

Medical Students Entering Primary Care: Tracking Workforce Outcomes to Determine Return on Investment

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EXECUTIVE SUMMARY

In 1993, the General Assembly mandated an annual report on the progress of medical school graduates going into primary care. North Carolina AHEC and the Sheps Center produce this report each year using state licensure databases as well as national databases.

North Carolina is a national model for tracking annual workforce outcomes of its medical school graduates. Increasingly, the North Carolina General Assembly has been interested in knowing the workforce outcomes of medical schools and residency programs to better evaluate return on investment of state funds.

The data show:

- Of the 436 NC medical school graduates from the class of 2012, 73 (17%) were in practice in primary care in NC in 2017, with just 4 (1%) in a rural NC county.
- Five-year outcome data have been consistent for the cohorts from 2008-2012, with ECU retaining the most graduates in practice in NC, followed by UNC, Wake Forest, and Duke.
- For the class of 2012, a greater percentage of public medical school graduates were practicing in primary care in-state five years after graduating (ECU: 38%, n=28; UNC: 20%, n=32), compared to private medical school graduates (Wake Forest: 7%, n=8; Duke: 6%, n=5).
- Just 1% (n=4/436) of graduates from the 2012 cohort were in practice in primary care in a rural NC county, two from each of the public medical schools. This percent is similar to those from prior graduating classes. All four were practicing in Family Medicine.
- In contrast to prior years, across all schools, graduates who matched to Internal Medicine-Pediatrics were retained in state in the highest percentage (n=7 of 8, 88%). The greatest numeric retention, as in prior years, was for physicians practicing Family Medicine (n=30 of 49, 61%).

With a new school of medicine (Campbell) now graduating students annually, increased attention to GME expansion in rural areas, and the implementation of the Medicaid 1115 waiver, it will be important to continue collecting and tracking data on NC medical education outcomes so that the state can monitor trends and identify best practices.

Introduction

In 1993, the North Carolina General Assembly expressed interest in expanding the pool of generalist physicians for the state. In N.C.S.L.1993-321, the General Assembly required each of the state's four medical schools to develop a plan to expand the percent of medical school graduates choosing residency positions in primary care. Primary care was defined as family practice, general internal medicine, general pediatric medicine, internal medicine-pediatrics and obstetrics-gynecology. It set the goal for the East Carolina University (ECU) and UNC Schools of Medicine at 60% of graduates entering primary care. For the Wake Forest University and Duke University Schools of Medicine, it set the goal at 50%. Campbell University School of Osteopathic Medicine graduated its first class in 2017 and was therefore not included. Since 1994, the Cecil G. Sheps Center for Health Services Research at the University of North Carolina at Chapel Hill ("Sheps Center") and the NC Area Health Education Centers program (AHEC) have collaborated to produce this report.

ECU has met the NCGA's goal five times since the inception of the report, most recently for the class of 2005 (when 59% of that year's graduates reported practicing in primary care specialties in 2010). Since then, no medical school has reached the legislated benchmark. Given the national trend of increasing physician specialization, it is unrealistic to expect that the schools will meet the goals set in 1993. Furthermore, the legislation required medical school graduates to enter primary care but made no mention of practice in North Carolina or in underserved areas.

The legislation had important consequences in that it ensured workforce outcomes for NC medical schools were tracked each year. North Carolina became a national model in this regard. John Iglehart, National Correspondent for the New England Journal of Medicine, featured data from NC's annual medical student tracking report as an example of how to track these outcomes in his 2018 article on "The challenging quest to improve rural health care."¹

Increasingly, the NC General Assembly has expressed interest in the outcomes of NC medical schools and graduate medical education (GME) programs, also known as residencies. The state invests public dollars in both education settings and increasingly seeks information on the return on investment (ROI) of those funds. Data from prior cohorts of the medical student tracking report were highlighted in a report to the Joint Legislative Oversight Committee on Health and Human Services and the Joint Legislative Education Oversight Committee.² That report, and a report on the workforce outcomes of GME in NC,³ were mandated by N.C.S.L. 2017-57, the Appropriations Act of 2017.

¹ Iglehart J. The challenging quest to improve rural health care. NEJM, 2018. 378(5):473-479.

<https://www.nejm.org/doi/full/10.1056/NEJMp1707176>

² Spero JC, Fraher EP. 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. Program on Health Workforce Research and Policy, Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill. January 2018. <http://www.shepscenter.unc.edu/product/evaluating-workforce-outcomes-north-carolinas-medical-education-programs/>

³ Fraher EP, Spero JC, Galloway E, Terry J. The Workforce Outcomes of Physicians Completing Residency Programs in North Carolina. Program on Health Workforce Research and Policy, Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill. January 2018. <http://www.shepscenter.unc.edu/product/evaluating-workforce-outcomes-north-carolinas-medical-education-programs/>

Because residency placement is correlated with eventual practice location, interest in tracking NC residency outcomes has grown given, especially given financial support to GME programs via Medicaid and AHEC. AHEC and its partner hospitals have begun to measure the outcomes of residency programs supported by AHEC. In the 2018 legislative session, a Medical Education and Residency Study bill (H1002/S773) was introduced. That bill did not pass but would have required further tracking of medical school and GME outcomes for the purposes of better informing the legislature on what the outcomes are so state funds can be most effectively targeted. The Sheps Center, in collaboration with AHEC, is a national leader in tracking the workforce outcomes for medical schools and GME programs at the program level. Thus, there are resources within the state that can accomplish this work if a similar bill is passed in future sessions.

The Data

Data included in this report come from several sources: A) the North Carolina Medical Board's annual licensure file, maintained by the NC Health Professions Data System, B) the graduate medical education tracking file of Association of American Medical Colleges (AAMC), C) the physician Masterfile of the American Medical Association (AMA), and D) data from the alumni and student affairs offices from Duke University School of Medicine, the Brody School of Medicine at East Carolina University, the University of North Carolina at Chapel Hill School of Medicine, and Wake Forest University School of Medicine, and E) the Federal Office of Management and Budget (for population and core based statistical area data). The format for the information on medical students is consistent with and comparable to the baseline information provided in the May 1994 report "Expanding the Pool of Generalist Physicians for North Carolina."

Campbell University School of Osteopathic Medicine (Campbell) is not mandated to provide data for this report, as the school did not exist when the 1993 legislation was passed. Campbell's first class graduated in 2017. In prior years this report has not emphasized initial residency match data, as some physicians change residency specialties or locations over the course of their GME training. Outcomes are better measured after graduation from residency. However, given that workforce outcomes five years following graduation will only be available for Campbell starting in 2022, we began reporting initial match data in the 2017 report.

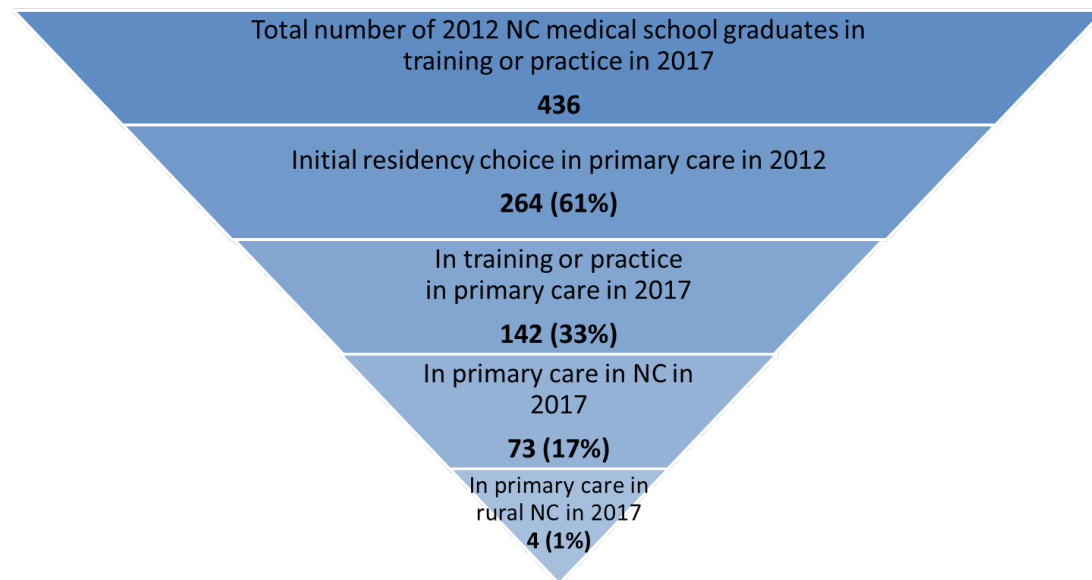
While we have historically examined NC medical school graduates at five years following graduation per legislative requirements, physicians in psychiatry, obstetrics & gynecology (ob/gyn), surgery, medicine/pediatrics are just completing residency or fellowship/specialty training at this point in their career trajectory and may not have settled in a permanent practice location. This is the case for general surgeons, whose standard training period is 5 years, and for ob/gyns, psychiatrists and medicine/pediatrics residents who often do a fellowship after a four-year residency. Ten years following graduation from medical school would be a more appropriate time-frame to allow for fellowship training following residency. The Sheps Center has tracked ten-year outcomes in the past. However, the ten-year analysis has not been routinely conducted due to a lack of resources and staff capacity.

Another issue over the past decade has been the dramatic increase of physicians choosing full time hospitalist practice, which decreases the proportion of primary care physicians in general internal medicine and, increasingly, other specialties. Hospitalists are included in primary care counts in the findings presented in this report because we do not have a way to systematically identify them in the dataset; this is likely a substantial issue for counts of internal medicine physicians.

Retention of Graduates in Primary Care: Class of 2012

The most valuable measure of the choice of primary care careers is retention of graduates in clinical primary care after residency. Table 1 (page 11) shows the graduates and the percentage that remained in primary care five years (in 2017) after graduation.

Figure 1: 2012 NC Medical School Graduates: Retention in Primary Care in NC's Rural Areas Five Years After Graduating

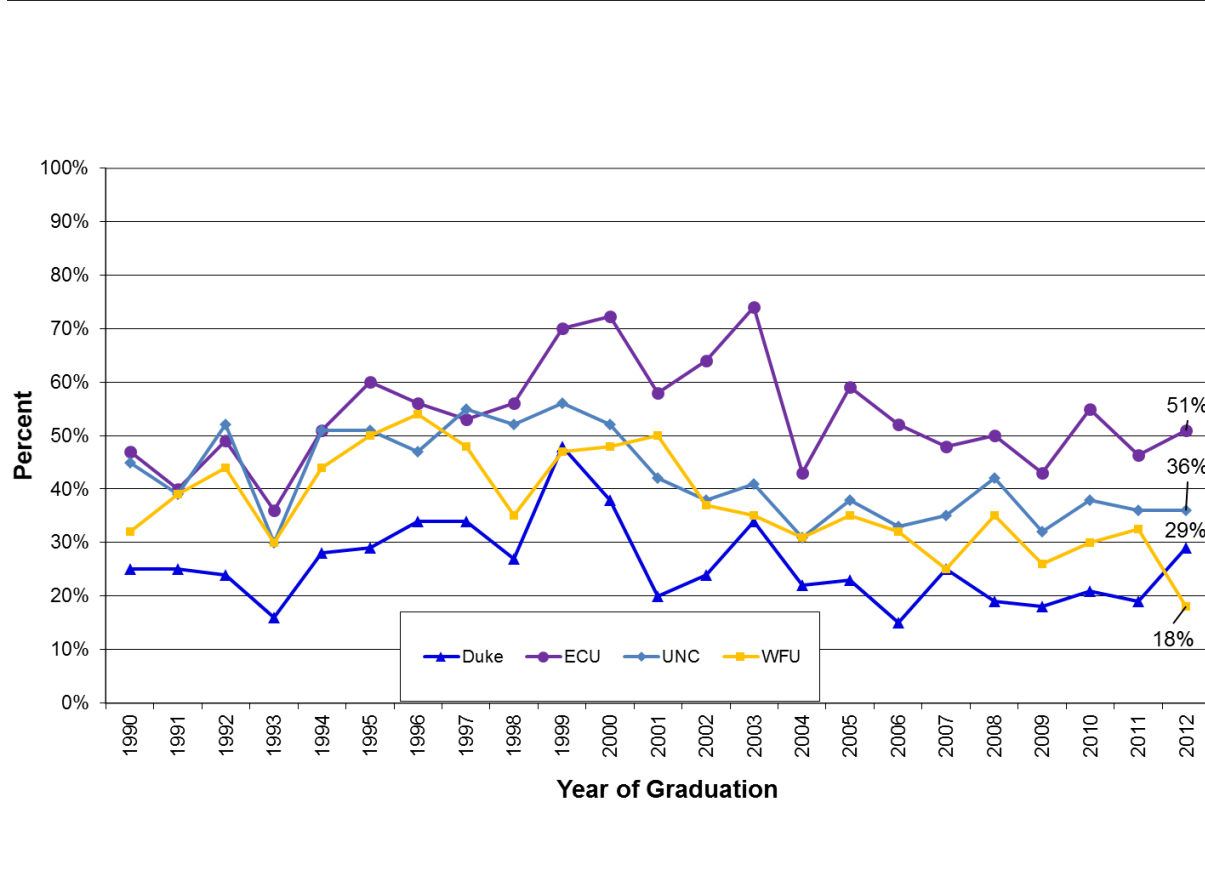


Produced by the Program on Health Workforce Research and Policy, Sheps Center for Health Services Research, University of North Carolina at Chapel Hill. Source: North Carolina Health Professions Data System with data derived from the Association of American Medical Colleges, and the NC Medical Board, 2017. Rural source: US Census Bureau and Office of Management and Budget, July 2017. "Core Based Statistical Area" (CBSA) is the OMB's collective term for Metropolitan and Micropolitan Statistical areas. Here, nonmetropolitan counties include micropolitan and counties outside of CBSAs.

Out of the 437 medical school graduates in 2012, 436 are still in training or practice as of 2017 (Figure 1). From this number, 142 (or 33%) remained in one of the five primary care specialties (per the 1993 legislation mandating this analysis, these specialties include family medicine, general internal medicine, general pediatrics, obstetrics & gynecology, and internal medicine-pediatrics). Seventy-three (17%) were in primary care in NC, with just four (1%) in primary care in a rural NC county. Two of those four were from ECU, with the other two from UNC.

Figure 2 shows the trend in the percentage of physicians who graduated from NC medical schools practicing in primary care five years after graduation from 1990 - 2012. This graph shows that graduates from each school tend to fall into a relatively stable range of percentages, with ECU tending to have the highest percentage of graduates practicing in primary care five years after graduation, followed by UNC, Wake Forest, and then Duke.

Figure 2: Percentage of North Carolina Medical Graduates (Classes 1990-2012) Practicing in Primary Care Five Years After Graduating

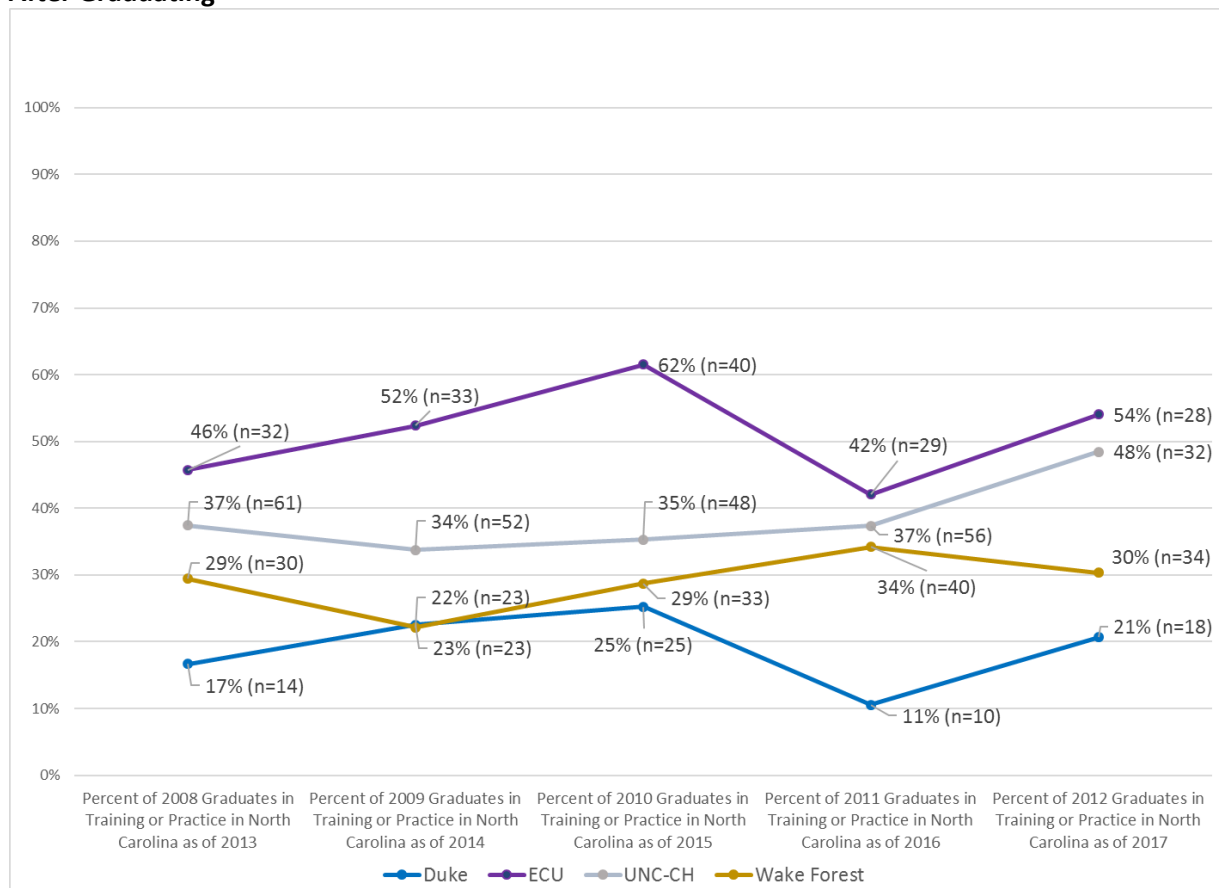


Note: Primary Care = Family Medicine, General Pediatric Medicine, General Internal Medicine, Internal Medicine/Pediatrics, and Obstetrics/Gynecology. The NC Medical Board changed the way specialty data are collected in 2010, which may affect primary care counts. Sources: NC Health Professions Data System and NC AHEC with data derived from Duke, UNC-CH, ECU, Wake Forest, NC Medical Board, and AAMC.

Retention of Graduates in North Carolina

A greater percentage of graduates from the state's public medical schools are retained in NC five years after graduating, compared to the state's private medical schools (Figure 3). ECU has consistently retained the greatest percentage of its graduates from the 2008-2012 cohorts in state five years post-graduation, followed by UNC, Wake Forest, and Duke.

Figure 3: Percent of NC Medical School Graduates in Training or Practice in North Carolina Five Years After Graduating



Produced by the Program on Health Workforce Research and Policy, Sheps Center for Health Services Research, University of North Carolina at Chapel Hill. Source: North Carolina Health Professions Data System with data derived from the Association of American Medical Colleges, and the NC Medical Board, 2017.

Table 2 (page 13) describes medical school graduates remaining in North Carolina. The number of 2012 graduates from all four medical schools remaining in NC five years later is 171 or 39%, the highest point it has been over the past five years, as the prior four cohorts ranged from 31% to 35%. ECU's Brody School of Medicine graduates continue to show the highest rate of retention in North Carolina at 54% (n=40), and in primary care in the state (38%, n=28).

Retention in Rural Areas

Table 3 (page 15) shows the retention of 2012 graduates in rural counties nationally, in NC, and in primary care as of 2017. Out of 73 graduates practicing in primary care in NC in 2017, only 4 (1%) practiced in rural counties. The percent practicing in primary care in rural has fluctuated between 1% and 3% over the past five years. NC has 54 rural (or non-metropolitan) counties based on the 2017 Office of Management and Budget Core Based Statistical Area definition.

Retention in Psychiatry

Table 4 (page 17) shows the retention of the 2012 graduates in psychiatry. There were nine graduates who graduated from NC medical schools in 2012 in practice in psychiatry in North Carolina in 2017, seven from UNC, one from Duke, and one from ECU. None practiced in a rural county.

Differences in Retention by Practice Specialty

To determine overall retention by practice specialty, we consolidated data for all NC medical schools in Table 5 (page 18). For the 2012 cohort, 61% (n=30) of physicians who initially matched to family medicine (n=49) remained in clinical family medicine in NC five years post-graduation, with 8% (n=4) practicing in rural NC counties. Comparatively, 5-year retention of general internal medicine physicians was lowest of all five primary care specialties, with 14% (n=18) of 2011 NC med school grads who initially matched to categorical Internal Medicine programs (n=130) remaining in generalist practice in NC, and zero retained in rural counties. It is important to understand that initial internal medicine match numbers are imprecise, both inflated since they include physicians who do a preliminary year before moving on to a different residency specialty and deflated because they include a sizable percentage of hospitalists. Some graduates who completed an internal medicine residency and later specialized remained in NC but are not included in this count.

Specialty analyses

Looking across NC medical schools by initial match specialty over time, some specialties result in a greater percent of graduates practicing in NC five years later than others do. Family medicine leads in this category, with 61% (n=128/209) of family medicine graduates practicing in state five years later for the graduating classes of 2008-2012. In some cases, the lack of retention is because physicians tend to subspecialize, which is one explanation for why the overall retention for general internal medicine physicians in NC was lower than other specialties, (10%, n=56/542). General Surgery is not shown on this chart because general surgery residencies last five years, after which many surgeons are entering fellowships for subspecialty training. Psychiatry has seen an upward trend of physicians remaining in practice in state five years later for the last five cohorts, with 18% (n=3/17) in practice in NC in for the class of 2008 compared to 50% (n=9/18) for the class of 2012. It remains to be seen if this trend will hold going forward.

Table: NC Medical School Graduates in Primary Care or Psychiatry in North Carolina Five Years After Graduating by Initial Residency Specialty, Graduating Classes of 2008-2012

Initial Residency Specialty	Number Initially Matched to Specialty	Number in Practice in Specialty Five Years After Graduating	Percent in Practice in Specialty Five Years After Graduating
Family Medicine	209	128	61%
Internal Medicine	542	56	10%
Pediatrics	271	69	25%
IM/ Peds	65	26	40%
OBGYN	133	49	37%
Psychiatry	81	29	36%

Source: Program on Health Workforce Research and Policy at the Cecil G. Sheps Center for Health Services Research, with data derived from annual medical student tracking reports, 2009-2018.

Initial Match Data: 2018 Graduating Cohort

As mentioned earlier, this report has not emphasized initial match data from the NC medical schools, since residents sometimes switch specialties or residency programs throughout the course of their training, and many subspecialize. However, Campbell has graduated two classes of medical students and initial match counts are the only data available thus far on Campbell's workforce outcomes. We offer a note of caution when interpreting these data and a reminder that the five-year outcome data are more accurate in estimating the workforce outcomes for each medical school. Matches to "primary care" specialties (Family Medicine, Internal Medicine, Pediatrics, Internal Medicine-Pediatrics, and Obstetrics & Gynecology) are inflated compared to the number of graduates eventually expected to practice in those fields. We also track two other needed specialties in NC: psychiatry and general surgery. Prior trends indicate that many NC graduates, including most of those who match to Internal Medicine and General Surgery, will go on to complete fellowship training and eventually practice in a sub-specialty field. Family Medicine is an exception to this trend.

Table 6 (page 19) shows that in 2018, a higher percent of graduates from public NC medical schools matched to an NC residency (ECU=44%, n=31/71; UNC=37%, n=62/168) than did graduates from private medical schools (Duke=35%, n=36/102; Wake Forest=24%, n=25/105; Campbell=23%, n=34/151). Similarly, the highest percent of matches to a primary care, psychiatry, or general surgery residency in NC were for ECU (35%, n=25/71) and UNC (24%, n=41/168), followed by Duke (16%, n=16/102), Campbell (15%, n=22/151), and Wake Forest (10%, n=11/105).

Discussion

While most people interact with the health system at some point in their lives and have a general understanding of the work physicians do, the majority are unaware of the specifics related to physician training—for example, the difference between a medical student and a resident. This confusion holds for legislators⁴ and other influential stakeholders, which is not surprising as they often come from career paths outside the health system and have limited experience with health professionals other than as a patient. When concerns about the availability of physicians to meet the demand for healthcare arise, expanding medical education is a logical first impulse for those unfamiliar with physician training.

It is at this point that the long history of NC's medical student tracking project becomes valuable. The annual reports show consistently the low percentage of NC medical graduates that go into primary care practice in rural areas—typically between 1% and 3% annually. Knowing that this is the starting point, the state can then look to other strategies if it seeks to boost the physician supply in these areas. There is no question that all the medical schools bring substantial benefits to the state in terms of nationally lauded healthcare, jobs, research dollars, etc. However, this project has shown that public medical school graduates, particularly graduates from ECU, are more likely to practice in state and in primary care specialties than are private medical school graduates. This finding is not surprising, as ECU: A) only admits NC residents, and B) producing physicians to serve state needs is part of its mission. UNC also has a mission to serve the state. This project has demonstrated that NC graduates who match to Family Medicine are more likely to be in practice in NC in their initial match specialty compared to those who match to other specialties.

A key driver of retention of primary care physicians in North Carolina is the availability of community based primary care residencies in the state. Medical students must go through at least 3 years of

⁴ Spero JC, Fraher EP, Ricketts TC, Rockey PH. GME in the United States: A Review of State Initiatives. Cecil G. Sheps Center for Health Services Research, The University of North Carolina at Chapel Hill. September 2013.

training before being able to practice independently, and the many practice close to their residencies for the remainder of their careers.⁵⁶⁷

The Role of AHEC Residencies in Primary Care

AHEC primary care residencies have a better track record of keeping physicians in the state. Data from the American Medical Association physician master file demonstrate that 50% of active physicians who completed an NC AHEC residency remained in practice in NC, compared to 38% who completed a non-AHEC residency.⁸ AHEC residencies, however, have grown only minimally over the last decade, and most new residency positions have been devoted to subspecialty physicians in large hospitals—often because these positions are self-funded by the hospitals themselves. In recent years, federal and philanthropic support has focused on building primary care capacity, with support for new residencies or expansions of residencies in community health center settings (Hendersonville, Greensboro, Prospect Hill and New Hanover) and the legislature has supported new residencies at MAHEC and Cape Fear and started planning for residencies in the East associated with Brody School of Medicine. The Department of Health and Human Services has developed a plan for a substantial expansion of rural residencies in needed specialties and included an emphasis on creating the workforce for Medicaid in the 1115 Medicaid reform waiver.

Changes in the NC Health Care Landscape

Several contextual issues in North Carolina are important to underscore. First, hospitals and health care systems have increasingly consolidated over the last several years. Second, in terms of the pipeline of primary care providers, the Campbell School of Medicine and many new Nurse Practitioner and Physician Assistant programs have opened over the last decade. Many of these graduates are potentially available for primary care or other needed specialties. Third, the past few years have seen a lack of certainty about the Affordable Care Act and NC is soon to implement changes to the Medicaid program with the 1115 waiver. The health policy environment within the state is shifting and it is unclear what the ultimate effect will be on the supply of physicians and other health professionals.

Data from this annual report points to the stabilization of practice patterns in primary care and in rural settings at a level that is much lower than the 50% targets set by the NC legislature. There are 14 counties in the state⁹ where the entire county is identified as persistent primary care health professional shortage areas, meaning they have met Federal criteria as a health professional shortage area in at least 6 of the last 7 designation periods. Furthermore, there are additional counties that meet these criteria but do not apply for the designation. Getting more primary care generalists for high need communities will require new strategies to care for these populations.

⁵ Dorner FH, Burr RM, Tucker SL. The geographic relationships between physicians' residency sites and the locations of their first practices. *Acad Med.* 1991;66(9):540–4

⁶ Seifer SD, Vranizan K, Grumbach K. Graduate medical education and physician practice location. *JAMA.* 1995;274(9):685–91.

⁷ Fagan EB, et. al. Family medicine graduate proximity to their site of training: policy options for improving the distribution of primary care access. *Fam Med.* 2015;47(2):124–30.

⁸ Fraher EP, Spero JC. The State of the Physician Workforce in North Carolina: Overall Physician Supply Will Likely Be Sufficient but Is Maldistributed by Specialty and Geography. Program on Health Workforce Research and Policy, The Cecil G. Sheps Center for Health Services Research, The University of North Carolina at Chapel Hill. August 2015. Accessed 10/15/2015 at <http://www.shepscenter.unc.edu/wp-content/uploads/2015/08/MedicalEducationBrief-ShepsCenter-August20151.pdf>

⁹ Beaufort, Clay, Currituck, Dare, Gates, Graham, Hoke, Hyde, Montgomery, Northampton, Robeson, Stokes, Tyrrell, Washington.

TABLE 1
North Carolina Medical Students - Retention in Primary Care Five Years After Graduation
2012 Graduates

School <i>Primary Care* Residency Specialty</i>	Number of 2012 Graduates in Training or Practice as of 2017	Number of 2012 Graduates in Training or Practice with an Initial Residency Choice of Primary Care*	Percent of 2012 Graduates in Training or Practice with an Initial Residency Choice of Primary Care*	Number of 2012 Graduates in Training or Practice in Primary Care** as of 2017	Percent of 2012 Graduates in Training or Practice in Primary Care** as of 2017
Duke	87	52	60%	25	29%
<i>Family Medicine</i>		3	3%	4	5%
<i>Internal Medicine</i>		32	37%	9	10%
<i>Pediatrics</i>		12	14%	8	9%
<i>IM/ Peds</i>		1	1%	1	1%
<i>OBGYN</i>		4	5%	3	3%
ECU	74	57	77%	38	51%
<i>Family Medicine</i>		18	24%	18	24%
<i>Internal Medicine</i>		21	28%	7	9%
<i>Pediatrics</i>		10	14%	5	7%
<i>IM/ Peds</i>		4	5%	4	5%
<i>OBGYN</i>		4	5%	4	5%
UNC-CH	163	103	63%	59	36%
<i>Family Medicine</i>		19	12%	18	11%
<i>Internal Medicine</i>		45	28%	15	9%
<i>Pediatrics</i>		22	13%	12	7%
<i>IM/ Peds</i>		3	2%	3	2%
<i>OBGYN</i>		14	9%	11	7%
Wake Forest	112	52	46%	20	18%
<i>Family Medicine</i>		9	8%	9	8%
<i>Internal Medicine</i>		32	29%	7	6%
<i>Pediatrics</i>		11	10%	4	4%
<i>IM/ Peds</i>		0	0%	0	0%
<i>OBGYN</i>		0	0%	0	0%
Total	436	264	61%	142	33%
<i>Family Medicine</i>		49	11%	49	11%
<i>Internal Medicine</i>		130	30%	38	9%
<i>Pediatrics</i>		55	13%	29	7%
<i>IM/ Peds</i>		8	2%	8	2%
<i>OBGYN</i>		22	5%	18	4%

*2012 Primary Care Residency Specialty includes Family Medicine, General Pediatric Medicine, General Internal Medicine, Internal Medicine/Pediatrics, and Obstetrics/Gynecology. Source: Association of American Medical Colleges (AAMC). Internal medicine in this case also includes "medicine - preliminary," which likely overestimates the initial primary care figures.

** As of 2017, primary care definitions are based on NC Medical Board licensure data (for NC physicians) and AAMC data (for non-NC physicians) and include Family Medicine (Family Medicine, Family Medicine-Adolescent Medicine, Family Medicine-Geriatric, Family Medicine-Sports Medicine, General Practice; Internal Medicine (Internal Medicine, Internal Medicine-Geriatric); Pediatrics (Pediatrics, Pediatrics-Adolescent, Pediatric-Sports Medicine); Internal Medicine-Pediatrics (Internal Medicine-Pediatrics, Internal Medicine-Adolescent Medicine); OBGYN (Obstetrics & Gynecology, Obstetrics, Gynecology).

Note: One Duke grad initially matched to general surgery but practiced in family medicine in 2017. In all cases, 2017 counts include physicians who branched in from other specialties, even though those physicians are not included in counts of initial residency matches.

TABLE 2:
North Carolina Medical Students-Primary Care Retention in NC
2012 Graduates

School <i>Primary Care*</i> <i>Residency Specialty</i>	Number of 2012 Graduates in Training or Practice as of 2017	Number of 2012 Graduates in Training or Practice in North Carolina as of 2017	Percent of 2012 Graduates in Training or Practice in North Carolina as of 2017	Number of 2012 Graduates in Training or Practice in Primary Care** in North Carolina as of 2017	Percent of 2012 Graduates in Training or Practice in Primary Care** in North Carolina as of 2017	Number of 2012 Graduates in Training or Practice in Primary Care** in Rural*** Counties in North Carolina as of 2017	Percent of 2012 Graduates in Training or Practice in Primary Care** in Rural*** Counties North Carolina as of 2017
Duke	87	18	21%	5	6%	0	0%
Family Medicine				1	1%	0	0%
Internal Medicine				3	3%	0	0%
Pediatrics				0	0%	0	0%
IM/ Peds				1	1%	0	0%
OBGYN				0	0%	0	0%
ECU	74	40	54%	28	38%	2	3%
Family Medicine				14	19%	2	3%
Internal Medicine				5	7%	0	0%
Pediatrics				4	5%	0	0%
IM/ Peds				4	5%	0	0%
OBGYN				1	1%	0	0%
UNC-CH	163	79	48%	32	20%	2	1%
Family Medicine				11	7%	2	1%
Internal Medicine				7	4%	0	0%
Pediatrics				6	4%	0	0%
IM/ Peds				2	1%	0	0%
OBGYN				6	4%	0	0%
Wake Forest	112	34	30%	8	7%	0	0%
Family Medicine				4	4%	0	0%
Internal Medicine				3	3%	0	0%
Pediatrics				1	1%	0	0%
IM/ Peds				0	0%	0	0%
OBGYN				0	0%	0	0%
Total	436	171	39%	73	17%	4	1%
Family Medicine				30	7%	4	1%
Internal Medicine				18	4%	0	0%
Pediatrics				11	3%	0	0%
IM/ Peds				7	2%	0	0%
OBGYN				7	2%	0	0%

*2012 Primary Care Residency Specialty includes Family Medicine, General Pediatric Medicine, General Internal Medicine, Internal Medicine/Pediatrics, and Obstetrics/Gynecology. Source: Association of American Medical Colleges (AAMC). Internal medicine in this case also includes "medicine - preliminary," which likely overestimates the initial primary care figures.

** As of 2017, primary care definitions are based on NC Medical Board licensure data (for NC physicians) and AAMC data (for non-NC physicians) and include Family Medicine (Family Medicine, Family Medicine-Adolescent Medicine, Family Medicine-Geriatric, Family Medicine-Sports Medicine, General Practice; Internal Medicine (Internal Medicine, Internal Medicine-Geriatric); Pediatrics (Pediatrics, Pediatrics-Adolescent, Pediatric-Sports Medicine); Internal Medicine-Pediatrics (Internal Medicine-Pediatrics, Internal Medicine-Adolescent Medicine); OBGYN (Obstetrics & Gynecology, Obstetrics, Gynecology).

***"Rural" is based on 2017 Core-Based Statistical Area (CBSA) definitions, and includes counties that are "micropolitan" and "outside of CBSAs." Using this definition, NC has 54 rural counties.

Note: One Duke grad initially matched to General Surgery but practiced in internal medicine in NC in 2017. In all cases, 2017 counts include physicians who branched in from other specialties, even though those physicians are not included in counts of initial residency matches.

Sources:

	Association of American Medical Colleges			NC Medical Board		

Compiled by:

NC AHEC Program

Cecil G. Sheps Center for Health Services Research

TABLE 3
North Carolina Medical Students-Retention in Rural Practice
2012 Graduates

School <i>Primary Care*</i> <i>Residency Specialty</i>	Number of 2012 Graduates in Training or Practice as of 2017	Number of 2012 Graduates in Training or Practice in North Carolina as of 2017	Percent of 2012 Graduates in Training or Practice in North Carolina as of 2017	Number of 2012 Graduates in Training or Practice in Rural*** Counties as of 2017	Percent of 2012 Graduates in Training or Practice in Rural*** Counties as of 2017	Number of 2012 Graduates in Training or Practice in Rural*** Counties in North Carolina as of 2017	Percent of 2012 Graduates in Training or Practice in Rural*** Counties in North Carolina as of 2017	Number of 2012 Graduates in Training or Practice in Primary Care** in Rural*** Counties in North Carolina as of 2017	Percent of 2012 Graduates in Training or Practice in Primary Care** in Rural*** Counties North Carolina as of 2017
Duke	87	18	21%	1	1%	0	0%	0	0%
Family Medicine								0	0%
Internal Medicine								0	0%
Pediatrics								0	0%
IM/ Peds								0	0%
OBGYN								0	0%
ECU	74	40	54%	3	4%	3	4%	2	3%
Family Medicine								2	3%
Internal Medicine								0	0%
Pediatrics								0	0%
IM/ Peds								0	0%
OBGYN								0	0%
UNC-CH	163	79	48%	4	2%	3	2%	2	1%
Family Medicine								2	1%
Internal Medicine								0	0%
Pediatrics								0	0%
IM/ Peds								0	0%
OBGYN								0	0%
Wake Forest	112	34	30%	0	0%	0	0%	0	0%
Family Medicine								0	0%
Internal Medicine								0	0%
Pediatrics								0	0%
IM/ Peds								0	0%
OBGYN								0	0%
Total	436	171	39%	8	2%	6	1%	4	1%
Family Medicine								4	1%
Internal Medicine								0	0%
Pediatrics								0	0%
IM/ Peds								0	0%
OBGYN								0	0%

*2012 Primary Care Residency Specialty includes Family Medicine, General Pediatric Medicine, General Internal Medicine, Internal Medicine/Pediatrics, and Obstetrics/Gynecology. Source: Association of American Medical Colleges (AAMC). Internal medicine in this case also includes "medicine - preliminary," which likely overestimates the initial primary care figures.									
** As of 2017, primary care definitions are based on NC Medical Board licensure data (for NC physicians) and AAMC data (for non-NC physicians) and include Family Medicine (Family Medicine, Family Medicine-Adolescent Medicine, Family Medicine-Geriatric, Family Medicine-Sports Medicine, General Practice; Internal Medicine (Internal Medicine, Internal Medicine-Geriatric); Pediatrics (Pediatrics, Pediatrics-Adolescent, Pediatric-Sports Medicine); Internal Medicine-Pediatrics (Internal Medicine-Pediatrics, Internal Medicine-Adolescent Medicine); OBGYN (Obstetrics & Gynecology, Obstetrics, Gynecology).									
***"Rural" is based on 2017 Core-Based Statistical Area (CBSA) definitions, and includes counties that are "micropolitan" and "outside of CBSAs." Using this definition, NC has 54 rural counties.									
Sources:									
	Association of American Medical Colleges				NC Medical Board				
Compiled by:									
NC AHEC Program									
Cecil G. Sheps Center for Health Services Research									

**Table 4: North Carolina Medical Students – Retention in Psychiatry
2012 Graduates**

School	Number of 2012 Graduates in Training or Practice as of 2017	Number of 2012 Graduates in Training or Practice in North Carolina as of 2017	Percent of 2012 Graduates in Training or Practice in North Carolina as of 2017	Number of 2012 Graduates in Training or Practice in Psychiatry* in North Carolina as of 2017	Percent of 2012 Graduates in Training or Practice in Psychiatry* in North Carolina as of 2017	Number of 2012 Graduates in Training or Practice in Psychiatry* in Rural** Counties in North Carolina as of 2017	Percent of 2012 Graduates in Training or Practice in Psychiatry* in Rural** Counties North Carolina as of 2017
Duke	87	18	21%	1	1%	0	0%
<i>Psychiatry</i>				1	1%	0	0%
<i>Child & Adolescent Psychiatry</i>				0	0%	0	0%
ECU	74	40	54%	1	1%	0	0%
<i>Psychiatry</i>				1	1%	0	0%
<i>Child & Adolescent Psychiatry</i>				0	0%	0	0%
UNC-CH	163	79	48%	7	4%	0	0%
<i>Psychiatry</i>				4	2%	0	0%
<i>Internal Medicine-Psychiatry</i>				1	1%	0	0%
<i>Psychosomatic Medicine</i>				2	1%	0	0%
Wake Forest	112	34	30%	0	0%	0	0%
<i>Psychiatry</i>				0	0%	0	0%
<i>Child & Adolescent Psychiatry</i>				0	0%	0	0%
Total	436	171	39%	9	2%	0	0%
<i>Psychiatry</i>				6	1%	0	0%
<i>Child & Adolescent Psychiatry</i>				0	0%	0	0%
<i>Internal Medicine-Psychiatry</i>				1	0%	0	0%
<i>Psychosomatic Medicine</i>				2	0%	0	0%

*As of 2017, Psychiatry definitions are based on NC Medical Board licensure data (for NC physicians) and AAMC data (for non-NC physicians) and include Psychiatry, Child and Adolescent Psychiatry, Psychoanalysis, Forensic Psychiatry, Psychosomatic Medicine, Psychiatry/Geriatric, Family Medicine-Psychiatry, Internal Medicine-Psychiatry, and Pediatrics-Psychiatry.

**"Rural" is based on 2017 Core-Based Statistical Area (CBSA) definitions, and includes counties that are "micropolitan" and "outside of CBSAs." Using this definition, NC has 54 rural counties.

Sources:

Association of American Medical Colleges

NC Medical Board

Compiled by:

NC AHEC Program

Cecil G. Sheps Center for Health Services Research

Table 5: North Carolina Medical Students – Retention by Medical Specialty in NC
2012 Graduates

	Physician Specialty						
	Family Medicine	Internal Medicine	Pediatrics	IM/ Peds	OBGYN	General Surgery	Psychiatry
Number of 2012 Graduates in Training or Practice in 2017 that Initially Matched to Specialty*	49	130	55	8	22	46	18
Number (Percent) of 2012 Graduates in Training or Practice as Generalist** in Specialty as of 2017	49 (100%)	38 (29%)	29 (53%)	8 (100%)	18 (82%)	29 (63%)	20 (111%)
Number (Percent) of 2012 Graduates in Training or Practice as Generalist** in Specialty in North Carolina as of 2017	30 (61%)	18 (14%)	11 (20%)	7 (88%)	7 (32%)	6 (12%)	9 (50%)
Number (Percent) of 2012 Graduates in Training or Practice As Generalist** in Specialty in Rural*** Counties in North Carolina as of 2017	4 (8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Note: One UNC graduate initially matched to Internal Medicine but practiced in Internal Medicine-Psychiatry in 2017. One ECU graduate initially matched to pediatrics but practiced in psychiatry in 2017. In all cases, 2017 counts include physicians who branched in from other specialties, even though those physicians are not included in counts of initial residency matches.							
*2012 Data Source: Association of American Medical Colleges (AAMC). Internal medicine in this case also includes "medicine - preliminary," which likely overestimates the initial match to Internal Medicine.							
**Physicians who branch from primary care or general surgery specialties into subspecialty fields are not included in these counts, even if they remain in practice in NC. Practice specialty definitions are based on NC Medical Board licensure data (for NC physicians) and AAMC data (for non-NC physicians) and include Family Medicine (Family Medicine, Family Medicine-Adolescent Medicine, Family Medicine-Geriatric, Family Medicine-Sports Medicine, General Practice; Internal Medicine (Internal Medicine, Internal Medicine-Geriatric); Pediatrics (Pediatrics, Pediatrics-Adolescent, Pediatric-Sports Medicine); Internal Medicine-Pediatrics (Internal Medicine-Pediatrics, Internal Medicine-Adolescent Medicine); OBGYN (Obstetrics & Gynecology, Obstetrics, Gynecology); General Surgery (General Surgery, Abdominal Surgery, Colon & Rectal Surgery, Critical Care Surgery, Head and Neck Surgery, Oncology Surgery, Pediatric Surgery, Transplant Surgery, Trauma Surgery, and Vascular Surgery); and Psychiatry (Psychiatry, Child and Adolescent Psychiatry, Psychoanalysis, Forensic Psychiatry, Psychosomatic Medicine, Psychiatry/Geriatric, Family Medicine-Psychiatry, Internal Medicine-Psychiatry, and Pediatrics-Psychiatry.)							
***"Rural" is based on 2017 Core-Based Statistical Area (CBSA) definitions, and includes counties that are "micropolitan" and "outside of CBSAs." Using this definition, NC has 54 rural counties.							

TABLE 6

North Carolina Medical Students - Initial Choice of Primary Care Residency

2018 Graduates

School Residency Specialty	Number of 2018 Graduates with an Initial Residency Match	Number of 2018 Graduates with an Initial Residency Match in NC (All Specialties)	Percent of 2018 Graduates with an Initial Residency Match in NC (All Specialties)	Number of 2018 Graduates with an Initial Residency Choice of Primary Care*, Psychiatry, or General Surgery	Percent of 2018 Graduates with an Initial Residency Choice of Primary Care*, Psychiatry, or General Surgery	Number of 2017 Graduates with an Initial Residency Choice of Primary Care, Psychiatry, or General Surgery in NC*	Percent of 2018 Graduates with an Initial Residency Choice of Primary Care, Psychiatry, or General Surgery in NC*
Campbell	151	34	23%	99	66%	22	15%
Family Medicine				35	23%	9	6%
Internal Medicine				33	22%	3	2%
Pediatrics				12	8%	3	2%
IM/ Peds				2	1%	1	1%
OBGYN				5	3%	2	1%
Psychiatry				8	5%	4	3%
General Surgery				4	3%	0	0%
Duke	102	36	35%	58	57%	16	16%
Family Medicine				5	5%	1	1%
Internal Medicine				24	24%	9	9%
Pediatrics				6	6%	0	0%
IM/ Peds				6	6%	0	0%
OBGYN				4	4%	2	2%
Psychiatry				4	4%	0	0%
General Surgery				9	9%	4	4%
ECU	71	31	44%	50	70%	25	35%
Family Medicine				15	21%	8	11%
Internal Medicine				8	11%	5	7%
Pediatrics				13	18%	5	7%
IM/ Peds				5	7%	2	3%
OBGYN				2	3%	0	0%
Psychiatry				3	4%	3	4%
General Surgery				4	6%	2	3%
UNC-CH	168	62	37%	116	69%	41	24%
Family Medicine				31	18%	15	9%
Internal Medicine				37	22%	9	5%
Pediatrics				14	8%	5	3%
IM/ Peds				4	2%	1	1%
OBGYN				14	8%	4	2%
Psychiatry				11	7%	6	4%
General Surgery				5	3%	1	1%
Wake Forest	105	25	24%	50	48%	11	10%
Family Medicine				6	6%	4	4%
Internal Medicine				17	16%	2	2%
Pediatrics				7	7%	2	2%
IM/ Peds				0	0%	0	0%
OBGYN				9	9%	2	2%
Psychiatry				7	7%	1	1%
General Surgery				4	4%	0	0%

Total	446	188	42%	373	84%	115	26%
<i>Family Medicine</i>				92	21%	37	8%
<i>Internal Medicine</i>				119	27%	28	6%
<i>Pediatrics</i>				52	12%	15	3%
<i>IM/ Peds</i>				17	4%	4	1%
<i>OBGYN</i>				34	8%	10	2%
<i>Psychiatry</i>				33	7%	14	3%
<i>General Surgery</i>				26	6%	7	2%

*2018 Primary Care Residency Specialty includes Family Medicine, Internal Medicine, Pediatrics, Internal Medicine-Pediatrics, and Obstetrics/Gynecology. Source: Class of 2018 Residency Match lists downloaded from NC Medical School Websites, except for Campbell and Duke. Campbell data via Matt Huff, Office of Clinical Affairs and Graduate Medical Education, Campbell University School of Osteopathic Medicine, personal communication with Julie Spero on 27 September 2018. Duke data via Sheba Hall, Office of Student Affairs, Duke University School of Medicine, personal communication with Julie Spero on 28 Sept 2018.

Notes

Limitations: The information used in this analysis to determine a medical graduate's initial specialty choice for residency and to determine retention in primary care comes from different sources. When calculating retention in primary care five years after graduation, data from the AAMC are used to determine initial choice of residency. AAMC does not differentiate between internal medicine and medicine-preliminary, so the data may appear to be inflated for initial residency choice of primary care. Two data sources are used to determine current practice or training area. For physicians practicing in North Carolina, NC Medical Board (NCMB) data are used to determine the physician's current self-reported primary area of practice. For physicians practicing outside of North Carolina, AAMC data are used to determine current practice or training area. AAMC data are based on the AMA Physician Masterfile.

Beginning with the class of 2006 all MDs graduating in a year, regardless of month, are counted with that year's graduates.

Primary Care Tables: Primary care coding was revised in 2014 to reflect more accurate aggregation of AMA minor codes to AMA major codes. Primary care residency specialties are defined by legislation passed by the NC General Assembly in 1993 (Senate Bill 27/ House Bill 729) and include family medicine, general internal medicine, general pediatric medicine, internal medicine-pediatrics, and obstetrics and gynecology. Specialties included under the definitions of current practice specialties for primary care, psychiatry, and general surgery were revised in 2014 and reviewed by practicing clinicians for accuracy.

"Primary Care" is defined for both initial specialty of residency training (identified using AAMC data and denoted by the use of one asterisk) and for current practice or training area (identified using either NCMB data for physicians in NC and AAMC data for physicians practicing out of state and denoted by the use of two asterisks). More specialties are included under the definition of "primary care" for current practice or training area than for specialty of residency training because physicians may specialize within their primary care area of practice following training. For example, a physician who entered residency training in "pediatrics," and following completion of training reported a current practice area of "adolescent medicine" would be counted as a primary care physician.

General Surgery Tables: For tables calculating retention in general surgery five years after graduation, it is important to note that surgical residencies are currently a minimum of five years, and students who select an initial specialty of general surgery often transition to more specialized surgical training.

State-Supported Students at Duke and Wake Forest Medical Schools: Prior analysis tracked outcomes just for the subgroup of students that received the state IMEO funds (roughly 35% of the Wake Forest Students and 20% of the Duke students). Students were identified using data from NCSEAA. The IMEO grant program was repealed in 2009 legislation (see Senate Bill 202) and tracking for those students is no longer a component of this analysis.