Examining Provider Need by Specialty Area

Chapter 4

Examining the overall supply of physicians and nonphysician clinicians can mask shortages in particular specialty areas and overlook the importance of having an appropriate mix of practitioners. The NC IOM Task Force on Primary Care[a] and Specialty Supply examined the overall supply of medical practitioners as well as the supply of specialty providers to determine if there are critical shortages.[b] The Task Force noted the need to ensure that North Carolina has an appropriate mix of provider types, especially with respect to primary care and specialty care, which are critical to cost-effectiveness and quality of care for the entire population.[1] The Task Force examined the supply of primary care providers, providers who deliver babies, general surgeons, and psychiatrists.

North Carolina needs to have an appropriate mix of provider types, especially with respect to primary and specialty care, which are critical to cost-effectiveness and quality of care for the entire population.

The Task Force was unable to explore supply issues related to every specialty. For example, the Task Force was unable to fully explore the adequacy of providers trained to address the needs of our aging population or to fully explore all the pediatric subspecialties. North Carolina's elderly population is growing rapidly, and individuals over the age of 65 make more office visits to providers than younger individuals. However, data limitations prevent accurate assessment of the supply of physicians who care for geriatric patients. Licensure data identify the physician's primary and secondary specialties but do not give any information on the type of patients the physician typically sees in practice. In 2005 there were 293 physicians who reported a primary or secondary specialty of geriatrics or family practice/geriatric; however, the number of physicians actually providing care to the elderly is higher. Older individuals may comprise a large percent of the patient population of family physicians, internists, and other primary care physicians, but the data do not capture this information. Similarly, the Task Force realized that the number of child-related specialty providers may be limited across the state, but it was not able to analyze all potential shortage areas. For this reason, in Chapter 2 the Task Force recommended support and expansion of the health workforce research center at the Cecil G. Sheps Center for Health Services Research. (Recommendation 2.1.) The workforce center could do a more comprehensive evaluation of potential shortage areas and identify needs for new data collection.

Available data indicate the overall supply of many provider types is probably sufficient to meet the current needs of the state's population. However, there is significant geographic maldistribution, which leads to the undersupply or insufficient mix of provider types in some areas.

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a Throughout this document, primary care providers are defined as those who indicate a primary specialty of general practice, family practice, internal medicine, obstetrics/gynecology, or pediatrics. Providers who choose a sub-specialty as their primary specialty are not included in these data.

b The licensure data used in this analysis are derived from the NC Health Professions Data System (HPDS). The HPDS is maintained by the Cecil G. Sheps Center for Health Services Research at the University of North Carolina at Chapel Hill. The system was initiated in 1975 to collect and disseminate timely and reliable data on licensed health professionals in North Carolina. Data on 18 health professions are collected with the cooperation of the independent health professional licensing boards. Data on physicians, physician assistants, and nurse practitioners are provided by the NC Medical Board. Data on certified nurse midwives are provided by the NC Midwifery Joint Committee. Support for the HPDS is provided by the NC Area Health Education Centers Program and the University of North Carolina Office of the Provost (Health Affairs).

Primary Care Providers

What is Primary Care and Who Provides It?

Primary care providers (PCPs) provide preventive, primary, and acute medical services that can address most of a person's healthcare needs. Primary care providers serve as the entry point into the healthcare system for most patients. Good primary care should be comprehensive, accessible to the patient, coordinated, and accountable and should provide for continuous care.[2] Primary care visits account for approximately one-half of all visits to physician offices.[3]

Primary care providers include physician assistants (PAs), nurse practitioners (NPs), certified nurse midwives (CNMs), and doctors both of allopathic medicine (MDs) and osteopathic medicine (DOs) who are family practitioners, general practitioners, internists, pediatricians, and obstetrician/gynecologists. Table 4.1 illustrates growth of primary care provider professionals between 2000 and 2005.

Table 4.1
North Carolina Primary Care* Provider Growth, 2000-2005

Active in Profession (October)[c]

	2000	2001	2002	2003	2004	2005	Percent Change (2000-2004)	Percent Change (2004-2005)
North Carolina Population	8,078,429	8,198,279	8,312,755	8,422,375	8,540,468	8,683,242	5.7%	1.7%
Total Primary Care Providers (physicians, NPs, PAs, CNMs)	8,480	9,022	9,434	9,650	9,916	10,226	16.9%	3.1%
Total Primary Care Physicians	6,696	6,908	7,125	7,265	7,401	7,660	10.5%	3.5%
Total Primary Care Allopathic Physicians (MD)	6,567	6,764	6,942	7,086	7,195	7,424	9.6%	3.2%
Total Primary Care Osteopathic Physicians (DO)	129	144	163	179	206	236	59.7%	14.6%
Family Practice	2,713	2,224	2,294	2,347	2,376	2,452	-12.4%	3.2%
General Practice	199	176	164	151	142	141	-28.6%	-0.7%
Internal Medicine	2,203	2,313	2,395	2,481	2,542	2,652	15.4%	4.3%
Obstetrics/Gynecology	919	937	955	960	981	988	6.8%	0.7%
Pediatrics	1,202	1,258	1,317	1,326	1,360	1,427	13.1%	4.9%
Primary Care Nurse Practitioners (NP)	826	1,016	1,144	1,198	1,259	1,287	52.4%	2.2%
Primary Care Physician Assistants (PA)	791	926	972	991	1,061	1,081	34.1%	1.9%
Certified Nurse Midwives (CNM)	167	172	193	196	195	198	16.8%	1.5%

* Primary care providers include those who indicate a primary specialty of general practice, family practice, internal medicine, obstetrics/gynecology, or pediatrics.
Source: NC Health Professions Data System. North Carolina State Demographics: Annual North Carolina Population Growth.

c Data are for in-state professionals and include physicians with an unknown activity status because these individuals are generally new graduates who have not yet secured employment at the time of data collection.

Primary care provider growth is occurring in the areas of internal medicine, obstetrics/gynecology, and pediatrics, and among NPs and PAs. However, evidence indicates that fewer providers of all types, including physicians, PAs, and NPs, are going into primary care than in the past. For example, between 1997 and 2005, the number of medical student graduates choosing primary care residencies dropped 50%.[4] Instead, students are moving into specialty areas. Similar trends are experienced among NPs and PAs.[5]

One reason for declining interest in primary care is that primary care physicians experience increased demands with lower overall reimbursement. The number of and need for recommended preventive and chronic care treatment services has increased to the point that it is impossible for physicians to provide all recommended care to their patient mix in a regular workday. A primary care practice serving a panel of 2,300 patients has to work more than seven hours a day to provide all recommended evidence-based preventive services to patients, plus more than 10 hours a day to provide all recommended services to patients with chronic illnesses.[5] Although the scope of care has increased, primary care provider reimbursement has decreased in inflation-adjusted dollars. Between 1995 and 2003, inflation-adjusted salaries decreased 7.1% for all physicians, but 10.2% for primary care physicians.[6] Primary care physicians are paid less for their services than are specialists, as insurers generally pay more for procedures and less for cognitive and diagnostic skills. (See Chart 4.1.) The median income of specialists is approximately twice that of primary care providers. In 1992, the Centers for Medicare and Medicaid Services developed a Resource-Based Relative Value Scale (RBRVS) fee schedule to assign payment rates for medical services in an effort to more fairly and accurately value all physician services. Despite these adjustments, which increased the relative value of physician evaluation and management work, some services continue to be undervalued while others are overvalued.[7] Many consider primary care services to be some of those most undervalued.

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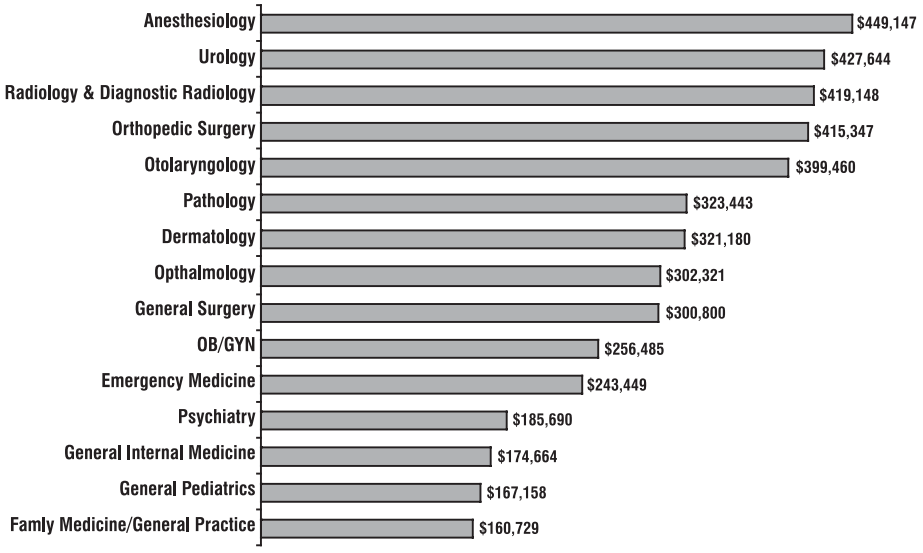
Chart 4.1
Median Physician Salary by Specialty, 2006



Source: Cohen J. Presented at: Primary Care and Specialty Summit, North Carolina Institute of Medicine; December 21, 2006. Citing MGMA Physician Compensation and Production Survey 2001-2006.

Trends away from primary care could impact population health.[8] Primary care is very important for preventing disease, increasing quality of care, and reducing costs. Evidence indicates that unnecessary hospitalization rates are higher in communities with limited access to primary care providers. Studies also show quality of care is higher and expenditures are lower in states with higher generalist-to-population ratios compared to those with higher specialist-to-population ratios.[4,8]

One way to encourage greater interest in primary care is to decrease payment inequities. To address payment inequities, the Task Force recommended:

Recommendation 4.1. (Priority Recommendation)

a) **The State Health Plan, Division of Medical Assistance, and private insurers should enhance payments to primary care providers to recognize the value of diagnostic and cognitive skills, particularly those payments that incentivize primary care providers to create comprehensive primary care homes that include lifestyle interventions, preventive health services, chronic disease management, and case management through use of case managers.**

b) **Reimbursement levels for primary care services through Medicaid, NC Health Choice, State Health Plan, and private insurers should be continually evaluated to ensure they are adequate to meet the costs of care across the state, particularly in underserved areas.**

As physicians continue to specialize and move away from primary care, the growth of NPs and PAs, who are more likely to work in primary care, is very important to the provision of primary care services. However, NPs and PAs are not necessarily complete replacements for primary care physicians because the scope of allowable activities for PAs and NPs is based, in part, on the services and tasks negotiated in the practice agreement with the supervising physician.[d] Thus, NPs and PAs may not be able to provide the full range of services provided by a physician. As a result, federal workforce programs calculate NPs and PAs as 0.50 the full-time equivalent (FTE) of a physician. Other research suggests that a more accurate FTE is in the range of 0.75.[e,9] The FTE for an individual NP or PA will vary by provider based on a number of factors including the provider's scope of practice, patient population/acuity, healthcare setting, supervisory agreement with the physician, and specialty.

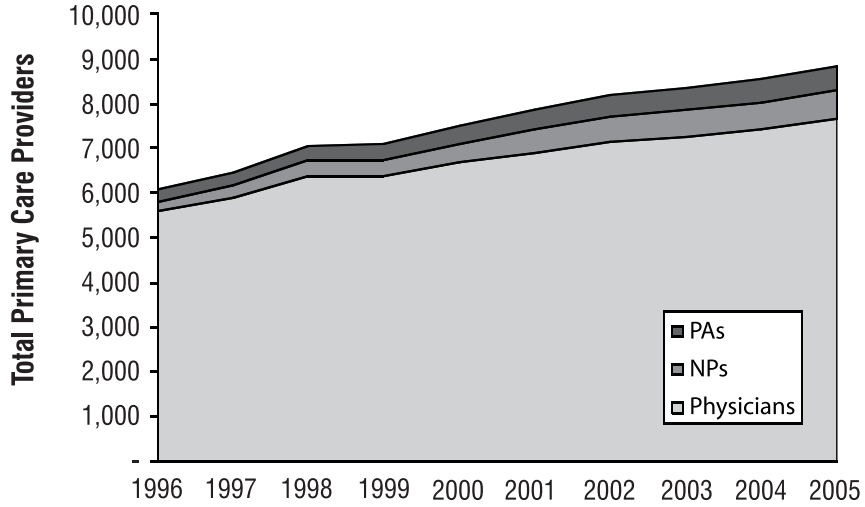
The FTE also is related to the environment in which an NP or PA practices. The National Center for Health Workforce Analysis, Bureau of Health Professions, Health Resources and Services Administration, conducted an analysis of professional practice environments for NPs and PAs in each state. It found that, as of 2000, North Carolina had the most favorable practice environment for PAs and was the 10th most favorable practice environment for NPs.[10] Therefore, it is likely that the FTE for PAs and NPs in North Carolina would be on the higher end of the spectrum across the country.

d As with other healthcare providers, PAs or NPs may only provide the services that are consistent with their education, training, skills, and competence.

e The study was done for PAs, but in North Carolina NPs' scope of practice is substantially similar to that of PAs; therefore, the research is being extrapolated to NPs as well.

Depending on the equivalency used, NPs and PAs account for a varying portion of the primary care workforce in North Carolina. Based on the federal designation of 0.50 FTE, primary care NPs and PAs accounted for approximately 13% of total primary care providers in 2005. (See Chart 4.2.) On the other hand, using a research-based FTE such as 0.75, NPs and PAs accounted for approximately 19% of primary care providers in 2005. (See Chart 4.3.) Regardless of the FTE used, NPs and PAs account for an increasing percentage of primary care providers in the state and play an important role in providing primary care services. While they are critically important providers of care,

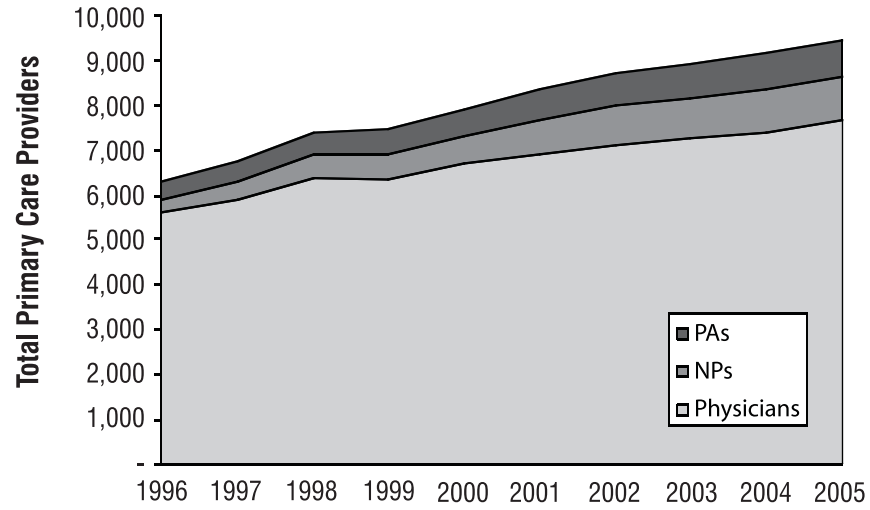
Chart 4.2
Total North Carolina Primary Care Workforce: Physicians, PAs, NPs Adjusted to Federal FTE Weight (50%)



Source: NC Health Professions Data System. FTE is full time equivalent.

NPs and PAs account for an increasing percentage of primary care providers in the state and play an important role in providing primary care services.

Chart 4.3
Total North Carolina Primary Care Workforce: Physicians, PAs, NPs Adjusted to Research-Based FTE Weight (75%)



Source: NC Health Professions Data System. FTE is full time equivalent.

it is unlikely they can completely fill the needs left by a decreasing growth rate in primary care physician supply. The state health professional workforce research center recommended in Chapter 2 would be a valuable entity for evaluating the supply and relative work of these different types of primary care providers. Furthermore, it could use that information to analyze the need for specific primary care provider types.

Primary Care Physicians

While recent data indicate overall primary care physician supply has experienced moderate annual growth (generally between 2-5%), there is a risk that this growth rate will fall below the population's growth rate in the near future. In recent years, the difference between North Carolina primary care physicians' growth rates and the state's population growth rate has narrowed. For the past five years the growth of primary care physicians has slowed, from a rate of 5.2% (between 1999-2000) to 1.9% (between 2003-2004).[11] Provisional data suggest that annual growth in primary care providers increased to 3.5% this year; however, because the North Carolina Medical Board has adopted a new registration system, it is unclear whether this is a one-year aberration or the beginning of an upward trend in primary care. North Carolina's annual population growth rate remained relatively stable throughout 2000 and 2004 (approximately 1.4%) but increased to 1.7% between 2004 and 2005.[11]

Regardless of aggregate state population and provider growth rates, county-level data indicate that over the past ten years North Carolina experienced an increase in the number of counties in which provider-to-population ratios declined. Table 4.2 illustrates between 2001 and 2005 30 counties experienced a decrease in primary care providers-to-population ratios compared to 11 counties between 1996 and 2000. Fourteen of the 30 counties with a decrease in primary care providers per population are persistent shortage areas, meaning they have been designated as primary care health profession shortage areas in six of the past seven years.

Table 4.2
Change in Primary Care Providers (Physicians, NPs, and PAs) per 10,000 Population (Number of counties)

	1996-2000		2001-2005	
County Type	Loss	Gain	Loss	Gain
Rural				
Not PHPSA*	4	35	12	27
Whole-County PHPSA	3	7	5	5
Part-County PHPSA	3	13	5	11
Urban				
Not PHPSA	1	22	4	19
Whole-County PHPSA	0	1	0	1
Part-County PHPSA	0	11	4	7
Total	11	89	30	70

*PHPSA is a persistent health professional shortage area, meaning the area has been designated as a health professional shortage area (HPSA) by the federal government for six of the previous seven years.

Source: NC Health Professions Data System.

There are a number of strategies that could be introduced in North Carolina to try to impact these changes in the primary care provider-to-population ratios. Some strategies focus on increasing the overall supply of providers; other strategies focus specifically on increasing primary care or other needed provider types. Some of these ideas are outlined in Chapter 2. They include increasing enrollment at North Carolina medical schools (see Recommendation 2.4); targeting state financial support to North Carolina health professions schools that produce the greatest proportion of professionals who meet healthcare needs of the state (see Recommendation 2.8); developing a new state-supported medical school (see Recommendation 2.5); and developing new primary care residency positions (see Recommendation 2.9).

Osteopathic physicians could play an important role in providing primary care services in North Carolina.

Doctors of Osteopathy (DOs):
Osteopathic medicine is a field of medicine that includes additional training in the study of the body's musculoskeletal system and in hands-on diagnosis and treatment. Osteopaths often use a treatment method called manipulation, which involves gentle application of force to the body to promote movement of tissue, prevent abnormal movement, and release compressed bones and joints.[12] Osteopathic medicine emphasizes achieving wellness through health education, injury prevention, and disease prevention.[13] In North Carolina, 55% of all active DOs have a primary care specialty compared to 43% of all active physicians. Therefore, osteopathic physicians could play an important role in providing primary care services in North Carolina. In 2005, DOs accounted for only 3.1% of primary care physicians practicing in the state. Nonetheless, osteopathic medicine is growing rapidly, and between 1995 and 2005 the number of practicing DOs increased 298% (108 to 430). During that time, 69 counties experienced an increase in the DO-to-population ratio, and only seven counties experienced a decrease. The other 24 counties had no DO in either year.

There are only 26 osteopathic physician training programs across the country, and none are located in North Carolina.[14] Doctor of Osteopathy programs will soon produce over 3,500 medical graduates per year, but only approximately 50 of those students will be from North Carolina. Strategies to expand the DO population in North Carolina, particularly those practicing primary care, include financially supporting North Carolina osteopathic students to train in other states in exchange for returning to practice in North Carolina, developing an osteopathic training program in North Carolina, and developing joint American Osteopathic Association-approved primary care residency positions in the state. (See Recommendations 2.5, 2.6, and 2.10.)

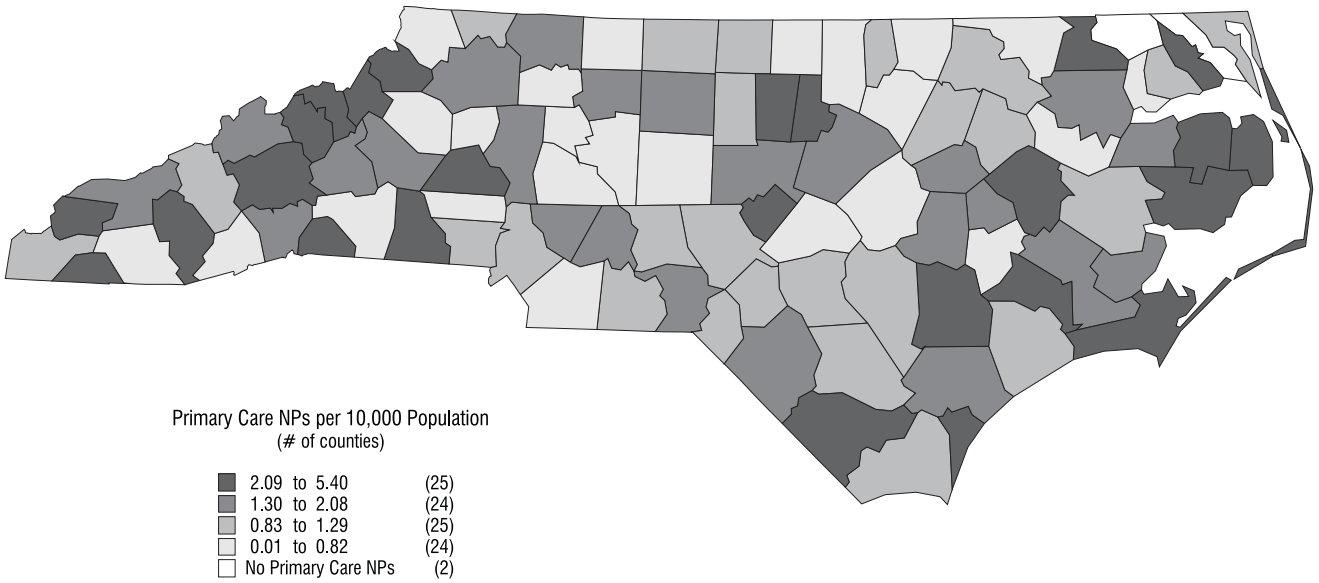
Nurse Practitioners and Physician Assistants

The numbers of NPs and PAs have increased over the last decade. Between 2001 and 2005, both the number of NPs and the number of PAs practicing in North Carolina grew by 32%.[15,16] In 2005, there were 2,440 NPs and 2,674 PAs practicing in the state. The supply of both professions has grown faster than the population in recent years.

Nurse Practitioners:
Between 2001 and 2005, 63 of North Carolina's counties experienced an increase in the NP-to-population ratio. Thirty-six counties saw a decrease in the ratio while

one had no NP in either year. Two counties, Camden and Gates, have no NP practicing in the area, while Mecklenburg (243), Durham (235), and Wake (199) counties have the most total NPs. The greatest concentrations of NPs per 10,000 population are located along the western and eastern borders of the state and in the very center. (See Map 4.1.) The counties with the highest NP-to-10,000 population ratios are Durham, Orange, and Hyde counties. According to an analysis of practice environments by the National Center for Health Workforce Analysis, North Carolina has the tenth most favorable practice environment for NPs.[f,10]

Map 4.1
Primary Care Nurse Practitioners per 10,000 Population, North Carolina, 2005



Source: North Carolina Health Professions Data System, Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill, with data derived from the North Carolina Medical Board, 2005.

Counts include active, instate, nurse practitioners indicating a primary specialty of family practice, general practice, internal medicine, ob/gyn or pediatrics.

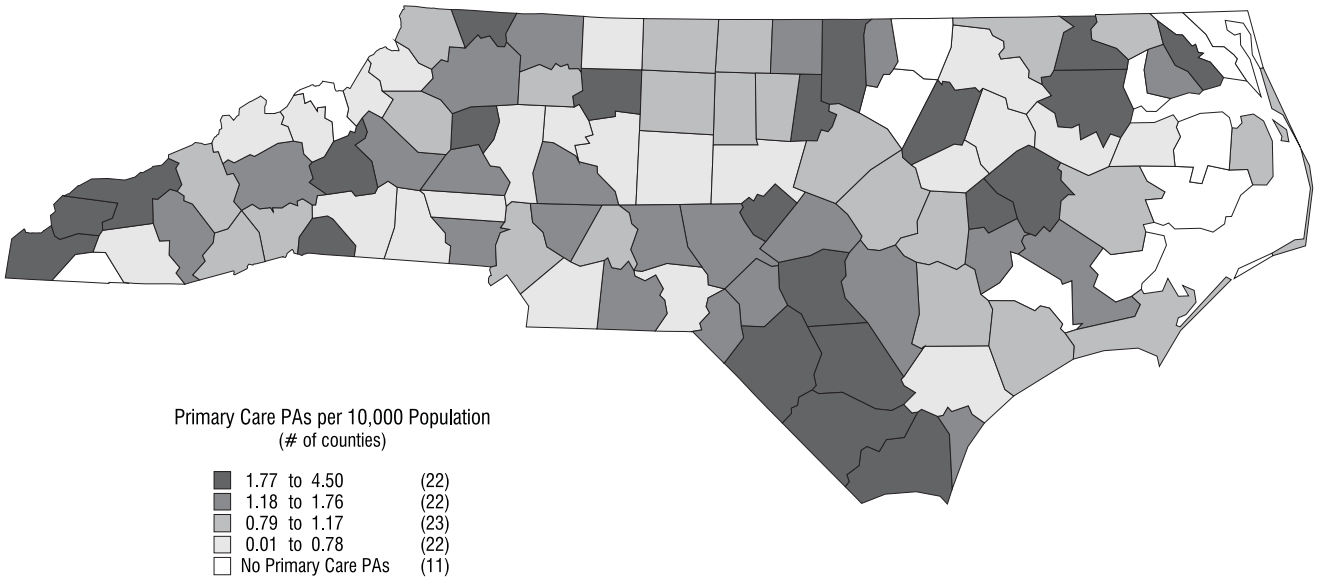
Physician Assistants:
The 7.0% (+176) increase in PAs from 2004 to 2005 continues a pattern of growth. In 2005, 52 counties increased their PA-to-population ratio, and 44 counties decreased their PA-to-population ratio. An additional four counties had no PAs in either year. The counties with the largest PA-to-10,000 population ratios are widely distributed across the state. (See Map 4.2).

Currently, PAs view North Carolina as having a regulatory environment conducive to practice. In a national study that examined practice environments for PAs, North Carolina was considered to have the most positive practice environment for

f The factors that keep North Carolina from being one of the most favorable practice environments for NPs, according to the National Center for Health Workforce Analysis, include not having a specific NP licensure, language mentioning a collaborative relationship with a physician, regulation by the Board of Nursing with another entity, the necessity to have a written practice agreement, and periodic review of records by a physician.

PAs.[g,17] Further, the authors found that a positive practice environment was strongly correlated with supply of PAs. Legislators and regulators should be vigilant so as to avoid regressive moves to restrict practice unless there is compelling evidence that such moves are needed to protect the citizens of North Carolina.

Map 4.2
Primary Care Physician Assistants per 10,000 Population, North Carolina, 2005



Source: North Carolina Health Professions Data System, Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill, with data derived from the North Carolina Medical Board, 2005.

Counts include active, instate physician assistants indicating a primary specialty of family practice, general practice, internal medicine, ob/gyn or pediatrics.

NPs and PAs offer a valuable opportunity to more quickly increase the number of primary care providers in North Carolina. Training NPs and PAs takes between two and three years, on average, compared to more than four years for medical school and approximately three years of residency training for a physician. Thus, compared to training physicians, it is less costly to train NPs and PAs, and it is possible to see a more rapid increase in the available provider population. Furthermore, NPs and PAs provide a significant amount of care in rural areas compared to their physician counterparts. Between 2001 and 2005, almost half (47%) of the 264 primary care providers gained in rural North Carolina counties were either NPs or PAs. NPs and PAs comprised 26% of total primary care providers in rural counties in 2001 and 28% in 2005. In 2005, they accounted for 42% of total primary care providers in whole-county persistent health professional shortage areas (PHPSAs) compared to 23% of primary care providers in counties not designated as PHPSAs.

g The authors examined the states' legal, reimbursement, and prescriptive authority for PAs in establishing the rating system for PAs' practice environment. North Carolina, Oregon, and Montana were the only states that were rated as having an excellent practice environment.

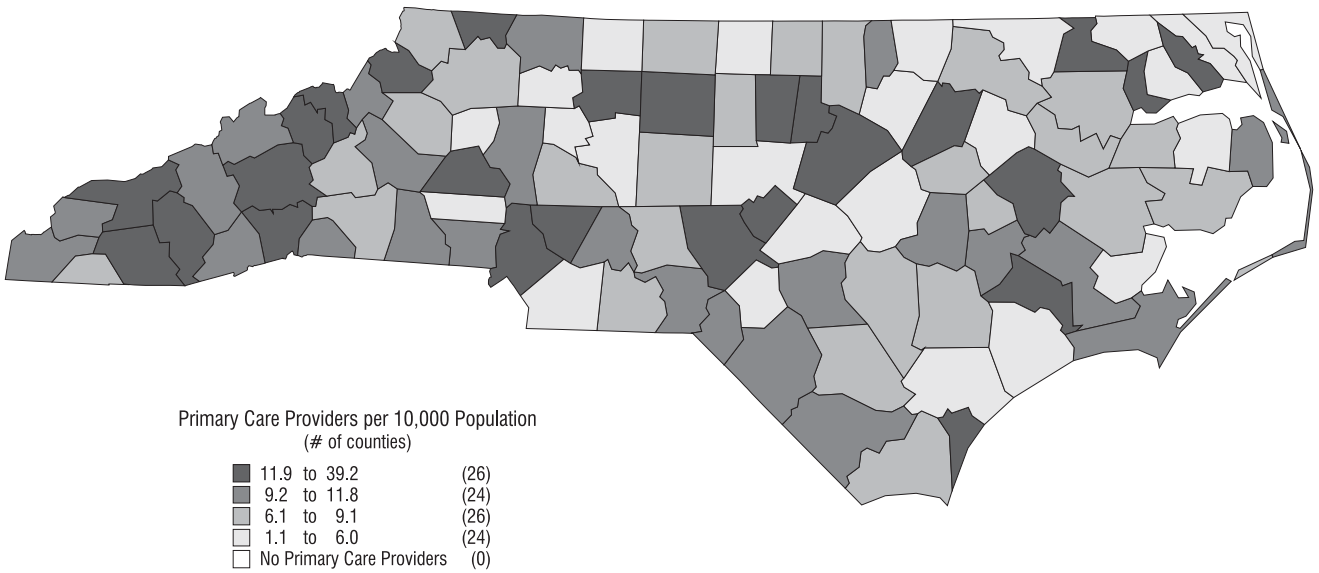
Strategies for increasing the supply of NPs and PAs include increasing student enrollment in North Carolina NP and PA programs, developing a new PA training program in North Carolina, and maintaining or improving the regulatory environment for NPs and PAs. (See Recommendations 2.7, 2.8, and 2.12.)

Obstetrician-Gynecologists and Certified Nurse Midwives:
Many obstetrician-gynecologists (OB-GYNs) and CNMs serve as primary care providers for women. Increasing their supply also can help address primary care shortages. Strategies to increase the supply of OB-GYNs and CNMs are discussed more fully in the section below on Providers Delivering Babies.

Primary Care Provider Distribution Is a Major Challenge Currently Facing the State

While the current supply of primary care providers may be adequate to meet the health-care needs of most North Carolinians, providers are not well distributed across the state. Maldistribution of healthcare providers has historically been a problem in North Carolina and in the rest of the nation, particularly in rural areas. The problem appears to be getting worse after several years of improvement. Fifty-eight counties have primary care provider-to-10,000 population ratios below the state average (9.8 per 10,000 population). Map 4.3 illustrates ratios are typically larger in urban areas, but there also are large proportions in some less-populated areas, especially in the western part of the state.[16]

Map 4.3
Total Primary Care Workforce: Physicians, Physician Assistants, and Nurse Practitioners, North Carolina, 2005



Source: North Carolina Health Professions Data System, Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill, with data derived from the North Carolina Medical Board, 2005.

Counts include active, instate, nonfederal, non-resident-in-training physician assistants, nurse practitioners, and physicians indicating a primary specialty of family practice, general practice, internal medicine, ob/gyn or pediatrics.

Although there were increases in the primary care provider-to-population ratio in health professional shortage areas (HPSAs)[h] between 1979 and 2001, beginning in 2002 that ratio leveled off. The most recent (2005) data indicate a slight drop in whole-county HPSA primary care provider-to-population ratios. Rural areas face more critical shortages than most urban areas. For example, in 2005 all 11 of the whole-county HPSAs in the state were rural.[11]

The most significant immediate problem with primary care provider supply is distribution of providers across the state. Strategies to address such maldistribution are outlined in Chapters 2 and 3. They include using new state financial support for health professions training programs to encourage or reward programs producing providers who serve in underserved communities in North Carolina (Recommendations 2.8 and 2.9); increasing funding for loan repayment or other financial incentives to recruit and retain providers in underserved areas (Recommendations 3.3 and 3.5); and providing funding to support *locum tenens* programs or other systems of support to help providers establish and remain in practice in underserved areas (Recommendations 2.14 and 3.5).

Ensuring that women have continuous and early prenatal care is critical to the well-being of the infant and mother.

Providers Who Deliver Babies[i]

There were 119,773 live births in North Carolina in 2004.[18] The number of births grew in the mid-1990s but then held relatively stable at approximately 120,000 for the last five years. By 2020, state demographers expect approximately 135,000 live births per year.[19] Ensuring that women have continuous and early prenatal care is critical to the well-being of the infant and mother. Women need access to physicians and other clinicians who are trained to deliver babies and who can address any complications that might arise during delivery.

Most births occur in hospitals and are attended by physicians, generally obstetrician-gynecologists (OB-GYNs) or family physicians. In 2004, 89.4% of births in North Carolina hospitals were attended by physicians, and 10% were attended by CNMs.[18] The number of births attended by CNMs has increased steadily since 1990, when only approximately 2% of all births were attended by midwives.[20]

There has been steady growth in the number of OB-GYNs over the last five years (2000-2004); however, not all OB-GYNs deliver babies. The percentage of OB-GYNs delivering babies increased gradually over the same time period until 2003 when both the number and percentage of OB-GYNs who reported delivering babies declined. (See Table 4.3.) There has been a more precipitous drop in the number of family physicians who report delivering babies. Between 2003 and 2004, the number of family physicians delivering babies declined by 12% (from 232 in 2003

h The Bureau of Health Professions in the US Department of Health and Human Services has designated certain communities, population groups, or medical facilities as Health Professional Shortage Areas (HPSAs). Certain counties, or parts thereof, will be designated as HPSAs if they have more than 3,500 people per primary care provider. Population groups can be designated as HPSAs if they have specific access barriers, and there is a high ratio of people in that population group to practitioners serving the population. For more information on HPSA designations, see Chapter 3.

i Data for providers delivering babies will be based on 2004 data collected by the NC Health Professions Data System. 2005 data had too many missing values to be reliable for comparing changes in the numbers and percentages of providers delivering babies compared to previous years.

to 205 in 2004). Of the 101 physicians who stopped providing deliveries between 2003 and 2004, 56 (56%) were family physicians.[21] Family physicians who offer delivery and prenatal services are extremely valuable in rural areas, where they provide over a quarter of the prenatal (33%) and delivery services (26%) available in rural communities.[11] Recently, some advocates have recommended removing obstetrical training from family physician training, but such a move could have a strong negative impact on the prenatal and delivery services available in rural communities.

While the overall supply of providers who offer prenatal care and deliveries may currently be adequate, there is a maldistribution issue.

Table 4.3
North Carolina Providers Delivering Babies, 2000-2004

	2000	2001	2002	2003	2004
Total Live Births	**120,245**	**118,112**	**117,307**	**118,292**	**119,773**
OB-GYNs total	919	937	954	960	981
OB-GYNs delivering	651	701	742	750	748
% OB-GYNs delivering	70.8%	74.8%	77.8%	78.1%	76.2%
Family Physicians (FPs)	2,173	2,224	2,293	2,327	2,040
FPs delivering	212	227	228	232	205
% FPs delivering	9.8%	10.2%	9.9%	10.0%	10.0%
Total Physicians delivering	863	928	970	982	953
Births/physicians	139.3	127.3	120.9	120.5	125.7
CNMs	167	172	193	196	195

Source: NC Health Professions Data System.

At this point, it is unclear whether the one-year decline in physicians delivering babies is the beginning of a trend or a one-year aberration. Providers who deliver babies have experienced a significant increase in malpractice premiums in recent years. For example, between 2001 and 2002, premiums for OB-GYNs increased 15%.[22] Increased liability insurance costs may deter some providers from offering delivery services. North Carolina state government used to offer payments to help rural practitioners who delivered babies offset some of their malpractice costs through a program called the Rural Obstetrical Care Incentive (ROCI) Program. This program, which ran from 1988 through 2001, had a beneficial impact on retention of rural providers who deliver babies.[23]

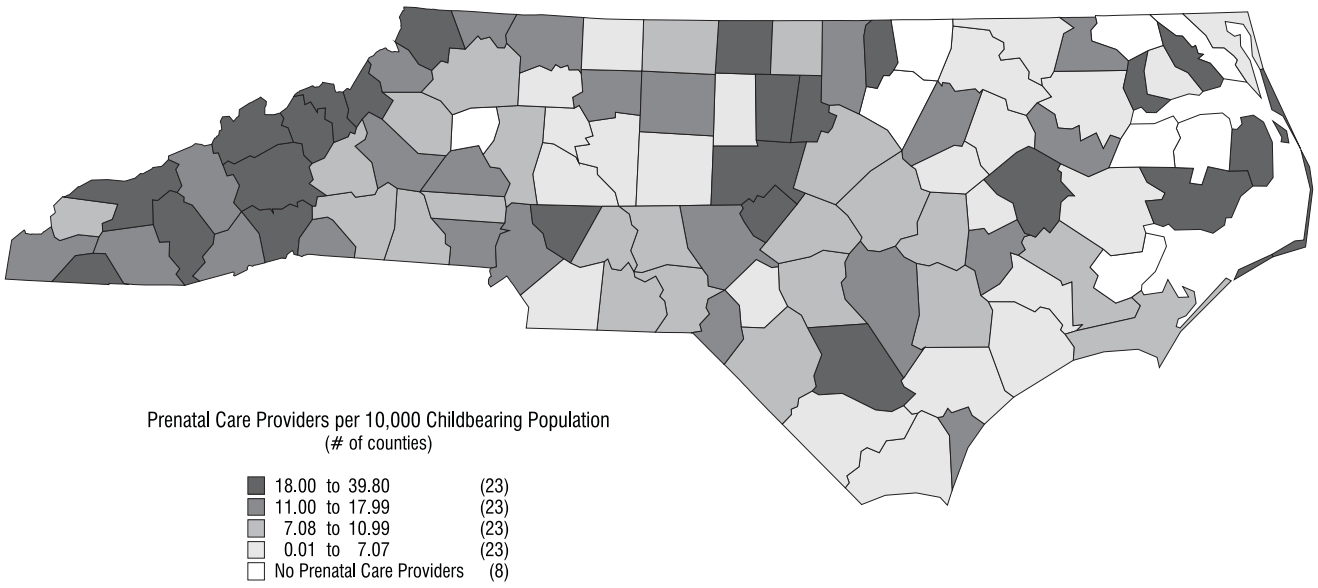
CNMs also are licensed to provide prenatal, intrapartum, postpartum, newborn, and family planning services. In 2004, there were 195 CNMs licensed to practice in North Carolina. CNMs practice in a variety of settings, including private practice, health departments, federally qualified health centers, hospitals, and university settings. Most CNMs provide prenatal care, but not all CNMs deliver babies.[j] Under state law, a CNM must have a supervising physician in order to practice;[24] thus CNMs can deliver babies only in communities where they have arrangements

j CNMs are not required to report on their licensure file whether they deliver babies. However, in a survey of CNMs in the state, 10% of CNMs (14) who responded to the survey (137) reported they did not attend births. Most midwives who attend births deliver 80 or fewer babies per year. Personal correspondence from Francie Likis, CNM, doctoral candidate at the University of North Carolina at Chapel Hill, April 3, 2006.

with supervising physicians. High malpractice costs also are an issue for CNMs who deliver babies. CNMs face a number of challenges with respect to their practice environment in North Carolina. A study by the National Center for Health Workforce Analysis of the most favorable professional practice environments for CNMs in each state found North Carolina ranked 24th among states.[k,10] This ranking is less favorable than the practice environment for PAs (top rank) or NPs (tenth).

While the overall supply of providers who offer prenatal care and deliveries may currently be adequate, there is a maldistribution issue. Currently 13 counties in the state have no physicians reporting a practice location[l] that provides prenatal care services. Eight of these counties have no providers (physician, CNM, PA, NP) who report providing prenatal care on their licensure files. (See Map 4.4.) Community members in these counties have access to some prenatal care through their local health departments, but delivery services would not be available in these counties. Even in counties with prenatal providers, there is wide variation in the ratio of providers to women of childbearing age.

Map 4.4
Prenatal Care Providers per 10,000 Childbearing Population, North Carolina, 2004



Source: North Carolina Health Professions Data System, Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill, with data derived from North Carolina Medical Board and North Carolina Board of Nursing, 2004.

Counts include active, in-state, non-federal, non-resident-in-training physicians, PAs, and NPs who report providing prenatal care, and also includes CNMs. Counts for physicians, PAs, and NPs include primary, secondary, and other practice location. Childbearing age: 15-44.

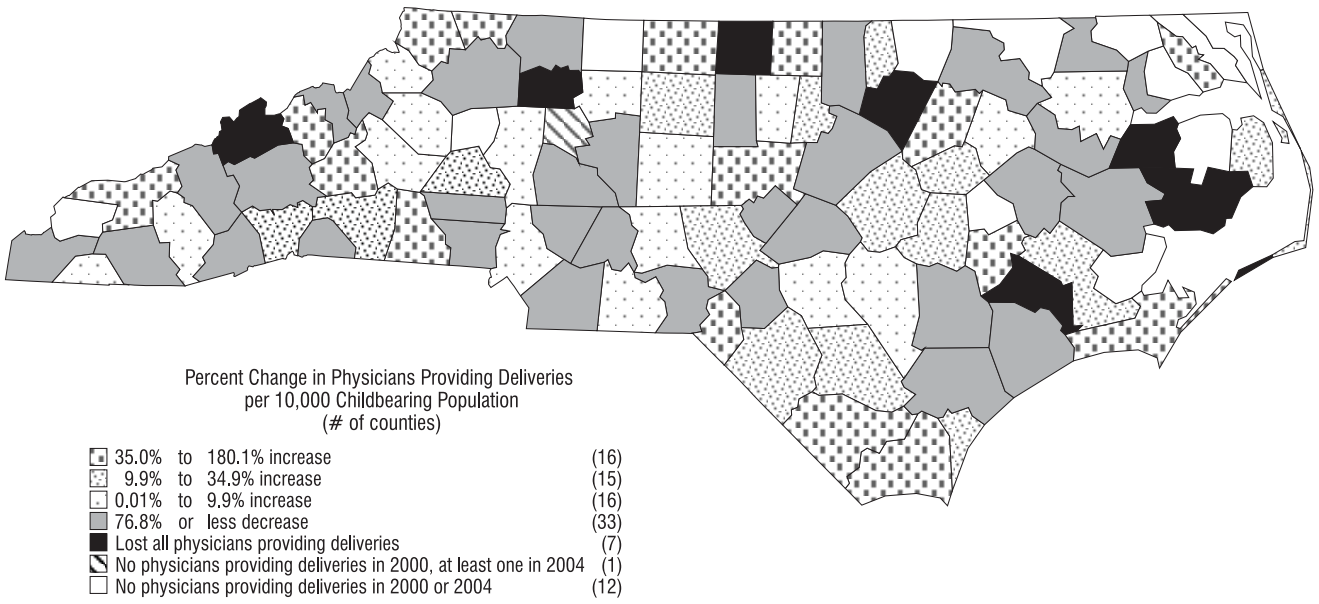
k According to a study conducted by the National Center for Health Workforce Analysis in 2000, some of the factors restricting the positive practice environment for CNMs in North Carolina include regulation involving the Board of Medicine, a restricted scope of practice, the inability to practice autonomously, and the inclusion of physician supervisory language in practice statutes.

l These data include physicians' reports of primary, secondary, and tertiary practice locations.

There is even more of a maldistribution issue for physicians who deliver babies. There are currently 19 counties without physicians who report delivering babies; 12 of these counties have not had a physician deliver a baby in the last five years.[m] More than one-half of all North Carolina counties (52) had either a decline in the ratio of physicians delivering babies to women of childbearing years over the last five years (40 counties) or no physicians providing deliveries in either 2000 or 2004 (12 counties). Almost two-thirds (63%) of counties with no physicians delivering babies in 2004 were health professional shortage areas as were 45% of other counties that experienced a decrease in the ratio of physicians providing deliveries to the population.[n] However, loss of physicians delivering babies appears to have a minimal impact on average distance traveled to deliver babies.[25]

Strategies for increasing access to prenatal care and delivery services can be targeted either to increasing overall supply of providers offering obstetrics/gynecology services

Map 4.5
Percent Change in Physicians Performing Deliveries per 10,000 Childbearing Population, North Carolina, 2000-2004



Source: North Carolina Health Professions Data System, Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill, with data derived from the North Carolina Medical Board, 2000-2004.

Counts include active, in-state, non-federal, non-resident-in-training physicians who report providing obstetric deliveries. Counts include primary, secondary, and other practice location. Childbearing age: 15-44 years.

m The counties with no physicians providing deliveries in 2000 or 2004 include Alexander, Camden, Currituck, Gates, Graham, Greene, Northampton, Pamlico, Perquimans, Stokes, Tyrrell, and Warren. The counties that had at least one physician delivering babies in 2000 but none in 2004 include Caswell, Franklin, Hyde, Jones, Madison, Washington, and Yadkin.

n Fifteen of the 33 counties (45%) that experienced a loss in the ratio of physicians providing deliveries per childbearing population; four of the seven counties (57%) that had at least one physician providing deliveries in 2000 but none in 2004; and eight of the 12 counties (67%) that had no physicians delivering babies in either 2000 or 2004 were health professional shortage areas in 2005.

or addressing unequal distribution of such providers across the state. Given the maldistribution of providers, it is important to encourage use of CNMs in low-provider areas. In this effort, it is important to support a more positive practice environment for CNMs across the state. Strategies for addressing the maldistribution issue include providing more funding to the Office of Rural Health and Community Care to expand their efforts to place providers in underserved areas (Recommendation 3.3), changing admission policies in medical schools and other health professions programs to accept more students from underserved areas and offer students training opportunities in these communities (Recommendations 2.9 and 3.2), and creating other incentives or practice support to assist providers who establish practice in underserved communities (Recommendation 3.5). Other recommendations follow below.

Recommendation 4.2.

The NC OB/GYN Society, NC Area Health Education Centers Program, East Carolina University Nurse Midwifery program, NC Academy of Family Physicians, and North Carolina medical schools should change the practice environment to encourage acceptance of certified nurse midwives into practice.

Recommendation 4.3.

The NC General Assembly should appropriate $206,000 annually to expand the East Carolina University Nurse Midwifery program by 30%.

Recommendation 4.4. (Priority Recommendation)

The NC General Assembly should appropriate $2 million to provide malpractice premium subsidies (similar to the Rural Obstetrical Care Incentive Program) for physicians and certified nurse midwives who provide delivery services in medically underserved areas.

General Surgeons

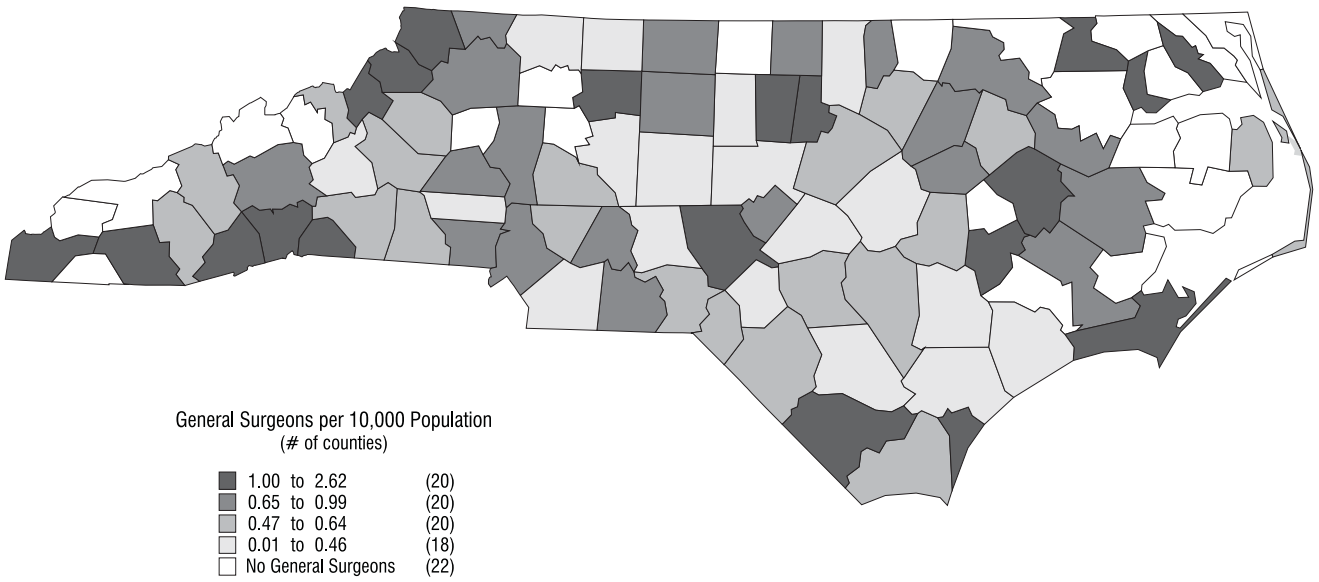
Population growth and, particularly, aging of the population are increasing demand for all medical services including surgeries. Older individuals use more medical services than younger populations. Therefore, increased life expectancy and retirement of the baby boomer generation will have, beginning in 2011, a profound effect on need for surgical services in the future. Research indicates that utilization rates of surgical services will surpass overall population growth rates.[26] Traditionally, general surgeons have provided a significant amount of needed surgical care, including care in the following nine content areas: alimentary tract surgery, surgery of the abdomen, breast/skin/soft tissue surgery, head/neck surgery, vascular surgery, endocrine surgery, surgical oncology, management of trauma, and care of critically ill patients with underlying surgical conditions.[27]

North Carolina has more general surgeons per 10,000 population (0.75) than the nation as a whole (0.60) or the south (0.64). However, access to surgeons varies drastically in different areas of North Carolina. In 2005, North Carolina had 22 counties with no surgeons,[o] while another 35 counties had below the state average

o The counties with no general surgeons include Alexander, Bertie, Bladen, Camden, Caswell, Clay, Currituck, Gates, Graham, Greene, Hyde, Jones, Madison, Northampton, Pamlico, Perquimans, Swain, Tyrrell, Warren, Yadkin, and Yancey.

of 0.62 general surgeons to 10,000 population. The majority of the counties with no surgeons or fewer than 0.62 surgeons per 10,000 population are found in the eastern and western parts of the state. (See Map 4.6.)

Map 4.6
General Surgeons per 10,000 Population, North Carolina, 2005



Source: North Carolina Health Professions Data System, Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill, with data derived from the North Carolina Medical Board, 2005.

Counts include active, instate, non-federal, non-resident-in-training physicians indicating a primary specialty of general surgery.

Between 1995 and 2005, 47 North Carolina counties experienced a decline in the number of general surgeons per population, and another four lost all general surgeons. Eighteen counties had no surgeons in either year. Only 31 counties experienced an increase in the ratio. More recent trends from the last five years (2000-2005) indicate an even more alarming development, with 53 counties experiencing a reduction of general surgeons and five counties losing all general surgeons. Seventeen counties had no general surgeons in either year. Only 25 counties had an increase in general surgeon supply. (See Table 4.4 and Map 4.7.)

A number of different issues may be contributing to the decline in general surgeons in North Carolina and across the nation, including decreased interest in general surgery as a career; increased demand for specialists; less interest in surgery than other medical specialties among women who now represent an increasing percentage of the physician workforce; and aging of the general surgery workforce. Surgical training programs have had limited success attracting women. Between the academic years 1996-1997 and 2001-2002, women accounted for almost 43% of US medical graduates, but in academic year 2002-2003 they accounted for only 25% of general surgery residents.[27]

General surgery is not only less attractive to women, it is losing popularity among both genders. In 1987, 7.8% of medical students across the country chose general

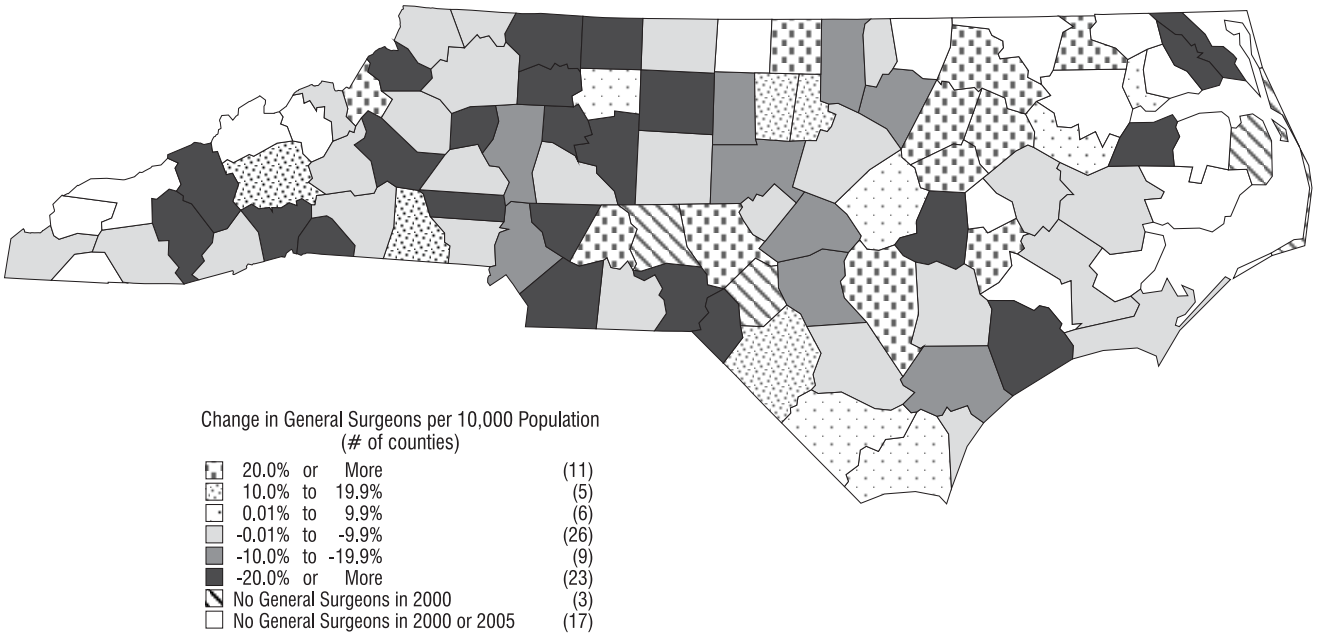
surgery as a career compared to only 5.8% in 2002.[28] In addition, the general surgical residency attrition rate reached 20% in 2000. This decline in general surgery interest may reflect medical students' perceptions that general surgeons have poorer quality of life because of relatively long work hours and intensive training.[26,27] In fact, data indicate general surgery residents traditionally work more hours per week than residents in

Table 4.4
Percent Change in General Surgeons per 10,000 Population, North Carolina (Number of counties)

Percent of Change	Number of counties 1995-2005	Number of counties 2000-2005
20% or More	19	11
10% to 19.9%	6	5
0.01% to 9.9%	5	6
-0.01% to -9.9%	14	26
-10% to -19.9%	11	9
-20% or More	22	18
Lost all General Surgeons (decrease)	4	5
No General Surgeons in initial year (increase)	1	3
No General Surgeons either year (no change)	18	17

Source: NC Health Professions Data System.

Map 4.7
Percent Change in General Surgeons per 10,000 Population, North Carolina, 2000-2005



Source: North Carolina Health Professions Data System, Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill, with data derived from the North Carolina Medical Board, 2000 & 2005.

Counts include active, instate, non-federal, non-resident-in-training physicians indicating a primary specialty of general surgery.

other specialties.[28] There also is increased demand for specialists as a result of foci on healthcare quality and standards.[27] Technical developments in surgery also may influence medical student career choice away from general surgery.[28] A trend is growing among general surgeons toward progressive specialization during the fellowship following residency training. Progressive specialization occurs when physicians voluntarily narrow their scope of practice within the course of their training.

A decline in general surgeons will likely have the largest negative impact on rural areas. Aging of the general surgery population is of greatest concern to small/isolated rural areas because general surgeons aged 50 years or older, a group likelier to retire sooner, are significantly more likely to live in those areas compared to urban areas.[29] Furthermore, general surgeons are integral to the sustainability of many rural hospitals. General surgeons generate valuable revenue for rural hospitals, and many hospital administrators see general surgery as a key component of a rural hospital's financial viability.[30] Certain aspects of rural practice pose challenges for general surgeons, including changing referral patterns, limited reimbursement, rural hospital closures, and recruitment difficulties. Fortunately, some of the reduction in general surgery interest by US allopathic medical students is offset by international medical graduates (IMGs).[28] In fact, IMG general surgeons are more likely to work in rural areas than in urban areas.[29]

Certain aspects of rural practice pose challenges for general surgeons, including changing referral patterns, limited reimbursement, rural hospital closures, and recruitment difficulties.

Strategies for addressing overall supply and maldistribution issues related to general surgeons in North Carolina include those focused on overall supply and maldistribution issues. Related to overall supply, state funding should support academic health centers that increase the number of providers who obtain qualifications for and practice in shortage specialties such as general surgery and report their data to the Health Workforce Policy Board. (See Recommendation 2.8.) Additionally, funding could be provided to expand the number of general surgery residency positions. (See Recommendation 2.9.) Special consideration should be given to funding a track in an existing residency program that focuses on training general surgeons for rural practice. To improve distribution, strategies include providing more funding for loan repayment programs to general surgeons in underserved areas or developing a *locum tenens* program to give general surgeons time off. (See Recommendations 3.3 and 3.5.)

Psychiatrists[p]

Nationally, in a given year almost one-third of nonelderly adults experience a mental disorder.[31] A sizable number of children also have behavioral or emotional disorders. Nearly 15% of North Carolina children exhibit a behavioral disorder such as attention deficit disorder, anxiety, or depression.[32] Despite the widespread need, most individuals with serious mental problems do not receive treatment. Factors limiting access to needed services include the stigma attached to mental illness and inadequate supply or maldistribution of mental health professionals who are able to treat people using both medications and psychotherapy. Some people who need mental health services are unable to afford care because they lack health

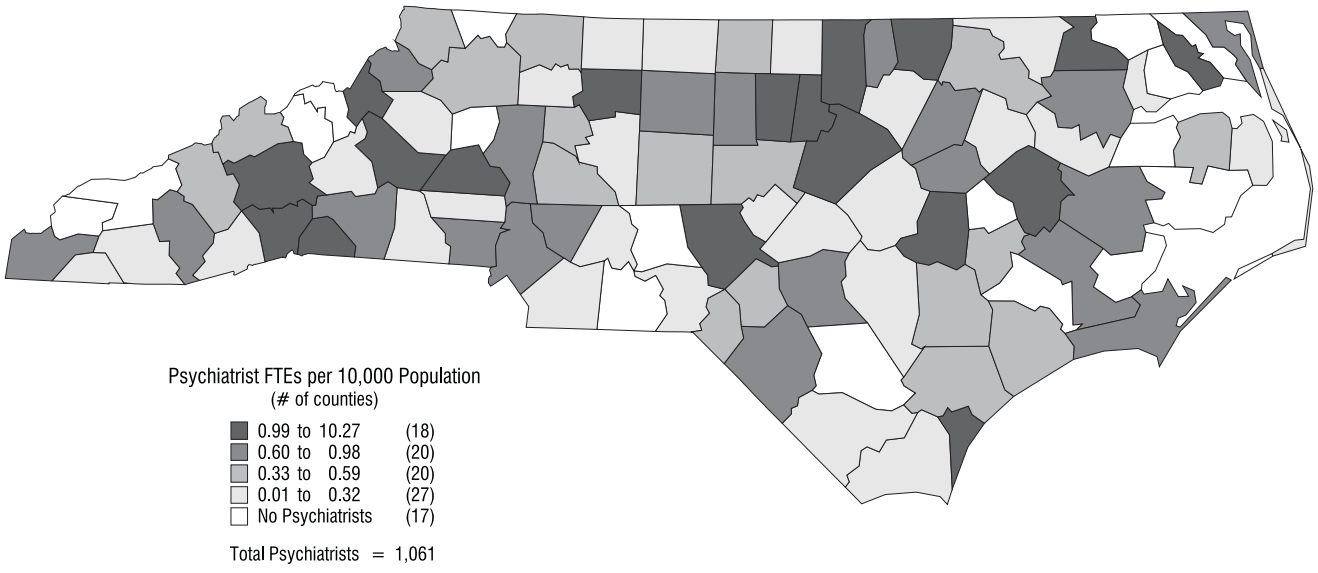
p Excerpted, with permission, from: Fraher E, Swartz M, Gaul K. The Supply and Distribution of Psychiatrists in North Carolina: Pressing Issues in the Context of Mental Health Reform. 2006. Available at: http://www.shepscenter.unc.edu/hp/Psychiatrist_Brief.pdf. Accessed May 2, 2006.

insurance coverage or, if insured, they may have less comprehensive coverage for mental and behavioral health services than they have for other health services.

Many types of health professionals treat mental health disorders, including, but not limited to, psychiatrists, psychologists, primary care providers, social workers, and clinical nurse specialists. While these practitioners are all trained to treat people with mental disorders, certain patients need consultation and treatment by psychiatrists, who are able to treat people using medicine and psychotherapy. Psychiatrists are generally among the lowest paid of physician specialties, which may discourage some physicians from choosing to specialize in psychiatry. (See Chart 4.1.)

North Carolina has a higher psychiatrist-to-population ratio than most other states in the south with the exception of Virginia.[33] North Carolina has 2.4 psychiatrists per 10,000 population. Between 1995 and 2004, the ratio of psychiatrist-to-population remained relatively steady. However, psychiatrists are not evenly distributed throughout the state. In 2004, there were 17 counties with no psychiatrists,[q] and another 27 counties with ratios low enough (0.33 or below) to be designated as mental health professional shortage areas.[24] Psychiatrists are most heavily located close to the state's four mental health hospitals, in counties with major medical centers, and in large metropolitan areas. (See Map 4.8.)

Map 4.8
Psychiatrist Full-Time Equivalents per 10,000 Population, North Carolina, 2004



Source: North Carolina Health Professions Data System, Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill, with data derived from the North Carolina Medical Board, 2004.

Psychiatrists include active (or unknown activity status), instate, nonfederal, non-resident-in-training physicians who indicate a primary specialty of psychiatry, child psychiatry, psychoanalysis, psychosomatic med, addiction/chemical dependency, forensic psychiatry, or geriatric psychiatry, and secondary specialties in psychiatry, child psychiatry and forensic psychiatry.

q The counties with zero full-time equivalent psychiatrists in 2004 include Alexander, Alleghany, Anson, Bladen, Camden, Gates, Graham, Greene, Hyde, Jones, Mitchell, Montgomery, Pamlico, Perquimans, Swain, Washington, and Yancey.

Between 1999 and 2004, nearly two-thirds of North Carolina counties either experienced a decline in the proportion of psychiatrists-to-population or had no psychiatrists. Five counties lost all their psychiatrists, 48 counties experienced a decline in the ratio of psychiatrists-to-population, and 12 counties had no psychiatrists in either 1999 or 2004. North Carolina's mental health reform also has had an impact on the provision of care to mental health patients in the public sector. Mental health services in North Carolina are coordinated by local management entities (LMEs). Between 2003 and 2005, the number of LME psychiatrists[r] per capita fell 16%. Per capita losses were higher in rural areas (20%) compared to urban areas (14%), and small population LMEs lost 44% of their psychiatrists.[35]

Between 1999 and 2004, nearly two-thirds of North Carolina counties either experienced a decline in the proportion of psychiatrists-to-population or had no psychiatrists.

In general, psychiatrists are less likely than all other physicians to locate in rural areas or in health professional shortage areas. (See Table 4.5.) In 2004, 15.6% of psychiatrists had their primary practice in a nonmetropolitan county, compared to 21.6% of physicians with other specialties. Similarly, 28.5% of psychiatrists were located in areas that were designated as health professional shortage areas compared to 37.9% of other physicians.

Table 4.5
Primary Practice Location of Psychiatrists and Non-Psychiatrist Physicians, North Carolina, 2004

	Non-metropolitan counties	Metropolitan counties	Whole-county HPSAs	Part-county HPSAs	Not a HPSA
Psychiatrists (%)	15.6%	84.4%	2.1%	26.4%	71.5%
All other physicians (%)	21.6%	78.4%	3.3%	34.6%	62.1%
Ratio of Psychiatrists per 10,000 population	0.58	1.49	0.30	0.83	1.63

Source: Fraher E, Swartz M, Gaul K. *The Supply and Distribution of Psychiatrists in North Carolina: Pressing Issues in the Context of Mental Health Reform.* 2006. Chapel Hill, NC: Cecil G. Sheps Center for Health Services Research.

In the absence of psychiatrists, primary care providers are often faced with the responsibility of diagnosing and managing the care of people with mental illness. However, seven of the 17 counties with no psychiatrists also are whole-county primary care health professional shortage areas. Viewed from another perspective, 11 of the 19 counties that have persistently (six out of the last seven years) been designated as primary care health professional shortage areas also are designated as mental health professional shortage areas.

The supply of child psychiatrists is even more limited. In 2004, 43 counties had no child psychiatrists, and another 42 counties had less than one child psychiatrist per 10,000 population age 18 and younger. Further, the supply of physicians with a primary specialty in child psychiatry has declined 24% over the past decade.

Strategies to address such shortages may target overall supply and education, distribution of providers across North Carolina, and new models of care. A strategy

r LME psychiatrists include those that are directly employed by the LME, individually contracted, or contracted through a provider agency or member of the provider community.

focused on overall supply includes targeting state funding to support academic health centers that increase the number of providers who obtain qualifications for and practice in shortage specialties such as psychiatry and report their data to the Health Workforce Policy Board. A recommendation focused on addressing maldistribution concerns includes increasing funding to the Office of Rural Health and Community Care to increase recruitment efforts to shortage areas. (See Recommendation 3.3 in Chapter 3.) Another includes increasing funding to the NC Area Health Education Centers Program to expand residency positions in child psychiatry and general psychiatry. (See Recommendation 2.9.) Residency funds should be targeted to adding residency positions as well as providing funding to create model community-based teaching sites to prepare psychiatrists to serve rural and other underserved populations. Additional funds are required to provide incentives to residents and other trainees to participate in rotations in underserved communities. Other recommendations related to these strategies are listed below.

In the absence of psychiatrists, primary care providers are often faced with the responsibility of diagnosing and managing the care of people with mental illness.

Recommendation 4.5.

North Carolina medical schools and other health professions programs, specialty societies, and the NC Area Health Education Centers Program should strengthen and expand the mental and behavioral health and psychopharmacology components of training and continuing education to increase competencies in mental and behavioral healthcare for all graduates, with a special emphasis in integrating behavioral health and primary care. Innovative approaches may include special tracks in psychology/behavioral health, better integration of behavioral health content into current curricula, postgraduate programs in behavioral health, and education for psychiatrists and other mental health in working collaboratively with primary care professionals in more integrated models of care.

Recommendation 4.6. (Priority Recommendation)

The NC General Assembly and the NC Division of Mental Health, Developmental Disabilities and Substance Abuse Services, should provide funding to targeted rural communities to establish new models of care to serve public patients in rural and underserved communities.

a) **New models of care should be developed collaboratively with the NC Division of Mental Health, Developmental Disabilities and Substance Abuse Services, the NC Area Health Education Centers Program, the NC Office of Rural Health and Community Care, academic healthcare institutions, and primary care and specialty societies.**

b) **Models should include psychiatrists and other mental health professionals and have close linkages to primary care providers in the service area.**

c) **To improve the professional environment in these settings, these sites should qualify for higher levels of reimbursement, have strong linkages to academic health centers, and have a strong focus on integrated care.**

Recommendation 4.7. (Priority Recommendation)

The NC General Assembly, public and private insurers, and payers (including, but not limited to, the State Health Plan, NC Division of Medical Assistance, and NC Division of Mental Health, Developmental Disabilities and Substance Abuse Services) should pay for:

a) psychiatric consultations for primary care providers and other clinicians either through face-to-face consultations or telemedicine; and

b) services provided by primary care providers to patients who have been diagnosed with a psychiatric diagnosis.

Reimbursement levels for mental and behavioral health services through Medicaid, NC Health Choice, State Health Plan, and other payers should be continually evaluated to ensure they are adequate to meet the costs of care across the state, particularly in underserved areas.

References

1. Baicker K, Chandra A. Medicare spending, the physician workforce, and beneficiaries' quality of care. *Health Aff*. Web Exclusive. April 7, 2004;W4:184-197. Available at: http://content.healthaffairs.org/cgi/reprint/hlthaff.w4.184v1.pdf. Accessed August 31, 2006.
2. Estes EH. Primary care: Building a model for the new medical environment. *NC Med J*. July/Aug 2002;63(4):189-194.
3. Hing E, Cherry DK, Woodwell BA. *National Ambulatory Medical Care Survey: 2004*. Summary Table 5. Number and percent distribution of office visits with corresponding standard errors by selected visit characteristics, according to prior-visit status: United States, 2004. Centers for Disease Control and Prevention. Atlanta, GA: US Department of Health and Human Services. Available online at: http://www.cdc.gov/nchs/data/ ad/ad374.pdf. Accessed July 24, 2006.
4. Bodenheimer T. Primary care—Will it survive? *N Engl J Med*. August 31, 2006;355(9):861-864.
5. NC Health Professions Data System. *New to File and New to Practicing*. Cecil G. Sheps Center for Health Services Research. Chapel Hill, NC: University of North Carolina at Chapel Hill; September 2006.
6. Tu H, Ginsburg PB. *Losing Ground: Physician Income: 1995-2003*. Tracking Report. No. 15. Washington, DC: Center for Studying Health System Change; June 2006. Available at: http://www.hschange.org/CONTENT/851/851.pdf. Accessed September 23, 2006.
7. Medicare Payment Advisory Commission. *Report to the Congress: Medicare Payment Policy*. Washington, DC: Medicare Payment Advisory Commission; March 2006. Available at: http://www.medpac.gov/publications/congressional_reports/Mar06_TOC.pdf. Accessed October 4, 2006.
8. Starfield B, Shi L, Grover A, Macinko J. The effects of specialist supply on populations' health: assessing the evidence. *Health Aff*. 2005; Jan-June;Suppl Web Exclusive:W5-97-W5-107.
9. Larson EH, Hart LG, Ballweg R. National estimates of physician assistant productivity. *J Allied Health*. Fall 2001;30(3):146-152.
10. National Center for Health Workforce Analysis. *A Comparison of Changes in the Professional Practice of Nurse Practitioners, Physician Assistants, and Certified Nurse Midwives: 1992 and 2000*. Bureau of Health Professions. Available at: http://bhpr.hrsa.gov/healthworkforce/reports/scope/scope1-2.htm. Accessed September 15, 2006.
11. NC Health Professions Data System. Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill. 2006.
12. Doctor of Osteopathy. In: Medline Plus [database online]. Bethesda, MD: National Library of Medicine. Available at: http://www.nlm.nih.gov/medlineplus/encyclopedia.html. Accessed November 8, 2006.
13. American Association of Colleges of Osteopathic Medicine [Web site]. Available at: http://www.aacom.org/. Accessed September 6, 2006.
14. Michael M. Presented at: Primary Care and Specialty Supply Task Force Steering Committee Meeting, North Carolina Institute of Medicine; February 13, 2006; Cary, NC.
15. NC Health Professions Data System. *Annual Profiles: 2000*. Cecil G. Sheps Center for Health Services Research. Chapel Hill, NC: University of North Carolina at Chapel Hill; 2005. Available at: http://www.shepscenter.unc.edu/hp/prof00.htm. Accessed July 13, 2006.
16. NC Health Professions Data System. *Annual Profiles: 2005*. Cecil G. Sheps Center for Health Services Research. Chapel Hill, NC: University of North Carolina at Chapel Hill; 2006.
17. Wing P, Langelier MH, Salsberg ES, Hooker RS. The changing professional practice of physician assistants: 1992 to 2000. *JAAPA*. January 2004;17:37-49.
18. State Center for Health Statistics. *North Carolina Vital Statistics*. Volume 1: 1998-2004. NC Vital Facts: 1996, 1997. Available online at: http://www.schs.state.nc.us/SCHS/data/vitalstats.cfm.
19. NC State Demographics Unit. Available at: http://demog.state.nc.us/. Accessed September 25, 2006.
20. Jones-Vessey K. North Carolina live births attended by certified nurse midwives. *NC Med J*. March/April 2004;65(2):118-119.

21. Ricketts T, Fraher E, Gaul K, King J, Hadley H. Trends in physician supply in North Carolina. Presented at: Primary Care and Specialty Supply Task Force Steering Committee Meeting, North Carolina Institute of Medicine; October 2005; Durham, NC. Available at: http://www.nciom.org/projects/supply/data.html#policy_options.
22. Trends in 2002 rates for physicians' medical professional liability insurance. *Medical Liability Monitor*. October 2002.
23. Taylor DH, Ricketts TC, Berman JL, Koimaga JT. One state's response to the malpractice insurance crisis: North Carolina's rural obstetrical care incentive program. *Public Health Reports*. Sept-Oct 1992;107(5):523-529.
24. NCGS §90-178.3(b).
25. Felter K. Analysis using NC hospital discharge data. Unpublished.
26. Etzioni DA, Liu JH, Maggard MA, Ko CY. The aging population and its impact on the surgery workforce. *Annals of Surgery*. August 2003:238(2)170-177.
27. Stitzenberg KB, Sheldon GF. Progressive specialization within general surgery: Adding to the complexity of workforce planning. *J Am Coll Surg*. 2005;201(6):925-932.
28. Newton DA, Grayson MS. Trends in career choice by US medical school graduates. *JAMA* 2003;290(9):1179-1182.
29. Thompson MJ, Lynge DC, Larson EH, Tachawachira P, Hart G. Characterizing the general surgery workforce in rural America. *Arch Surg*. 2005;140:74-79.
30. Zuckerman R, Doty B, Gold M, et al. General surgery programs in small rural New York state hospitals: A pilot survey of hospital administrators. *J Rural Health*. 2006;22(4)339-342.
31. Kessler R, Demler O, Frank RG, et al. Prevalence and treatment of mental disorders, 1990 to 2003. *N Engl J Med*. June 16, 2005;352(24):2515-2523.
32. Williams J, Klinepeter K, Palmes G, Pulley A, Foy JM. Diagnosis and treatment of behavioral health disorders in pediatric practice. *Pediatrics*. 2004;114(3):601-606.
33. National Center for Health Workforce Analysis. *State Health Workforce Profiles, Highlights from the 2000 Profiles*. Rockville, MD: Bureau of Health Professions, Health Resources and Services Administration; 2004. Available at: http://bhpr.hrsa.gov/healthworkforce/reports/profiles/. Accessed July 5, 2006.
34. Bureau of Health Professions, Health Resources and Services Administration. Available at: http://bhpr.hrsa.gov/shortage/hpsaguidement/htm. Accessed September 30, 2006.
35. *Discarding Community Psychiatrists: The Third Report Card by the North Carolina Psychiatric Association*. Raleigh, NC: North Carolina Psychiatric Association; April 18, 2006. Available at: http://ncpsychiatry.org/NCPA%20Report%20Card%20III.pdf. Accessed October 5, 2006.