5-2013

Practice Characteristics of Graduates of East Tennessee State University Quillen College of Medicine: Factors Related to Career Choices in Primary Care

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Practice Characteristics of Graduates of East Tennessee State University Quillen College of Medicine: Factors Related to Career Choices in Primary Care

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A dissertation

presented to

the faculty of the Department of Educational Leadership and Policy Analysis

East Tennessee State University

In partial fulfillment

of the requirements for the degree

Doctor of Education in Educational Leadership

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by

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May 2013

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Keywords: medical students, residents, career decisions, rural, primary care

ABSTRACT

Practice Characteristics of Graduates of East Tennessee State University Quillen College of Medicine: Factors Related to Career Choices in Primary Care

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The nation is facing a physician shortage, specifically in relation to primary care and in rural underserved areas. The most basic function of a medical school is to educate physicians to care for the national population. The purpose of this study was to examine the physician practicing characteristics of the graduates of East Tennessee State University Quillen College of Medicine including factors that influence graduates' specialty choices and practice locations, especially those related to primary care.

Secondary data for this study were collected from the college's student database system and the American Medical Association Physician Masterfile. The study population included all living graduates with Doctor of Medicine (MD) degrees who graduated from 1998 through 2009 (n=678). Statistical procedures included Pearson Chi-square, logistic regression, independent *t* tests, ANOVA, and multiple linear regression.

Data analyses revealed that the majority of graduates were between 24 and 29 years of age, male, white, non-Hispanic, and from metropolitan hometowns. Most had completed the generalist track and initially entered a primary care residency training program. The majority passed USMLE Step 1 and Step 2 on the first attempt. The USMLE Step 2-CK average was 212.50. The average cumulative GPA was 3.44. Graduates were nearly evenly divided between primary care and nonprimary care practice, with the majority practicing in metropolitan areas.

Graduates who initially entered primary care residency training were more likely to practice primary care medicine than those who entered nonprimary care programs; however, fewer graduates were practicing primary care than had entered primary care residency training. Graduates who attended internal medicine residency training were less likely to be practicing primary care medicine than those who attended family medicine, pediatrics, or OB/GYN

programs. Women and Rural Primary Care Track graduates were significantly more likely to practice primary care than were men and generalist track graduates, respectively. Nonprimary care physicians had significantly higher USMLE Step 2-CK scores than did primary care physicians (PCPs). PCPs practiced in more rural locales than non-PCPs. Family physician graduates tended to practice in more rural locales than OB/GYNs or pediatricians. Hometown location predicted practice location over and above medical school track.

DEDICATION

This work is dedicated to my husband Charlie, without whom I could not have made it this far. Your love, support, encouragement, and confidence in me have allowed me to pursue this dream. Thank you for your patience and many sacrifices throughout this journey. I love you more than I can put into words and appreciate everything you have done for me and for our family.

To my wonderful son Riley, who joined me on this journey just as it began: you are the reason that I have been working so hard and my constant reminder that there is so much more to life than work. You have shown me what true happiness is about. I promise to love and support you as you find your own path through life.

ACKNOWLEDGEMENTS

I would like to express my thanks and appreciation to everyone that has supported me throughout this journey. Thank you to my committee members: Dr. Bethany Flora, Dr. Don Good, Dr. Brian Martin, and Dr. Jasmine Renner. The feedback, encouragement, and support that I have received from you throughout this process have been invaluable. I would like to especially acknowledge Dr. Good: thank you for all of the support you have given me, the time you have spent reviewing drafts, reading emails, listening to phone calls, and commiserating with me over all of the little details. I am lucky to have had you as my mentor and chair.

Thank you to Dr. Beth Bailey, Dr. Reid Blackwelder, Dr. John Franko, Dr. Fred Tudiver, and all of the wonderful people in the Department of Family Medicine who have encouraged and supported me in pursuit of this degree. A special thanks to Dr. Blackwelder, who was the inspiration behind my topic: we won't be a part of the "Deans' Lie" anymore! Thank you also to my friends in QCOM Admissions & Records, Carol Plummer and Doug Taylor. I could not have completed this work without you.

Thank you to my ELPA classmates and friends: Cheri Clavier, Luke Finck, Charlotte Hoover, Derriell Springfield, and many others. Your support and friendship has been one of the most surprising and delightful parts of my doctoral program. I hope that these friendships continue to grow as we move on to new pursuits. I expect great things from all of you.

Finally, thank you to my wonderful family that has supported me throughout this journey. This dissertation has truly been a group effort. I know that I would not be where I am today without all of you.

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CHAPTER 1

INTRODUCTION

The United States population is growing rapidly. According to the U.S. Census Bureau (2008), the population is growing by more than 30 million people every decade. By 2020 the population is projected to grow by 1% per year. By 2030 nearly one in five U.S. citizens will be 65 and older. This age group is expected to more than double by 2050. Older Americans use more physician services, account for more hospitalizations, and are more likely to acquire costly chronic illnesses than younger age groups (Salsberg, 2006). In 2004 patients aged 65 years and older averaged 7.6 ambulatory care physician visits compared to 3.3 visits for patients under 65 (Burt, McCaig, & Rechtsteiner, 2010). In 2010 patients aged 65 and older accounted for 39% of hospital discharges and were more likely to have overnight hospital stays than younger patients (Adams, Martinez, Vickerie, & Kirzinger, 2011). As the population continues to age, the prevalence of chronic diseases also increases. Patients are living longer but doing so with multiple chronic conditions that require continuing physician care and health resources (Salsberg, 2006).

Just as the population ages and requires more health care resources, the physician population is also aging. During the 1960s and 1970s U.S. medical schools doubled enrollment. However, enrollment levels remained nearly constant between 1980 and 2005. As a result a large number of physicians are reaching retirement age (Salsberg, 2006). Combined with the growing and aging U.S. population, retiring physicians have set the stage for a physician shortage. Evidence shows that primary care, commonly considered to be family medicine, general internal medicine, and general pediatrics, is associated with improved quality of care and decreased medical costs (Fisher et al., 2003; Starfield, Shi, & Macinko, 2005). However, the National Center for Health Workforce is projecting a nationwide shortage of almost 100,000 physicians, primary care accounting for more than a third of the total projected shortages by 2020 (Bureau of Health Professions, 2008). Though the supply of physicians is projected to increase modestly between now and 2025, the demand for physicians is projected to increase even more sharply. These projections are based on the increasing number of older individuals who have multiple chronic conditions as well as an aging primary care physician workforce in decline.

In addition to the overall physician shortage there is also a geographic maldistribution of physicians. Higher proportions of physicians live and work in urban areas. Additionally rural communities are generally sicker, poorer, and less educated. Hart's (1971) inverse care law states that "the availability of good medical care tends to vary inversely with the need for it in the population served. This ... operates more completely where medical care is most exposed to market forces, and less so where such exposure is reduced," (p. 406). According to a 2001 report from the US General Accounting Office (GAO, 2003), nonmetropolitan counties had 122 physicians/100,000 population compared to 267 physicians/100,000 population in metropolitan counties. Of those, nonmetropolitan counties had 59 generalists/100,000 population compared to 94 generalists/100,000 population in metropolitan counties. Residents of rural areas, compared to urban residents, are more likely to report fair or poor health, have chronic health conditions, and die from heart disease. Despite this fact rural residents are less likely to receive proper medical care. Even though 20% of Americans live in rural areas, only 9% of US physicians practice there (Agency for Healthcare Research and Quality [AHRQ], 2005).

The Quillen College of Medicine (QCOM) at East Tennessee State University (ETSU), a public school of medicine accredited by the Liaison Committee on Medical Education (LCME), was created through the enactment of the Veterans Administration Medical School Assistance and Health Manpower Training Act (1972) passed by the United States Congress. The act provided for the establishment of the ETSU medical school and several others throughout the country in conjunction with the Veterans Administration hospitals. The College of Medicine was officially established by the Tennessee General Assembly in March 1974. The college received its letter of provisional accreditation from the LCME in June 1977 and enrolled its first class of students in August 1978. Full accreditation status was awarded in February 1982. The college is named after former Tennessee First District Representative, James H. (Jimmy) Quillen, who was instrumental in the establishment of the school (James H. Quillen College of Medicine, 2012).

The primary mission of QCOM is to educate future physicians, especially those with an interest in primary care, to practice in underserved rural communities. To fulfill this mission QCOM emphasizes primary care as the focus of medical practice and training programs (QCOM, n.d.a.). The 2012 edition of *U.S. News & World Report* ranked QCOM third in the nation for excellence in preparing physicians who will practice in rural medical settings. QCOM consistently ranks among the top 10 schools in the country for rural medicine and in the top 25% of medical schools for primary care education.

One of the ways in which QCOM emphasizes rural primary care training is through the Rural Primary Care Track (RPCT) curriculum. The program began in 1992 as a result of a grant from the Kellogg Foundation. It is comprised of a 4-year community-based experiential curriculum. The goals of the RPCT are to emphasize community, rural culture, interdisciplinary team interactions, and leadership development. Educational experiences occur in rural communities located within 1 hour of the main campus. RPCT students also participate in courses emphasizing interdisciplinary teamwork with nursing, pharmacy, and public health students (QCOM, n.d.b.).

Nearly 1,700 medical doctors have graduated from QCOM and approximately 270 medical students are currently enrolled. According to 2012 NRMP Main Residency Match results, 50% of QCOM students entered into a primary care residency. Although much is known regarding graduates' initial residency matches, less is known about their long-term career decisions. In an analysis of the American Medical Association (AMA) Physician Masterfile, Mullan, Chen, Petterson, Kolsky, and Spagnola (2010) reported that 53.5% of QCOM graduates were primary care physicians. However, according to the Med School Mapper tool provided by the Robert Graham Center (www.medschoolmapper.org), 46% of QCOM graduates are practicing primary care.

According the QCOM Rural Programs website, of the graduates who have completed the RPCT curriculum, 78% have chosen primary care residency training and 48% chose to stay in Tennessee for residency training. Of the first 25 RPCT graduates who have completed their residency training, 80% are practicing in towns of less than 25,000 people. However, only 22.2% of QCOM students completing the 2012 Association of American Medical Colleges (AAMC) Medical School Graduation Questionnaire indicated that they planned to locate their practices in a medically underserved area.

Although the statistics above seem to indicate that QCOM is fulfilling its rural primary care mission, the data do not tell the whole story. Many graduates entering primary care residency training programs do not continue to practice primary care medicine. Residents may change programs, complete specialty or subspecialty fellowships, or fail to complete their residency training entirely. Few medical graduates who initially enter internal medicine residency training eventually become general internists, with subspecialization estimates ranging from 80%-98% (Harris, 2009; Hauer et al., 2008). Similarly not all graduates entering pediatric residency training will become general pediatricians, with approximately 60% choosing to subspecialize (American Board of Pediatrics, 2012). According to the 2012 AAMC Medical School Graduation Questionnaire, 73.3% of QCOM students planning to specialize in family medicine, internal medicine, or pediatrics plan to subspecialize in that field. Bland, Meurer, and Maldonado (1995) note that few medical schools across the country systematically track strategies they use to influence primary care choices.

Statement of the Problem

A shortage of primary care physicians exists in the United States especially in underserved rural communities. The Quillen College of Medicine espouses a rural, primary care focus; however, little is known about the long-term career decisions of QCOM graduates. Robust data exist regarding medical students' initial residency choices, but the effects of specialization and subspecialization are unknown.

The purpose of this study was to examine the physician practicing characteristics of the graduates of ETSU Quillen College of Medicine including factors that influence graduates' specialty choices and practice locations, especially those related to primary care.

Research Questions

1. Is there a significant relationship between graduates' residency types (primary care or nonprimary care) and whether they are practicing primary care or nonprimary care medicine?

2. Among graduates who attended a primary care residency, is there a significant relationship between the residency type (family medicine, internal medicine, pediatrics, and obstetrics-gynecology) and whether they are practicing primary care or nonprimary care medicine?
3. To what extent do graduate characteristics (gender, age at graduation, race, and hometown location), curricular experiences, (medical school track: RPCT or generalist), and academic performance (GPA, USMLE Step 1, and USMLE Step 2-CK scores) predict physician specialty choice (primary care or nonprimary care)?
4. Is there a significant difference in the practice locations as measured by RUCA codes between graduates practicing primary care and graduates practicing nonprimary care specialties?
5. Are there significant differences in practice locations as measured by RUCA codes among the primary care physician specialties (family medicine, general internal medicine, general pediatrics, and obstetrics-gynecology)?
6. To what extent do graduate characteristics (gender, age at matriculation, race, and hometown location), curricular experiences, (medical school track: RPCT or generalist), and academic performance (GPA, USMLE Step 1, and USMLE Step 2-CK scores) predict practice location as measured by RUCA codes?

Significance of the Study

Many factors influence medical students' and residents' specialty choice decisions. There is robust literature in the area of medical student specialty choice including research on age, sex, debt, lifestyle, income, clerkship experiences, mentors or role models, prestige, and other factors.

In most cases this research is based on medical students' residency specialty choice and does not follow eventual physician practice choices. Given the fact that many graduates initially matching to a primary care residency training program choose to specialize or subspecialize later, research specifically on medical students' influences concerning primary care may not generalize to practicing physicians.

By considering student characteristics, curricular experiences, and academic performance on physician career choices, this research will add to the body of literature in the field of medical education. The Quillen College of Medicine has a rural primary care mission and understanding factors related to physician specialty choices and practice locations of graduates of this institution could inform administrators' decisions in the admissions process. Furthermore this research could inform policymakers' decisions regarding resources aimed at decreasing primary care physician shortages.

Delimitations and Limitations

The delimitations and limitations listed below establish the boundaries for the study in describing the population chosen for the study and the limits on generalizing to a larger population.

1. This study is limited to graduates from one college of medicine at a specific university and results are not necessarily generalizable to other populations or institutions.
2. This study is limited to variables available from either the AMA Physician Masterfile or QCOM student records. Additional factors may influence physician specialty choice outcomes, which were beyond the scope of this study.

3. Inconsistencies may be present in reporting work addresses and a delay in information updates to the AMA Physician Masterfile.
4. The primary and secondary specialties in the AMA Physician Masterfile are self-reported. The number of primary care physicians may be overestimated because of self-reporting of specialists who dedicate some of their practice to providing primary care (Grumbach, Becker, Osborn, & Bindman, 1995).

Definitions of Terms

Health care and medical education have a unique vernacular. Many terms are commonly understood; however, some terms require more narrow definitions. The following terms are defined for use in this study:

1. National Resident Matching Program (NRMP) – a private, not-for-profit corporation that provides an impartial service for matching medical students' preferences for residency positions with program directors' preferences for applicants, known as "The Match." The Match provides a uniform date for decisions about residency selection for applicants and programs. Applicants submit a rank-ordered list of programs where they have interviewed. Program directors submit a rank-ordered list of applicants. The lists are compared, using a computerized matching algorithm. Results are posted on the NRMP website on the third Friday of March, known as Match Day, at 1:00 PM eastern time.
2. Primary Care - the provision of a broad range of personal medical care (preventive, diagnostic, palliative, therapeutic, curative, counseling, and rehabilitative) in a manner that is accessible and comprehensive (AMA, 2012a). Primary care includes health promotion, disease prevention, health maintenance, counseling, patient education, and

diagnosis and treatment of acute and chronic illnesses in a variety of health care settings (e.g., office, inpatient, critical care, long-term care, home care, day care, etc.). Primary care is performed and managed by a personal physician often collaborating with other health professionals, and using consultation or referral as appropriate (AAFP, 2012). For purposes of this study, primary care specialties included Family Medicine, General Internal Medicine, General Pediatrics, and Obstetrics and Gynecology.

3. Primary Care Physician (PCP) - a generalist physician who provides definitive care to the patient at the point of first contact and takes continuing responsibility for providing the patient's care. Such a physician must be specifically trained to provide primary care services (AAFP, 2012). For purposes of this study, PCPs included Family Physicians, General Internists, General Pediatricians, and Obstetrician-Gynecologists.
4. Rural Primary Care Track (RPCT) - a 4-year community-based experiential curriculum. The goals of the RPCT are to emphasize community, rural culture, interdisciplinary team interactions, and leadership development.
5. Rural-Urban Commuting Area (RUCA) codes - a system of classification for U.S. Census tracts using measures of population density, urbanization, and daily commuting. Whole numbers (1-10) distinguish metropolitan, micropolitan, small town, and rural commuting areas based the size and direction of commuting flows. Generally, the larger the number, the more rural the area. A ZIP code approximation of the Census tract-based RUCA codes was used in this study. A RUCA code ≥ 4.0 was considered to be "rural." See Appendix A for a RUCA code definitions.
6. USMLE Step 1 – first step of the United States Medical Licensing Examination. Step 1 assesses whether medical students understand and can apply basic science concepts to the

practice of medicine. For purposes of this study, the raw score was coded as Pass or Fail on the first attempt.

7. USMLE Step 2 – second step of the United States Medical Licensing Examination. Step 2 is divided into two parts: Clinical Knowledge (CK) and Clinical Skills (CS). Step 2 assesses whether medical students can apply medical knowledge, skills, and understanding of clinical science essential for the provision of patient care under supervision. Administration of Step 2-CS began in 2004; therefore, in this study only Step 2-CK raw scores were for used analysis.

Overview of the Study

The nation is facing a physician shortage especially in relation to primary care and in rural underserved areas. The most basic function of a medical school is to educate physicians to care for the national population. The purpose of this study is to provide information about factors influencing physician career choices. This study is presented in five chapters. Chapter 1 includes the introduction, statement of the problem, research questions, significance of the study, delimitations and limitations, and definition of terms. Chapter 2 contains a review of pertinent literature. Chapter 3 explains the methodology used in the study, including data collection and analyses. Chapter 4 presents the research findings and analysis of data. Chapter 5 provides a summary of the findings, conclusions, implications for practice, and recommendations for further research.

CHAPTER 2

REVIEW OF LITERATURE

History of Medical Education and Residency Training

In the early history of the United States, the practice of medicine was considered more of a trade rather than a profession. Medical training was primarily through apprenticeship with practicing physicians, rather than through a formal system of medical education. The teaching physicians, or preceptors, themselves were frequently poorly trained. There were no licensing requirements or board examinations. Without minimum educational standards, both trained and untrained practitioners could enter into medical practice with relative ease (Shi & Singh, 2012). During this time medical care was largely provided by botanical healers, midwives, barbers, apothecaries, and the clergy (Kaptchuk & Eisenberg, 2001).

In 1800 there were only four medical schools in the United States: College of Philadelphia (later became University of Pennsylvania), King's College (later became Columbia University), Harvard University, and Dartmouth College. By 1850 the number of medical schools had grown to 42. For the most part these schools were established by physicians who would then affiliate with a local college for classroom space and degree conferral. Student fees were paid directly to the physicians operating the schools. Eventually physicians trained in medical schools outnumbered those trained through apprenticeships and the Doctor of Medicine (MD) degree became the standard of competence (Shi & Singh, 2012).

Although these early medical schools were conferring the Doctor of Medicine degree, the state of medical education in the U.S. was lacking in science-based training; there were no laboratories or clinical observations. Students continued to be taught by local practitioners who had little education and training themselves (Shi & Singh, 2012). A typical school year lasted 4 months and students graduated in 2 years. Each American medical school set its own standards, resulting in an inconsistent and disorganized state of medical education (Numbers & Warner, 1985).

<u>Medical Education Reform</u>

Beginning in 1870 American medical education underwent dramatic changes. Medical schools began affiliating with universities. In 1971 Harvard University president, Charles Eliot, completely revamped the medical student curriculum. He lengthened the academic year from 4 to 9 months and extended the length of medical education from 2 to 3 years. Furthermore, laboratory instruction and clinical subjects such as chemistry, physiology, anatomy, and pathology were added to the curriculum (Shi & Singh, 2012).

Johns Hopkins University further revolutionized medical education when it opened its medical school in 1893. Johns Hopkins was the first medical school to require a college degree rather than a high school diploma as a requirement for admission. Additionally the school had a full-time faculty for the basic science courses and its own teaching hospital (Rothstein, 1985). This became the model of medical education for other institutions across the country. As standards were raised, the proprietary, physician-ran medical schools began to struggle and eventually were closed (Shi & Singh, 2012).

The Association of American Medical Colleges (AAMC) was established by 22 medical schools in 1876. The objective of the first meeting was "to consider all matters related to reform in medical college work," (Association of American Medical Colleges [AAMC], 2012, para. 1). One of the early goals of the AAMC was to standardize medical education. The AAMC believed "in the advancement of medical education in the United States, and the establishment of a common policy among medical colleges in the more important matters of college management," (para. 2). However, as the AAMC set standards and curricula, it was unable to enforce any of its recommendations.

Flexner Report. During the late 19th century, there was considerable strife between the various factions of medical practitioners – those educated at university-affiliated medical schools, those educated at proprietary medical schools, apprentice trained, and nonphysicians. In 1847, the American Medical Association (AMA) was founded principally to form a barricade between orthodox medicine and the irregulars, (Kaptchuck & Eisenberg, 2001). The AMA's primary goal "was to advance the professionalization, prestige, and financial well-being of its members," (Shi & Singh, 2012, p. 92). In 1904 the AMA established the Council on Medical Education (CME) to promote medical education reform (Beck, 2004). CME began with two major initiatives: 1) the standardization of preliminary educational requirements for medical school admission and 2) the promotion of the "ideal" medical curriculum. This curriculum would consist of 2 years of laboratory sciences followed by 2 years of clinical rotations in teaching hospitals (Council on Medical Education [CME], 1905). CME enlisted the help of the Carnegie Foundation for the Advancement of Teaching to survey medical school in the U.S. in an effort to promote its agenda. The Carnegie Foundation appointed Abraham Flexner to head the effort (Beck, 2004).

Flexner investigated five areas at all 155 U.S. medical schools: entrance requirements, size and training of the faculty, size of endowment and tuition, quality of laboratories, and availability of a teaching hospital. The Flexner Report, published in 1910, reported that few medical schools had the resources, facilities, or staff to meet the proposed CME standards. Flexner indicated that the state governments should regulate medical schools. State licensing boards began forcing medical schools to implement heightened admissions standards and stricter curriculum requirements. As a result many schools were forced to close (Beck, 2004; Shi & Singh, 2012).

Medical Licensing. Medical education reform and the licensing of physicians developed simultaneously. During the 1870s states began enacting medical licensure laws. Initially licensure only required a medical school diploma. Then state licensing bureaus began rejecting candidates for licensure if they deemed that their medical school was inadequate (Shi & Singh, 2012). In 1888 Frank Dent, a physician from the Eclectic sect, a group that used botanical remedies and other alternative medicines, claimed that West Virginia's statute requiring physicians to hold a degree from a reputable medical college, pass a state examination, or prove practice in West Virginia for the previous 10 years was unconstitutional, conflicting with the Fourteenth Amendment that declares no State shall deprive any person of life, liberty, or property without due process of law. In a landmark Supreme Court decision, Justice Stephen J. Field ruled that "no one has the right to practice medicine without having the necessary qualifications of learning and skill" (*Dent v. West Virginia*, 1889, p. 129). Eventually states began requiring that all physicians graduate from an acceptable medical school and pass a licensing examination. In 1912 several licensing boards formed the Federation of State Medical Boards. This new group voluntarily agreed to base its standards of accreditation on the CME standards (Beck, 2004).

Today the Federation of State Medical Boards (FSMB) and the National Board of Medical Examiners (NBME) sponsors the United States Medical Licensing Examination (USMLE). The USMLE is a three-step examination that assesses a physician's ability to apply knowledge, concepts, and principles and demonstrate fundamental skills that constitute the basis of patient care (United States Medical Licensing Examination [USMLE], 2012). Medical students typically take Step 1 toward the end of the second year of medical school. Step 2 is divided into two parts: Clinical Knowledge (CK) and Clinical Skills (CS). Step 2 assesses whether medical students can apply medical knowledge, skills, and understanding of clinical science essential for the provision on patient care under supervision. Step 2 is usually completed during the fourth year of medical school. Step 3 assesses whether medical graduates can apply medical knowledge and understanding of biomedical and clinical science essential for the unsupervised practice of medicine. Step 3 is typically taken toward the end of the first year of residency. USMLE limits individuals to three attempts per Step within a 12 month period. Although the individual state licensing boards make decisions independently regarding the use of the USMLE results, all accept a passing score as evidence that an applicant demonstrates the core competencies required to practice medicine.

Graduate Medical Education. In the late 1800s most physicians did not pursue graduate training. Over time most medical graduates began entering hospital-based rotating internships. These internships eventually became a requirement for medical licensure (Rich et al., 2002). By the 1920s internship had become an accepted part of medical practice preparation. However, graduate medical education, or residency, has held various meanings and has changed considerably from its inception in the late 19th century. In fact, the term "graduate medical education" referred to internship and residency education as well as continuing medical education when it first appeared in *JAMA* in the early 20th century (Donini-Lenhoff & Hedrick, 2000).

At the turn of the 20th century graduate medical education (GME) often meant a period of study in European hospitals and clinics. The development of hospitals came much later in the United States than in Europe and for this reason European medical tours offered incomparable clinical experiences for U.S. physicians (Stevens, 1978). As hospitals were developed in the U.S., it became common for them to employ "house staff," which could refer to undergraduate students, graduate trainees, or full-fledged physicians. Often these medical interns were seen as junior medical apprenticeships. Questions arose as to whether GME was merely on-the-job training or the continuation of medical education. Many hospital internships were tied to specific medical schools, limiting opportunities for outsiders, especially minorities.

By 1914 the AMA Council on Medical Education recognized five university-affiliated graduate medical programs: Alabama, California, Harvard, Minnesota, and Tulane. At this time, the U.S. commissioner of education estimated 75%-80% of medical graduates were taking internships and at least one state board required it for licensure (Stevens, 1978). Residencies were also being established. In 1915 the University of Minnesota offered a 3-year training program associated with the Mayo Clinic. In 1927 the AMA published a list of "Hospitals Approved for Residencies in Specialties," which included 270 hospitals in 14 different areas of medicine (Donini-Lenhoff & Hedrick, 2000). Today over 3,000 teaching institutions sponsor more than 9,000 ACGME accredited programs in 107 specialties and subspecialties (AMA, 2012b).

Development of the Specialty Boards

Flexner's call for more research-based education led to a more scientific understanding of disease and illness. As scientists began pursuing narrower areas of medicine, generalist physicians began dividing into specialized areas (as cited in Cassel & Reuben, 2011, p. 1169). In 1916 the American Medical Association and the American Ophthalmological Society created the first board to certify medical specialists. The American Board of Ophthalmology developed standards to recognize physicians with knowledge and expertise in the area of identifying and treating disorders of the eye (American Board of Ophthalmology, 2012). In 1933 four specialties came together to create the Advisory Board for Medical Specialties, now the American Board of Medical Specialties (ABMS). By 1936 the ABMS encompassed 11 specialties. Today ABMS is comprised of 24 specialty member boards.

One of the ABMS member boards, the American Board of Internal Medicine (ABIM), approved four subspecialties in the 1940s: allergy, cardiovascular disease, gastroenterology, and tuberculosis (pulmonary disease after 1946). Another six internal medicine subspecialties were added in the 1970s and another 10 between the late 1980s and today (Figure 1).

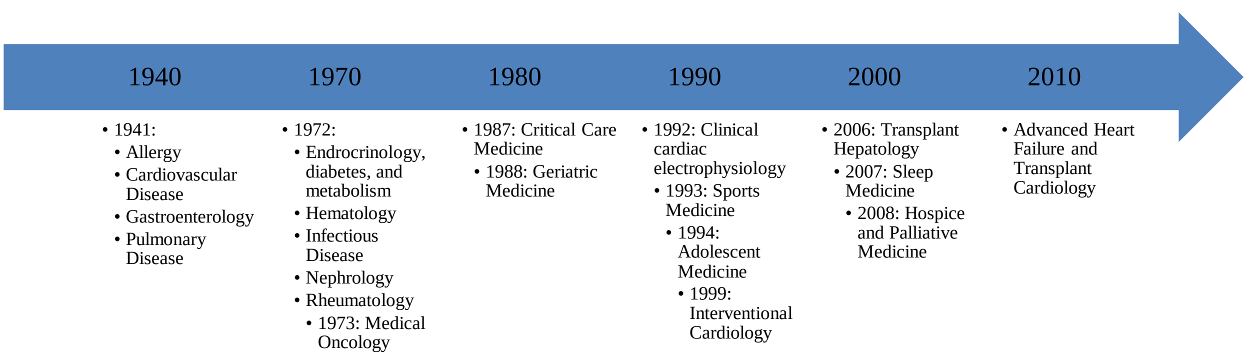

Figure 1. Timeline of Subspecialties Approved by the American Board of Internal Medicine. Adapted from Cassel & Reuben, 2011.

In the early 20th century the ABMS was viewed favorably. Many saw the specialty boards as a way of curtailing unqualified practitioners claiming to be specialists. However, some began to become concerned that the continual fragmentation of medical care through specialization and subspecialization would lead to the diminishing of the generalist physician. These concerns resulted in the creation of a generalist 'specialty' – family medicine. At the same time there were calls to strengthen general internal medicine (Cassel & Reuben, 2011).

Growth of Specialization after World War II. From 1940 to 1950 the number of approved specialties declined from 30 to 28. However, the number of available residency positions more than tripled during this time (Donini-Lenhoff & Hedrick, 2000). Specialist physicians held more prestige than generalists; during WWII board-certified specialists were accorded a higher military rank and pay than general practitioners. The passage of the GI Bill allowed returning physicians to receive tuition and living expenses for residency education. Many veterans used the opportunity to pursue specialty training. The percentage of full-time specialists in the physician workforce increased from 23.5% in 1940 to 36.2% in 1950 (Stevens, 1971). Today over two thirds of the physician workforce is composed of specialist physicians (AHRQ, 2012).

Defining Primary Care

Primary care is the provision of a broad range of personal medical care (preventive, diagnostic, palliative, therapeutic, curative, counseling and rehabilitative) in a manner that is accessible and comprehensive (AMA, 2012a). Primary care includes health promotion, disease prevention, health maintenance, counseling, patient education, and diagnosis and treatment of acute and chronic illnesses in a variety of health care settings (e.g., office, inpatient, critical care, long-term care, home care, day care, etc.). Primary care is performed and managed by a personal physician often collaborating with other health professionals, and using consultation or referral as appropriate (AAFP, 2012).

The terms “primary care physician” (PCP) and “generalist physician” typically refer to physicians who have received training in general practice or family medicine, general internal medicine, or general pediatrics without advanced subspecialty training (Grumbach et al., 1995). PCPs provide first contact for patients and longitudinal comprehensive care. Specialist physicians provide secondary or tertiary care and predominantly see patients on a referral basis for clinical problems limited to a specific organ system, type of disease, or procedure. Data from the 2009-2010 National Ambulatory Medical Care Survey showed that generalists spent more time providing direct patient care and were more likely than specialists to see patients during evening and weekend hours. Additionally, generalists were more likely to set aside time for same-day appointments and reported shorter wait periods for patients to get a routine medical appointment than specialists (Hing & Schappert, 2012).

Grumbach et al. (1995) found that the way in which generalist physicians are defined greatly affects estimates of the overall physician workforce. Four different definitions of generalist physicians were developed based upon the primary and secondary specialty listings in the AMA Physician Masterfile data. The authors found that the total number of generalists based upon the most restrictive criteria was 25% lower than the conventional method of measuring primary care physicians. These “pure generalists” listed either only a primary care field or both the primary and secondary fields were in primary care. The most commonly published method of measuring the generalist supply includes all physicians with a primary generalist specialty regardless of their secondary specialty. Grumbach and colleagues also found that physicians listing a primary specialty of family practice were the least likely to have a secondary specialty in a nonprimary care field. They note that the "lack of specificity about terms such as *primary care* and *generalist physicians* translates into imprecision of measurement," (p. 1405).

Obstetrics and Gynecology. I have previously limited the fields of primary care to family medicine, general internal medicine, and general pediatrics; however, there is some argument to be made that obstetrics and gynecology (OB/GYN) be included as a primary care specialty. OB/GYNs provide many preventive services for women including health screenings and disease prevention, evaluation and counseling, and immunization services. Many women rely on both a primary care provider and an OB/GYN for their care. A 2000 analysis of a survey of women's health found that 7% of women aged 18-64 rely exclusively on an OB/GYN (Kaiser Family Foundation, 2000). Coleman et al. (2007) found in a survey of 935 American College of Obstetricians and Gynecologists Fellows, 54.9% self-identified as generalists and estimated that 37% of private nonpregnant patients rely on them for routine primary care. Forty-two states and the District of Columbia have adopted policies to give women enrolled in managed care direct access to OB/GYNs (National Conference of State Legislatures, 2011). Direct access to OB/GYNs (without a generalist referral) increases the likelihood that women will receive primary care services from OB/GYNs.

Medical Career Decision-Making Models

Conceptual models of physician career specialty choice can aid health policymakers and health researchers in several ways. Understanding factors associated with primary care choice can inform those designing interventions to build the primary care workforce. A model may also demonstrate gaps in knowledge and identify a need for more research. A theory or model that informs educators about the process of specialty choice decision-making has the potential to assist educators to help students make better informed decisions regarding their careers. Knowledge of specific factors related to specialty choice is necessary in order to construct a relevant and accurate depiction of the medical career decision-making process.

Bland, Meurer, and Maldonado (1995) developed a model of determinants of specialty choice to improve the validity of the conclusions drawn from an analysis and synthesis of the literature on primary care specialty choice from 1987 through 1993. Their model is built on the idea that specialty choice is based on a student's perceived characteristics of a specialty and the desire to match those characteristics to the student's career needs including personal needs, societal needs, and the need to meet the expectations of others. These needs are determined by a combination of life experiences, demographics, and personality. According to the model medical school experiences greatly influence the specialty distribution of graduates dependent upon the culture of the institution. The Bland-Meurer model has three major components: student characteristics, medical school characteristics, and students' perceptions of the medical specialty. The model depicts the relationship between student characteristics, institution type and culture, faculty composition, and curricular experiences on specialty choice.

Reed, Jernstedt, and Reber (2001) used decision theory as a referent for a synthesis of the literature pertaining to medical student specialty choice. Subjective expected utility theory (SEU), a widely accepted decision theory, is based on three ideas: 1) the more one values an outcome, the more one favors choices that include that outcome; 2) the more likely one believes a positive outcome to be, the more likely one is to make a choice that includes that outcome; 3) values and likelihood interact – as value increases, likelihood becomes more important. There are three necessary conditions associated with SEU including taking into account the assets of the decision maker, taking into account the consequences of the choice, and not violating the rules of probability theory when evaluating the consequences' likelihood. Reed et al. (2001) make recommendations to improve the specialty choice decision process. First, the factors associated with specialty choice should be explored and confirmed. Second, they recommend that the specialty decision making process should be recognized as a developmental process. And finally, they indicate that students should be longitudinally tracked especially in regards to specialty choice stability.

A more recent model of the specialty choice process was also developed by applying decision-making theories to the relevant literature. Bennett and Phillips (2010) argue that medical students are not a homogenous group and that "applying one conceptual model to all students misrepresents the decision-making process and may lead to incorrect assumptions and conclusions," (S84). The Bennet-Phillips model depicts four distinct pathways from matriculation to specialty choice. Primary care committed students matriculate and graduate committed to primary care. Primary care positive students are interested in primary care but not committed and may choose either a primary care or nonprimary care specialty. Undecided students are truly unsure of their specialty preference. Nonprimary care committed students matriculate and graduate committed to a nonprimary care specialty. Factors influencing student decisions include demographics, curricula, student interests, identity development, health care environment, and financial and lifestyle considerations (Figure 2).

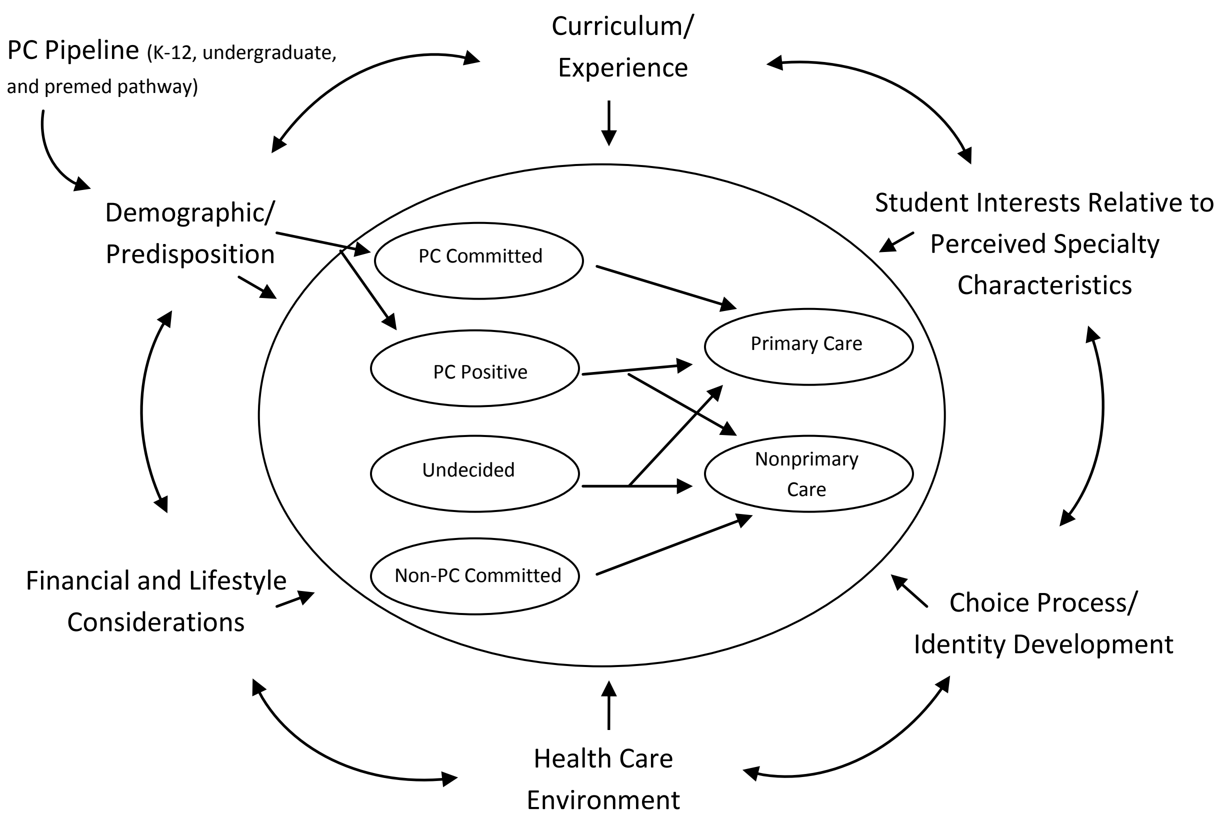

Figure 2. Conceptual Model of the Process of Primary Care Specialty Choice. Adapted from Bennet & Phillips, 2010.

Bennett and Phillips (2010) recommend different treatment of the four distinct categories in regards to primary care intervention. Efforts should focus on recruitment and retention for those students committed to primary care. For students committed to nonprimary care specialties, Bennett and Phillips propose that educators focus on teaching the importance of primary care and interdisciplinary collaboration, rather than trying to influence these students into becoming primary care physicians. Finally they contend that the highest potential for building the primary care workforce lies with interventions focused on those students who are primary care positive and those who are truly undecided. Unfortunately there is no known method of accurately identifying these students early on. Market forces, curricular interventions, payment reforms, and the health care environment may all affect specialty choice decisions for the more malleable students.

Factors Influencing Primary Care Career Choices

Understanding how students come to choose a particular medical specialty is crucial to shifting the balance of specialties among practicing physicians. Investigators have examined a wide range of variables attempting to explain or predict physician specialty choice. Factors associated with primary care specialty choice include gender, age, marital status, rural background, medical school type, medical school curricula, faculty make-up, and an institutional culture (Bennett & Phillips, 2010; Bland et al., 1995). Decisions related to specialty choice are influenced by many different variables. However, a few similarities emerge for those choosing primary care careers.

Bland et al. (1995) conducted a meta-analysis of the literature from 1987 to 1993 related to primary care specialty choice. The synthesis of literature was conducted to address three research questions: 1) What factors have been hypothesized and studied as factors that may predict or influence the specialty choices of graduating medical students, particularly in relation to primary care careers? 2) What are the relationships between these factors, and how do they exert their influences on medical student career decision making? 3) Based on evidence obtained from the best medical education research available, what can medical schools and policymakers do to increase the numbers of students choosing primary care careers?

After a search of the literature 108 studies were included in the final meta-analysis. Bland et al. found several student characteristics associated with the choice of a primary care career including being female, being older, being married, having a broad undergraduate background, having nonphysician parents, having relatively low income expectations, being interested in diverse patients and health problems, and having less interest in prestige, high technology, and surgery. The literature also suggested that required family practice clerkships and longitudinal primary care experiences were associated with primary care specialty choice, with the number of required weeks in family practice having the strongest association. Institutional culture and faculty composition were also associated with primary care specialty choice. Both a strong representation of primary care faculty and a mission related to primary care at the institution were related to primary care specialty choice. The authors noted a strong and consistent association between public medical schools and greater output of primary care physicians.

Bennett and Phillips (2010) conducted a systematic search of the literature to create their model of medical specialty choice. They used the terms "primary care" AND "career" to search MEDLINE and EMBASE, each resulting in nearly 200 articles. Six review articles were included in the analysis. From those the most highly consistent factors associated with primary care specialty choice were female gender, attendance at a publically funded medical school, rural background or plan for a rural career, and lower expected income. Family medicine clerkships and longitudinal primary care experiences were also associated with primary care specialty choice, although they were reported in fewer studies. Bennett and Phillips pointed out that not all concepts related to specialty choice are easily measured. "The concept of a 'hidden curriculum' that subtly discourages primary care choice through the culture of the academic health center, the example of role models, and curricular elements was often addressed in these reviews," (p. S82). Additional findings from primary studies analyzed since 2001 related to primary care specialty choice included social consciousness and an interest in underserved care, valuing patient relationships and behavioral health, an interest in obstetrics and outpatient procedures, high assessment of medical school primary care experiences, taking a rural elective, attending a medical school with community linkages, program funding from Title VII of the Public Health Act, and moderate but not high educational debt.

AAMC Medical School Graduation Questionnaire Analyses

The Medical School Graduation Questionnaire (GQ) is a national questionnaire administered by the Association of American Medical Colleges. The GQ is used by medical schools for program evaluation and to learn more about medical student experiences. The GQ covers topics related to clinical experiences, general medical education, student services, medical school experiences, diversity, financial aid, and career intentions. First administered in 1978 participation in the GQ is entirely voluntary and medical schools only receive aggregate data (AAMC, n.d).

Kassebaum and Szenas (1994) analyzed factors influencing career decisions from the 1993 AAMC GQ. Their analyses included 8,128 respondents who indicated their specialty or subspecialty intentions. Specialties and subspecialties were sorted into four categories: 1) generalist specialties including general family practice, general internal medicine, and general pediatrics; 2) medical specialties including family, internal, and pediatric subspecialties, allergy and immunology, dermatology, medical genetics, occupational medicine, psychiatry and neurology, public health, and preventive medicine; 3) surgical specialties including general surgery, colon and rectal surgery, neurological surgery, obstetrics and gynecology, ophthalmology, orthopedic surgery, otolaryngology, plastic surgery, thoracic surgery, and urology; 4) support specialties including anesthesiology, emergency medicine, nuclear medicine, pathology, physical medicine and rehabilitation, and radiology.

Kassebaum and Szenas (1994) found that patient contact factors (type of patients, emphasis on patient education and prevention, emphasis on primary care) were rated higher by those intending careers as generalists than by the other specialties. Intellectual opportunities factors (intellectual content of the specialty, challenging diagnostic problems, opportunity for research) were rated higher for those intending nongeneralist careers. Leadership and prestige were more important for those intending surgery specialties. Lifestyle factors such as predictable working hours and not too demanding of time and effort were rated more highly for those interested in support specialty careers. Additionally, income was less important for those intending generalist careers.

Jeffe, Whelan, and Andriole (2010) used multivariate logistic regression to identify predictors of graduates' choice of specialty based on data from 1997-2006 graduates of Liason Committee on Medical Education (LCME) accredited medical schools that had completed the AAMC Matriculating Student Questionnaire (MSQ) and the GQ. They examined demographic, attitudinal, and career intention variables from the MSQ and GQ in association with specialty choice outcomes. The authors reported a decrease in graduates choosing generalist career paths during the study period.

> From 1997 to 2006, there was an overall decrease in the proportions of GQ respondents who chose general internal medicine (from 15.7% to 6.7%), general pediatrics (from 10.2% to 6.6%), family medicine (from 17.6% to 6.9%), and obstetrics-gynecology (from 8.2% to 6.1%), whereas there was an overall increase in the proportions who chose internal medicine (from 6.8% to 11.4%) and pediatrics (from 2.2% to 4.4%) subspecialties. (p. 950)

During this time the proportion of female medical graduates reached parity with male medical graduates, increasing from 42.5% to 50.8%.

Logistic regression revealed that students who placed greater importance on social responsibility and had more altruistic beliefs about health care at matriculation were more likely to choose a primary care specialty at graduation. Students who ascribed greater importance to prestige at matriculation were less likely to choose a primary care specialty at graduation. Women were more likely to choose generalist careers and obstetrics-gynecology than were men. Graduates who indicated they had plans to practice in underserved communities or were undecided were also more likely to pursue generalist or OB/GYN careers. Graduates attributing greater importance to intellectual challenge, innovation, and research, who had a physician parent, and who planned full-time academic medicine careers were more likely to pursue nonprimary care careers (Jeffe et al., 2010).

Robert Graham Center Study

The Robert Graham Center is a research center founded by the American Academy of Family Physicians (AAFP) in 1997 that focuses on policy studies in family medicine and primary care. Although a functioning division of the AAFP, the Graham Center operates with editorial independence. With support from the Josiah Macy, Jr. Foundation, researchers from the Graham Center completed a study of influences on medical student and resident specialty and practice location choices. Phillips et al. (2009) linked data from 1980 through 2004 AAMC GQ responses to data from the AMA Physician Masterfile, National Health Service Core, and the Bureau of Health Professions to examine relationships between financial and educational factors and medical students' likelihood of eventually practicing as primary care physicians and caring for underserved populations. The authors noted that most studies regarding specialty choice and practice location are taken from decisions students make at graduation or shortly thereafter, such as the AAMC GQ. This study focused on which specialties physicians were practicing and where they were practicing rather than medical student intentions.

Phillips et al. found that rural birth, interest in serving underserved or minority populations, exposure to Title VII in medical school, and rural or inner-city training experiences significantly increased the likelihood of practicing primary care and serving in rural or underserved communities. Attending a public rather than private medical school significantly increased the likelihood of choosing a primary care specialty and practicing in a rural or underserved area. And although they found that women were more likely than men to choose a primary care career, they were less likely to choose rural practice.

The income gap between primary care and subspecialist physicians has been growing steadily since 1979 (Figure 3). To account for the growing income gap between specialists and generalists, the authors calculated relative income of the physicians at the time of graduation as the Consumer Price Index (CPI) adjusted salary for a radiologist divided by the CPI adjusted salary for a primary care physician. The larger the income gap at the time of graduation, the less likely students were to choose a primary care career, work in a Federally Qualified Health Center or Rural Health Center, or practice in a rural area. "The association between this income gap and most of these outcomes is stronger than debt at graduation," (Phillips et al., 2009, p. 20).

Phillips et al. (2009) concluded that the growing income physician disparity greatly influences medical student behavior. They also stated that there was clear evidence that student selection and curriculum are important in producing primary care physicians and physicians willing to serve in rural and underserved areas, as public and rural schools produce more primary care and rural physicians. The authors indicated concern for the feminization of primary care as women were less likely to serve in rural and underserved communities. They suggest that efforts are needed to make rural practice more attractive to women.

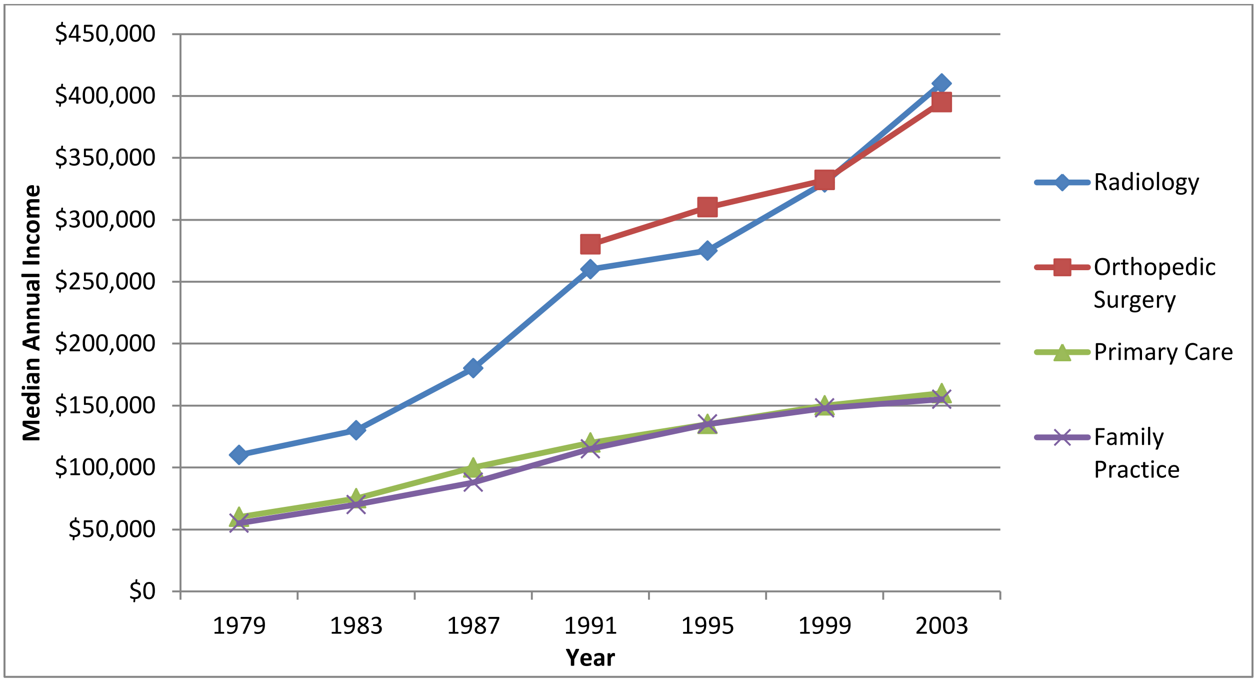

Figure 3. Progress of the Physician Payment Gap. Adapted from Phillips et al., 2009.

Internal Medicine Resident Career Decisions

Understanding factors contributing to career decisions in internal medicine is critical considering a majority of internal medicine residents will choose to subspecialize. Several studies have examined career choices of internal medicine residents and factors associated with those choosing a generalist path. DeWitt, Curtis, and Burke (1998) conducted a structured survey and semistructured telephone survey of 88 graduates of the University of Washington Internal Medicine Primary Care Track. Of the participating graduates 82% had reported themselves very committed to primary care at the beginning of residency; however, only 68% pursued generalist career paths. Breadth of knowledge used in primary care practice, breadth of clinical problems in practice, and opportunity for continuity of care were more important influences on career choice for generalists than specialists. The need for better salaries for generalists was mentioned by 50% of interviewees. A majority of graduates (78%) identified a mentor who influenced their career choices. Interestingly 73% of graduates indicated it was easier to be a specialist than a generalist, mentioning a smaller area of expertise required for specialists and a smaller core of knowledge to master.

Garibaldi, Popkave, and Bylsma (2005) analyzed results of 25,700 third-year (PGY3) residents who took the Internal Medicine In-Training Exam (IM-ITE) from 1998-2003. At the end of the exam residents have the option of completing a survey to provide information about training issues and career choices. In 2002 more extensive questions were added including reasons for specific career choices. The percentage of PGY3s planning careers in general internal medicine declined from 54% in 1998 to 27% in 2003. Less than 20% of PGY1s in 2003 were planning to pursue generalist careers, evidence for a continuing decline of internal medicine residents entering primary care. Ninety-four percent of PGY3s planning subspecialty careers agreed that their choice was a good match with their interests compared to 85% of those planning generalist careers. Of residents seeking subspecialty fellowships, 73% were planning procedure-oriented subspecialties and frequently cited the desire for higher income as a reason for their choice. Approximately 40% of residents in the study were women. Women were significantly more likely than men to pursue careers in general internal medicine (27% versus 19%). Of those planning subspecialty careers, women were more likely to choose careers that allowed them to have more time with family rather than a need for higher income.

West, Drefahl, Popkave, and Kolars (2009) conducted a follow-up study to Garibaldi et al. They examined self-reported factors related to career determination of PGY3s who took the residency questionnaire portion of the 2005-2007 IM-ITEs. West et al. found that long-term patient relationships were significantly more important for primary care program residents than others ($p<.001$). Women were significantly more likely to rate long-term patient relationships as more important than men ($p<.001$) as well as rate financial considerations as less important ($p<.001$). Interestingly residents planning careers as generalists were the least likely to rate the specialty of a mentor as highly important to their career decisions. The authors suggest that this finding may highlight the need for effective mentorship for residents interested in primary care.

Dick, Wilper, Smith, and Wipf (2011) performed a retrospective study to assess whether curricular factors were associated with pursuing a career in primary care upon completion of an internal medicine residency program. The files of 451 graduating residents of the University of Washington Internal Medicine program from 1996 to 2006 were examined for analysis. Logistic regression was used to analyze the relationship of residency track (categorical or primary care), gender, year of graduation, timing of clinic rotation, having a rural training experience, and stated career choice. Primary care residency track, a rural training experience, more recent year of graduation, and male gender were found to be associated with intended primary care career choice. Similar to Garibaldi et al.'s (2005) findings, the percentage of graduates intending a career in primary care declined from 61.5% in 1996 to 18.2% in 2006. Dick et al. (2011) anecdotally noted that there were many residents who intended primary care careers at graduation who switched to a subspecialty after a few years, further reducing the generalist percentage.

Influences on Rural Practice

Many researchers have investigated predictors of physician practice in rural areas. Factors related to physician rural practice include gender, race and ethnicity, socioeconomic status, rural or urban background, financial issues, role of spouse or partner, and medical school and residency curricula (Dick et al., 2011; Phillips et al., 2009; Rabinowitz, Diamond, Markham, & Santana, 2012; Rosenthal, McGuigan, & Anderson, 2000; Zink et al., 2010). However, the reasons behind why a physician chooses to locate to an area are layered and complex. Comprehending the research on physician rural practice is complicated by the varied definitions of rural used throughout the literature.

Defining Rural

The concept of rurality is complex and multifaceted. Rural connotes rustic landscapes, isolation, sociocultural and socioeconomic stereotypes, and low population density. However, these labels do not encompass all that is rural. Although no universal definition of rural exists, it is important that the correct definition be used for the correct purpose. Rural definitions are used for many policy decisions regarding our nation's resources. As of 2008, federal agencies were using more than two dozen definitions of rural (Cromartie, 2008).

Rural definitions can be built around geography, population density, or commuting areas. The use of these different definitions can result in dramatic differences in rural estimates. Depending on the definition used the portion of the U.S. population considered rural ranges from 17%-49% (Cromartie, 2008). Most definitions are based from counties, ZIP code areas, and census tracts (Table 1); there are advantages and disadvantages to each. County boundaries represent political jurisdiction and remain stable over time; however, county size varies substantially, and larger counties may include both urban and rural areas. ZIP code areas allow for a finer level of precision than counties and are easy to implement with programs that rely on addresses. But because ZIP codes are based on postal routes, they change frequently from year to year. Census tracts represent the smallest and most refined level of geography, and are only subject to change every 10 years. The disadvantage to census tract use is that policy can be hard to implement because census tract data are not commonly used by programs (Coburn et al., 2007).

Table 1

Commonly Used Rural Definitions

Definition	Description	Geographic Unit Used
U.S. Census Bureau: Urban and Rural Areas	Rural areas consist of all territory, population, and housing units located outside of urbanized areas and urban clusters. Urbanized areas include populations of at least 50,000 and urban clusters include between 2,500 and 50,000. The core areas of both urbanized areas and urban clusters are defined based on population density of 1,000 per square mile and then certain blocks adjacent to them are added that have at least 500 persons per square mile.	Census Block and Block Groups
Economic Research Services, U.S. Department of Agriculture & WWAMI Rural Health Research Center: Rural-Urban Areas (RUCAs)	This classification scheme utilizes the U.S. Census Bureau's urbanized area and cluster definitions and work commuting information. The RUCA categories are based on the size of settlements and towns as delineated by the Census Bureau and the functional relationships between places as measured by tract-level work commuting data. This taxonomy defines 33 categories of rural and urban census tracts.	Census Tract, ZIP Code approximation available
U.S. Office of Management and Budget (OMB): Core Based Statistical Areas (i.e. Metropolitan and Nonmetropolitan areas)	A metropolitan area must contain one or more central counties with urbanized areas. Nonmetropolitan counties are outside the boundaries of metropolitan areas and are subdivided into two types, micropolitan areas and noncore counties. Micropolitan areas are urban clusters of 10,000 or more persons.	County

Table 1 (continued)

Definition	Description	Geographic Unit Used
Economic Research Service, U.S. Department of Agriculture: Rural-Urban Continuum Codes (Beale Codes)	This classification scheme distinguishes metropolitan counties by the population size of their metropolitan area, and nonmetropolitan counties by degree of urbanization and adjacency to a metropolitan area or areas. All counties and county equivalents are grouped according to their official OMB metropolitan-nonmetropolitan status and further subdivided into three metropolitan and six nonmetropolitan groupings.	County
Economic Research Service, U.S. Department of Agriculture: Urban Influence Codes	This classification scheme subdivides the OMB metropolitan and nonmetropolitan categories into 2 metropolitan and 10 nonmetropolitan categories. Metropolitan counties are divided into two groups by the size of the metropolitan area. Nonmetropolitan-micropolitan counties are divided into three groups by their adjacency to metropolitan areas. Nonmetropolitan-noncore counties are divided into seven groups by their adjacency to metropolitan or micropolitan areas and whether they have their "own town" of at least 2,500 residents.	County
Office of Rural Health Policy, U.S. Department of Health and Human Services: RUCA Adjustment to OMB Metropolitan and Nonmetropolitan Definition	This method uses RUCAs 4-10 to identify small towns and rural areas within large metropolitan counties. In addition, census tracts within metropolitan areas with RUCA codes 2 and 3 that are larger than 400 square miles and have population density of less than 30 people per square mile are also considered rural.	Census tract within OMB Metropolitan Counties

Note. Adapted from Coburn et al., 2007.

The two most commonly used federal rural classification systems, that of the Census Bureau and that of the Office of Management and Budget (OMB), provide strikingly different sets of places defined as rural. Thirty million people living in rural areas according to the Census Bureau live in areas defined as metropolitan according the OMB. Likewise 20 million people in rural-designated areas by the OMB live in urban areas according to the Census Bureau (Coburn et al., 2007). The OMB uses county level designations, while the Census Bureau uses Census tracts. OMB definitions are used for federal programs such as Medicare and programs designed to improve health provider shortages in rural areas. The Census Bureau's definitions are frequently used for demographic and economic data (Hart, Larson, & Lishner, 2005). These incongruent rural definitions could result in contrasting conclusions and policy implications. According to Hart et al. (2005), "an appropriate rural and urban taxonomy should (1) measure something explicit and meaningful; (2) be replicable; (3) be derived from available, high-quality data; (4) be quantifiable and not subjective, and (5) have on-the-ground validity," (p. 1150).

RUCA. Rural-Urban Commuting Area Codes (RUCAs) are a Census tract-based classification schemed developed collaboratively between the Health Resources and Service Administration's (HRSA's) Office of Rural Health Policy, the Department of Agriculture's Economic Research Services, and the Washington, Wyoming, Alaska, Montana, and Idaho (WWAMI) Rural Health Research Center (WWAMI Rural Health Research Center, n.d.). In addition to the Census Bureau's Urbanized Area and Urbanized Cluster definitions, daily work commuting information was used to define 33 categories of rural and urban Census tracts. Categories are based on the size of settlements as described by the Census Bureau and functional relationships between places and the way in which people commute (Hart et al., 2005). A ZIP code RUCA approximation was also developed for ease of use. Although slightly less precise than the Census tract version, the RUCA ZIP codes can be used with ZIP code health-related data. RUCA use has increased since its development in 1998. In 2005 new versions of the Census tract and ZIP codes were released based off of the 2000 Census. These codes are currently being used for several federal programs as well as by health care researchers.

Predictors of Rural Practice

Wilson et al. (2009) conducted a systematic review of the existing evidence of strategies to recruit and retain healthcare professionals to rural communities. Using the keywords '(rural OR remote) AND (recruitment OR retention),' 110 articles were included in the review. Wilson et al. note the lack of a universal definition of rural or remote and emphasized the need for such a definition. In the review 17 distinct definitions of rural or remote were used. Recruitment was defined as "the attraction of healthcare professionals to, and their installation in, rural settings," (p. 1062). Retention was defined as "a stay of more than 5 years in total or more than 2 years beyond the termination of service agreement requirements," (p. 1062). The authors concluded that well-defined student selection and educational strategies hold the most value for rural recruitment and retention, with the strongest evidence suggesting that a rural background is linked to rural healthcare practice. They also stated that favoring applicants with an interest in general practice and a service orientation could help to eliminate the rural-urban disparity. A summary of their recommendations is found in Table 2.

Table 2

Reducing the Rural-Urban Mismatch – Policy Issues, Implementation Strategies, and Topics for Further Research

Policy level	**Policy issue**
Government	Key determinants of success include: length of time on national priority agenda, long-term political commitment and integration of efforts with those factors of other sectors such as education and civil service.
Medical school	Including a clear focus on issues related to the health of rural/underserved communities in the goal statement of the institution.

Strategies for implementation and further evaluation:
Topics ranked according to the evidence available

Need for implementation Strong evidence	**Need for implementation and further research** Moderate evidence	**Need for more research** Weak or absent evidence
Selection policies (consider selection profile) - Rural origin (rural primary/secondary school) - Career intent (rural practice) - Gender (male)	Rural exposure during training Scholarships with rural service agreements Rural outreach/support	Selection on basis of ethnicity Developing optional working models Coercive policies: - Community service - Foreign recruitment
Developing more medical schools in rural areas or developing more satellite rural campuses		

Note. Adapted from Wilson et al., 2009.

The University of Minnesota (UMN) Medical School has two programs designed to promote rural primary care practice. The UMN-Duluth medical school campus recruits applicants from rural communities who are interested in practicing family medicine and express a desire to practice in rural or Native American communities. In their first year of medical school students are assigned to a family medicine preceptor in the community. At the end of the first year and for three sessions in the second year, the students live with the rural preceptor for 3 days – experiencing the physician's everyday life and working environment. The Rural Physician Associate Program (RPAP) takes third year medical students and immerses them into a rural community for 9 months under the mentorship of a primary care preceptor.

Zink et al. (2010) conducted logistic regressions to determine whether RPAP participation, medical school location (Twin Cities or Duluth), and childhood community (metropolitan or rural) predicted rural practice setting and primary care specialty choice. Communities were identified as rural or metropolitan based on the Office of Management and Budget's definitions of metropolitan and nonmetropolitan communities. RPAP participation, the UMN-Duluth location, and being raised in a rural community were all found to be significantly related to rural practice ($p<.001$). There was also a significant interaction between being raised in a rural community and attending UMN-Duluth on rural practice ($p=.03$).The UMN-Duluth and RPAP experiences were also significantly related to primary care specialty choice ($p<.001$), although being raised in a rural community was not a significant predictor of primary care specialty choice. The combination of the first 2 years of medical school in Duluth and the RPAP experience yielded the highest number of rural primary care physicians. Of graduates who participated in both curricula 54% chose rural practice and 86% chose general primary care.

Rabinowitz et al. (2012) studied the relationship between three factors self-reported at matriculation into Jefferson Medical College and students' rural practice outcomes. The Physician Shortage Area Program (PSAP) preferentially admits a cohort of medical school applicants with the factors growing up in a rural area, planning to practice in a rural area, and planning to practice family medicine. The practice locations were obtained for graduates of the classes of 1978-1982 and were coded as either rural or urban based on Rural-Urban Density

Typology (RUDT) of the practice counties. A logistic regression revealed that all three factors were related to rural practice (*p*<.001). Forty-five percent of graduates with all three predictors were practicing in rural areas; 33% with two predictors were practicing in rural areas; 21% with one predictor were practicing in rural areas. Very few students without any combination of the three factors were practicing rural medicine 30 years after graduating. Considering these factors were determined at entry into medical school, the authors suggested that background and career plans are more influential than curricula, residency location, income, or spouse or partner. Rabinowitz et al. (2012) noted that it is difficult to account for a predisposition toward rural practice when studying policy because there are few data sources where these factors have been prospectively collected.

Summary

There is a growing primary care physician shortage in the United States. This problem is exacerbated in rural and underserved areas. Additionally there is evidence that fewer medical students are choosing to pursue primary care career paths. Specialty and geographic maldistribution of physicians results in gaps in access to care. To meet the increasing need for primary care physicians and physicians dedicated to working in rural and underserved areas, medical schools need to work to develop strategies to increase the numbers of graduates pursuing primary care careers as well as those interested in practicing in rural and underserved areas. Understanding trends in specialty choice and factors influencing graduates' career paths can inform educational strategists working to meet this challenge.

American medical education has changed greatly throughout the course of history. What was once a loosely organized inconsistent system based on apprenticeships has become a standardized regulated educational structure. Increasing requirements for curricula and licensure changed the face of medical education in the United States and ultimately the practice of medicine. The balance of physicians has shifted from little-to-no specialization at the turn of the 20th century to more than two thirds choosing to specialize today. Based on recent evidence from graduating medical students, the numbers of primary care physicians will likely continue to decline as more generalist physicians retire and fewer graduates choose generalist careers.

Studies of medical students' career decision-making have shown that specialty choice is related to student factors such as gender, socioeconomic status, rural or urban background, and attitudes and values; curriculum factors such as exposure to family medicine clerkships and rural training experiences; and institutional factors such as public or private medical school, institutional culture, and faculty make-up. Women, those from rural backgrounds, those interested in continuity of care, and those holding more altruistic beliefs about healthcare are more likely to choose primary care careers. Attending a public medical school, longer exposure to a primary care clerkships, and rural training experiences increase the likelihood of medical students choosing primary care. Lifestyle and income also play important roles in medical student career decisions. Similar factors have been studied in relation to those choosing to practice medicine in rural and underserved areas. Men, students who grew up in rural areas, and those choosing generalist careers are more likely to practice in rural communities. Exposure to rural training experiences in both medical school and residency also increases the likelihood of rural practice.

The Quillen College of Medicine (QCOM) at East Tennessee State University (ETSU), a public school of medicine accredited by the LCME, has a mission to educate future physicians, especially those with an interest in primary care, to practice in rural and underserved communities. QCOM emphasizes primary care as the focus of its medical practice and training programs as well as promoting rural practice through the Rural Primary Care Track. Admissions committees attempt to increase the likelihood of producing physicians interested in rural primary care by using selection criteria related to rural primary care practice. Exposure to a curriculum emphasizing rural primary care hopefully strengthens the probability of choosing a primary care career path. However, factors associated with medical student career choices have not been analyzed at this institution. Furthermore, long-term practice locations of QCOM graduates have not been studied.

CHAPTER 3

RESEARCH METHODS

The purpose of this study was to examine the physician practicing characteristics of the graduates of ETSU Quillen College of Medicine (QCOM) including factors that influence graduates' specialty choices and practice locations, especially those related to primary care. This chapter introduces the research methodology, including the research questions and null hypotheses, instrumentation, population, data collection, and data analysis. This study employed a quantitative, nonexperimental methodology involving secondary data analysis. This design allows for describing what has occurred, exploring comparisons among groups, and examining trends within the data (McMillan & Schumacher, 2010).

Research Questions and Null Hypotheses

For this study, data were collected from student records of graduates of ETSU QCOM and matched with data from the American Medical Association (AMA) Physician Masterfile. The combined database was analyzed for trends related to graduate specialty choices and practice locations. The focus of the study was on the following research questions and associated hypotheses.

1. Is there a significant relationship between graduates' residency types (primary care or nonprimary care) and whether they are practicing primary care or nonprimary care medicine?

   $H_0 1$: Whether graduates are practicing primary care medicine or nonprimary care medicine is independent of whether they attended a primary care or nonprimary care residency type.

2. Among graduates who attended a primary care residency, is there a significant relationship between the residency type (family medicine, internal medicine, pediatrics, and obstetrics-gynecology) and whether they are practicing primary care or nonprimary care medicine?

$H_0 2$: Whether graduates are practicing primary care medicine or nonprimary care medicine is independent of whether they attended a family medicine, internal medicine, pediatric, or obstetrics-gynecology residency.

3. To what extent do graduate characteristics (gender, age at graduation, race, and hometown location), curricular experiences, (medical school track: RPCT or generalist), and academic performance (GPA, USMLE Step 1, and USMLE Step 2-CK scores) predict physician specialty choice (primary care or nonprimary care)?

$H_0 3_1$: There is no significant relationship between graduates' characteristics (gender, age at graduation, race, and hometown location) and whether they are practicing primary care or nonprimary care medicine.

$H_0 3_2$: There is no significant relationship between graduates' medical school track and whether they are practicing primary care or nonprimary care medicine.

$H_0 3_3$: There is no significant relationship between graduates' academic performance measures (GPA, USMLE Step 1 scores, and USMLE Step 2-CK scores) and whether they are practicing primary care or nonprimary care medicine.

$H_0 3_4$: No combination of graduates' characteristics, curricular experiences, or academic performance measures significantly predicts physician specialty choice.

4. Is there a significant difference in the practice locations as measured by RUCA codes between graduates practicing primary care and graduates practicing nonprimary care specialties?

H_04: There is no significant difference in the practice locations as measured by RUCA codes of graduates practicing primary care and graduates practicing nonprimary care medicine.

5. Are there significant differences in practice locations as measured by RUCA codes among the primary care physician specialties (family medicine, general internal medicine, general pediatrics, and obstetrics-gynecology)?

H_05: There are no significant differences in practice locations as measured by RUCA codes among those practicing family medicine, general internal medicine, general pediatrics, or obstetrics-gynecology.

6. To what extent do graduate characteristics (gender, age at matriculation, race, and hometown location), curricular experiences, (medical school track: RPCT versus Generalist), and academic performance (GPA, USMLE Step 1 and Step 2 scores) predict practice location as measured by RUCA codes?

H_06_1: There is no significant relationship between graduates' characteristics (gender, age at graduation, race, and hometown location) and their practice locations as measured by RUCA codes.

H_06_2: There is no significant relationship between graduates' medical school track and their practice locations as measured by RUCA codes.

H_06_3: There is no significant relationship between graduates' academic performance measures (GPA, USMLE Step 1 scores, and USMLE Step 2-CK scores) and their practice locations as measured by RUCA codes.

H_06_4: No combination of graduates' characteristics, curricular experiences, or academic performance measures significantly predicts practice location as measured by RUCA codes.

Instrumentation

Secondary data for this study were collected from the college's student database system and the AMA Physician Masterfile. Alumni reports were provided by the QCOM Office of the Registrar. The Registrar's Office maintains a permanent academic record for every student and is responsible for registering each student, processing course drops and adds, the distribution of grade sheets, and recording of grades and evaluations. The office maintains an up-to-date address for each student for the Quillen College of Medicine. The office also maintains the permanent record for every graduate and at his or her request provides transcripts verifications of degree conferred and other material needed for licensure and/or hospital staff appointments.

The AMA Physician Masterfile was initially established in 1906 as a record keeping tool supporting AMA membership and mailing activities. The Masterfile has since expanded to include education, training, and professional certification information on nearly all Doctors of Medicine and Doctors of Osteopathic Medicine in the United States. Today it includes current and historical data for more than 1.4 million physicians, residents, and medical students. A record is initially established when an individual enters an LCME-accredited medical school. Additional information is added to the record as the physician's career develops. Masterfile records are never removed even in the case of death. The AMA Division of Survey and Data Resources (SDR) is responsible for collecting, analyzing, and managing data within the Masterfile which serves as a primary resource for professional medical organizations, universities and medical schools, research institutions, governmental agencies, and other health-related groups. Physicians' records are subject to change and are continuously updated through the extensive data collection and verification efforts performed within SDR. Physicians are presented with their Masterfile information and asked to submit updates electronically or direct written change requests.

Population

The Quillen College of Medicine (QCOM) is a public school of medicine located on the grounds of the U.S. Veterans Affairs Medical Center, Mountain Home, directly adjacent to the main campus of East Tennessee State University (ETSU) in Johnson City, Tennessee. QCOM is governed by the Tennessee Board of Regents and is the only medical school in the system. Together with the College of Nursing, College of Clinical and Rehabilitative Health Sciences, Gatton College of Pharmacy, and College of Public Health, QCOM forms ETSU's Academic Health Science Center. The College is fully accredited by the Liaison Committee on Medical Education.

The population for this study included all living graduates with Doctor of Medicine (MD) degrees of ETSU QCOM who graduated in 1998 or after and have completed residency training. GPA was not available for graduates prior to 1998. Considering that most residency training programs are at least 3 years in length, data were collected for students who graduated from QCOM from 1998 through 2009 (n=678). Those who did not graduate, were deceased, or had not completed residency training were omitted from the study.

Data Collection

Prior to beginning this study, permission to conduct research was obtained from the ETSU Institutional Review Board (IRB). This study was deemed exempt from review under federal guidelines.

A database was created for analysis from secondary data collected from the college's student database system, Banner Student, as well as data from the AMA Physician Masterfile of ETSU QCOM graduates. Permission was obtained from the Dean of the College of Medicine to use the data for this study. The Associate Registrar of the College of Medicine provided data from the student academic record system, including initial residency match results. An AMA Physician Masterfile database of QCOM graduates was purchased from an AMA Database Licensee. Web searches were conducted to identify specialty choice and current practice location for graduates whose data were incomplete. A third party coded the office zip codes in the AMA Masterfile with RUCA codes. The file was sent to the Associate Registrar who added data from student records. After corresponding data were identified from the student records and the AMA Masterfile, the resulting database was deidentified and names were removed and replaced with anonymous codes. Data were deidentified in such a way as to ensure that students' rights were not violated and research was conducted in compliance with the Family Educational Rights and Privacy Act. The college's official confidentiality policy was observed during the data analysis process, and the researcher was the sole person with access to the computer that was used in the process.

Data Analysis

All data were analyzed using SPSS version 19 (SPSS Inc., 2011, Chicago, IL.). Descriptive statistics included demographics of the study population, percentage of students practicing primary care and nonprimary care specialties, and practice location by rural versus urban setting. All findings reported were based on the .05 level of significance (alpha).

Research question 1 was analyzed with a two-way contingency table analysis using Pearson Chi-square. The two variables were the type of residency program (primary care and nonprimary-care) and the type of physician practice (primary care and nonprimary-care).

Research question 2 was analyzed with a two-way contingency table analysis using Pearson Chi-square. The two variables were primary care residency type (family medicine, internal medicine, obstetrics and gynecology, and pediatrics) and type of physician practice (primary care and nonprimary-care).

Research question 3 was analyzed using logistic regression. The predictor variables were gender (0 = Female, 1 = Male), age at graduation in years, race (0 = White, 1 = Non-white), hometown location (0 = urban, 1 = rural), medical school track (0 = Generalist, 1 = RPCT), GPA, USMLE Step 1 (0 = fail, 1 = pass), and USMLE Step 2 scores. The criterion variable was physician specialty choice (0 = nonprimary-care, 1 = primary care).

Research question 4 was analyzed using independent t-test. The independent variable was physician practice type (primary care versus nonprimary-care) and the dependent variable was practice locations as measured by the RUCA code ZIP code approximation.

Research question 5 was analyzed using Analysis of Variance (ANOVA). The independent variable was the four types of primary care specialties (family medicine, internal medicine, obstetrics and gynecology, and pediatrics) and the dependent variable was practice location as measured by the RUCA code ZIP code approximation.

Research question 6 was analyzed using multiple regression. The predictor variables were gender (0 = Female, 1 = Male), age at graduation in years, race (0 = White, 1 = Non-white), hometown location (0 = urban, 1 = rural), medical school track (0 = Generalist, 1 = RPCT), GPA, USMLE Step 1 (0 = fail, 1 = pass), and USMLE Step 2 scores. The criterion variable was practice location as measured by the RUCA code ZIP code approximation.

Summary

Chapter 3 reported the methodology and procedures for conducting this study. After a brief introduction, a description of the research design, research questions and null hypotheses, instrumentation, selection of the population, the data collection procedures, and the consequential data analysis procedures were defined. The results of the data analyses are presented in following chapter.

CHAPTER 4

RESULTS AND ANALYSIS OF DATA

The purpose of this study was to examine the physician practicing characteristics of the graduates of ETSU Quillen College of Medicine (QCOM) including factors that influence graduates' specialty choices and practice locations, especially those related to primary care. Analyses included examining student characteristics, curricular experiences, academic performance, and residency type related to physician specialty choice and physician practice location for students who graduated with a Doctor of Medicine (MD) degree from ETSU QCOM from 1998 through 2009. Data analyzed were extracted from the University's student database system, Banner Student, as well as from the AMA Physician Masterfile of QCOM graduates.

The study population consisted of 678 living graduates of the classes of 1998-2009 of ETSU QCOM. Student records were used only if all data were available. Students who did not graduate, had not completed residency training, were practicing out of the country, or were deceased were omitted from the study. Students with missing data were also omitted. The data of 671 (99%) students were usable.

Independent variables included residency type, gender, age at graduation in years, race, hometown location, medical school track, GPA, USMLE Step 1, and USMLE Step 2-CK scores. Statistically significant comparisons and possible relationships were sought between these independent variables and physician practice type (primary care versus nonprimary care) and practice location as measured by RUCA code ZIP code approximation.

Chapter 4 presents a demographic overview of the population under study followed by statistical analyses of the research questions and associated hypotheses. An alpha level of .05

was used to determine the significance of the data. The major findings of the study are addressed in this chapter.

Demographics

The demographic characteristics of the population under study are presented in Table 3. The results indicated that the majority of graduates were male (53.5%), white (84.9%), and completed the generalist track (85.2%). Students ranged in age from 23 to 55 years at the time of graduation, with a mean age of 29.5 years and a median age of 28 years. Hometown RUCA scores ranged from 1.0 to 10.6, with a mean of 2.6. Seventy-six percent of graduates had hometown RUCAs less than 4.0, indicating that the majority were from metropolitan areas. Most graduates initially attended primary care residency training (59.9%); of these, 31.6% attended a family medicine program, 32.6% attended an internal medicine program, 11.2% attended an obstetrics-gynecology program, and 24.6% attended a pediatric program.

Table 3

Demographic Characteristics of the Study Population (N =671)

Variable	Percent
Gender	
Male	53.5
Female	46.5
Graduation Age (*M* = 29.5)	
< 24	0.1
24-29	69.3
≥ 30	30.6
Race	
White	84.9
Non-white	15.1
Hometown RUCA (*M* = 2.26)	
< 4	76.0
≥ 4	24.0
Medical School Track	
Generalist	85.2
RPCT	14.8
GPA (*M* = 3.44)	
USMLE Step 1	
Pass	92.1
Fail	7.8
USMLE Step 2 CK (*M* = 212.50)	
Pass	73.3
Fail	26.7
Residency Type	
Primary Care	59.9
Nonprimary Care	40.1
Practice Type	
Primary Care	50.2
Nonprimary Care	49.8
Practice RUCA (*M* = 1.89)	
< 4	81.4
≥ 4	18.6

Cumulative grade point averages ranged from 2.26 to 4.00, with a mean GPA of 3.44. A histogram showing the distribution of graduates GPAs is shown in Figure 4. The negative skew indicates a higher concentration of high GPAs.

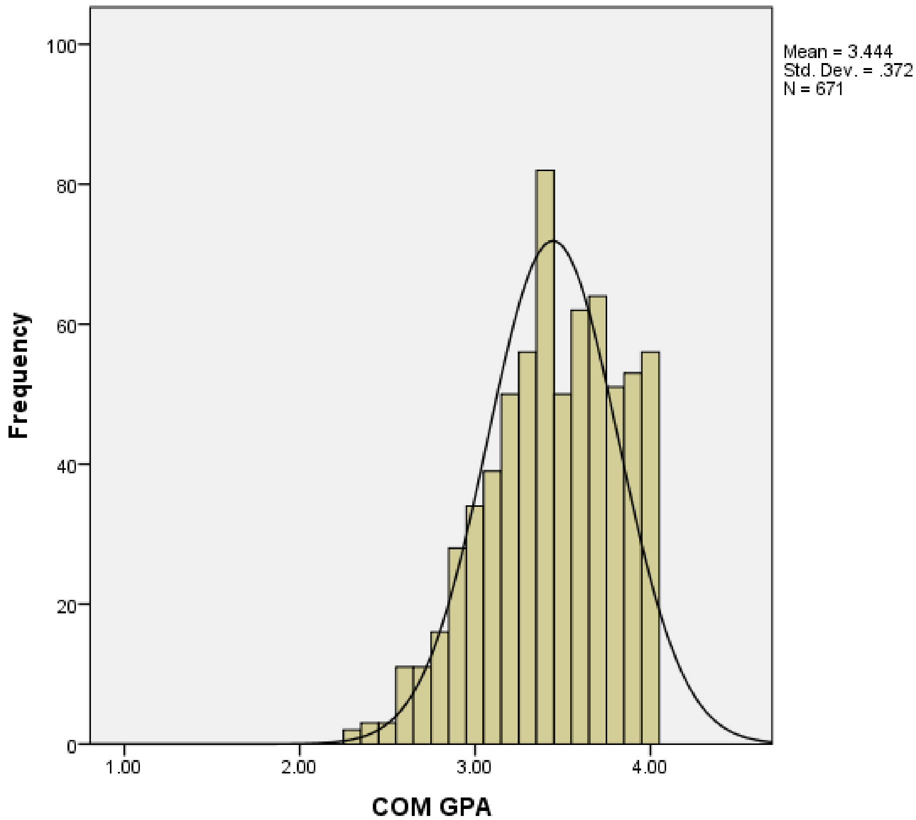

Figure 4. Histogram of cumulative GPAs

The majority of graduates passed the USMLE Step 1 on the first attempt (92.1%). USMLE Step 2-CK scores ranged from 118 to 276, with a mean of 212.50. The current passing Step 2-CK score is 196, with 73.3% of graduates achieving this score on the first attempt. A histogram showing the distribution of Step 2-CK scores is shown in Figure 5. The slight negative skew indicates a higher concentration of high Step 2-CK scores.

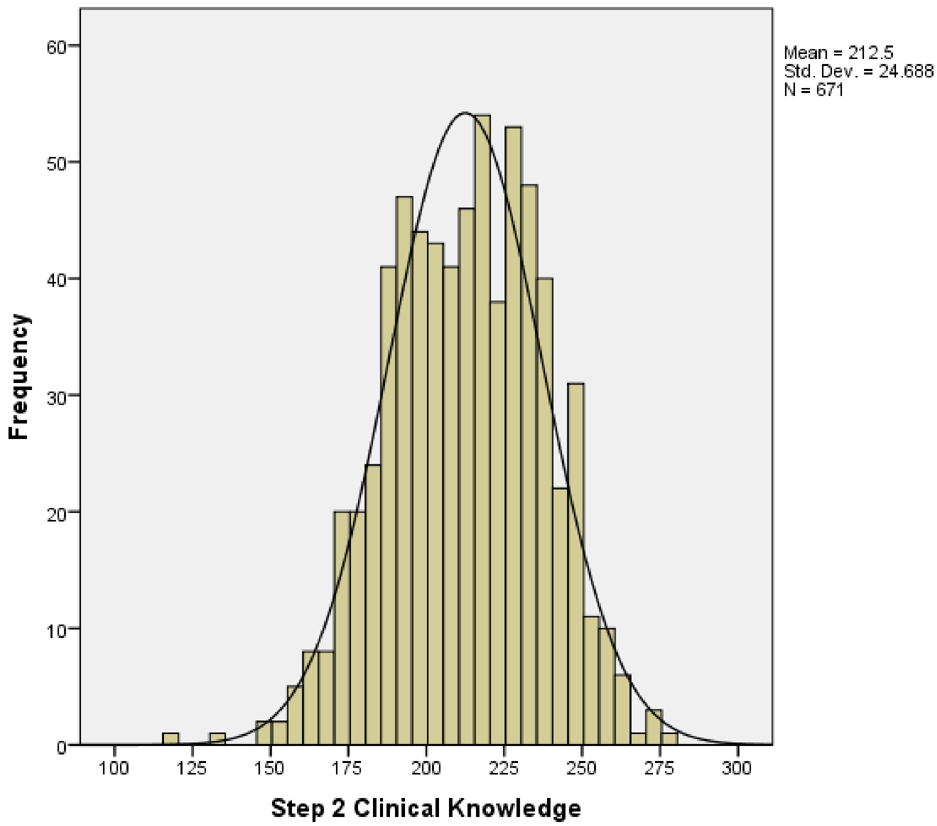

Figure 5. Histogram of Step 2 Clinical Knowledge Scores

The majority of graduates were practicing primary care (50.2%); of these, 38.3% were family practitioners, 22.6% were general internists, 13.4% were obstetrician-gynecologists, and 25.8% were pediatricians. Practice RUCA codes ranged from 1.0 to 10.6, with a mean of 1.89. Most graduates (81.4%) had practice RUCAs less than 4.0, indicating that the majority were practicing medicine in metropolitan areas.

Analysis of Research Questions

Six research questions guided this study and 12 null hypotheses were tested. The questions and associated hypotheses are presented with analyses and accompanying tables and figures.

Research Question #1

RQ1: Is there a significant relationship between graduates' residency types (primary care or nonprimary care) and whether they are practicing primary care or nonprimary care medicine?

$H_0 1$: Whether graduates are practicing primary care medicine or nonprimary care medicine is independent of whether they attended a primary care or nonprimary care residency type.

A two-way contingency table analysis was conducted to evaluate whether graduates who attended primary care residency training were more likely to practice primary care medicine. The two variables were residency type (primary care and nonprimary care) and practice type (primary care and nonprimary care). Residency type and practice type were found to be significantly related, Pearson $\chi^2(2, N = 671) = 300.88$, $p < .001$, Cramer's $V = .67$; therefore, the null hypothesis was rejected. As seen in Table 4 the percentage of graduates who were practicing primary care medicine was significantly greater when they attended a primary care residency type (77.6%) rather than a nonprimary care residency type (9.3%).

Table 4

Comparison of Practice Types of Graduates Who Attended Primary Care and Nonprimary Care Residencies

	Residency Type			
	Nonprimary Care		Primary Care	
Practice Type	*N*	%	*N*	%
Nonprimary Care	244	90.7	90	22.4
Primary Care	25	9.3	312	77.6
Total	269	100.0	402	100.0

A follow-up one sample chi-square test was conducted to evaluate whether the number of graduates practicing primary care was significantly different from the number of graduates who initially entered a primary care residency. The frequency of graduates practicing primary care was found to be significantly different from the frequency of graduates who initially entered a primary care residency, $\chi^2(1, N = 671) = 26.72$, $p < .001$. There were significantly fewer graduates practicing primary care (50.2%) than initially entered primary care residency training (59.9%).

Research Question #2

RQ2: Among graduates who attended a primary care residency, is there a significant relationship between the residency type (family medicine, internal medicine, pediatrics, and obstetrics-gynecology) and whether they are practicing primary care or nonprimary care medicine?

$H_0$2: Whether graduates are practicing primary care medicine or nonprimary care medicine is independent of whether they attended a family medicine, internal medicine, pediatric, or obstetrics-gynecology residency.

A 2 x 4 contingency table analysis was conducted to assess the relationship between physician practice type (primary care or nonprimary care) and primary care residency type (family medicine, internal medicine, pediatrics, and obstetrics-gynecology). Physician practice type and primary care residency type were found to be significantly related, Pearson $\chi^2(2, N = 402) = 50.98$, $p < .001$, Cramer's $V = .36$; therefore, the null hypothesis was rejected. As shown in Table 5, percentage of graduates practicing a nonprimary care specialty tended to be higher for those who attended an internal medicine residency program.

Table 5

Comparison of Practice Types of Graduates by Type of Primary Care Residency Attended

	Residency Type							
	Family Medicine		Internal Medicine		Obstetrics-Gynecology		Pediatrics	
Practice Type	*N*	%	*N*	%	*N*	%	*N*	%
Nonprimary Care	12	9.4	57	43.5	6	13.3	15	15.2
Primary Care	115	90.6	74	56.5	39	86.7	84	84.8
Total	127	100.0	131	100.0	45	100.0	99	100.0

Follow-up pairwise comparisons were conducted to evaluate the differences among these proportions. The Bonferonni method was used to control for Type I error at the .05 level across all three comparisons. As shown in Table 6 graduates who attended internal medicine residency training were significantly less likely to be practicing primary care medicine than those who attended family medicine, pediatrics, or OB/GYN residency training programs. None of the other comparisons were significant.

Table 6

Results of Pairwise Comparisons of Residency Types Using the Bonferroni Method

Comparison	χ^2	*p*	Cramer's *V*
Internal vs. Family	38.19	<.001	.39
Internal vs. Pediatrics	21.09	<.001	.30
Internal vs. OB/GYN	13.27	<.001	.28
Family vs. OB/GYN	.54	.464	.06
Family vs. Pediatrics	1.72	.190	.09
Pediatrics vs. OB/GYN	.08	.774	.02

Research Question #3

RQ3: To what extent do graduate characteristics (gender, age at graduation, race, and hometown location), curricular experiences, (medical school track: RPCT or generalist), and academic performance (GPA, USMLE Step 1, and USMLE Step 2-CK scores) predict physician specialty choice (primary care or nonprimary care)?

H_03_1: There is no significant relationship between graduates' characteristics (gender, age at graduation, race, and hometown location) and whether they are practicing primary care or nonprimary care medicine.

H_03_2: There is no significant relationship between graduates' medical school track and whether they are practicing primary care or nonprimary care medicine.

H_03_3: There is no significant relationship between graduates' academic performance measures (GPA, USMLE Step 1 scores, and USMLE Step 2-CK scores) and whether they are practicing primary care or nonprimary care medicine.

H_03_4: No combination of graduates' characteristics, curricular experiences, or academic performance measures significantly predicts physician specialty choice.

A logistic regression analysis was conducted to evaluate how well student characteristics predicted the odds of graduates practicing primary care. The analysis included student characteristics (gender, age at graduation, race (white or nonwhite), and hometown RUCA code) as the predictors. The criterion variable for the analysis was practice type. Age at graduation and hometown RUCAs were standardized for analysis. A test of the full model versus a model with intercept only was statistically significant, $\chi^2 = (4, N = 671) = 36.51$, $p < .001$; therefore, the null hypothesis for student characteristics was rejected. The model was able to correctly classify 58% of those that were practicing primary care and 65% of those who were not, for an overall success rate of 61%. Employing a .05 criterion of statistical significance, gender was the only predictor that had a significant effect on primary care choice.

A second logistic regression analysis included medical school track (RPCT or generalist) as the predictor and practice type as the criterion variable. A test of the full model versus a model with intercept only was statistically significant, $\chi^2 = (1, N = 671) = 9.79$, $p = .002$; therefore, the null hypothesis for medical school track was rejected. However, the model was only able to correctly classify 19% of those who were practicing primary care but 90% of those who were not for an overall success rate of 54%.

The third logistic regression analysis included academic performance measures (GPA, USMLE Step 1 (pass or fail), and USMLE Step 2-CK scores) as the predictors for practice type. GPA and Step 2-CK scores were standardized for analysis. A test of the full model versus a model with intercept only was statistically significant, $\chi^2 = (3, N = 671) = 9.02$, $p = .029$; therefore, the null hypothesis for academic performance was rejected. The model was able to correctly classify 54% of those who were practicing primary care and 54% of those who were not for an overall success rate of 54%. Employing a .05 criterion of statistical significance, standardized USMLE Step 2-CK scores was the only predictor that had a significant effect on primary care choice.

Considering one predictor from each analysis was significant, a final logistic regression analysis was conducted to evaluate how gender, medical school track, and USMLE Step 2-CK scores predicted the odds of graduates practicing primary care. The predictor variables were gender, medical school track (RPCT or generalist), and standardized USMLE Step 2-CK scores. A test of the full model versus a model with intercept only was statistically significant, χ^2 = (3, N = 671) = 53.63, p < .001; therefore, the null hypothesis for the combination of predictor variables was rejected. The model was able to correctly classify 65% of those who were practicing primary care and 62% of those who were not for an overall success rate of 63%.

Table 7 shows the logistic regression coefficient, odds ratio, estimated R^2, χ^2, and overall prediction success rate for each of the predictors in each model. In the final model the odds ratio for gender indicates that when holding all other variables constant, a woman is 2.6 times more likely to practice primary care than a man. RPCT graduates were nearly twice as likely as generalist track graduates to practice primary care. Inverting the odds ratio for Step 2-CK scores reveals that, although significant, Step 2-CK scores had a small effect, with a one-point increase in the standardized score decreasing the odds of primary care practice by a multiplicative factor of 1.29.

Table 7

Logistic Regression Predicting Primary Care Practice

	Model 1		Model 2		Model 3		Model 4	
Predictor	***β***	Odds Ratio	***β***	Odds Ratio	***β***	Odds Ratio	***β***	Odds Ratio
Gender	.94**	2.55					.94**	2.55
zGradAge	.08	1.08						
Race	.05	1.05						
zHomeRUCA	.04	1.04						
zMSTrack			.70**	2.00			.66**	1.93
zGPA					-.001	1.00		
Step1					-.05	0.95		
zStep2					-.24*	0.79	-.26**	0.77
R^2	.07		.02		.02		.10	
χ^2	36.51**		9.79**		9.02*		53.63**	
Prediction Success Rate	61%		54%		54%		63%	

* $p < .05$; ** $p < .01$.

Univariate analysis indicated that women were significantly more likely to practice primary care (62.5%) than were men (39.6%), $\chi^2 = (8, N = 671) = 35.16$, $p < .001$; RPCT graduates were significantly more likely to practice primary care (64.6%) than were generalist track graduates (47.7%), $\chi^2 = (8, N = 671) = 9.66$, $p = .002$; and that graduates practicing nonprimary care had significantly higher USMLE Step 2 CK scores ($M = 215.36$, $SD = 26.47$) than did graduates practicing primary care ($M = 209.67$, $SD = 22.47$), $t(669) = 3.00$, $p = .003$. However, there was no significant difference in the pass-fail rates between graduates practicing primary care and those practicing nonprimary care medicine χ^2 (1, N = 671) = .428, p = .513.

Research Question #4

RQ4: Is there a significant difference in the practice locations as measured by RUCA codes between graduates practicing primary care and graduates practicing nonprimary care medicine?

$H_0$4: There is no significant difference in the practice locations as measured by RUCA codes of graduates practicing primary care and graduates practicing nonprimary care.

An independent samples *t* test was conducted to evaluate whether the difference in practice locations of graduates as measured by RUCA codes between those practicing primary care and those practicing nonprimary care medicine. The test was significant, $t(669) = 4.28$, $p < .001$; therefore, the null hypothesis was rejected. The RUCA codes were significantly higher for primary care physicians (M = 2.21, SD = 2.27) than for nonprimary care physicians (M = 1.57, SD = 1.49. The 95% confidence interval for the difference in means was .34 to .92. The eta square index indicated that 3% of variance of RUCA score was accounted for by whether an alumnus was a PCP or non-PCP (η^2 = .03, indicating a small effect size). PCPs tended to practice in more rural locales than non-PCPs. A graphic representation of the difference in the means for primary care and nonprimary care physicians is shown in Figure 6.

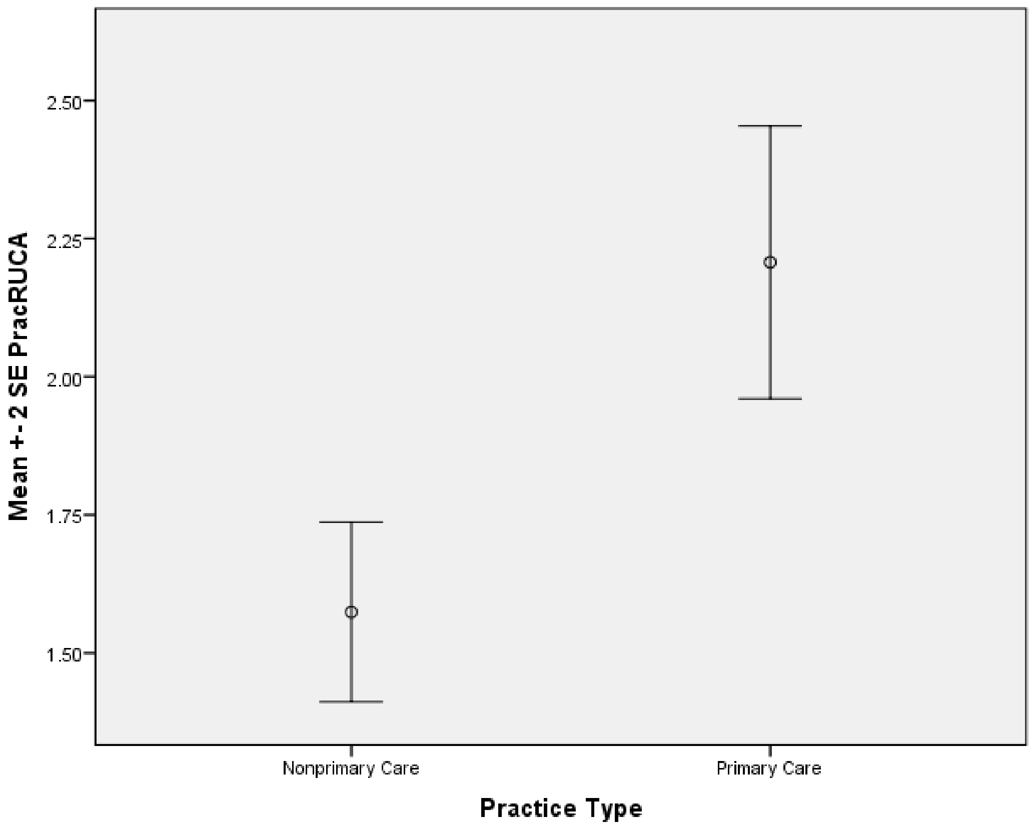

Figure 6. Standard error of the mean for practice location RUCA scores for primary care and nonprimary care physician graduates

Research Question #5

RQ5: Are there significant differences in practice locations as measured by RUCA codes among the primary care physician specialties (family medicine, general internal medicine, general pediatrics, and obstetrics-gynecology)?

$H_0$5: There are no significant differences in practice locations as measured by RUCA codes among those practicing family medicine, general internal medicine, general pediatrics, or obstetrics-gynecology.

A one-way analysis of variance was conducted to evaluate the relationship between primary care physician specialties and practice location as measured by RUCA codes. The independent variable primary care specialty type included four levels: family medicine, internal medicine, obstetrics-gynecology, and pediatrics. The dependent variable was practice location RUCA score. The ANOVA was significant, $F(3, 333) = 33.04$, $p < .001$. The eta square index indicated that 6% of variance of RUCA score was accounted for by PCP specialty type ($\eta^2 = .06$, indicating a medium effect size).

Because the overall *F* test was significant, post hoc multiple comparisons were conducted to evaluate pairwise differences among the means of the four groups. A Tukey procedure was selected for multiple comparisons because equal variances were assumed. There were significant differences in the means between family physicians compared to obstetrician-gynecologists (p=.002) and pediatricians (p=.001). There were no significant differences between any other groups. The 95% confidence intervals for the pairwise differences, as well as, the means and standard deviations for the four primary care specialties, are reported in Table 8. A graphic representation of the differences among the means of the four primary care specialty types is shown in Figure 7.

Table 8

Means and Standard Deviations of Practice RUCAs with 95% Confidence Intervals of Pairwise Differences

PCP Specialty	N	M	SD	Family	Internal	OB/GYN
Family	129	2.83	2.67			
Internal	76	2.18	2.32	-.17 to 1.48		
OB/GYN	45	1.46	1.32	.39 to 2.37	-.35 to 1.80	
Pediatrics	87	1.69	1.65	.35 to 1.93	-.41 to 1.39	-1.28 to .81

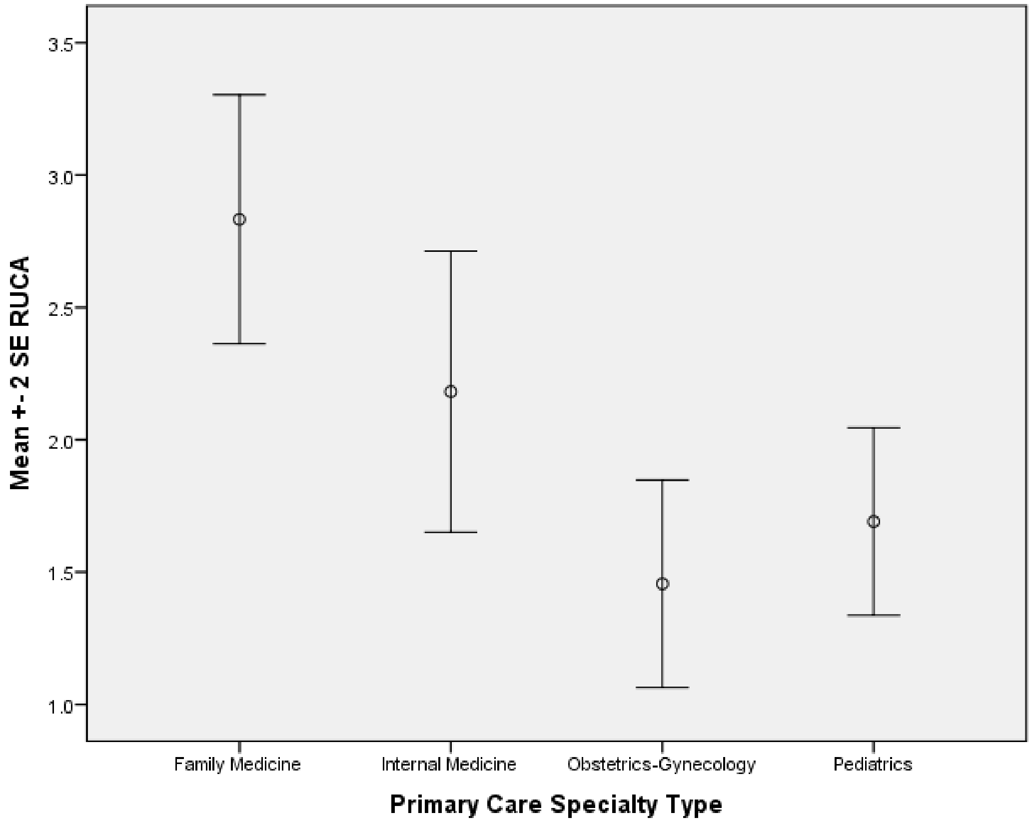

Figure 7. Standard error of the mean for practice location RUCA scores for four primary care specialty types

Research Question #6

RQ6: To what extent do graduate characteristics (gender, age at matriculation, race, and hometown location), curricular experiences, (medical school track: RPCT or generalist), and academic performance (GPA, USMLE Step 1, and USMLE Step 2-CK scores) predict practice location as measured by RUCA codes?

H_06_1: There is no significant relationship between graduates' characteristics (gender, age at graduation, race, and hometown location) and their practice locations as measured by RUCA codes.

H_06_2: There is no significant relationship between graduates' medical school track and their practice locations as measured by RUCA codes.

H_06_3: There is no significant relationship between graduates' academic performance measures (GPA, USMLE Step 1 scores, and USMLE Step 2-CK scores) and their practice locations as measured by RUCA codes.

H_06_4: No combination of graduates' characteristics, curricular experiences, or academic performance measures significantly predicts practice location as measured by RUCA codes.

Three linear regression analyses were conducted to evaluate how well student characteristics, curricular experiences, and academic performance predicted practice location as measured by RUCA codes. The first analysis included student characteristics (gender, age at graduation, race (white or nonwhite), and hometown RUCA code) as the predictors. The second analysis included medical school track (RPCT or generalist) as the predictor. The third analysis included academic performance measures (GPA, USMLE Step 1 (pass or fail), and USMLE Step 2-CK scores) as the predictors. The criterion variable for all three analyses was practice RUCA code score. The linear combination of student characteristics was significant, $R^2 = .04$, $F(4, 666) = 7.68$, $p < .001$; therefore, the null hypothesis for student characteristics was rejected. The regression equation for medical school track was significant, $R^2 = .01$, $F(1, 669) = 5.82$, $p = .016$; therefore, the null hypothesis for medical school track was rejected. However, the linear combination of academic performance measures was not significant, $R^2 = .003$, $F(3, 667) = 2.77$, $p = .532$; therefore, the null hypothesis for academic performance measures was retained. Based on these results, it appears that academic performance measures are not good predictors of practice location.

Next a multiple regression analysis was conducted with both student characteristics and medical school track as predictors. The linear combination of all five predictors was significantly related to practice location RUCA code scores, $R^2 = .05$, $F(5, 665) = 6.85$, $p < .001$; therefore, the null hypothesis for the combination of predictor variables was rejected. Table 9 shows the coefficients to indicate the relationship of individual predictors to practice location RUCA codes. The graduates' characteristics predicted practice location significantly over and above medical school track status, R^2 change = .04, $F(4, 665) = 7.05$, $p < .001$, but medical school track status did not predict practice location significantly over graduates' characteristics, R^2 change = .01, $F(1, 665) = 3.43$, $p = .065$. Based on these results, RPCT participation appears to offer little additional predictive power beyond that contributed by graduates' characteristics.

Table 9

Coefficients of the Multiple Linear Regression Between Practice Location RUCA Codes and the Predictor Variables

	Unstandardized Coefficients		Standardized Coefficients		
Predictors	*β*	*SE*	*β*	*t*	*p*
Gender	.007	.150	.002	.045	.965
zGradAge	.028	.016	.068	1.773	.077
HomeRUCA	.162	.032	.199	5.074	<.001
Race	-.058	.214	-.011	-.273	.785
MedSchoolTrack	.389	.210	.071	1.851	.065

Indices to indicate the relative strength of the individual predictors of practice location for graduates are indicated in Table 10. Of these, both hometown RUCA and RPCT participation were significantly correlated to practice RUCA. However, when accounting for all other predictors only hometown RUCA was significant. Univariate analysis reveals that graduates who were enrolled in the RPCT track had significantly higher hometown RUCA codes (M = 2.87, SD = 2.78) than those who were enrolled in the generalist track (M = 2.15, SD = 2.29), $t(669) = -2.46$, $p = .015$, indicating that those from rural hometowns are more likely to enter the RPCT program and this interest in rural medicine continues into their medical practice. It is tempting to conclude that hometown location is the most useful predictor of practice location. However, judgments about the relative importance of the predictors are difficult because they are related; for example, nonwhites were more likely to come from urban hometowns, $t(669) = 8.62$, $p < .001$, as were older graduates, $r(669) = -.157$, $p < .001$.

Table 10

The Bivariate and Partial Correlations of Graduate Characteristics and Medical School Track with Practice Location RUCA codes

Predictors	Correlation between each predictor and practice RUCA	Correlation between each predictor and practice RUCA controlling for all other predictors
Gender	.008	.002
GradAge	.037	.069
Hometown RUCA	.198*	.193*
Race	-.058	-.011
Medical School Track	.093*	.072

*$p < .001$

Summary

This chapter presented the descriptive and comparative analyses for practice specialty type and practice location of 671 graduates of ETSU Quillen College of Medicine. Six research questions and 12 null hypotheses guided data analysis. Chi-square, t-tests for independence, one-way ANOVA, logistic regression, and multiple linear regression analyses were used to identify relationships between graduate characteristics, curricular experiences, academic performance, and residency type and practice specialty and practice location. From these tests, all research questions had statistically significant findings. A summary of these findings as well as conclusions, implications for practice, and recommendations for further study are presented in Chapter 5.

CHAPTER 5

SUMMARY, CONCLUSIONS, IMPLICATIONS FOR PRACTICE, AND RECOMMENDATIONS FOR FUTURE RESEARCH

This chapter includes a summary of findings, conclusions, implications for practice, and recommendations for future research. The purpose of this study was to examine the physician practicing characteristics of the graduates of ETSU Quillen College of Medicine (QCOM) including factors that influence graduates' specialty choices and practice locations, especially those related to primary care. Analyses included examining student characteristics, curricular experiences, academic performance, and residency type related to physician specialty choice and physician practice location for 671 students who graduated with a Doctor of Medicine (MD) degree at ETSU QCOM from 1998 through 2009. Independent variables included initial residency type, gender, age at graduation, race, hometown location, medical school track, GPA, USMLE Step 1 scores, and USMLE Step 2-CK scores. Demographic characteristics of the population under study were summarized and statistically significant comparisons and possible relationships between the independent variables and physician practice specialty type and physician practice location as measured by RUCA code ZIP code approximation were sought. Statistical methods included two-way contingency table analysis, chi-square, logistic regression, independent *t* test, one-way ANOVA, and multiple linear regression to answer the research questions.

Summary of Findings

Chapter 1 of this dissertation presents six research questions used as the basis for statistical analysis. These research questions are reported again in Chapter 3 along with the corresponding hypotheses. Two-way contingency table analyses were used to test the hypotheses for research questions 1 and 2. Logistic regression analyses were used to test the hypotheses for research question 3. A *t* test for independence was used to test the hypothesis for research question 4. One-way ANOVA was used to test the hypothesis for research question 5. Multiple linear regression analyses were used to test the hypotheses for research question 6. The level of significance applied in the statistical analyses was $p < .05$. All six research questions had statistically significant findings.

Analysis of the data revealed that the majority of graduates of the classes of 1998-2009 of ETSU QCOM were between 26 and 30 years of age at the time of graduation, male, white, from metropolitan areas, and completed the generalist track. Most graduates initially attended primary care residency training, with the majority of those a family medicine program or an internal medicine program. Cumulative grade point averages ranged from 2.26 to 4.00, with a mean GPA of 3.44. The majority of graduates passed the USMLE Step 1 on the first attempt. USMLE Step 2-CK scores ranged from 118 to 276, with a mean of 212.50. The majority of graduates are practicing primary care in metropolitan areas. Practice RUCA codes ranged from 1.0 to 10.6, with a mean of 1.89.

Graduates who initially entered primary care residency training were more likely to practice primary care medicine than those that entered nonprimary care residency training. However, the proportion of graduates practicing primary care medicine was significantly lower than those that entered primary care residency training. Graduates who attended internal medicine residency training were significantly less likely to be practicing primary care medicine than those who attended family medicine, pediatrics, or OB/GYN residency training programs. Women were significantly more likely to practice primary care than were men. RPCT graduates were significantly more likely to practice primary care than were generalist track graduates. Graduates practicing nonprimary care had significantly higher USMLE Step 2-CK scores than did graduates practicing primary care.

Graduates practicing primary care had significantly higher RUCA codes than those practicing nonprimary care, indicating that PCPs practiced in more rural locales than non-PCPs. Family physician graduates had significantly higher RUCA codes than OB/GYNs or pediatricians, indicating that they practice in more rural locales. There were no differences between general internists and family physicians or between any other groups. Multiple linear regression found that graduate characteristics and medical school track were significantly related to practice RUCA codes. Further analyses revealed that hometown RUCA significantly predicted practice RUCA code, over and above medical school track. Hometown RUCA code and RPCT participation were related, implying that those that were from more rural hometowns were more likely to participate in the RPCT program and to practice medicine in rural locations.

Conclusions

The demographics for the graduate data analyzed varied in comparison to the literature and to the AAMC Graduation Questionnaire. Graduates in the population under study were older at graduation in comparison to those who completed the 2012 AAMC Graduation Questionnaire. The majority of graduates in this study (69.3%) were 24-29 at the time of graduation, while 30.6% were 30 years of age or older; 83.1% of graduates from 126 medical schools that completed the 2012 AAMC Graduation Questionnaire were 24-29 years of age at the time of graduation, while 16.5% were 30 years of age or older. Male graduates comprise the majority at QCOM (53.5%), as well as medical schools nationally (52.1%; see Appendix D). The study population at QCOM was less racially and ethnically diverse compared to medical schools nationally. White, non-Hispanic graduates made up 84.9% of the study population compared to 63.3% nationally (Appendix D). The majority of the study population was from metropolitan areas (76%); however, the percentage from a rural hometown (24%) was much greater than had been found in a national analysis (0.8%) of the AMA Physician Masterfile (Phillips et al., 2009).

Research Question #1

Is there a significant relationship between graduates' residency types (primary care versus nonprimary care) and whether they are practicing primary care or nonprimary care medicine?

A 2 x 2 contingency table analysis was conducted to evaluate the relationship between residency type and practice type. The chi-square statistic was significant, indicating that residency type and practice type were related. Graduates who initially entered a primary care residency type were more likely to practice primary care medicine. However, a one-sample chi-square test revealed that there were significantly fewer graduates practicing primary care than had initially entered primary care residency training.

QCOM graduates entered primary care residency programs at a higher rate than the national average. Nearly 60% of QCOM graduates initially entered a primary care residency training program, whereas between 2007 and 2012 only 43.7% of U.S. medical school graduates entered primary care residency training (Appendix E). Although fewer graduates were practicing primary care medicine than had entered primary care residency training, the difference was only 9.7%. The overall percentage of QCOM graduates practicing primary care (50.2%) in this study is considerably greater than the overall percentage of all southern medical schools (35.4%) (Mullan et al., 2010). QCOM is succeeding in its mission to produce primary care physicians.

Research Question #2

Among graduates who attended a primary care residency, is there a significant relationship between the residency type (family medicine, internal medicine, pediatrics, and obstetrics-gynecology) and whether they are practicing primary care or nonprimary care medicine?

A 2 x 4 contingency table analysis was conducted to evaluate the relationship between primary care residency type and practice type. The chi-square statistic was significant, indicating that primary care residency type and practice type were related. Follow-up pairwise comparisons revealed that graduates who initially entered internal medicine residency training were less likely to practice primary care medicine than those who initially entered family medicine, pediatrics, or OB/GYN training programs. This is not surprising as internal medicine is often a starting point for those wishing to subspecialize later. Although many of the graduates who initially entered internal medicine residency training chose to subspecialize, overall the subspecialization rates were lower than national averages. Harris (2009) reported that 20%-25% of internal medicine residents become general internists. By comparison, 56.5% of the study population who initially entered internal medicine residency training was practicing primary care. Only 15.2% of the study population who initially entered pediatric residency training was not practicing primary care. The American Board of Pediatrics (2012) reported that approximately 60% of pediatric residents choose to subspecialize. Very few family medicine residents (9.4%) and OB/GYN residents (13.3%) in this study were practicing nonprimary care specialties.

Research Question #3

To what extent do graduate characteristics (gender, age at graduation, race, and hometown location), curricular experiences, (medical school track: RPCT or generalist), and academic performance (GPA, USMLE Step 1, and USMLE Step 2-CK scores) predict physician specialty choice (primary care versus nonprimary care)?

A series of logistic regression analyses were conducted to evaluate how well graduates' characteristics, curricular experiences, and academic performance predicted primary care practice type. The final model found that the combination of female gender, RPCT enrollment, and lower USMLE Step 2-CK scores significantly predicted primary care practice. Women were 2.6 times more likely to practice primary care than men. RPCT graduates were nearly twice as likely as generalist track graduates to practice primary care. A one-point increase in standardized Step 2-CK scores decreased the likelihood of primary care practice by a factor of 1.29.

Similar research has also found that women were significantly more likely to practice primary care than men (Garibaldi, Popkave, & Bylsma, 2005; Jeffe et al., 2010; Phillips et al., 2009). The overall primary care gender difference was likely influenced by higher percentages of women in OB/GYN and pediatrics. Family medicine and internal medicine had achieved gender parity. Although the RPCT program at QCOM has not been exactly duplicated elsewhere, others have found that primary care tracks and rural training experiences increased the likelihood of primary care practice (Dick et al., 2011; Phillips, et al., 2009). Phillips et al. (2009) reported that rural birth was a significant predictor of primary care practice; however, in the current study population hometown location was not a significant predictor of primary care practice. Jarecky, Donnelly, Rubeck, and Schwartz (1993) found that lower achieving students were more likely to choose primary care careers than high achieving students. It should be noted that although PCPs had significantly lower Step 2-CK scores than non-PCPs, there was no significant difference in the pass/fail rates between graduates practicing primary care and those practicing nonprimary care medicine.

Research Question #4

Is there a significant difference in the practice locations as measured by RUCA codes between graduates practicing primary care and graduates practicing nonprimary care specialties?

An independent samples *t* test was used to evaluate the difference in practice RUCA codes between graduates practicing primary care and those practicing nonprimary care. PCPs had significantly higher RUCA codes than non-PCPs, indicating that PCPs tended to practice in more rural locales than non-PCPs. Wilson et al. (2009) noted that students with an interest in primary care were more likely to practice in rural locations. The ratio of PCPs and non-PCPs in a location is likely dependent on access to larger towns with more resources. In 2001 nonmetropolitan counties with large towns had more specialists than generalists per 100,000 people, while nonmetropolitan counties without a large town and rural counties had more generalists per 100,000 (GAO, 2003).

Research Question #5

Are there significant differences in practice locations as measured by RUCA codes among the primary care physician specialties (family medicine, general internal medicine, general pediatrics, and obstetrics-gynecology)?

A one-way ANOVA was conducted to evaluate whether there were differences in practice RUCA codes among the primary care specialty types. The overall *F* test was significant and post-hoc comparisons were conducted to evaluate pairwise differences among the means of the four groups. Family physicians had significantly higher RUCA codes than pediatricians and OB/GYNs. Family physicians were practicing in the most rural locales of the four groups (although not significantly more rural than general internists). Rural areas have historically depended more on family physicians than other specialties. In the past 30 years there has been a decline in the percentage of other primary care specialties choosing rural practice (as cited in Phillips et al., 2009). Rabinowitz et al. (2012) found that students planning to practice family medicine at matriculation were significantly more likely to practice in rural locations.

Research Question #6

To what extent do graduate characteristics (gender, age at matriculation, race, and hometown location), curricular experiences, (medical school track: RPCT or generalist), and academic performance (GPA, USMLE Step 1, and USMLE Step 2-CK scores) predict practice location as measured by RUCA codes?

A series of linear regression analyses were conducted to evaluate how well graduate characteristics, curricular experiences, and academic performance predicted practice location as measured by RUCA codes. The linear combination of graduate characteristics was significantly related to practice location. Medical school track was also significantly related to practice location. However, the linear combination of academic performance measures was not significantly related to practice location. Graduates' characteristics significantly predicted practice location over and above medical school track. Although hometown RUCA and RPCT enrollment were both significantly correlated to practice RUCA, only hometown RUCA was significant when accounting for all other variables. An independent *t* test found that graduates who completed the RPCT track had significantly higher hometown RUCA codes than those who completed the generalist track.

Students from rural hometowns seem more likely to show an early interest in rural medicine and enroll in the RPCT program. This interest in rural medicine continues into their medical practice. In a review of the literature Wilson et al. (2009) found strong evidence that rural origin or background is associated with rural practice. Zink et al. (2010) found a significant interaction between being raised in a rural community and rural medical school experiences on rural practice. Although rural hometown background and RPCT participation were related in this study, hometown location significantly predicted practice location over and above RPCT participation. Rabinowitz et al. (2012) suggested that background and career plans are more influential on practice location than curricula, residency location, income, or spouse or partner. Several studies have found that male gender was a significant predictor of rural practice location (Phillips et al., 2009; Rabinowitz, Diamond, Markham, & Paynter, 2001; Wilson et al., 2009). In the current study gender was not predictive of rural practice.

Implications for Practice

The purpose of this study was to examine the physician practicing characteristics of the graduates of ETSU Quillen College of Medicine including factors that influence graduates' specialty choices and practice locations, especially those related to primary care. The results of this research have a number of important implications on admissions practices, advisement, and curricula decisions at that institution.

1. The study population was less racially and ethnically diverse in comparison to national data. This highlights the need to increase recruitment of students to QCOM of other races and ethnicities than white, non-Hispanic.
2. Graduates who attended family medicine residency training had a significantly lower subspecialization rate than those who initially attended internal medicine residency training. Advisors should consider steering students interested in providing primary care services to adults toward family medicine residency programs rather than internal medicine residency programs.
3. Women were more likely to practice primary care than men and were more likely to become pediatricians and OB/GYNs than men. However, gender did not have a significant effect on rural practice. Men comprised a slight majority of the study population. Because women were more likely to practice primary care than men and gender did not affect practice location, individuals responsible for admissions decisions should not be concerned that female applicants will be less likely to practice rural primary care medicine. Administrators and advisors should encourage men early to enter primary care fields.
4. Graduates of the RPCT program were more likely to practice primary care medicine than generalist track graduates. Currently up to 25% of the class is admitted into the RPCT program. Administrators should consider expanding the program to additional students.
5. Non-PCPs had significantly higher Step 2-CK scores than PCPs. The overall pass-fail rate was not significantly different. Advisors should encourage students with high Step 2-CK scores to pursue primary care fields. Primary care requires a broad knowledge base. In a survey of internal medicine residency graduates, 73% of participants agreed that it

was easier to be a specialist than a generalist, mentioning a smaller area of expertise required for specialists and a smaller core of knowledge to master (DeWitt et al., 1998).

6. PCPs were practicing in more rural areas than non-PCPs. QCOM should continue the primary care rural curricula focus. Those responsible for admissions decisions should consider career intentions when reviewing applicants.
7. Family physicians were practicing in the most rural locales. Past research has shown that students with an interest in family practice were more likely to practice in rural areas (Rabinowitz et al., 2012). Admissions committee members should consider applicants' career plans when making admissions decisions, paying particular attention to plans for family practice rather than only asking about primary care.
8. Nationally rural student matriculation into medical schools has declined while rural health care shortages persist (Hyer et al., 2007). Hometown location was the most significant predictor of rural practice. Admissions committee members should continue to give preference to applicants from rural areas.

Recommendations for Future Research

This quantitative study was conducted within the limitations outlined in Chapter 1. Several recommendations for expanding this study include, but are not limited to:

1. A survey of graduates could expand upon potential variables that influence specialty choice and practice location. Possible questions could include the role of mentors, spouses, debt load, lifestyle considerations, and timing of decisions. Additionally a qualitative design could contribute to a deeper understanding of medical student career choice.

2. Similar studies in comparable colleges of medicine should be conducted to reveal whether the findings in this study are unique to the institution or are generalizable to a wider population.
3. Additional demographic characteristics should be included in similar analyses to reveal other predictors of specialty choice and practice location (for example, marital status, socioeconomic background, and parents' careers).
4. Undergraduate variables should be included in similar analyses to reveal additional predictors of specialty choice and practice location (for example, undergraduate institution location, major, undergraduate GPA, and MCAT scores).
5. Additional curricular variables should be included in similar analyses to reveal other predictors of specialty choice and practice location (for example, specific clerkship rotations and elective courses).
6. A similar study should be conducted investigating variables related to physician practice in federally-designated medically underserved areas.
7. The effects of national health care policy changes on rural primary care physician practice should be investigated in future studies.

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APPENDICES

APPENDIX A

Version 2.0 Rural-Urban Commuting Areas (RUCAs) Code Descriptions

1 Metropolitan area core: primary flow within an Urbanized Area (UA)

1.0 No additional code

1.1 Secondary flow 30% through 49% to a larger UA

2 Metropolitan area high commuting: primary flow 30% or more to a UA

2.0 No additional code

2.1 Secondary flow 30% through 49% to a larger UA

3 Metropolitan area low commuting: primary flow 10% through 29% to a UA

3.0 No additional code

4 Large rural area core: primary flow within an Urban Cluster of 10,000 through 49,999 (large UC)

4.0 No additional code

4.1 Secondary flow 30% through 49% to a UA

4.2 Secondary flow 10% through 29% to a UA

5 Large rural high commuting: primary flow 30% or more to a large UC

5.0 No additional code

5.1 Secondary flow 30% through 49% to a UA

5.2 Secondary flow 10% through 29% to a UA

6 Large rural low commuting: primary flow 10% through 29% to a large UC

6.0 No additional code

6.1 Secondary flow 10% through 29% to a UA

7 Small rural town core: primary flow within an Urban Cluster (UC) of 2,500 through 9,999 (small UC)

7.0 No additional code

7.1 Secondary flow 30% through 49% to a UA

7.2 Secondary flow 30% through 49% to a large UC

7.3 Secondary flow 10% through 29% to a UA

7.4 Secondary flow 10% through 29% to a large UC

8 Small rural town high commuting: primary flow 30% or more to a small UC

8.0 No additional code

8.1 Secondary flow 30% through 49% to a UA

8.2 Secondary flow 30% through 49% to a large UC

8.3 Secondary flow 10% through 29% to a UA

8.4 Secondary flow 10% through 29% to a large UC

9 Small rural town low commuting: primary flow 10% through 29% to a small UC

9.0 No additional code

9.1 Secondary flow 10% through 29% to a UA

9.2 Secondary flow 10% through 29% to a large UC

10 Isolated small rural areas: primary flow to a tract outside a UA or UC (including self)

10.0 No additional code

10.1 Secondary flow 30% through 49% to a UA

10.2 Secondary flow 30% through 49% to a large UC

10.3 Secondary flow 30% through 49% to a small UC

10.4 Secondary flow 10% through 29% to a UA

10.5 Secondary flow 10% through 29% to a large UC

10.6 Secondary flow 10% through 29% to a small UC

UA=Urbanized Area

UC=Urban Cluster

Note: When thinking about the RUCA coding scheme, it is important not only to think of the stated criteria for a code but to consider the specific criteria for the other codes that did not apply and that allowed a Census tract/ZIP code area to be coded with a specific code.

APPENDIX B

Permission Letter to Dean of ETSU Quillen College of Medicine

Dr. [redacted], Dean
ETSU Quillen College of Medicine
PO Box [redacted]
Johnson City, TN 37614

Dear Dr. [redacted],

As a doctoral student at East Tennessee State University in the Educational Leadership and Policy Analysis program, I am currently working to complete my dissertation. I would like to examine the physician practicing characteristics of the graduates of ETSU Quillen College of Medicine including factors that influence graduates' specialty choices and practice locations. By considering student characteristics, curricular experiences, and academic performance on physician career choices, this research will add to the body of literature in the field of medical education. Realizing that QCOM has a rural, primary care mission, understanding factors related to physician specialty choices and practice locations of graduates of this institution could inform administrators' decisions in the admissions process. Furthermore, this research could inform policymakers' decisions regarding resources aimed at decreasing primary care physician shortages.

Please consider this correspondence as an official request to obtain QCOM data for my dissertation. Understanding that retrieving data from available records will provide more validity than surveys or questionnaires, I would like to request permission to obtain information available on the Banner system and in student records through the QCOM Office of the Registrar. You may be assured that all information obtained will be managed in accordance with the Family Educational Rights and Privacy Act as well as the ETSU Institutional Review Board.

I would like to request permission to study records associated with all students that graduated from QCOM prior to 2010. Factors that I intend to review include: age at time of graduation, gender, race, hometown, medical school track, GPA, and USMLE Step 1 and Step 2 scores. This data will be combined with data from the AMA Physician Masterfile including office address and primary and secondary specialties.

I appreciate your willingness to assist with the research process and data extraction associated with my dissertation topic. Please be assured that I will be happy to share the results of my study with you and the faculty and staff of QCOM. If you have any questions or need additional information, you may reach me at [redacted] or [redacted]@etsu.edu.

Once again, I appreciate your support and look forward to working with you in the future.

Sincerely,

Ivy Click, Doctoral Candidate
Department of Educational Leadership and Policy Analysis

Approved By:

____

Dean, ETSU Quillen College of Medicine

APPENDIX C

Exemption Letter from ETSU Institutional Review Board

East Tennessee State University
Office for the Protection of Human Research Subjects • Box 70565 • Johnson City, Tennessee 37614-1707
Phone: (423) 439-6053 Fax: (423) 439-6060

February 8, 2013

Ivy Click

Dear Ivy,
Thank you for recently submitting information regarding your proposed project "Practice Characteristics of Graduates of East Tennessee State University Quillen College of Medicine: Factors Related to Career Choices in Primary Care"

I have reviewed the information, which included a new protocol submission and subsequent emails which outlined the following plan.

a. Third party (not a member of the research team) gets access to the AMA Physician Masterfile with the following data points: name, preferred mailing address, office address, license state, type of practice, primary and secondary specialties, and residency training site.
b. Third party takes zip code from office address and looks up the zip code, and then codes as urban or rural.
c. Third party codes type of practice as either primary care or non-primary care (and if primary care, internal medicine or family medicine or pediatrics)
d. Third party codes residency training site as either urban or rural and residency type (primary care or non-primary care, and if primary care, internal medicine or family medicine or pediatrics)
d. Third party deletes all columns except: name, urban/rural practice locale, type of practice (primary care or non-primary care; if primary care, internal medicine or family medicine or pediatrics), and type of residency training site (urban or rural) and residency type (primary care or non-primary care; if primary care, internal medicine or family medicine or pediatrics)
e. Third party give the revised database to Carol Plummer, COM
f. Carol adds age at time of graduation, gender, race, type of hometown (rural or urban), medical school track, GPA, and USMLE Step 1 and Step 2 scores.
g. Carol deletes the column of names and gives the database to PI.

PI would then have:

1. Whether locale is urban or rural
2. Whether practice is primary care or non-primary care
3. If the practice is primary care, whether it is internal medicine, family medicine, or pediatrics
4. Whether residency training site was urban or rural

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5. Whether residency type was primary care or non-primary care
6. If the residency type was primary care, whether it is internal medicine, family medicine, or pediatrics
7. Age at time of graduation
8. Gender
9. Race
10. Whether hometown was urban or rural
11. Medical school track
12. GPA
13. USMLE step 1 and 2 scores

Example:

Gender	Race	Ageat Grad	Hometown	Track	GPA	Step 1	Step 2	Res Loc	ResType	ResPC	Prac Loc	PracType	PracPC
Male	White	26	Rural	Generalist	3.2	Pass	214	1.2	Primary Care	Family Medicine	10.6	Primary Care	Family Medicine

The determination is that this proposed activity as described in the plan above meets neither the FDA nor the DHHS definition of research involving human subjects. Therefore, it does not fall under the purview of the ETSU/VA IRB.

IRB review and IRB approval by East Tennessee State University is not required. This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these activities are human subject research in which the organization is engaged, please submit a new request to the IRB for a determination.

Thank you for your commitment to excellence.

Sincerely,
George Youngberg, M.D.
Chair, ETSU/VA IRB

Cc: Don Good
Doug Taylor
Carol Plummer

APPENDIX D

Total U.S. Medical School Graduates by Race and Ethnicity, Permanent Residency, and Sex, 2003-2012

Graduates' Responses to Race/Ethnicity and Permanent Residency			Class of 2003	Class of 2004	Class of 2005	Class of 2006	Class of 2007	Class of 2008	Class of 2009	Class of 2010	Class of 2011	Class of 2012
Women	Non-Hispanic or Latino	Black or African American	668	642	689	733	724	718	684	751	719	737
		American Indian or Alaska Native	47	43	46	79	66	76	62	64	72	63
		Asian	1,429	1,458	1,465	1,630	1,657	1,727	1,786	1,758	1,918	1,889
		Native Hawaiian or Other Pacific Islander	17	15	21	22	15	16	21	20	22	40
		White	4,254	4,446	4,539	4,638	4,869	4,864	4,880	4,906	4,964	4,818
		Other Non-Hispanic or Latino Race	0	0	1	124	155	39	14	18	13	18
	Hispanic or Latino	Mexican American	161	191	145	175	179	192	193	221	219	202
		Puerto Rican	144	152	142	159	151	191	176	163	179	157
		Cuban	0	0	0	40	31	41	45	52	53	66
		Other Hispanic or Latino	143	142	139	168	201	188	222	202	210	208
	Non-U.S.	Foreign	75	76	73	99	104	105	130	141	153	144
		No Race Response or Unknown Citizen	90	96	152	148	119	105	136	123	147	225
	Unduplicated Total for Women		***7,028***	***7,261***	***7,412***	***7,748***	***7,925***	***7,969***	***8,035***	***8,130***	***8,395***	***8,291***
Men	Non-Hispanic or Latino	Black or African American	343	390	355	390	360	395	390	387	410	426
		American Indian or Alaska Native	54	56	50	60	57	79	68	65	63	70
		Asian	1,738	1,713	1,653	1,601	1,643	1,597	1,695	1,745	1,849	1,832
		Native Hawaiian or Other Pacific Islander	16	13	25	19	20	17	25	31	27	20
		White	5,645	5,675	5,497	5,391	5,441	5,494	5,619	5,759	5,817	5,827
		Other Non-Hispanic or Latino Race	0	0	2	176	177	50	16	25	20	12
	Hispanic or Latino	Mexican American	187	199	197	185	193	196	186	213	237	233
		Puerto Rican	134	154	131	129	131	136	169	143	178	140
		Cuban	0	0	1	31	44	53	62	53	52	75
		Other Hispanic or Latino	180	170	182	177	180	190	196	211	212	213
	Non-U.S.	Foreign	81	77	98	86	111	112	108	129	139	127
		No Response or Unknown Citizen	125	121	159	158	149	140	153	196	174	294
	Unduplicated Total for Men		***8,503***	***8,568***	***8,348***	***8,179***	***8,215***	***8,199***	***8,432***	***8,706***	***8,968***	***9,050***
All	Non-Hispanic or Latino	Black or African American	1,011	1,032	1,044	1,123	1,084	1,113	1,074	1,138	1,129	1,163
		American Indian or Alaska Native	101	99	96	139	123	155	130	129	135	133
		Asian	3,167	3,171	3,118	3,231	3,300	3,324	3,481	3,503	3,767	3,721
		Native Hawaiian or Other Pacific Islander	33	28	46	41	35	33	46	51	49	60
		White	9,899	10,121	10,036	10,029	10,310	10,358	10,499	10,665	10,781	10,645
		Other Non-Hispanic or Latino Race	0	0	3	300	332	89	30	43	33	30
	Hispanic or Latino	Mexican American	348	390	342	360	372	388	379	434	456	435
		Puerto Rican	278	306	273	288	282	327	345	306	357	297
		Cuban	0	0	1	71	75	94	107	105	105	141
		Other Hispanic or Latino	323	312	321	345	381	378	418	413	422	421
	Non-U.S.	Foreign	156	153	171	185	215	217	238	270	292	271
		No Response or Unknown Citizen	215	217	311	306	268	245	289	319	321	519
	Unduplicated Total Enrollment		***15,531***	***15,829***	***15,760***	***15,927***	***16,140***	***16,168***	***16,467***	***16,836***	***17,363***	***17,341***

Source: AAMC 12/17/2012

APPENDIX E

Residency Applicants of U.S. Medical School Graduates by Specialty, 2007-2012

U.S. Medical School (Public and Private) ERAS Users by Specialty	2007		2008		2009		2010		2011		2012	
	Applicants	Average Number of Applications	Applicants	Average Number of Applications	Applicants	Average Number of Applications	Applicants	Average Number of Applications	Applicants	Average Number of Applications	Applicants	Average Number of Applications
Anesthesiology	1,599	25.3	1,652	25.9	1,749	27.1	1,741	27.0	1,728	28.6	1,793	29.2
Child Neurology (Neurology)	2	1.0	0	0.0	2	1.0	3	1.0	1	1.0	48	3.1
Dermatology	653	54.7	585	57.2	672	55.9	674	59.6	663	55.6	624	55.6
Emergency Medicine	1,596	26.5	1,648	26.3	1,703	26.3	1,790	28.0	1,880	31.4	1,803	35.6
Emergency Medicine/Family Medicine	64	1.0	20	1.0	25	1.0	23	1.3	24	1.6	30	1.6
Family Medicine	1,855	11.7	1,904	13.0	1,862	12.7	2,135	15.1	2,291	16.8	2,361	18.7
Family Medicine/Preventive Medicine	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	103	1.0
Internal Medicine	7,198	16.3	7,083	17.1	7,390	16.9	7,451	19.1	7,656	20.6	7,775	22.3
Internal Medicine/Dermatology	72	2.4	74	3.7	91	3.7	90	5.2	125	4.1	117	4.0
Internal Medicine/Emergency Medicine	138	3.3	95	4.5	88	5.4	82	5.1	85	5.3	238	3.6
Internal Medicine/Family Practice	17	1.6	22	1.4	30	1.5	17	1.4	24	1.5	19	1.3
Internal Medicine/Medical Genetics	0	0.0	0	0.0	0	0.0	0	0.0	7	1.9	4	1.8
Internal Medicine/Neurology	0	0.0	0	0.0	10	1.3	18	2.2	6	1.2	14	1.7
Internal Medicine/Pediatrics	420	13.5	394	13.8	397	13.7	455	16.1	456	18.3	486	15.8
Internal Medicine/Preventive Medicine	0	0.0	0	0.0	0	0.0	65	1.5	44	1.7	48	1.5
Internal Medicine/Psychiatry	48	4.4	59	5.6	74	3.5	93	4.6	90	3.3	70	3.9
Neurodevelopmental Disabilities	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	14	1.4
Neurological Surgery	0	0.0	0	0.0	250	40.0	304	39.9	297	42.2	319	37.9
Neurology	434	16.9	455	18.9	475	17.7	466	20.0	538	20.9	526	21.5
Nuclear Medicine	25	8.0	23	7.5	22	6.5	28	5.1	52	3.9	30	3.0
Obstetrics and Gynecology	1,132	23.4	1,142	26.2	1,156	26.2	1,203	29.8	1,166	32.0	1,185	31.2
Orthopaedic Surgery	942	47.3	956	50.0	992	49.0	1,078	51.6	1,074	56.9	1,078	62.0
Otolaryngology	434	39.2	408	42.4	478	40.8	457	44.7	435	46.2	519	42.4
Pathology-Anatomic and Clinical	524	16.0	521	17.0	574	18.0	584	18.8	541	18.8	573	18.2
Pediatrics	2,140	16.7	2,053	17.4	2,139	17.6	2,198	18.4	2,308	20.3	2,384	21.3
Pediatrics/Dermatology	34	1.6	8	1.0	18	1.0	9	1.0	0	0.0	0	0.0
Pediatrics/Emergency Medicine	28	2.3	35	2.2	29	2.1	32	2.3	29	2.4	23	2.3
Pediatrics/Medical Genetics	0	0.0	0	0.0	0	0.0	0	0.0	57	2.6	21	4.6
Pediatrics/Physical Medicine and Rehabilitation	8	2.3	16	1.9	18	3.8	15	2.6	16	2.3	11	2.4
Pediatrics/Psychiatry/Child and Adolescent Psychiatry	56	4.5	67	5.1	75	4.9	84	3.7	48	5.9	49	4.6
Physical Medicine and Rehabilitation	362	18.7	352	17.9	357	15.8	398	16.7	408	17.0	360	20.1
Plastic Surgery	250	28.4	223	33.7	236	36.5	218	15.3	215	15.1	182	16.5
Plastic Surgery-Integrated	0	0.0	0	0.0	0	0.0	232	23.5	235	25.0	396	13.5
Preventive Medicine	0	0.0	0	0.0	0	0.0	90	4.9	109	3.8	91	5.5
Psychiatry	948	16.3	887	16.2	994	16.2	994	19.2	998	20.3	1,020	20.9
Psychiatry/Family Practice	42	2.5	50	2.6	52	2.5	79	2.6	35	3.5	75	2.1
Psychiatry/Neurology	19	2.6	25	2.9	12	3.3	56	1.8	58	1.6	40	2.1
Radiation Oncology	245	34.1	231	38.9	337	29.1	280	34.3	286	40.3	266	52.5
Radiology-Diagnostic	1,299	40.0	1,340	41.7	1,492	40.7	1,416	47.0	1,383	44.1	1,401	41.1
Surgery-General	2,246	22.1	2,339	23.6	2,587	22.2	2,663	25.6	2,702	27.7	2,920	29.7
Thoracic Surgery-Integrated	0	0.0	0	0.0	30	1.9	76	4.8	88	6.9	93	9.9
Transitional Year	3,449	8.7	3,345	8.9	3,653	8.7	3,433	9.1	3,294	9.2	3,149	9.2
Urology	338	43.3	375	44.6	354	43.7	308	44.0	307	47.8	361	49.7
Vascular Surgery-Integrated	0	0.0	35	3.9	49	10.2	92	8.5	122	9.6	70	20.2

Source: AAMC 12/17/2012

VITA

IVY CLICK

Personal Data:

Date of Birth: November 13, 1978
Place of Birth: Kingsport, Tennessee
Marital Status: Married

Education:

East Tennessee State University, Johnson City, Tennessee; Psychology, B.S.; 2001

East Tennessee State University, Johnson City, Tennessee; Psychology, M.A.; 2005

East Tennessee State University, Johnson City, Tennessee; Educational Leadership, Ed.D.; 2013

Professional Experience:

Graduate Assistant, Department of Psychology, East Tennessee State University, Johnson City, Tennessee; 2001-2003

Adjunct Faculty, Department of Psychology, East Tennessee State University, Johnson City, Tennessee; 2005

Research Assistant II, Department of Family Medicine, East Tennessee State University, Johnson City, Tennessee; 2006-2007

Research Coordinator, Department of Family Medicine, East Tennessee State University, Johnson City, Tennessee; 2007-present