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Workforce Outcomes of North Carolina Medical School Graduates: A Report to the Joint Legislative Oversight Committee on Health and Human Services and the Joint Legislative Education Oversight Committee

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INTRODUCTION

North Carolina Session Law 2017-57, the Current Operations Appropriations Act of 2017, directed the North Carolina Department of Health and Human Services (DHHS) and The University of North Carolina (UNC) to provide a report on the workforce outcomes of medical school and graduate medical education (GME) programs in North Carolina. The report will be reviewed by subcommittees appointed by the Joint Legislative Oversight Committee on Health and Human Services and the Joint Legislative Education Oversight Committee to assess the degree to which state support of physician training programs is meeting the health care needs of North Carolina's citizens.

The Program on Health Workforce Research and Policy at the Cecil G. Sheps Center at the University of North Carolina at Chapel Hill was asked to provide data for the report. This document focuses on medical school workforce outcomes; a second report summarizes data on the workforce outcomes of graduate medical education (GME or "residency training") programs in North Carolina.

This report responds to the legislation which asked DHHS and UNC to:

1. determine the identity, location, and number of positions for medical school in the state, broken down by location;
2. identify the number of graduates of medical education in the state who are in practice in North Carolina in 2016 in anesthesiology, neurology, neurosurgery, obstetrics and gynecology, primary care, psychiatry, surgery and urology.
3. track the outcomes of graduates of North Carolina medical school in primary care, obstetrics and gynecology, and psychiatry five years after completing medical school.

BACKGROUND

In 1993, the North Carolina General Assembly (S.L. 1993-321) mandated that each of North Carolina's four medical schools develop plans to expand the percent of medical students choosing a primary care residency. The UNC Board of Governors (BoG) was tasked with monitoring and annually reporting the progress of the four schools toward this goal by evaluating the number of State-supported medical graduates going into primary care five years after graduation. The North Carolina AHEC Program, in collaboration with the Program on Health Workforce Research and Policy at the Sheps Center, produces a report to the UNC BoG in October of each year, which is then forwarded to the Fiscal Research Division of the North Carolina General Assembly. Information in this report draws on those previous analyses. We also include additional information as requested in the 2017 legislation.

METHODS

Study Design

The analyses requested by the legislature required two different methodological approaches. We used a **cross-sectional approach** to identify the number of graduates of medical schools in the state who were in practice in North Carolina in 2016 in anesthesiology, neurology, neurosurgery, obstetrics and gynecology, primary care, psychiatry, surgery and urology. This analysis reflects a “snapshot” of all physicians in practice in the state in a single year: 2016. To be in active practice in 2016, physicians would have had to finish medical school at a point in time roughly before 2012. Thus, the cross-sectional analysis includes physicians who graduated from medical school any time before 2012.

We used a **cohort study design** to determine the workforce outcomes of graduates of the 2008, 2009, 2010, and 2011 medical school classes from ECU, UNC, Wake Forest and Duke. This cohort design allowed us to determine the number and percent of graduates of NC medical schools from those four years who were in practice *in NC five years after their graduation*. This analysis includes the number and proportion in rural counties and in primary care (family medicine, general internal medicine, general pediatrics and general OBGYN).

Data and Analysis

For the **cross-sectional analyses**, we used 2016 licensure data received from the NC Medical Board and housed by the NC Health Professions Data System (HPDS) at the Cecil G. Sheps Center for Health Services Research. The data include active, licensed physicians with a primary practice address in NC who are not in residency training and are not employed by the federal government as of October 31, 2016. Physician specialty is derived from their self-reported “primary area of practice,” the branch of medicine in which the physician predominantly works each day. The primary area of practice may be the same as their specialty (e.g. internal medicine, neurological surgery, or dermatology) but may also correspond to an area of work (e.g. hospitalist, urgent care, or student health). For the purposes of this analysis, we use the terms “primary area of practice” and “specialty” interchangeably.

Physician practice locations were coded to rural/urban status. A physician was defined as working in a rural area if his/her primary practice location was in either a) a non-metropolitan county according to the 2015 Federal Office of Management and Budget (OMB) classification, or b) a metropolitan county in an area with a Rural Urban Commuting Area (RUCA) code¹ of 4 or greater. Physicians with an active practice location in North Carolina were also assigned a “Tier designation.” The North Carolina Department of Commerce annually ranks the state’s 100 counties based on economic well-being. The 40 most distressed counties are assigned as Tier 1 counties, the next 40 as Tier 2, and the 20 least distressed as Tier 3 counties.

In addition to US medical schools, the Liaison Committee on Medical Education (LCME) accredits medical schools in Puerto Rico and Canada, and all programs are held to the same accreditation standards. In this analysis, physicians trained in Puerto Rico (0.34%, n=85) and Canada (0.61%, n=145) are included with counts of US-trained physicians (USMGs).

The analysis of the percent of graduates from the classes of 1990-2015 in active practice in the 2016 NC workforce used data on graduating class sizes for each year, which were obtained from the registrar’s offices at each medical school.

¹ Rural Urban Commuting Area codes and are a widely used method for assigning rural or urban status to a county, ZIP code or cluster of census tracts.



The **cohort analysis** relies on data from three different sources. Association of American Medical Colleges (AAMC) data are used to identify the names of graduates from NC medical schools and their residency program locations and specialties. These data are then matched to the AMA physician Masterfile to identify their practice location and specialty five years after graduating from medical school. We merged this file to the NC Medical Board licensure data to determine which physicians were in active practice in North Carolina. We summarized the results of the graduates from the classes of 2008, 2009, 2010 and 2011 and their practice outcomes five years after graduation in 2013, 2014, 2015 and 2016, respectively. We show the number who were in practice *in NC*, the number in practice in NC *in primary care*, and the number in practice in NC in primary care *in a rural area*. Unlike the cross-sectional analyses, the data for the cohort analysis include both physicians who are in active practice as well as physicians still in residency training. The definition of rural/urban is also slightly different, as “rural” is limited to non-metropolitan counties according to the Federal Office of Management and Budget. This slight change in methods is used to keep results of these analyses consistent across previous years.

Timeline for assessing workforce outcomes in the cohort study

Some observers have questioned whether a five-year timeline for tracking medical students is long enough to adequately measure outcomes. As more physicians pursue specialties that require longer training programs and take time out of training to do research or for personal reasons, ten years may be a more appropriate timeline for assessing workforce outcomes.

Findings: Cross-Sectional Analysis

645 students enroll in medical schools in North Carolina annually.

Table 1 shows the incoming class sizes for each of NC’s medical schools. UNC has the largest incoming class size (180 students, with plans to expand to 230) and trains medical students at multiple campuses across the state. ECU has the smallest class size with 80 students, with plans to expand to 120. Campbell University, which opened its doors to students in 2013, has the second largest incoming class size in the state, with 150 students. The differences in class sizes are important to keep in mind to assess the relative contributions of each institution to the physician workforce in North Carolina.

Table 1: Medical School First-Year Class Sizes, North Carolina, 2017

Medical School	Location	Incoming Class Size
Campbell University Jerry M. Wallace School of Osteopathic Medicine	Buies Creek, Harnett County	150
Duke University School of Medicine	Durham, Durham County	115
East Carolina University Brody School of Medicine	Greenville, Pitt County	80
University of North Carolina-Chapel Hill School of Medicine	Chapel Hill, Orange County Asheville Campus, Buncombe County Charlotte Campus, Mecklenburg County Wilmington Campus, New Hanover County	180
Wake Forest University School of Medicine	Winston-Salem, Forsyth County	120
Total First Year Medical Students in NC		645



Roughly a quarter of NC physicians completed medical school in-state

In 2016, slightly less than one quarter of physicians practicing the North Carolina graduated from a NC medical school (23.4%, n=5,592) (**Table 2**). The majority (60.5%, n=14,441) of NC physicians attended medical school in a US state other than North Carolina. The remaining 15% (n=3,609) of NC's physician workforce are International Medical Graduates (IMGs) who completed medical school outside the United States. IMGs must complete residency training in the US to obtain a US medical license.

Table 2: Active, Licensed North Carolina Physicians by Medical School Location, 2016

	Number	Percent
North Carolina (NCMGs)	5,592	23.4%
<i>Duke University School of Medicine</i>	795	3.3%
<i>East Carolina University Brody School of Medicine</i>	1,073	4.5%
<i>University of North Carolina at Chapel Hill School of Medicine</i>	2,383	10.0%
<i>Wake Forest University School of Medicine</i>	1,341	5.6%
Other US States, Canada, Puerto Rico (USMGs)	14,668	61.5%
Foreign Countries (IMGs)	3,609	15.1%
Total	23,869	100.0%

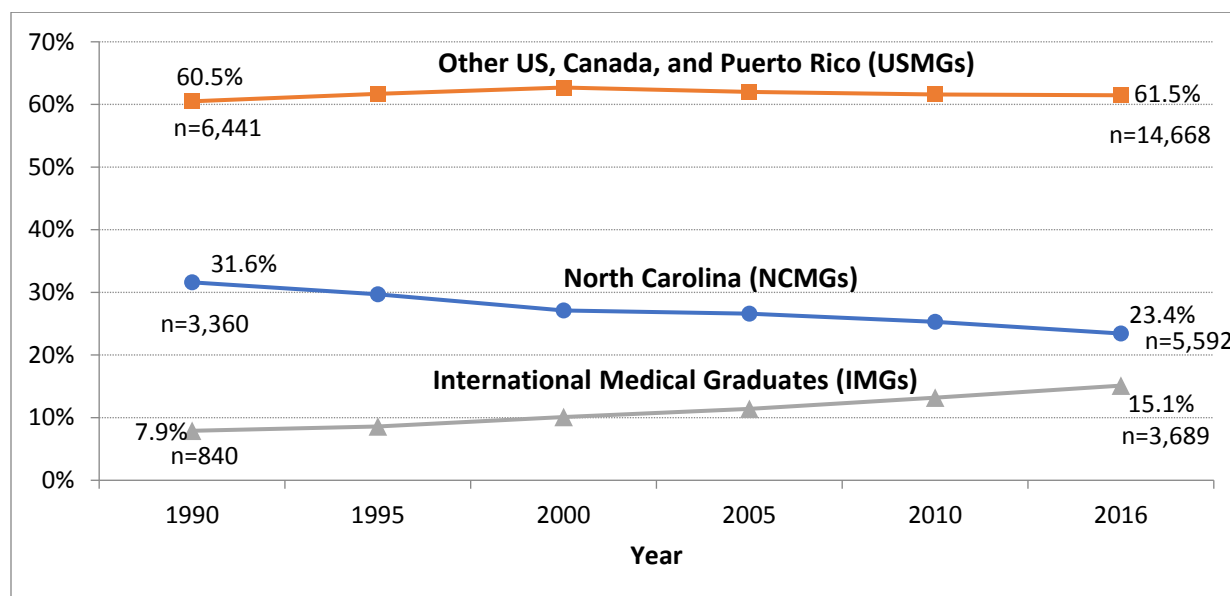
[Data are derived from the North Carolina Board of Medicine and include active, licensed physicians in practice in North Carolina as of October 31, 2016 who are not residents-in-training and are not employed by the Federal government. Source: North Carolina Health Professions Data System, Program on Health Workforce Research and Policy, Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill.]

The proportion of the NC workforce comprised of physicians who completed medical school in-state has declined over time, while the proportion of IMGs has nearly doubled.

The proportion of physicians in the NC workforce who completed medical school in other US states, Canada, or Puerto Rico has remained stable over the past 26 years, while physicians who graduated from a NC medical school has declined from roughly one-third to about one-quarter of NC's physician workforce (**Figure 1**). The proportion of International Medical Graduates in NC's workforce nearly doubled during that period, from 8% of the workforce in 1990 to 15% in 2016. Between 1990 and 2016, IMGs grew by 339%, far outpacing the growth of USMGs (126%) and NCMGs (66%). For context, NC's population grew 53.1% during that period.^{1,2}

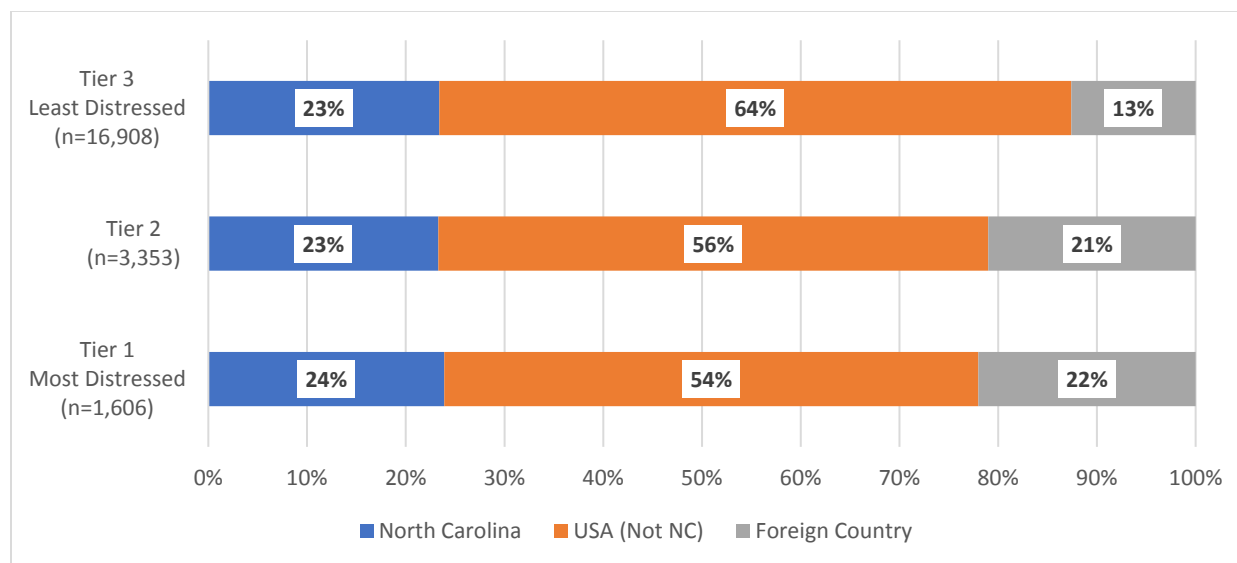
NC medical school graduates are relatively evenly proportioned at roughly 23% of the workforce across all three economic tiers (**Figure 2**). USMGs are the bulk of the NC physician workforce, and are numerically and proportionally most represented in every tier. While the proportion of USMGs is greatest (64%, n= 10,818) in the least economically distressed Tier 3 counties, USMGs make up a comparatively smaller percentage of the workforce in Tier 2 (56%, n=2,981) and Tier 1 (54%, n=869) counties. IMGs fill in the gaps in those counties. More than one in five physicians in Tier 1 and Tier 2 counties went to medical school outside of the United States. In Tier 1 counties, the least economically distressed, IMGs are just 13% (n=2,128) of the workforce.

Figure 1: Active Licensed NC Physicians by Medical School Location, 1990-2016



[Data are derived from the North Carolina Board of Medicine and include active, licensed physicians in practice in North Carolina as of October 31 of each year who are not residents-in-training and are not employed by the Federal government. Source: North Carolina Health Professions Data System, Program on Health Workforce Research and Policy, Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill.]

Figure 2: NC Physician Workforce by NC Economic Tier of Practice County and Medical School Location, 2016

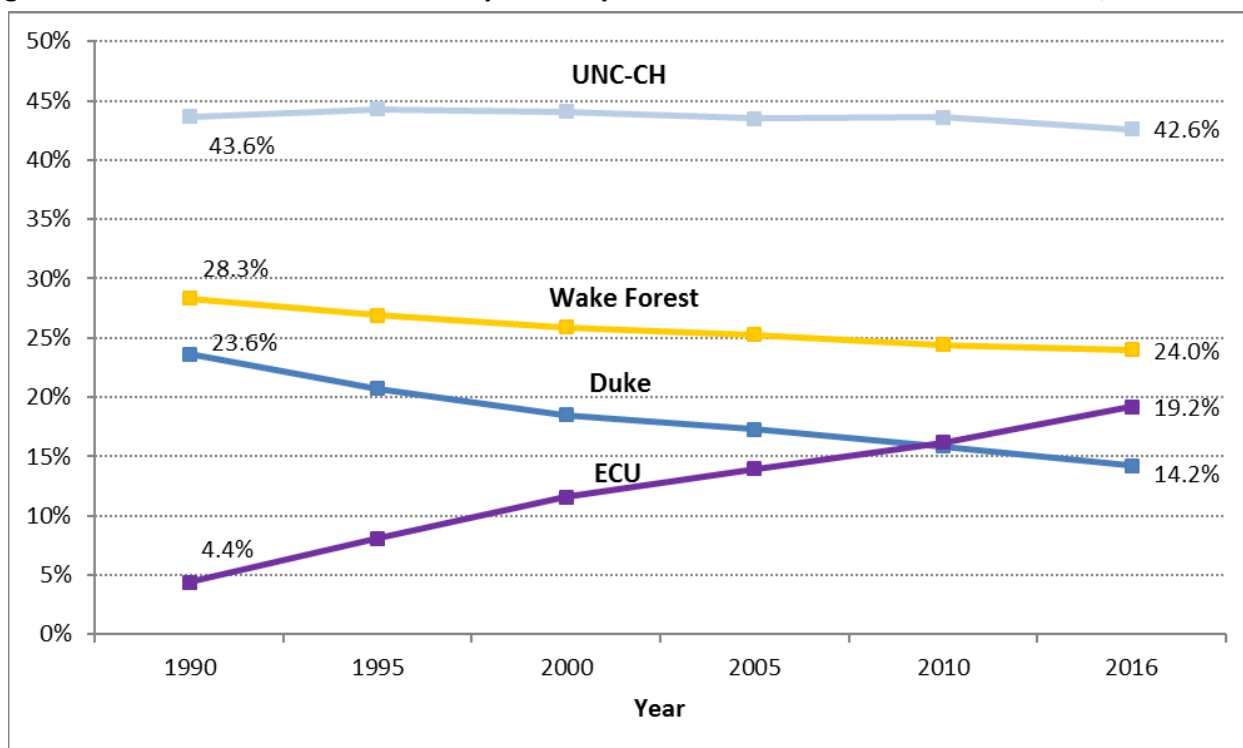


[Data are derived from the North Carolina Board of Medicine and include active, licensed physicians in practice in North Carolina as of October 31, 2016 who are not residents-in-training and are not employed by the Federal government. Data on 2016 NC economic tiers obtained from NC Department of Commerce. Source: North Carolina Health Professions Data System, Program on Health Workforce Research and Policy, Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill.]

UNC has consistently contributed largest percent of NC-educated physicians to workforce

In 2016, 5,592 physicians in the NC workforce had attended one of NC's four medical schools. (Campbell's inaugural class graduated in 2017.) Of those who graduated from an NC medical school, the proportion of those graduating from UNC has remained stable at roughly 43% since 1990 (**Figure 3**). The proportion of graduates at the state's two private schools, Wake Forest and Duke, has declined over time, while the proportion trained at ECU School of Medicine has increased from 4.4% to 19.2%. These data point to the trend of graduates of NC's public medical schools more often practicing in state relative to graduates of private medical schools. This trend is particularly stark when comparing graduates from ECU and Duke.

Figure 3: Active Licensed NC Educated Physicians by North Carolina Medical School Location, 1990-2016



[Data are derived from the North Carolina Board of Medicine and include active, licensed physicians in practice in North Carolina as of October 31 of each year who graduated from an NC medical school, are not residents-in-training, and are not employed by the Federal government. Source: North Carolina Health Professions Data System, Program on Health Workforce Research and Policy, Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill.]

Consistent with its mission, a higher proportion of ECU's graduates practice in-state compared to other NC medical schools

Nearly half (48%, n=875 of 1,825) of the physicians who graduated from ECU between 1990-2015 were in active practice in NC in 2016, compared to about one-third (35%, n=1,423 of 4,109) of UNC graduates, 28% (n=790) of Wake Forest graduates, and 16% (n=401) of Duke graduates (**Figure 4**). These data provide a cross-sectional snapshot of physicians in active practice in 2016. The data include physicians who graduated over a 25-year period. Because all these graduating classes are pooled, we do not know how retention varies by graduating cohort; earlier or later medical school cohorts may be more or less likely to be retained in practice in North Carolina.

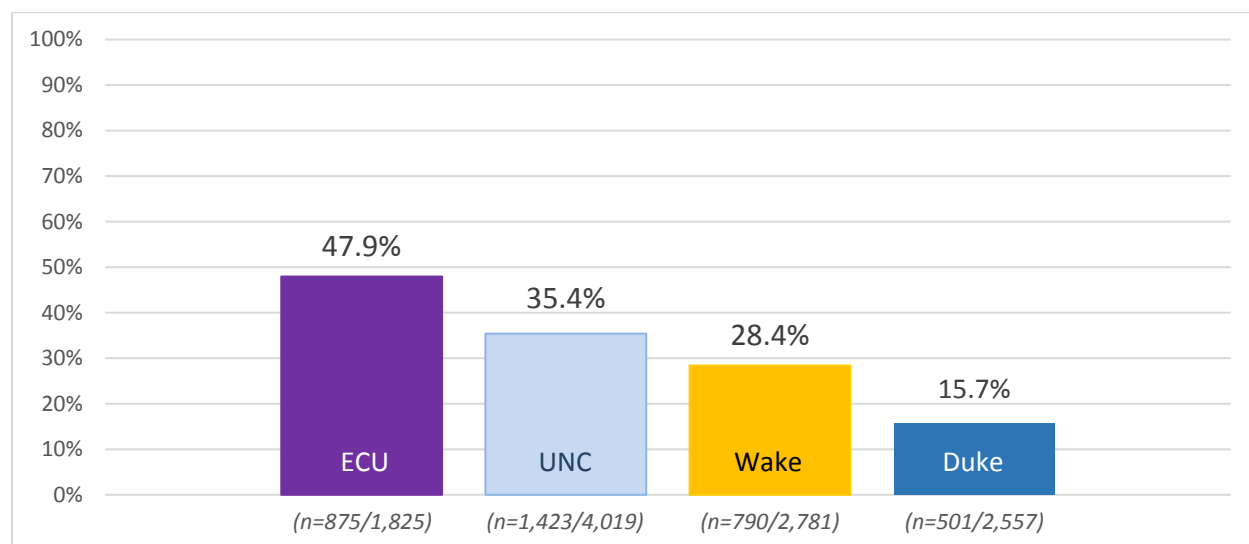


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The overall trends in retention of medical school graduates in North Carolina are consistent with each school's stated mission. ECU has been the most successful of the four schools in retaining its graduates in North Carolina. ECU's legislatively mandated mission is to increase the supply of primary care physicians to serve NC and only North Carolina applicants are considered for admission.^{3,4} Part of the UNC mission is to improve the health and wellbeing of North Carolinians, but its mission is broader and includes a focus on research as well as attention to national and international health issues. As Table 1 and Figure 2 show, UNC graduates still make up a significantly higher proportion of the NC physician workforce compared to other medical schools because UNC produces more graduates annually than other programs.⁵ In 2016, 1,423 UNC graduates were in practice in NC, which is 1.6 times greater than the number of ECU graduates (n=875), 1.8 times greater than the number of Wake Forest graduates (n=790), and 3.5 times greater than the number of Duke graduates (n=401). Wake Forest's mission statement is linked to Wake Forest Baptist Medical Center, and includes language about "serving as the premier health system in our region."⁶ This regional focus is in line with Wake Forest's relatively higher retention of graduates in state compared to Duke, the other private institution. Duke Health's vision statement says Duke will "build healthy communities" and "connect with the world to improve health globally," but neither the vision statement nor the school of medicine's values statement make specific mention of North Carolina.⁷ Duke is more outwardly focused than the public medical schools, and retains the fewest graduates in state.

Figure 4: Percent of Graduates from the Classes of 1990-2015 in Active Practice in 2016 NC Workforce



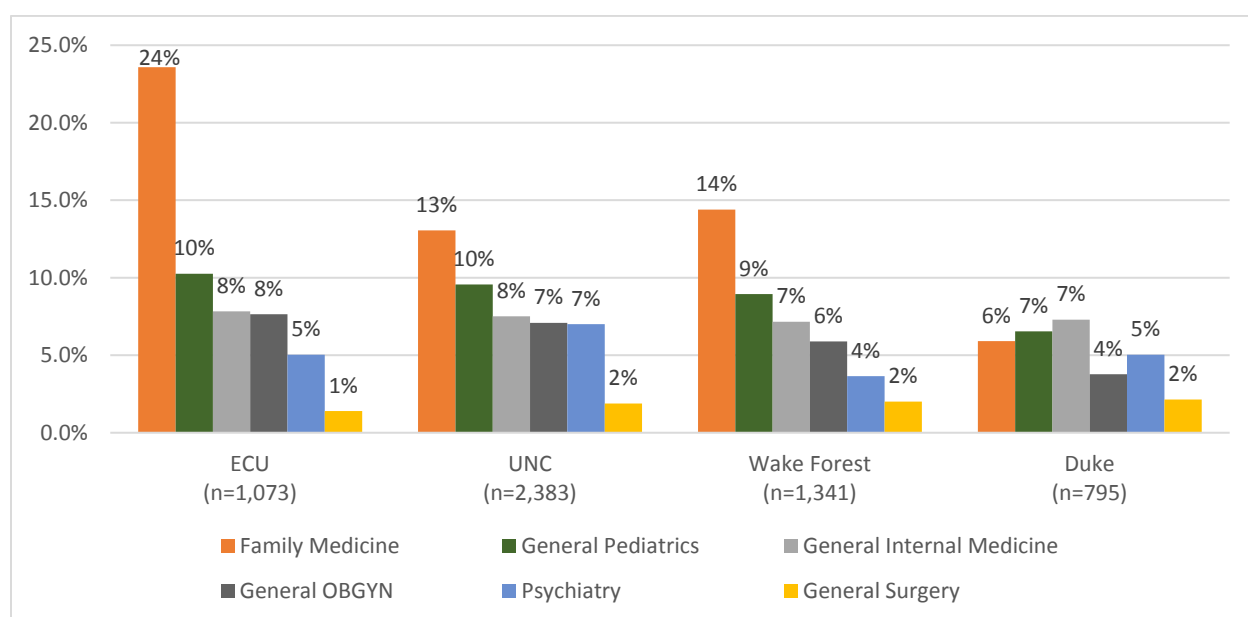
[Data are derived from the North Carolina Board of Medicine and include active, licensed physicians in practice in North Carolina as of October 31, 2016 who graduated from an NC medical school between 1990 and 2015, are not residents-in-training, and are not employed by the Federal government. Data on number of graduates from 1990-2015 obtained from the registrar's office of each medical school. Source: North Carolina Health Professions Data System, Program on Health Workforce Research and Policy, Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill.]



Consistent with its mission, ECU produces proportionally more primary care physicians who practice in NC than other NC medical schools do

Figure 5 shows that of the four NC medical schools, ECU produces proportionally more primary care physicians who practice in NC. Nearly one-quarter of ECU graduates practicing in NC are in family medicine. The specialty distribution of UNC and Wake Forest medical school graduates is similar, except that a higher percentage (7%) of UNC graduates in the NC workforce are psychiatrists. Of the 310 psychiatrists in the state who graduated from an NC medical school, 54% (n=167) are UNC graduates. Of the 104 general surgeons who graduated from an NC medical school, 43% (n=45) are UNC graduates. As expected from its mission, Duke produces proportionately fewer primary care physicians compared to the state's other medical schools.

Figure 5: Specialty of Active Physicians in North Carolina Workforce in 2016 by Medical School



[Data are derived from the North Carolina Board of Medicine and include active, licensed physicians in practice in North Carolina as of October 31, 2016 who graduated from an NC medical school, are not residents-in-training, and are not employed by the Federal government. Source: North Carolina Health Professions Data System, Program on Health Workforce Research and Policy, Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill.]

Together, NC medical school graduates comprise about one-third of the workforce in key primary care and high need specialties

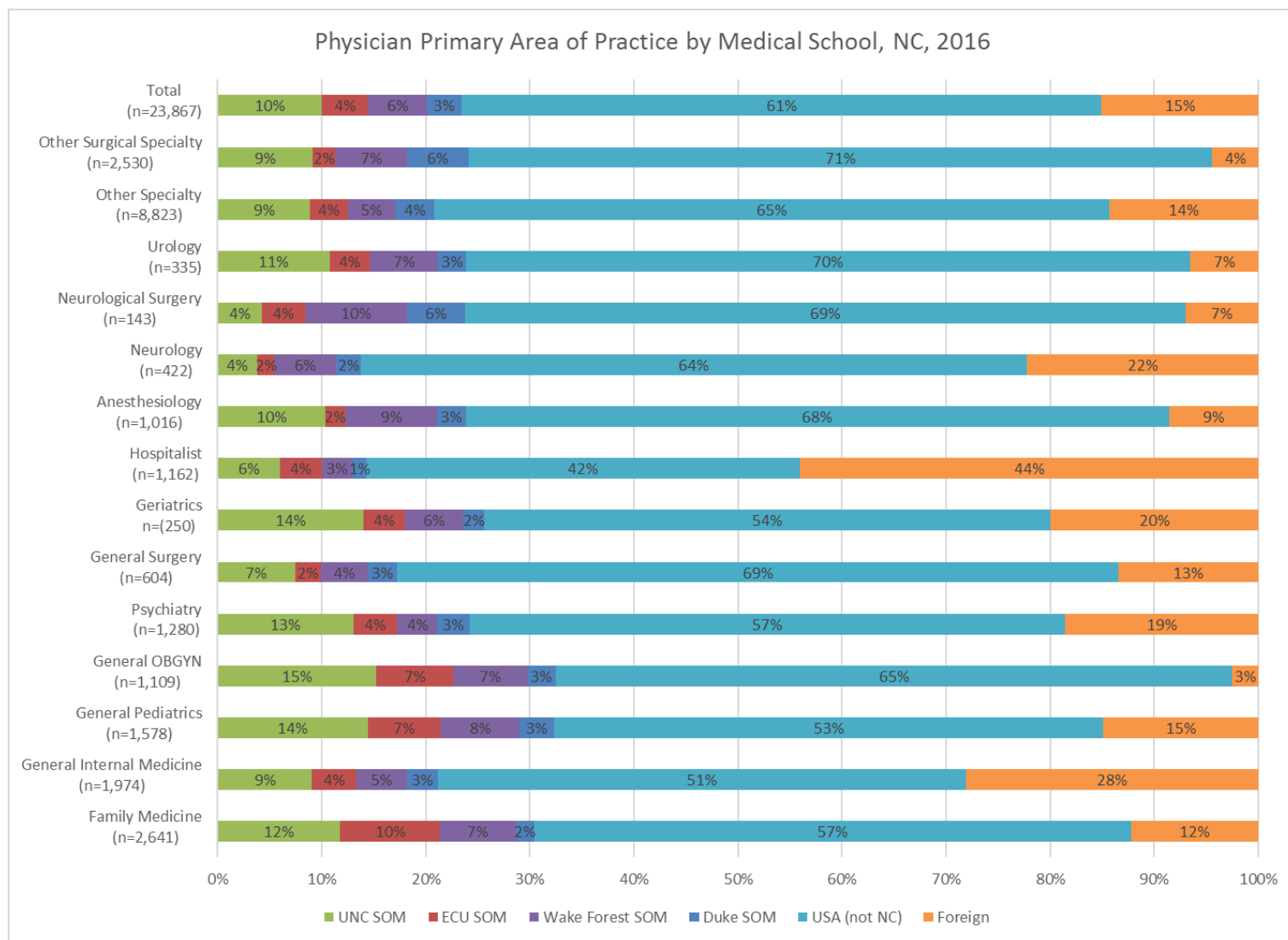
The contribution of medical schools to different physician specialties varies. Half (49%, n=529) of ECU grads practicing in NC are in a primary care specialty (family medicine, general internal medicine, general pediatrics, or OBGYN), a quarter of whom practice in family medicine (24%, n=253). Roughly a third of UNC and Wake Forest graduates in NC practice in primary care (37%, n=887 and 36%, n=488, respectively), while just a quarter of Duke graduates in NC practice in primary care (24%, n=187).

Although most physicians across all specialties were trained at medical schools outside the state (**Figure 6**, consistent with **Figure 1**), NC medical school graduates comprise close to one-third of the workforce in key primary care and high need specialties, including 30% of family medicine physicians (n=804/2,641), 32% of general pediatricians (n=510/1,578), and 28% of pediatric psychiatrists (n=58/204).



IMGs are 15% of NC's workforce, but are not distributed evenly across specialties. Some specialties rely heavily on IMGs; others have few IMGs. For example, 44% of hospitalists (n=512/1,162) and 28% of general internists (n=554/1,974) are IMGs. IMGs make up only 9% of anesthesiologists, 7% of urologists and neurologic surgeons, and 4% of other surgical specialists.

Figure 6: Medical School of Active Physicians in North Carolina Workforce in 2016, by Specialty



[Data are derived from the North Carolina Board of Medicine and include active, licensed physicians in practice in North Carolina as of October 31, 2016 who graduated from an NC medical school, are not residents-in-training, and are not employed by the Federal government. Source: North Carolina Health Professions Data System, Program on Health Workforce Research and Policy, Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill.]

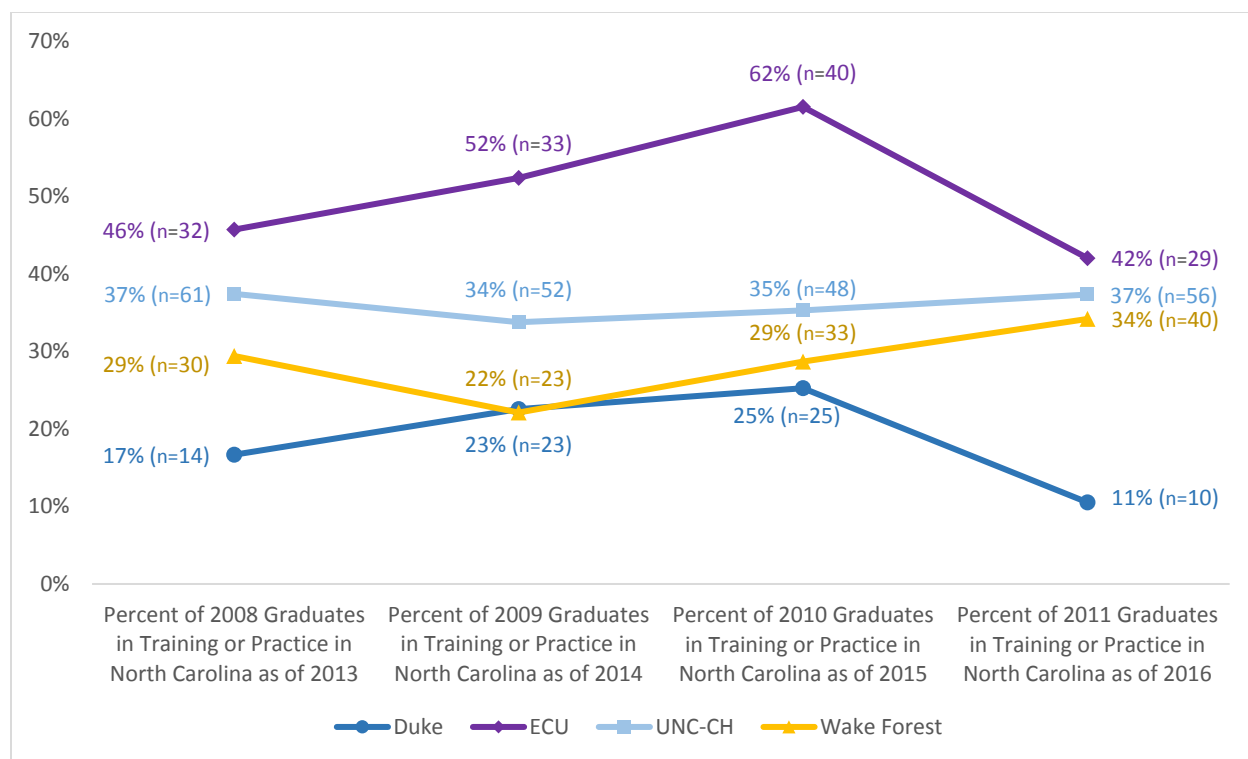


Findings: Cohort Analysis

In this section, we change perspective from examining the contributions of ECU, UNC, Wake Forest and Duke to the existing physician workforce in NC in 2016 to the workforce outcomes of individual cohorts of graduates from these schools in 2008, 2009, 2010, and 2011.

Figure 7 shows the variability year-to-year in the percent of medical school graduates from each medical school that are in practice in the state five years after graduation. Across these four cohorts, public medical schools had higher retention rates than private medical schools. ECU has consistently had a greater percentage of graduates in practice in NC five years post-graduation than the other NC medical schools.

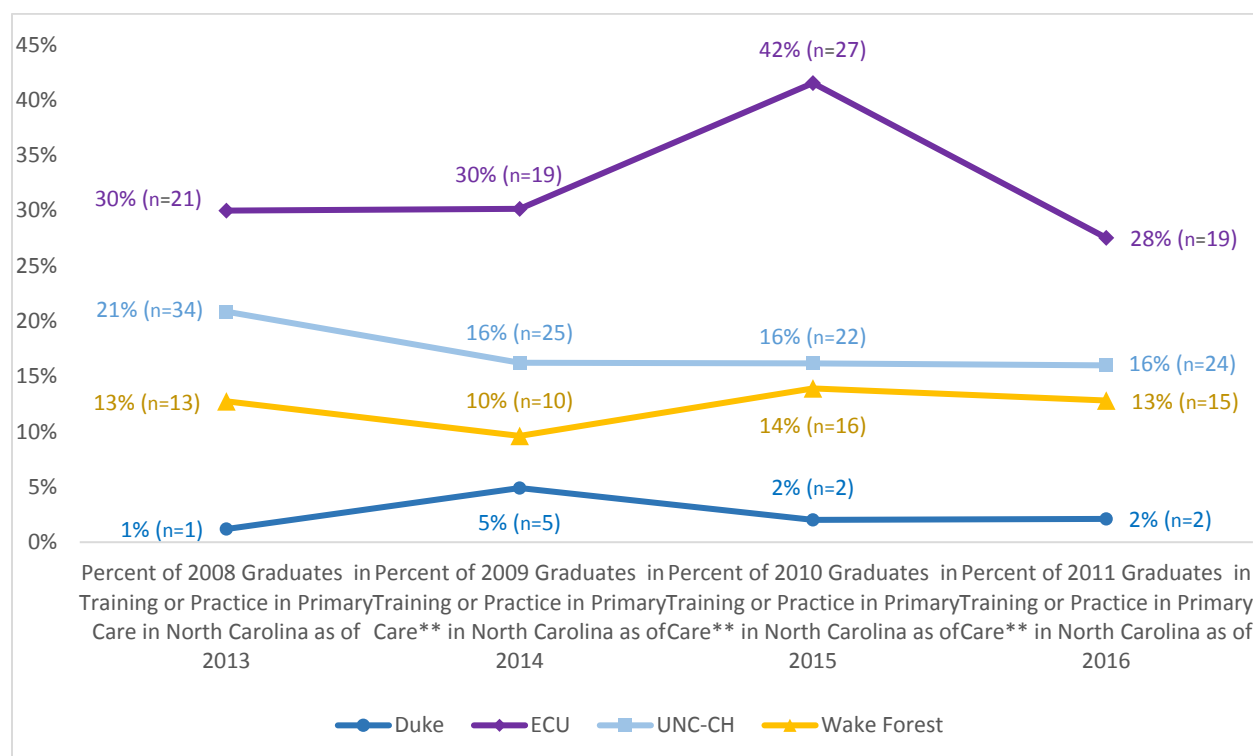
Figure 7: Percent of NC Medical School Graduates Retained In North Carolina Five Years after Graduating



[Data are derived from the AAMC include graduates of the classes of 2008, 2009, 2010, or 2011 from NC medical schools in NC and are matched to data derived from the North Carolina Board of Medicine. NCMB data include active, licensed physicians in practice in North Carolina as of October 31 in 2013, 2014, 2015, or 2016, respectively who graduated from an NC medical school, are not residents-in-training, and are not employed by the Federal government. Source: North Carolina Health Professions Data System, Program on Health Workforce Research and Policy, Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill.]

Figure 8 shows the percent of medical school graduates from each medical school in 2008, 2009, 2010, and 2011 that were retained in North Carolina *in primary care* five years after graduation (in 2013, 2014, 2015 and 2016 respectively). Consistent with other data in this report, ECU retained more graduates in primary care in NC than other schools, followed by UNC.

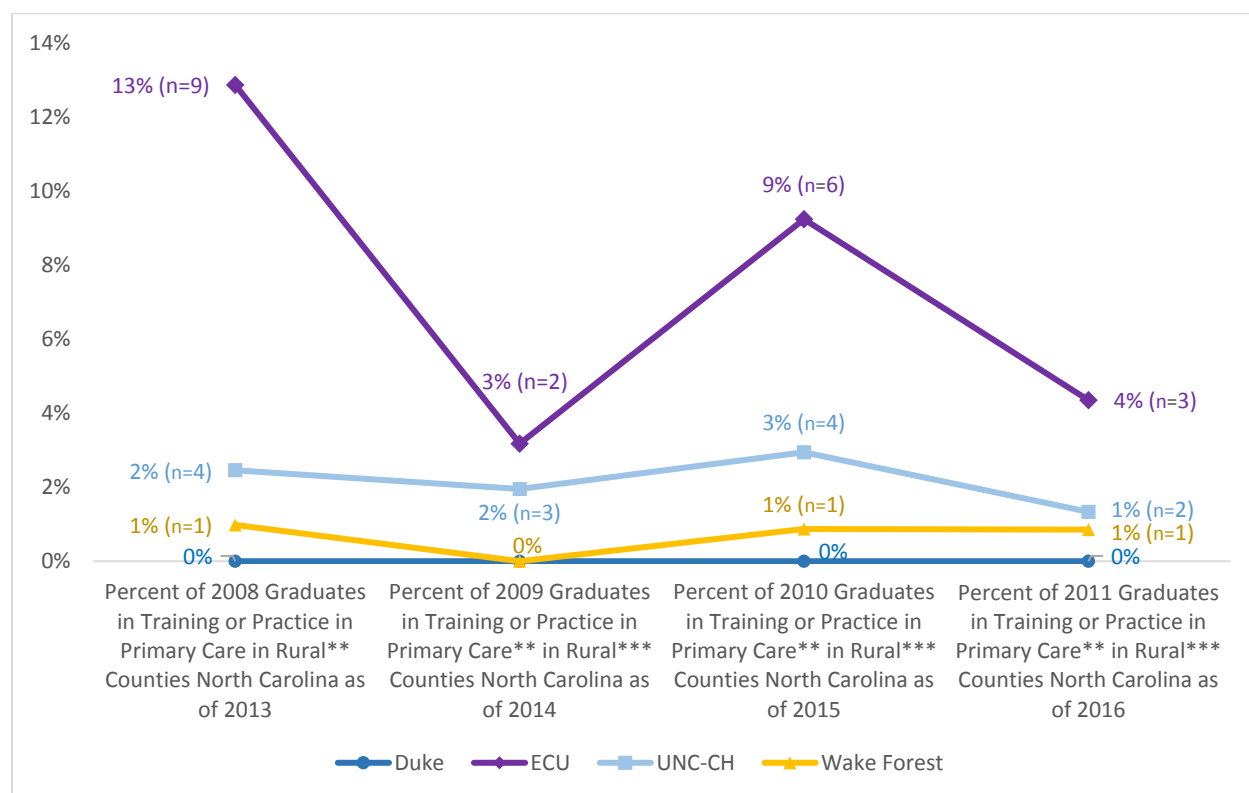
Figure 8: Percent of NC Medical School Graduates Retained In North Carolina in Primary Care Five Years after Graduating



[Notes: Primary care includes family medicine, general internal medicine, general pediatrics, and obstetrics & gynecology. Data are derived from the AAMC include graduates of the classes of 2008, 2009, 2010, or 2011 from NC medical schools in NC and are matched to data derived from the North Carolina Board of Medicine. NCMB data include active, licensed physicians in practice in North Carolina as of October 31 in 2013, 2014, 2015, or 2016, respectively who graduated from an NC medical school, are not residents-in-training, and are not employed by the Federal government. Source: North Carolina Health Professions Data System, Program on Health Workforce Research and Policy, Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill.]

Figure 9 shows the percent of medical school graduates from each medical school 2008, 2009, 2010, and 2011 that are retained in North Carolina *in primary care in rural counties* five years after graduation. The striking finding from Figure 8 is that the percent of medical students who end up practicing primary care in rural counties in North Carolina is small, ranging from a high of 4% of ECU graduates to none of the Duke graduates for the 2011 cohort. Despite year-to-year variability in the data, at five years post-graduation, ECU had more graduates practice in primary care in rural areas than other programs. UNC has remained around 2%, Wake Forest at 1%, and Duke has not had any graduates in rural primary care from the 2008, 2009, 2010, and 2011 cohorts.

Figure 9: Percent of NC Medical School Graduates Retained In North Carolina in Primary Care in a Rural County Five Years after Graduating



[Notes: Primary care includes family medicine, general internal medicine, general pediatrics, and obstetrics & gynecology. "Rural" is defined based on Federal Office of Management and Budget Core-Based Statistical Area (CBSA) definitions, and includes counties that are either micropolitan or outside of CBSAs. Data are derived from the AAMC include graduates of the classes of 2008, 2009, 2010, or 2011 from NC medical schools in NC and are matched to data derived from the North Carolina Board of Medicine. NCMB data include active, licensed physicians in practice in North Carolina as of October 31 in 2013, 2014, 2015, or 2016, respectively who graduated from an NC medical school, are not residents-in-training, and are not employed by the Federal government. Source: North Carolina Health Professions Data System, Program on Health Workforce Research and Policy, Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill.]

Conclusion

A declining proportion of the NC physician workforce is made up of physicians who graduated from a NC medical school. The percentage of the workforce that trained in countries other than the US, Canada, or Puerto Rico nearly doubled from 8% to 15% of the workforce between 1990 and 2016. UNC graduates make up the largest proportion of NC-educated physicians, representing 43% of NC medical school graduates in the state's workforce. The number of ECU graduates has grown rapidly in the NC physician workforce. In 1990, ECU graduates represented 4.4% of all NC medical school graduates in the state's workforce, and that percent increased to 19.2% in 2016. Consistent with its mission, ECU graduates are more likely than other NC medical school graduates to remain in-state, work in primary care and in rural communities.

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