bound increase in demand for physician services under the ACA that would be financed by federal dollars is 3.1 percent while the upper-bound increase would be 5.7 percent. If we used the physician shortage estimates for all nonfederal physicians in 2020 (which ranged from 4.9 percent to 14.2 percent in Table C-8), this means that federal funds under the ACA would cover 63 to 115 percent of the cost to fill those shortages using the lower-bound shortage estimates (the higher figure includes the impact of Medicaid expansion) and 22 to 40 percent of the cost to fill these shortages using the upper-bound shortage estimates.

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[3] As one example, the compensation of NPs in hospital emergency departments is more than 30 percent higher than their counterparts in long-term care facilities (Table C-2).

But even apart from filling these physician shortages, the ACA will expand demand for APRNs as well by the same percentages. Thus if we analyze the net increase in MD equivalents resulting from less restrictive APRN regulations (also in Table C-8), it is straightforward to calculate that anywhere from 34 to 63 percent of the increased supply could be funded purely through federal ACA funding. One component would represent the federally-financed cost of covering the additional physician shortages created by the ACA itself, while the second component would represent the federally-financed cost of covering the added demand for APRNs created by the ACA.

But the ACA by no means exhausts the opportunity to rely on federal financing to support the services provided by an expanded supply of APRNs. The amount of current federal funding available under Medicare and Medicaid is many multiples of the amount of new funding that will be injected as a result of the ACA. Even prior to the ACA, federal spending under Medicare and Medicaid alone accounted for 31.5 percent of total health spending in North Carolina (i.e., an amount equal to ten times the lower-bound increase in spending financed by federal dollars under the ACA). Nationally, the federal government accounted for 45 percent of health spending in 2008 (Fig. 3.4b in Conover, 2012), inclusive of all components (e.g., VA health, military health, federal employee health benefits etc.) and there is no reason to believe the picture is different in North Carolina. To the extent that individuals covered by Medicare, Medicaid or these other federally-financed programs fail to obtain needed services due to physician shortages, alleviating those shortages through expanded use of APRNs ultimately would be financed largely with federal dollars arriving from outside North Carolina's borders. For this reason, it was reasonable to conceptualize the entire expansion in APRN supply (which only represents a 5.8 percent increase in the 2012 MD supply) as being financed with federal dollars, regardless of whether Medicaid is expanded under the ACA.

Potential Health System Savings

There is roughly a 10:1 difference between our lower-bound and upper-bound estimates of potential cost savings arising from expanded use of APRNs.

The lower-bound estimate is based on a RAND Corporation assessment done for the State of Massachusetts. The RAND researchers used Massachusetts-specific data from the Medical Expenditure Panel Survey (MEPS) to estimate that NP and PA visits were 35 percent less expensive than physician visits ($72 per visit in 2008 dollars).[4] They then assumed that NPs (and PAs) could provide care for 6 simple, acute conditions: cough, throat symptoms, fever, earache, skin rash, and nasal congestion) as these corresponded to a set of conditions commonly treated at retail clinics. Nationally, these conditions account for 9.2 percent of all office-based visits in 2006.[5] Since MEPS data showed that only 4.8 percent of all office-based visits were provided by

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[4] PAs reportedly were only a tiny portion of their sample so most of this cost difference would have been driven by NPs.

[5] Based on data from the 2006 National Ambulatory Care Survey.

NPs and PAs in Massachusetts, RAND researchers assumed that greater use of such midlevel providers would gradually (over five years) increase to 9.2 percent. Consequently, overall savings would average 0.63 percent of what otherwise would have been spent on health care absent a policy change (Table 7.2 in Eibner et al., 2009).

Several considerations affect whether this is a reasonable number to apply to North Carolina. Factors that would make the figure too low include:

- **RAND Figures Represent Phased-in Savings Over Five Years.** The 0.63 percent savings figure for 2010-2020 assumes that savings are phased-in over the first five years. The implied steady-state savings once use of NPs and PAs has risen to 9.2 percent would be 0.73 percent—i.e., 16 percent larger.[6]

- **RAND Figures Entirely Exclude Medical Savings Such as Lower Hospitalizations**. The RAND figures are based entirely on the cost difference in providing NP/PA care vs. physician care in outpatient settings. But as documented in Section III, there is ample evidence that APRNs generate savings from lower resource use ranging from fewer tests/procedures to fewer hospital days from the avoidance of ambulatory-sensitive admissions (as one example).

- **RAND Figures Include Only Potential Savings from NPs**. If we assume that CNMs, CRNAs and CNSs each are capable of generating the same dollar amount of savings as NPs on a per-provider basis, use of the RAND figures underestimates potential savings by 79 percent.[7]

- **North Carolina Regulations Are More Restrictive than in Massachusetts**. While North Carolina and Massachusetts both fell into the most restrictive category of NP regulation in 2001 (Table 1 in Reagan and Salsberry, 2013), North Carolina maintained that position in 2010, whereas Massachusetts had moved up one level to category 4 (Exhibit 3a in Kuo et al., 2013). Thus, hypothetically, any change in APRN restrictions should have a greater influence in North Carolina compared to Massachusetts.

Factors that suggest the RAND figures may be too high include:

- **Midlevel Provider Use is Lower in Massachusetts Than in North Carolina**. That said, MEPS data showed that only 4.8 percent of visits in Massachusetts were provided by NPs and PAs, compared to 6.2 percent nationally. In that regard, roughly one-third of the estimated savings from expanded NP/PA use stems from the fact that Massachusetts was below average in use of such health professionals. North Carolina's 2012 supply of NPs (43.62/100,000) was nearly identical to the national average reported for 2008 (43.76/100,000 from Table 2 in Reagan and Salsberry, 2013). Consequently, it seems

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[6] This is a straightforward algebraic calculation from figures presented in Table 7.2 of Eibner et al., (2009).

[7] As shown in Table C-8, less restrictive regulation of APRNs would increase their number by 1,745 FTEs, of which NPs account for only 56% (977). Thus, the savings would be approximately 79 percent larger (i.e., 44%/56%) were the remaining categories of APRNs accounted for in the RAND savings estimate.

unlikely that North Carolina mirrors Massachusetts in terms of NP use being fully one third lower than the national average.

- **The Potential Minimum Share of Visits That Could Be Handled by NPs Has Declined**. As well, nationally, the share of visits attributable to the six simple acute procedures appears to have fallen from 9.2 percent in 2006 to 8.7 percent in 2010;[8] using this updated figure would lower the RAND estimate of net savings by 11 percent.

On balance, we believe the lower-bound health savings estimate are conservative rather than too high. Worth noting is that RAND researchers calculated their own upper-bound estimate of potential savings that was roughly double their lower-bound figure (1.25 percent). Even this upper-bound figure is relatively conservative for all the reasons cited above.

Potential Impact on Physician Supply

Fig. 2 showed that less restrictive regulation of APRNs could reduce the shortage of non-OB/GYN primary care doctors by at least 92 percent and the shortage of OB/GYNs by at least 17 percent. Since the same NPs and CNSs used to reduce the first-listed shortage can also be used to redress the latter shortage, there is a trade-off between these figures. For example, if priority were given to elimination of the OB/GYN shortage, then even in the lower-bound case, it hypothetically could be entirely eliminated; but in that case the non OB/GYN PCP shortage would decline by only 83 percent.

The lower-bound figures also show the shortage of anesthesiologists would be reduced by at least 85 percent; however, the figure does not take into account the 18.5 percent current shortage of CRNAs. If priority were given to filling the latter, it would mean the lower-bound reduction in the shortage of anesthesiologists would be only 20 percent. The shortage of all nonfederal physicians would decline by at least 41 percent. Note that all these "lower-bound" estimates of the reduction in the size of various physician shortages are based on "upper-bound" estimates of the shortages themselves. That is, any given expansion in APRN supply will, percentagewise, reduce the size of the lower-bound shortage figure much more than the upper-bound shortage.

The shortage of non-OB/GYNs may be exaggerated somewhat since it is based in part on the NCIOM estimate of an 8 percent shortage of all doctors, but has not been adjusted to reflect the reality that shortages for certain types of physicians, such as OB/GYNs, are much higher than this. That is, if the shortage of all primary care physicians really averages 8 percent, then the shortage of non-OB/GYN PCPs must be lower than this amount if OB/GYNs (constituting roughly one-eighth of the total number of PCPs) have a shortage that is 3.5 times as large. If so,

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[8] Calculated by authors from Table 9 in NCHS (2013). 2010 is the latest year for which Web tables from the National Ambulatory Care Survey are reported. In contrast to 2006 (Table 8 in Cherry et al., 2008), fever (S010) and nasal congestion (S400) did not show up in the 2010 list of twenty leading principal reasons for office visits. But we can infer from the percent distribution of listed conditions that each of these two missing conditions could not have accounted from more than 1 percent of total visits, so the 8.7 percent has been calculated using that assumption.

it is conceivable that APRN expansion would eliminate shortages for all PCPs, not just OB/GYNs.

The shortage of anesthesiologists may likewise be exaggerated since it is based on national figures showing that the shortage will grow by nearly one percentage point every year between 2007 and 2020. If North Carolina's shortage grew at only half that rate, for example, it would mean that expanded use of APRNs under less restrictive regulation would entirely eliminate the MDA shortage even in the lower-bound case.

Findings That Support the Upper-Bound Estimates

As noted earlier, we generally have less confidence that our upper-bound estimates represent a true ceiling than that lower-bound estimates serve as a true floor.

Potential Increase in Demand Due to the Affordable Care Act

While the election of a Republican president in 2016 may fundamentally alter the nature of the ACA, it is not inconceivable that even a Republican in the White House and majority in both houses of Congress would include support for greater coverage among the Medicaid-eligible population, that is, under 138 percent of poverty. That is, except for the most extreme party activists, there is not a lot of support for taking away coverage from the many millions who have gained it. And, there is bipartisan concern about what to do about uninsured people below poverty even if there is not a current consensus on how to fix that problem. Admittedly, a Republican solution to this problem may entail greater reliance on private health insurance rather than traditional Medicaid. And it may well entail a less generous federal match rate than the 90 percent Medicaid matching rate now provided for expansion populations under the ACA. But whatever form the subsidies take, even if the federal dollars amount to the equivalent of North Carolina's current 65 percent federal matching rate for traditional Medicaid, that would reduce the size of our upper-bound estimates by only 28 percent.

Potential Impact of Less Restrictive Regulation of APRNs

Economic Impact of Less Restrictive APRN Regulation per Added APRN. Our upper-bound estimate is derived from detailed information on physician practices, which in turn is based on extensive surveys conducted by the American Medical Association, over 70 medical specialty societies and the Centers for Medicare and Medicaid Services (Gillis, 2009). These surveys have been conducted several times since the Medicare physician fee schedule was first put into place in January 1992 and they have been validated and refined by parallels surveys conducted by the Medical Group Management Association. While not perfect, these surveys have produced information that is sufficiently accurate to be used routinely for guiding the Medicare physician fee schedule.

Unfortunately, there is no counterpart set of surveys for APRNs in part because such providers do not have their own separate fee schedule, but also because many fewer such providers have their own independent freestanding practices. Instead, the vast majority of such APRNs are

employed by organizations as diverse as major teaching hospitals (whose total employment may exceed 10,000 workers) to small community health centers (whose employment may be measured in only in dozens). That said, there are a lot of similarities between APRNs and physicians in terms of their requiring comparable amounts of space, medical equipment, supplies and support personnel to properly perform their roles. For that reason, we are comfortable that practice-expense-to-compensation ratios derived from physicians provide a reasonably accurate way of extrapolating the magnitude of such costs for APRNs even though inherently there will be less precision using such a method than if we had APRN surveys from which to derive the equivalent ratios. We see no reason to believe such figures are inherently biased upwards or downwards; they simply are less precise.

How Much Expanded APRN Use Could be Financed Using Federal Dollars? The upper-bound increase in demand for physician services under the ACA that would be financed by federal dollars is 5.7 percent. If we used the physician shortage estimates for all nonfederal physicians in 2020 (which ranged from 4.9 percent to 14.2 percent in Table C-8), this means that federal funds under the ACA would cover 22 to 40 percent of the cost to fill these shortages using the upper-bound shortage estimates (the higher figure representing Medicaid expansion or its equivalent).

For all the reasons explained earlier, we are comfortable with conceptualizing the missing 60-78 percent as being financed with federal dollars given that such dollars accounted for 45 percent of health spending even before the ACA was enacted.

Potential Health System Savings

The upper-bound estimate of health system savings is based on a Perryman Group study done for the State of Texas. This reportedly was based on an extensive literature review, with the complete description of methodology being as follows:

> In order to estimate the likely savings, The Perryman Group utilized academic studies which quantified savings from the use of Advanced Practice Registered Nurses on a conservative basis.[9] These amounts were then subjected to an acuity adjustment to account for the types of treatment which require the use of a physician. They were further reduced to reflect the probable lack of efficiency in implementing a broad utilization program. This process suggested that a net savings of about 6.2% was attainable.

Because this analysis was proprietary, we were unable to obtain further details on how the 6.2 percent figure was derived. But it is clear from the literature cited that the net savings figure

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[9] See, for example, "An Alternative Approach to Reducing the Costs of Patient Care? A Controlled Trial of the Multi-Disciplinary Doctor-Nurse Practitioner (MDNP) Model"; Ettner, Susan L. et al; Medical Decision Making, Jan-Feb2006 and "Nurse Practitioner Cost-Effectiveness"; American Academy of Nurse Practitioners. Also "Demonstration of the Cost-Effectiveness of a Nurse Practitioner/Physician Team in Long-Term Care Facilities; HMO Practice; 1994 and "The Effect of a Multidisciplinary Hospitalist, Physician, and Advanced Practice Nurse Collaboration on Hospital Costs"; Cowan, M.J., et al; The Journal of Nursing Administration, 2006.

accounts not only for the per-visit cost differences between APRNs and physicians (which was the sole basis for the RAND Corporation estimate of cost savings), but also differences in resource use related to services such as hospital care and medications. But because we have no way of replicating, updating or adjusting the number to make it more North Carolina-specific, we are reluctant to speculate that it could be even higher than shown even though the Perryman Group characterizes it as a conservative estimate.

Potential Impact on Physician Supply

Fig. 2 showed that less restrictive regulation of APRNs could reduce the shortage of non-OB/GYN primary care doctors by as much as 265 percent and the shortage of OB/GYNs by as much as 25 percent. If priority were given to elimination of the OB/GYN shortage, then in the upper-bound case, it hypothetically could be entirely eliminated; but in that case, the non-OB/GYN PCP shortage would decline by 219 percent. Taken at face value, this implies that less restrictive APRN regulation could result in head-to-head competition between APRNs and physicians that could adversely affect the incomes of either group.

However, this is based on an estimated shortage of 4.9 percent, consisting of a 1 percent "baseline" shortage of all physicians estimated by the NCIOM and the balance consisting of the lower-bound estimate of increased demand arising from the ACA. For all the reasons explained earlier, we have high confidence that this lower-bound estimate represents a true floor on the potential increase. But if the 4.9 percent figure were 10.6 percent (which could occur either because we underestimated the impact of ACA or because the 1 percent shortage figure from the NCIOM masks a larger shortage among PCPs), this would suffice to ensure that the increase in APRN supply did no more than fill in the shortage of physicians rather than create head-to-head competition with doctors.

The upper-bound figures also show that the shortage of anesthesiologists would be reduced by up to 220 percent; however, if priority were given to filling the 18.5 percent CRNA shortage, it would mean the upper-bound reduction in the shortage of anesthesiologists would be only 53 percent.

The shortage of all nonfederal physicians would decline by up to 118 percent. This too is based on an estimated shortage of 4.9 percent, consisting of the identical components just described for PCPs. In this case, however, if the ACA expansion figure were even 5 percent larger or the NCIOM figure 20 percent larger, this would suffice to ensure that the increase in APRN supply did no more than fill in the shortage of physicians.

Conclusions

Because we were conservative in selecting analytic assumptions, we have much greater confidence that all of our lower-bound estimates represent a true floor on what is likely to happen. We have less confidence that our upper-bound estimates represent a true ceiling: it is

conceivable, albeit unlikely that outcomes could be even better than even the upper-bound estimates indicate.

The practical implication is that we have a high degree of confidence that the impacts of less restrictive regulation of APRNs will be at least as large as described in the lower-bound estimates in this report. We have provided our rationale for why it is appropriate to view the entire increase in APRN utilization resulting from less restrictive regulation as being financed through an injection of external federal funds. Hence, the EIA assessment provided in Section III is a valid means of assessing the impact of that supply increase on the North Carolina economy. Thus, less restrictive regulation of APRNs should result in new jobs (at least 4,053 but possibly as many as 7,507), more payroll (from $257 to 476 million) and higher taxes (from $21.8 to 40.3 million). An expanded supply of APRNs would make impressive progress toward alleviating the anticipated shortage of physicians in 2020, and in the best case holds the promise of entirely eradicating the shortages of primary care physicians, OB/GYNs and anesthesiologists. North Carolinians would enjoy better access to care of equivalent or better quality even as the system shed some unnecessary costs in the process. It is rare that a health policy change is capable of generating such positive gains across all these dimensions.

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