FACTORS CONTRIBUTING TO THE UNIVERSITY OF KANSAS SCHOOL OF MEDICINE GRADUATES' CHOICE OF SPECIALTY AND PRACTICE LOCATION

By

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Submitted to the graduate degree program in Department of Educational Leadership and Policy Studies and the Graduate Faculty of the University of Kansas in partial fulfillment of the requirements for the degree of Doctor of Education.

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ABSTRACT

A retrospective, single institution study using archival data that describes graduates from the medical school and investigates factors that predict specialty choice and practice location of graduates. Student subjects consisted of the 1997 through 2008 graduates at the University of Kansas Medical School. Logistic regression was conducted to determine which factors predict specialty choice and practice location. Results indicated graduates who had a preference for primary care at matriculation, more recent graduates and graduates who completed a residency in Kansas were more likely to practice primary care. Age at graduation, having a rural background, graduation year, location of residency and practice specialty were all significant in predicting practice in Kansas. Results indicated that location of residency, age at matriculation and practice specialty were all significant in predicting practice in a medically underserved area. Graduates who were older were less likely to practice in state but more likely to practice in medically underserved areas. The study is important because the state of Kansas is not only grappling with a shortage of physicians and primary care physicians, it is also grappling with a mal-distribution of physicians in the state. Being able to determine specific characteristics of students who have the propensity to specialize in primary care and practice in state in rural areas will benefit the overall health of its citizens by increasing access to care and keeping the workforce of Kansas healthy as well.

DEDICATION

To my husband Hiep Nguyen, and my children: Madelynn Hanh Nguyen, Ava Huyen Nguyen and Gracie Ngoc Nguyen.

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CHAPTER ONE

Introduction

On a national scale, there is increasing pressure to reform the U.S. health care system in the face of growing numbers of uninsured individuals, widening health care disparities, and the rising cost of care. These factors fuel increasingly restricted access to much needed health care for millions of people in the US. The Affordable Health Care Act looks to expand coverage and to increase access to care and will potentially result in an even greater demand for physicians (Jeffe, Whelan & Andriole, 2010). A study by the National Association of Community Health Centers (NACHC) and the Robert Graham Center (2007) found that 56 million Americans don't have ready access to primary care due to shortages of primary care physicians in their communities. The Association of American Medical Colleges states that unless something is done, by the year 2025, the U.S. will face a shortage of 124,000 – 159,000 physicians (AAMC, n.d.).

To compound the physician shortage problem, there is an aging population with an increased prevalence of multiple chronic diseases that will require more time and coordination of care. Preventive care, care coordination for the chronically ill, and continuity of care are all hallmarks of primary care (Smith, 2011). All of these factors indicate more primary care providers are desperately needed. Instead of having more physicians entering primary care, the U.S. is grappling with a deepening shortage of primary care physicians since medical students are opting to enter primary care less readily as they do other specialties (Jeffe, et al., 2010). Popularity of primary care among U.S. medical students has been steadily declining for the past decade and is currently at historic low levels (Phillips, et al., 2009). It is estimated that only 16-18% of graduates

of U.S. allopathic medical school graduates are likely to go into primary care (Smith, 2011).

Given what potentially awaits students who decide to specialize in primary care include consistently lower job satisfaction rates compared with other specialties (Deshpande & DeMello, 2010), increases in educational debt (Schwartz, Durning, Linzer & Hauer, 2011) and a growing salary disparity relative to other specialties (Biola, Green, Phillips, Guirguis-Blake & Fryer, 2003), it is no surprise that medical students aren't opting to enter primary care as readily as they do other specialties. Some think that it will be a huge challenge for the U.S. to develop strategies that will increase the number of medical students who will pursue a career in primary care (Jeffe, et al., 2010).

Just as this is a national problem, the news for the state of Kansas is just as bleak, if not worse. It is estimated under the Affordable Care Act, Medicaid expansion would cover an estimated 144,000 additional Kansans which may result in an even higher demand for medical services (KHI, 2013). This influx of newly insured patients may overwhelm the Kansas physician workforce which is already under tremendous strain. As a whole, Kansas has a ratio of 213 physicians for every 100,000 residents, which is well below the national average of 259 physicians for every 100,000 residents. In addition, Kansas also has low-physician-per 100,000 ratios in five of its six major geographic regions (Grenier, et al, 2007). Since the University of Kansas School of Medicine (KU SoM) is the only medical school in the state, specialty choice and location practice of its graduates is extremely important for the state and the health of its citizens.

Purpose of the study

This is a retrospective, single institution study using archival data that describes graduates from the medical school and investigates factors that predict specialty choice and practice location of graduates. The descriptive analysis will give the basic characteristics of the graduates of KU SoM (i.e., race, gender, etc.). Location of where graduates completed their residency, where they are practicing (in Kansas or not) was investigated. If the graduates are practicing in Kansas, whether they are practicing in a medically underserved area was also investigated. I also compared how location of practice vary by gender and race and ethnicity of the physician.

In addition, a descriptive analysis of the specialty choice of graduates is also presented and then clustered into two categories of whether they specialized in primary care or non-primary care fields. I also compared how specialty choice vary by gender and race and ethnicity of the physician.

Another purpose of this study was to identify which variables may explain student specialty choice for graduates, particularly primary care specialty choice and determine which variables may predict which graduates decide to stay and practice in Kansas. The final purpose was to determine among those who practice in Kansas, what factors predict if they practice in a medically underserved area.

Research questions

1. What factors predict whether or not graduates of the medical school practice primary care?
2. What factors predict whether the graduates of the medical school practice in the state of Kansas?

3. Among those graduates who practice in the state of Kansas, what factors predict whether they practice in medically underserved areas?

Institutional Background

The University of Kansas School of Medicine (KU SoM) is a public medical school located on the University of Kansas Medical Center campus in Kansas City, Kansas. Since 1905 KU SoM has been educating physicians for the betterment of Kansas and the country. As the only medical school in the state of Kansas, KU SoM aims to improve the lives of all Kansas residents, whether they live in urban, suburban or rural areas (KUMC, n.d.). KU SoM's main campus is located in Kansas City, Kansas but recently added satellite campuses in Salina and Wichita. The school's mission statement emphasizes a commitment to enhancing "the quality of life and serve the community through discovery of knowledge, the education of health professionals and by improving the health of the public" (KUMC, n.d.).

KU SoM has gained a national reputation for educating family, primary care, and rural physicians (KUMC, n.d.). U.S. News & World Report ranks the University of Kansas' Medical School 35th among the top programs for training primary care physicians (US News, 2012). In addition, out of 141 U.S. allopathic and osteopathic medical schools, KU SoM was ranked 5th for having a "social mission", which took into account the percentage of medical school graduates who practice primary care, work in health professional shortage areas (HPSAs), and are underrepresented minorities (Mullan, Chen, Petterson, Kolsky & Spagnola, 2010).

As the U.S. faces a serious shortage of practicing physicians, medical schools are aiming to increase enrollment by 30% by the year 2015 (AAMC, nd). In addition to new

medical schools being developed, existing medical schools are exploring ways to increase the number of physicians graduated each year. Up until the year 2010, KU SoM admitted 175 medical students per year, all of whom completed their first and second years of medical school at the main campus in Kansas City, Kansas. For the third and fourth years of clinical training, approximately 55 students went to the Wichita campus for their education. In July 2011, in a move designed to help address Kansas' critical need for more doctors, KU SoM opened a new campus in Salina and expanded the Wichita campus to include third and fourth year training. The medical education program in Salina was aimed at students with a strong desire to practice in rural areas. With a class size of only eight students, KU SoM's Salina campus is the smallest four-year medical education site in the country (KUMC, 2013 Also beginning in the fall of 2011, an additional 8 first year students were admitted to the medical school at a satellite campus in Wichita for a total of 191 first year medical students each year. In the fall of 2012, the Wichita campus increased their first year medical student class size to 28 students for a total class size of 211 medical students per year for all three campuses.

Although it is estimated that Kansas' physician supply will increase over the next two decades, the state will most likely remain behind most states in remedying the physician workforce shortages. This is due to increased rates of out-of-state migration of medical school graduates, interns, and residents as a result of practice opportunities available in neighboring states and nationwide (Grenier, et al., 2007).

Statement of the problem

Physician workforce trends in Kansas follow that of the United States as a whole. As of 2010, Kansas had 6,058 active physicians in the workforce (Center for Workforce

Studies, 2011). This translates into a ratio of 213 physicians for every 100,000 residents, which is well below the national average of 259 physicians for every 100,000 residents. In addition, nearly 60% of active physicians in Kansas are non-primary care specialists compared to the national average of 65% (Greiner, et al., 2007). The physician workforce of the state of Kansas is important to study because primary care physicians continue to provide the majority of care to underserved populations, especially in rural communities. Primary care physicians disproportionately serve where access needs are the greatest (Bennett & Phillips, 2010) therefore increasing the number of primary care physicians in Kansas would be beneficial to the health of the public.

The state of Kansas is not only grappling with a shortage of physicians and a shortage of primary care physicians, it is also grappling with a mal-distribution of physicians in the state. There are a total of 105 counties in Kansas that are classified into six regions (Northwest, North Central, Northeast, Southwest, South Central, and Southeast). Kansas has low physician-per-100,000 ratios in five of the six geographic regions, with the under service most prominent in rural regions, especially in the southeastern and southwestern areas of the state (Greiner, et al., 2007). An overwhelming majority of Kansas' active physicians (84%) practice in two regions of the state (Northeast and South-central) (Greiner, et al., 2007).

Kansas is also considered to be a "net exporter" of physicians to the rest of the country. In comparison to the rest of the country, Kansas has nearly as many medical students (26.0 versus 26.6 per 100,000) but only half as many physicians in residencies and fellowships (18.4 versus 34.3 per 100,000) (Greiner, et al., 2007). It is estimated that 62% of the physicians who attend medical school in the state eventually practice outside

of Kansas (Greiner, et al., 2007). According to Greiner et al. (2007), 46% of physicians completing their graduate medical education (residency) in Kansas are practicing in the state, which is slightly below the national average of 48%. To complicate matters for Kansas, roughly 30% of active physicians in Kansas are age 55 or older (Greiner, et al., 2007). A significant number of these physicians will potentially be retiring in the near future, putting a further strain on the physician workforce in Kansas.

With the increase in the aging population coupled with an increase in the demand for physician services, the issue of physician shortage and mal-distribution for Kansas is only going to grow exponentially. Since the University of Kansas is the *only* medical school in the state, not only producing more primary care physicians but also keeping them in Kansas is extremely important to the well-being of the state, quite literally. Being able to determine specific characteristics of students who have the propensity to specialize in primary care and practice in state in rural areas will benefit the overall health of its citizens by increasing access to care, in addition to the well-being of the physician workforce of the state as a whole.

Significance of the study

Since there is a shortage and a mal-distribution of primary care physicians in the state of Kansas, understanding the population who is graduating from KU SoM, what they are specializing in and where they are practicing is becoming increasingly more important for workforce planning for the state. This study may provide some insight for KU SoM to help it achieve its' "common goal" of increasing the number of graduating physicians who ultimately practice primary care in the state of Kansas, and also in medically underserved, rural areas. This is important for the State of Kansas since

research has shown that health systems based on primary care tend to produce better health outcomes at less cost and also have more capacity to reduce health disparities compared to health care systems that are specialty centered (Bennett & Phillips, 2010). With Kansas facing an estimated $500 million deficit for fiscal year 2012 (Associated Press, 2011), having a health system based on primary care may help curb high healthcare costs.

To meet the need for more primary care physicians in Kansas, policies must address the location and career choices among practicing and future professionals that cause an oversupply in some areas and an acute shortage in others. Results from the study may give university officials useful information in the selection of their future classes. It is surprising but very few schools have tried systematically to modify their admission policies, recruitment strategies, and admission committee make-up to positively influence the number of students who go into primary care (Bland, Meurer, & Maldonado, 1995). Undergraduate and graduate medical education selection and admission criteria can be adjusted to influence eventual physician retention and distribution patterns to suit the medical needs of the citizens' of Kansas.

This study will add to the research on career specialty choice by offering additional insights on *actual* practice specialty attainment and practice location. Most studies are limited to specialty choice during medical school, residency or at post-graduate year 1, with very few studies using specialty attainment. Given that there are different specialty selection decision points for medical students, it is possible that factors that influence medical students' specialty choice may vary by time or stage of medical education (Connelly, et al., 2003). While studies that investigate medical students'

specialty choice at matriculation have shown some ability to predict students' eventual career choice (Wright, Scott, Woloschuk, & Brenneis, 2004), they may provide an incomplete picture. It is estimated that one quarter of medical student graduates change specialty or make a major career change after graduation from medical school (Schafer, Shore, & Hearst, 2001). Only 20-45% of fourth year medical students ultimately chose the specialty that they had been the most interested in at matriculation (Compton, et al., 2008). Moreover, 20% of students who expressed intentions at the end of medical school to pursue primary care careers switched away from primary care during their residency training (Schafer, et al., 2001). Studies that only look at career choice of medical students during their undergraduate medical education may not be an accurate reflection of actual area of practice.

Furthermore, little is known about the precision of first-year residency specialty choice in predicting future primary care practice (Rabinowitz, et al., 2000), so studies using first-year residence choice as a predictor also may not provide an accurate estimate of the proportion of primary care physicians. Lastly, understanding the factors that determine the composition and distribution of the physician workforce is becoming increasingly relevant, not only on a national level, but also on a state level. It is important to know how to get the right mix of physicians to practice where they are most needed in Kansas. In light of these issues, the purpose of my study in determining what demographic and entry variables predict practicing in a primary care field, staying in Kansas and practicing in a medically underserved community would be significant in shedding light on the factors associated with primary care choice and practice in the state of Kansas.

CHAPTER TWO

Review of the Literature

The career choices made by medical students and the factors influencing those choices are of perennial interest to researchers and medical workforce planners (Morrison, 2004). Choosing a specialty and practice location is a complex process dependent on many factors. There is no doubt that personal characteristics, economic forces, social expectations, training opportunities, and educational experiences all have an indirect effect on each individual person's specialty choice (Burack, et al., 1997). This literature review is conducted to review research studies pertaining to medical career specialty choice. This literature review highlighted student inputs at matriculation to medical school including, demographics (gender, race/ethnicity, age), career preference at matriculation, undergraduate major, and how they relate to two specific outputs (student specialty choice and practice location). Environmental factors that affect career specialty choice will also be discussed.

Specialty Choice

The most prevalent type of study in the specialty-choice literature seeks to determine whether there is any association with student characteristics as a direct determinant of specialty choice (Bland, et al., 1995). Studies have shown that students' specialty choice is influenced by student-related factors such as gender, race and ethnicity, socioeconomic status, rural or urban background and age (Phillips, et al., 2009). This section will discuss research regarding which student characteristics have shown to have had an impact on career specialty choice, particularly primary care.

Gender

Gender has been a variable commonly believed to affect career choice of medical students. Of particular interest to researchers is whether women and men differ in their specialty selection patterns as it pertains to primary care. Gender is considered to be a factor that is often associated with primary care specialty choice with females choosing primary care more often than males (Babbott, Baldwin, Killian, & Weaver, 1989; Bennett & Phillips, 2010; Lupton, Vercammen-Grandjean, Forkin, Wilson, & Grumbach, 2012; Nieman & Gracely, 1999; Rosenblatt & Andrilla, 2005; Schieberl, Covell, Berry, & Anderson, 1996; Xu, et al., 1995).

In a recent study, researchers utilized longitudinal data to evaluate trends in specialty choice and predictors of primary care choice for U.S. medical school graduates (Jeffe, et al., 2010). For this particular study, primary care was defined as family medicine, internal medicine (both general and subspecialty), obstetrics-gynecology, pediatrics (both general and subspecialty), and combined internal medicine/pediatrics. Individualized, linked data for all 1997-2006 U.S. medical school graduates who completed two American Academy of Medical School (AAMC) questionnaires, the Matriculating Student Questionnaire (MSQ) and the medical school Graduation Questionnaire (GQ) was analyzed. Demographic, attitudinal and career intention variables on the MSQ and GQ were examined to determine any association with specialty choice. Multivariate logistic regression was used to identify MSQ and GQ variables that were independently associated with primary care specialties. Results of this study indicated that female graduates were more likely to choose general internal medicine, general pediatrics, family medicine, or obstetrics-gynecology (Jeffe, et al., 2010).

Most research has lumped internal medicine, family medicine and pediatrics as primary care, but this approach may limit the value of the findings because research has shown that physicians within these three fields may not be a homogeneous group (Lawson & Hoban, 2003). On the other hand, results of studies that analyze factors associated with only one primary care specialty are not necessarily generalizable to other primary care specialties (Jeffe, et al., 2010). This is exemplified when you delve into the research deeper.

Lawson, Hoban & Mazmania (2004) tested the predictive validity of demographic variables. Logistic regression analyses were conducted to generate a predictive model of primary care residency choice, also including family medicine, general internal medicine, and pediatrics separately. Of the demographic variables they entered into the analysis, gender was the only variable predictive of primary care residency choice. When you look into how each separate discipline relates to career specialty choice, female students were approximately four times more likely to choose a pediatric residency than male students. Surprisingly though, this relationship did not attain statistical significance for the individual disciplines of family medicine or internal medicine. The researchers postulated that the reason why gender was a significant predictor of primary care residency choice overall was most likely accounted for by the strong relationship with pediatrics residency choice.

Although gender may be a significant predictor of primary care overall and for pediatrics, it may not be a significant predictor for family medicine. Studies have found higher proportions of women than men selecting family medicine but none of the differences were statistically significant (Bickel & Ruffin, 1995; Cooksey, Dry, Harman,

& Killian, 1997). Of three additional studies that used multivariate analyses with at least one other control variable, two did not find that gender predicted choice of family medicine (Colquitt, Zeh, Killlian, & Cultice, 1996; Stilwell, Wallick, Thal & Burleson, 2000). The third study found that being female only modestly increased the odds of choosing family medicine (Kassenbaum, Szenas, & Schuchert, 1996). Taken together, it may be female gender is only very slightly associated with but not consistently predictive of a career in family medicine (Senf, et al., 2003).

This gender effect may not be applicable to internal medicine either. A study investigating whether sociodemographic factors found to predict primary care careers in medical students would predict similarly for internal medicine residents. They hypothesized that residents entering internal medicine would be older, more often women, and more often come from more modest backgrounds and from nonmetropolitan areas (Diehl, et al., 2006). Results indicated that although the proportion of women who were practicing in general internal medicine was slightly higher than men, results were not statistically significant. An earlier study by Nieman & Gracely (1999) also found that female graduates were more likely to specialize in family practice, pediatrics, and obstetrics-gynecology, but not more likely to practice general internal medicine.

Hauer et al. (2008) investigated factors associated with medical students' career choices regarding internal medicine. Demographics, debt, educational experiences, and number who chose or considered a career in internal medicine were measured. A factor analysis was performed to assess influences on career chosen. In addition, logistic regression analysis was conducted to assess independent association of variables with internal medicine career choice. Results indicated that male students were more likely to

pursue careers in internal medicine (odds ratio [OR] 1.75; 95% confidence interval [CI], 1.20-2.56]. None of the other student characteristics included in the study were associated with choosing internal medicine.

When pediatrics, internal medicine and family medicine are combined into one variable (primary care), research has shown an association between gender and primary career choice (Bland, et al, 1995). A caveat is by combining all three fields into one single category, subtle differences in significant predictor variables among these three groups are lost when combined (Lawson & Hoban, 2003). Based on this research, gender will be a variable in this study.

Race/Ethnicity

Along with gender, research on whether race and ethnicity are predictive of primary care specialty has garnered much interest among not only medical educators but also policymakers due to the important implications for the health care of U.S.'s burgeoning minority communities. Before June 26, 2003, the Association of American Medical Colleges' (AAMC) definition of underrepresented minority (URM) included Blacks, Mexican-Americans, and Native Americans (American Indians, Alaska Natives, and Native Hawaiians), and mainland Puerto Ricans. But in 2004, the AAMC changed their definition to "underrepresented in medicine" (UIM), which is defined as those with lower representation in health profession schools than in the general population (AAMC, 2004). Asian Americans are excluded from this definition because they constitute about 4.8% of the U.S. population (U.S. Census Bureau, 2011) but 12.8% of U.S. physicians (American Association of Medical Colleges, 2010).

The racial/ethnic composition of the U.S. physician workforce does not reflect the diversity of the U.S. population. In 2010, African Americans, Hispanics/Latinos and Native American Indians comprised almost 30% of the U.S. population (U.S. Census Bureau, 2011) but only 12% of physicians in the U.S. (American Association of Medical Colleges, 2010). A diverse health care workforce is an essential component for promoting accessible, quality health care that will help to expand access for the underserved. Research indicates that underrepresented minorities in medicine play a key role in providing care to minority patients, and more likely to practice in underserved communities (American Association of Medical Colleges, 2010; Grumbach, Hart, Mertz, Coffman & Palazzo, 2003; Lupton, et al., 2012; Saha & Shipman, 2008). Although there is evidence that underrepresented minorities are more likely to care for poor and underserved populations, the research on the specialty choices of students of different ethnic or racial background is inconclusive because of mixed or conflicting results (Bland, et al., 1995; Meurer, 1995). The literature is unclear not only about whether underrepresented minority graduates prefer primary care careers, but also about the factors that influence their career choice (Rico & Stagnaro-Green, 1997).

Data from the AAMC's yearly medical school and graduation questionnaires were analyzed to help understand the medical interests of underrepresented minorities and other students (Council on Graduate Medical Education, 1998). The data is from a national database of all matriculating and graduating medical students in accredited medical schools in the U.S. Data for the graduating class of 1991 were linked from matriculation to graduation. At matriculation to medical school, Blacks and Mexican-American students were interested in primary care 28.7% and 33.9%, respectively.

Comparatively, 26.8% of Whites and 25.7% of Other were interested in primary care at matriculation. At graduation from medical school, all four groups had lower interest in primary care (Blacks = 25.8%; Mexican-American = 26.7%; White = 26.2%; Other= 21.9%). Lastly, at completion of residency, interest in primary care for all groups increased with Mexican-Americans and Blacks most interested in primary care (33% and 32.9%, respectively). Data were only used for descriptive purposes only, no statistical analysis was provided.

In looking at the literature for specialty choice and race/ethnicity, there is some evidence of underrepresented minorities specializing in primary care more often compared to Whites. Earlier studies from the 1970's and 1980's had strongly suggested that minority graduates were entering primary care specialties at a higher rate than majority graduates (Tekian & Foley, 1997). A study conducted in the mid-1990's investigated the factors influencing the career choices of graduates of the University of California, San Diego School of Medicine alumni classes of 1974, 1978, 1982, 1986, and 1990 (Schieberl, et al., 1996). Respondents answered questions about demographics, personal and medical school factors, and level of debt. Primary care specialty was defined as family medicine, general internal medicine, general pediatrics, and general obstetrics and gynecology. Analysis of demographic factors determined that many of the demographic factors were positively associated with choosing primary care. Respondents who were older, female and an underrepresented minority, from a rural background were significantly more likely to enter into primary care (Schieberl, et al., 1996). Underrepresented minority graduates chose primary care residencies significantly

more often than white students. Results also showed a higher percentage of Asian graduates than whites entered primary care, but results were not statistically significant.

A more recent study investigated the longer-term specialty choice and practice location of underrepresented minority and disadvantaged students who finished a University of California postbaccalaureate (UCPB) premedical program (Lupton, et al., 2012). For this study, primary care was defined as general internal medicine, general pediatrics, family medicine, general practice, geriatrics, adolescent medicine, or medicine/pediatrics. The researchers compared 303 UCPB alumni who matriculated into medical school and could be matched to the American Medical Association Physician Masterfile with 586 randomly selected control physicians who graduated from the same medical schools in the same years as UCPB alumni. Chi-square tests were used to compare gender, age, race/ethnicity (UIM versus not UIM), state of residence at the time of application to medical school, physician specialty (primary care vs. non-primary care), practice location, and work in underserved areas. The findings indicated that significantly more UCPB graduates were from underrepresented in medicine racial ethnic groups (African American, Latino, Native American/Alaska Native) compared with control physicians (192/303 [63.4% versus 78/586 [13.3%]; $P < .001$). A greater percentage of the UCPB alumni than the control group of physicians worked in a primary care specialty (161/303 [53.2%] versus 235/586 [40.1%]; $P < .001$). In addition, a greater percentage of UCPB alumni than the control physicians were practicing medicine in California (192/303 [63.4%] versus 255/586 [43.5%]; $P < .001$).

But there is research that have conflicting results from the above studies. Tekian & Foley (1997) analyzed the graduate population from the University of Illinois College

of Medicine and found that a disproportionate number of underrepresented minority students selected specialty fields other than primary care. For the graduating class of 1990-1994 only 25% of underrepresented minorities specialized in primary care. For the graduating class of 1995, a dismal 16% of underrepresented minorities opted to go into primary care. In addition, there is also additional literature which indicates no statistically significant difference between the specialty choices of underrepresented minorities compared to all other students (Babbott, et al., 1989; Bland, et al., 1995; Diehl, et al., 1996; Martini, Veloski, Barzansky, Xu, & Fields, 1994; Rabinowitz, et al., 1997).

Jeffe, Whelan & Andriole (2010) wanted to describe trends in specialty choice and identify predictors of primary care specialty choices among 1997-2006 graduates of U.S. MD-granting medical schools who completed the Association of American Medical Colleges' Matriculating Student Questionnaire and Graduation Questionnaire. Primary care was defined as general internal medicine, general pediatrics, internal medicine subspecialties, pediatrics subspecialties, family medicine, and obstetrics-gynecology. The sample included 64.9% of all 1997-2006 graduates (n=102,673). They analyzed individualized, linked data for all 1997-2006 U.S. graduates of accredited medical schools. Findings indicated underrepresented minorities were less likely than white graduates to choose general internal medicine, general pediatrics, or family medicine. Asian/Pacific Islander graduates were less likely than white graduates to choose family medicine, general pediatrics, and obstetrics-gynecology but more likely to choose general internal medicine and internal medicine subspecialties.

In addition to choosing primary care less often, differences may be seen between underrepresented minority racial/ethnic groups. A study which sought to describe the

professional characteristics and personal health habits of women physicians stratified by ethnicity, with regard to the choice of primary care specialties, type or location of practice site, and career satisfaction found that although Blacks and Hispanics in this study were more likely than Whites to choose primary care specialties, black physicians were underrepresented in general practice but especially prevalent in general internal medicine (Corbie-Smith, Frank & Nickens, 2000). In addition, Hispanic physicians were more likely to be pediatricians. Other studies indicate Hispanic physicians are more likely to select family medicine (Bennett & Philips, 2010; Colquitt, et al., 1996).

Rosenblatt & Andrilla (2005) used logistic regression to determine the independent association of students' debt with career choices, while controlling for students' demographic characteristics. The factors that best predicted students' career choices were the students' demographic characteristics, particularly race and gender. Minority students had very distinctive preference patterns. African Americans were just as likely to choose primary care as a specialty as other groups but had less interest in pediatrics. Overall in this study, UIM groups showed less interest in family medicine, all other factors being equal (Rosenblatt & Andrilla, 2005). African American's lack of interest in pediatrics was also shown to be the case in another study (Colquitt, et al., 1996).

Considering the previous studies discussed, there is some evidence that UIM graduates may choose to go into primary care more often than whites but results aren't conclusive. Although the literature of the 1970's and 1980's suggest more underrepresented minorities choose primary care specialties, more recent literature showed either no difference or UIM groups opting to enter primary care less often.

Studies focusing on the specialty choices of students with different ethnic backgrounds, namely underrepresented minorities, have had mixed results. Some show there are differences between underrepresented minorities and whites, while others show opposite or no effect. As a result of these findings, race/ethnicity was used in this study to determine whether there is any association to specialty choice or practice location.

Age/Marital Status

The average age of medical school graduates has changed little over the past few decades but the percentage of graduates aged 30 and older continues to increase (Xu, Veloski & Barzansky, 1997). In 2011, approximately 16% of medical school graduates were aged 30 and over (AAMC, 2011). Research indicates that being older has positive associations with primary care specialty choice (Bland, et al., 1995; Kassebaum, et al., 1996; Lawson & Hoban, 2003; Schieberl, et al., 1996; Xu, et al., 1997). Earlier studies found that respondents who were older were more likely to specialize in one of the primary care fields (Martini, et al., 1994).

Schieberl, et al. (1996) found that respondents in their study who were older in age than the mean at graduation were more likely to practice in one of the primary care specialty fields. Although smallest in number, the oldest group (older than 30 years) had the greatest proportion of graduates who chose primary care. A more recent study investigating entry characteristics that predicted student's ultimate career choice found predictive variables to include age and marital status (Scott, Gowans, Brenneis, Banner & Boone, 2011). Students who were older at exit from medical school ($p < .001$) and those who were married ($p < .001$) tended to specialize in family medicine more often.

Reasons for the associations may be that older students prefer specialties with shorter residency training so that they will have more time in practice and can meet financial obligations (Bland, et al., 1995). A study by Xu, Veloski & Barzansky (1997) was the first study to compare older and traditional aged students based on factors influencing their choice of primary care. They conducted a national survey of physicians who graduated from U.S. allopathic medical schools in 1983 and 1984 specializing in family practice, general internal medicine, or general pediatrics. For this study, physicians' who graduated at age 30 or older were considered the older graduates and those under 30 were considered usual aged graduates.

Results of the study by Xu, et al. (1997) indicated a higher percentage of the older aged group had made the decision to specialize in primary care before entering medical school. In addition, some factors influencing the choice of primary care were age-specific. For example, older graduates tended to be more influenced by children and familial responsibilities, whereas, their traditional-aged peers were more influenced by internship and residency experiences and by parents and role models during medical school. Older graduates also were more likely to have come from low-income families, have more educational debt, and to have made the decision to enter primary care earlier. These factors suggest the older students may have selected their major because of the shorter residencies so they have more time in practice and are able to meet financial obligations (Xu, et al., 1997). The older students may be more committed to their earlier decision to major in primary care and therefore, be less influenced by the socialization process during medical school. Given the literature regarding age and specialty choice, age was used as a variable in my study.

Career Preference at Matriculation

Most students do not enter medical school absolutely secure in the knowledge of what specialties they will eventually choose (Bland, et al., 1995; Jeffe, et al., 2010). The literature indicates that students enter medical school with a preference for primary care careers, but this preference changes over time (Scott, Gowans, Wright & Brenneis, 2007). A study examined patterns of change in specialty interests during medical school for the Class of 2003 at 15 medical schools in the U.S. (Compton, et al., 2008). Students were invited to complete 3 questionnaires about their specialty preference at three different times, at first year orientation, orientation to clinical rotations/wards (typically between second and third years) and their last year in medical school. Results showed that pediatrics, surgery and family medicine were the most popular career choices at first year orientation. By the time the students were starting their clerkships/wards, a majority of students had change their specialty choices (Compton, et al., 2008). Only 30% of those who were initially interested in primary care careers remained interested in all 3 time points. In contrast to this, 68% of those initially interested in non-primary care fields remained interested in non-primary care fields across all 3 time points. Regardless of what the students' initial specialty interest was, when changing to another specialty choice by the fourth year in medical school, a non-primary care specialty was the most likely new choice. Family medicine was one of the few specialties in which students were most likely to maintain their initial interest (23%).

Studies often cite the fourth year in medical school as the critical stage at which a decision is made (Connelly, et al., 2003) but often during the second and third year of students' postgraduate training physicians often subspecialize. A subjective measure that

may distinguish students who will later specialize in primary care includes initial specialty preference at matriculation (Bland, et al., 1995). Evidence suggests that students bound for primary care are more likely to have chosen their specialty choice before medical school (Bennett & Phillips, 2010; Campos-Outcalt, et al., 2004). Unfortunately though, as the previous study showed, most students do not ultimately choose the specialty choice that they originally prefer, and the direction of change is usually away from primary care.

For example, a study by Kassebaum, et al., (1996) used a national database from AAMC's Masterfile to show the relative predictive influences of selected demographic, structural, attitudinal, and educational variables on the specialty choice of students graduating from medical schools in 1995. Four separate logistic regressions were conducted, based on the specialty-subspecialty certification plans of students (general practice, family practice, general internal medicine, and general pediatrics). Results indicated that graduating students who had expressed interest in one of the generalist specialties at matriculation were almost two and a half times more likely to choose a generalist specialty ([OR=2.44]). The logistical regression model for family practice versus all other specialties showed that students who had expressed an interest in family practice at matriculation were almost five times as likely to choose family practice as a specialty ([OR=4.77]). In the case of general internal medicine, interest at matriculation showed a strong positive association with graduating students' intentions to pursue a career in general internal medicine ([OR= 2.58]). Students who expressed interest in general pediatrics at matriculation were over four times as likely to choose general pediatrics at graduation [OR= 4.20]) (Kassebaum, et al., 1996).

In the study by Kassebaum, et al., (1996) discussed previously, interest in family practice at matriculation was a powerful predictor of choice of family practice at graduation ([OR= 4.77]). Several studies have also validated those results (Campos-Outcalt, et al., 2004; Senf, et al., 1997). A study by Senf, et al. (1997) found that the best predictor of the practice of family medicine or of primary care was the level of interest at matriculation. Nearly half of the variation in practice choices in the study was accounted for by the students' interest at matriculation. A study by Campos-Outcalt, et al. (2004) comparing primary care graduates from schools that had an increase in numbers of graduates who specialized in primary care with those schools who had decreases also concluded that the family medicine preferences of matriculating students was an important variable affecting a school's production of family physicians. They found that at schools with increases, the proportion of students matriculating with a specialty preference of family medicine increased by 7.4%, compared with schools with decreases proportion declining 11.8%. The cumulative evidence suggests the most effective way to increase the number of physicians who will practice general medicine is to admit more students interested in family medicine career at matriculation. This study used career preference at matriculation as an independent variable.

Academic Background

In 2010, over half a million applications (521,876) were submitted to the 121 medical schools that reported entrance data to U.S. News. On average, just 9% of applicants were admitted. Compared to other schools such as business and law, 9% is a much smaller portion acceptance rate (US News, n d). On average, business schools in the U.S. extended offers to almost half of their applicants and law schools admitted

roughly 35% of their applicants. Needless to say, acceptance to medical school is extremely competitive. So competitive that some have suggested students who are so focused on getting into medical school at any cost suffer from the "premedical syndrome" which characterizes premedical students as being "over-achieving, excessively competitive, overspecialized, narrowly focused…" (Brieger,1999). One major component of an academic background includes what undergraduate major a graduate completed prior to medical school.

Undergraduate Major

The requirements for admission to medical school have remained unchanged for many decades (Dienstag, 2008). Since 1910, the Flexner Report has codified the requirement for scientific training as a criterion for admission into medical school and has emphasized basic science in the first 2 years in medical school. Criticism of the premed requirements began soon after the adoption of the Flexner report and is continued to the present (Dalen & Alpert, 2009). Critics cite the heavy emphasis on the sciences presenting an obstacle to the students' obtaining a broad-based education that will serve as a foundation for a rich and varied professional career. Medicine, as some have noted, should be more balanced, hence rooted both in the sciences and the humanities (Brieger, 1999). It is argued that the current premedical coursework is not preparing students to be better doctors, but instead it maximizes students' scores on the admission test and thus, their chances of acceptance into medical school (Kanter, 2008). This is evident as the majority of matriculating medical students (65%) major in biology or another physical science as college undergraduates (Kliff, 2007). Again, this may be due to the belief that this will enhance their chances of admission to and their performance in medical school

(Dickman, Sarnacki, Schimpfhauser, Katz, 1980). The national proportion of humanities and social science majors matriculating to medical school in 2009 was less than 18% (Muller & Kase, 2010).

A frequently studied concern is that students who majored in the humanities in undergraduate education might be inadequately equipped to perform academically at the same level as their peers who have a background in sciences (Schwartz, et al., 2009). Research indicate that there are no significant difference between these two groups in performance academically in medical school (Ashikawa, Hojat, Zeleznik, & Gonnella, 1991; Schwartz, et al., 2009; Smith, 1998; Yens & Stimmel, 1982), on objective measures of achievement, such as Steps 1 and 2 of the United States Medical Licensing Examinations (USMLE) (Hojat, Gonnella, Erdmann, Veloski & Xu, 1995) or residency performance (Schwartz, et al., 2009).

There is some evidence of higher attrition rates for students who had majored in humanities (Ashikawa, et al., 1991), higher percentages who seriously considered leaving medical school (Zeleznik, Hojat & Veloski, 1983), and a significantly higher rate of nonscholarly leave of absence (Muller & Kase, 2010). Researchers found that although students who majored in humanities were more likely to have academic difficulties during their first two years in medical school (preclinical years), by their third year, as a group, they were no different academically from their classmates who were from the traditional premedical background (Schwartz, et al., 2009). This may indicate that although medical students with humanities major may not do as well as their peers in the preclinical curriculum, by the time they get to their clinical clerkships, where they deal with real patients and clinical problem solving, they do just as well.

Unfortunately, there is paucity of research that systematically investigates whether humanities in undergraduate medical education has an observable impact on specialty choice of future doctors (Ousager & Johannessen, 2010). There have been conflicting evidence of whether having a humanities background have a significant influence on whether a student chooses a primary care field or not. Earlier studies showed no difference between students with a humanities background and those with a science background in choice of primary care fields (Dickman, et al., 1980; Stimmel & Serber, 1999). In contrast, Koenig (1992) found that students who had "broad based undergraduate preparation" were more likely to choose specialties with high levels of patient interaction , specifically family medicine, internal medicine, pediatrics, obstetrics-gynecology, and psychiatry. There is some additional evidence that indicates students who have backgrounds in humanities as undergraduates being more likely to select psychiatry as a specialty (Muller & Kase, 2010; Sierles, Vergare, Hojat & Gonnella, 2004) and students with science background more likely to select a surgery specialties (Koenig, 1992).

Researchers at the Mount Sinai School of Medicine of New York University reviewed the academic performance of 691 medical students who graduated from their medical school between 2004 and 2009. Mount Sinai School of Medicine has the Humanities and Medicine Program (HuMed) which offers qualified sophomores and juniors who major in humanities or the social sciences guaranteed admission to their medical school upon successful completion of a baccalaureate degree. HuMed students are not required to take traditional premed coursework or the MCAT. Researchers compared the medical school performance of humanities and social science majors with

those who were traditionally prepared for medical school training (Muller & Kase, 2010). Cross-tabulations and ANOVA were conducted comparing HuMed students with non HuMed students across various variables. Results of the study indicated that HuMed students performed just as well in medical school as those with traditional premed majors. No statistical significance was found in USMLE Step I failure rates, honors grades in clerkships, school leadership MSPE points, rank in the top 25% of the class, and Alpha Omega Alpha designation. More importantly for specialty choice selection, HuMed students were more likely to choose a residency in primary care (49.4% vs. 39%) and psychiatry (14% vs. 5.6%) and less likely to choose surgical subspecialties (7% vs. 13%) and anesthesiology (5.8% vs. 9%) (Muller & Kase, 2010). Given the fact that there is a need for more primary care physicians in the US, it is important to study whether this is true of students in Kansas as well. Considering the prior literature regarding undergraduate major, undergraduate major is a variable I will include in the study to determine whether there is any association between it and specialty choice.

Medical College Admission Test (MCAT)

The road to medical school for many depends on the Medical College Admissions Test (MCAT), since getting a high score on the test is crucial to gaining acceptance into medical school (Dalen, et al., 2009). The MCAT is a standardized, multiple-choice examination designed to assess the examinee's problem solving, critical thinking, writing skills, and knowledge of science concepts and principles prerequisite to the study of medicine. Scores are reported in Physical Sciences, Verbal Reasoning, Writing Sample, and Biological Sciences. Almost all U.S. medical schools require applicants to submit MCAT exam scores (AAMC, 2012). The Physical Sciences, Verbal Reasoning, and

Biological Sciences sections on the MCAT are scored between a 1 and a 15, with 1 being the lowest score and 15 being the highest score. In total, the lowest MCAT score a person can receive is a 3, and the highest MCAT score is a 45 (Princeton Review, n.d). In 2011, the average MCAT score for applicants was 28.2 but the average MCAT score for medical school matriculants was 31.1. MCAT scores have always counted heavily for admissions committees in determining entrance into medical school, particularly the science portion (Dickman, et al., 1980). This is understandable since MCAT scores have been found to be a better predictor of medical school performance than grade point averages (Hartocollis, 2010). Furthermore, MCAT scores yield significant predictive validity coefficients with medical licensing examinations taken years later (Callahan, Hojat, Veloski, Erdman & Gonnella, et al., 2010).

Lower MCAT scores is commonly cited by commentators as being a factor that is associated with primary care specialty choice but have had mixed results in reviews (Bennett & Phillips, 2010). Some research indicates lower scores on the MCAT physical science and biology scores may correlate with primary care choice (Kassebaum, et al., 1996; Martini, et al., 1994). Several studies used national samples of medical students and multivariate statistics to identify comprehensive models of primary care residency choice (Colquitt, et al., 1996; Kassebaum, et al., 1996; Martini, et al., 1994). Martini, et al. (1994) conducted cross-sectional retrospective studies by surveying 121 medical schools in addition to general practice physicians with the purpose of trying to identify predictors in medical schools that can be manipulated to affect the number of graduates who practice primary care. Researchers also made site visits to nine schools with a high proportion of graduates going into primary care. Results of the linear regression

indicated that mean MCAT scores on the science problem subtest for entering students in medical schools who had higher proportion of graduates specializing in primary care than in the schools who had lower proportions of graduates specializing in primary care. The effects of 27 variables were tested independently by adding each to the regression model, one at a time. An inverse relationship was noted between choice of primary care and mean scores on MCAT science and reading subtests. Those who scored higher on the MCAT on the two subtests chose primary care less often (Martini, et al., 1994). A study by Hojat, Gonnella, Veloski & Xu (1995) also noted that non primary care physicians scored higher than their primary care peers on the quantitative portion of the MCAT.

A study used national databases on the Association of Medical Colleges and conducted a logistic regression analysis to try to determine predictive influences of selected demographic, structural, attitudinal, and educational variables on the specialty choices of medical school graduates in 1995 (Kassebaum, et al.,1996). Odds ratios were calculated as the measure of association between individual and institutional variables and specialty choice, representing approximations of how much the likelihood of choosing a primary care specialty was increased or decreased by each variable. Results indicated that MCAT Chemistry subtest scores were found to be significantly and negatively related to choosing a primary care specialty. Graduates who scored 11 or higher on the subtest had lower odds of choosing a primary care career than did graduates who scored 10 or less [OR = 0.82] (Kassebaum, et al., 1996). Graduates with MCAT Quantitative scores of 11-15 were slightly more likely to choose a primary care specialty [OR = 1.19]. Based on this, I used MCAT sum scores as a variable in my study.

Geographical Background

As predictions of physician shortages worsen, many states are trying to protect their return of their investments in medical education by focusing efforts on retaining physicians trained in medical schools and residency programs from crossing state lines to practice medicine (AMA, 2012). Kansas, is ranked 40th in the nation with keeping physicians in state (AMA, 2012According to the 2011 State Physician Workforce Data Book (AAMC, 2011), out of 5,643 physicians who completed their residency in Kansas, 2,178 were currently practicing in Kansas, translating into a 38.6% retention rate, which is well below the national average of 48%. Since Kansas is considered to be a net exporter of physicians, it is imperative to determine what factors contribute to their medical students and residents staying in state to practice to protect their return of investment. In the following section of the literature review, research in what factors affect medical students and physicians practicing in the state they received their medical education will be discussed.

In-State

The geographical distribution of physicians is affected by a number of factors. There is overwhelming evidence to indicate where physicians attend medical school and complete their residency, have an influence on where they eventually practice (Burfield, Hough, & Marder, 1986; Georgia Board for Physician Workforce, 2012; Seifer, Vranizan, & Grumbach, 1995). For example, an earlier study examined whether physicians who are trained in a state eventually practice in that state or out of state (Burfield, Hough, Marder, 1986). This study used data from the AAMC's Physician Masterfile. This data file has been compiled and maintained t by the AAMC since 1906. The Physician Masterfile contains demographic and professional information on all

active physicians and residents in the U.S. Results of the study showed that 39.3% of physicians were practicing in the same state as their medical school and 51.1% of physicians were practicing in the state where they had received their residency training. Interesting to note, only 29.7% of physicians who obtained both their undergraduate and graduate medical education in the same state were practicing in that state.

For the same study, demographic information regarding the migration pattern of physicians showed that on average, 60% of a state's female physicians completed the majority of their residency training in that state, compared with only half of the state's male physicians (Burfield, Hough, & Marder, 1986). Older physicians and to some extent, the youngest physicians were more likely than other age groups to have trained in the state where they practiced. Physicians who had graduated from medical school 11 to 20 years earlier were most likely to have received their medical education outside of their state of practice.

A more recent study by Coffman, Levin, Colburn, & Grumbach (2001) also examined the relationship between practice location and location of medical school and residency. The study also investigated whether migration patterns differ among racial/ethnic groups. They analyzed data on California residents pursuing careers in medicine to determine whether underrepresented minorities who completed medical school and/or residency in California were more likely to practice in California. According to the study, location of medical school differed significantly across racial groups (Coffman, et al., 2001). Underrepresented minorities were more likely than any other Californians from other racial/ethnic groups to attend medical school in California. Between the years of 1985-1999, a total of 3,095 underrepresented minority Californians

attended medical school either in California or out of state. Of this population, 57% attended a medical school in California (n=1,707), compared with only 42% of non-Hispanic whites and 44% of Asians. Regarding location of residency, those URM Californians who attended medical school in California were much more likely than their peers who attended medical school out of state to enter residencies in California (74% versus 55%). In taking into account physician practice location, URM Californians who completed residency in California were much more likely to practice in California than those URM who completed residencies in other states (59% versus 17%) (Coffman, et al., 2001).

The characteristics of a physician's medical school also seemed to influence subsequent choice of practice location. Forty-eight percent of practicing physicians who attended a public school medical school did so in the state that they practiced (Burfield, Hough, & Marder, 1986), compared with 31% of physicians who graduated from a private medical school. The reputation of the school was also related to physicians' practice locations. For this particular study, schools were classified as "elite" if they received the highest scores on a survey of medical faculties conducted by Cole and Lipton (Burfield, et al., 1986). Physicians who attended schools defined as "non-elite" had a higher propensity to practice in the state where they graduated from medical school, where they received their residency training, or both compared with those graduating from "elite" schools (Burfield, et al., 1986).

A more recent study examining the relationship between graduate medical education and physician practice location did a cross-sectional analysis of physicians in active practice, classified by state of graduate medical education and stratified by

specialty and professional activity (Seifer, Vranizen & Grumbach, 1995). Logistic regression analysis was used to examine predictors of physicians remaining to practice in the same state they were trained. Results indicated on average, 51% of physicians practiced in the state in which they obtained their graduate medical education. The range among states included the lowest retention rate of 6% (Nevada) to the highest of 71% (California) (Seifer, et al.,1995). The strongest predictor of practicing in state was physician attending medical school in the same state as their graduate medical education (OR, 3.76, 95% CI, 3.65 to 3.87). In addition, results of univariate analyses indicated women were more likely compared to men to stay in state (OR, 1.236, 95% CI, 1.211-1.261) as well as physicians who were generalists compared with specialist (OR, 1.363, 95% CI, 1.337 -1.389).

In a national sample study of active physicians who completed their residency in the 1980's and 1990's found that about half were still practicing in the same state where they did their residency. Furthermore, generalist physicians were more likely than specialists (57% vs. 48%) to remain in the state they completed their residency (Association of American Medical Colleges, 1998). A more recent study which investigated practice locations of physicians used data from the AMA Physician Masterfile, a national database containing current and historical data on physicians who reside in the U.S. Their results indicated that a majority of general practice physicians and physicians in metropolitan areas practice in the same state they completed their most recent residency (Henderson, Farmer & Szwarc, 2003).

In essence, one of the principal determinants of location of practice for newly trained physicians is the location of their residency training programs (Fagan, et al., 2013;

Owen, Hayden & Bowman, 2005; Seifer, et al, 1995). Decades of studies have shown that graduate medical education (residency) graduates are most likely to practice within short geographic distances from the site of their GME training (Greiner, et al., 2007). There is some evidence that generalist (primary care) physicians also tend to stay in the state they completed their most recent residency. To a smaller extent, females and underrepresented minorities are more likely to stay in state where they receive their residency training. Prior literature has shown that there is an association between location of residency and eventual practice location; therefore, location of residency was included as a variable in this study to predict practice location of graduates of KU SoM.

Rural Background

People living in rural areas constitute one of the largest medically underserved populations in the U.S., as 21% of the U.S. population live in rural areas but only 10% of physicians practice in rural areas (Hyer, et al., 2007). Rural residents may be more vulnerable to physician shortages since they tend to be older, sicker, poorer, and are more likely to be uninsured compared to urban residents (Rabinowitz, Diamond, Markham & Wortman, 2008). Rural physician shortages have been a problem for over 80 years (Rabinowitz, Diamond, Markham & Wortman, 2008). Despite continued federal and state efforts to increase the number of physicians in rural areas, disparities between the supply of rural and urban physicians persist (Chen, Fordyce, Andes, & Hart, 2010). It doesn't look like the problem will be remedied anytime soon either as only 3% of medical school graduates are planning to practice in rural areas and small towns (Quinn & Hosokawa, 2010).

One of the most thoroughly studied factors of pre-medical school characteristics that is related to rural practice has been physicians' place of upbringing, which appears to be a key factor in the decisions physicians make about their initial practice site (Brooks, Walsh, Mardon, Lewis & Clawson, 2002). Research has consistently found that rural upbringing was positively associated with physicians' practicing in rural areas (Brooks, et al., 2002; Hyer, et al., 2007; Pretorius, Milling & McGuigan, 2008; Rabinowitz, Diamond, Hojat, & Hazelwood, 1999; Rabinowitz, et al., 2002; Wade, et al., 2007). For example, Rabinowitz et al. (1999) found that growing up in a rural area was the most important independent predictor of rural practice. The only other factor strongly associated with rural practice in the study was the student's expressed plan to specialize in family medicine. A more recent study examined the birth county of 540,000 U.S. born physicians who are actively seeing patients showed that physicians who were from the most rural counties were four times more likely to practice in a rural area compared to those from the most urban counties (Hyer, et al., 2007).

Demographic characteristics such as age, gender, and race or ethnicity have also been examined for their impact on rural practice. Historically, rural medical care was provided almost exclusively by male physicians due to the paucity of women in medicine and the tendency for few women graduates to locate to rural areas (Hart, et al., 2002). Despite the recent increase of female physicians, women remain substantially less likely than men to relocate within rural areas (Doescher, Ellsbury & Hart, 2000). The growing proportion of women entering medicine has some workforce analysts nervous because it might prolong the national shortage of rural physicians. Only 31% of rural physicians are women (Chen, et al., 2008). Women continue to be less likely than men to practice

in rural areas, although the gap is narrowing. A study by Xu, et al. (1997) examined relationships between physicians' choice of practicing medicine in underserved areas and their background variables. While gender was not identified as a significant variable in the combined model, a separate analysis showed that gender was significantly and negatively related to the choice of practice in a rural area. Men were more likely than women to practice in rural areas (Xu, et al., 1997). The authors of this study posited that physicians' personal and demographic characteristics are the most important factors influencing their decision to practice in underserved areas. One interesting note in this study, researchers also assessed medical school experiences in their regression analysis. They were surprised to find that medical school experiences had a negligible effect for rural practice and a negative effect for inner-city practice.

The same study by Xu, et al. (1997) also found that physicians' underrepresented minority status was an important factor in the choice to practice. Researchers initially did not distinguish between inner-city and rural locations but lumped both into "underserved" areas. In this study, an underrepresented minority physician was 2.7 times more likely than a white or Asian physician to practice in an underserved area, independent of the effect of all other variables. The researchers conducted further analyses of two multiple-logic models: one for inner-city versus non-underserved and one for rural versus non-underserved. Results indicated for underrepresented minorities, there was a negligible effect in the case of rural practice choice and a negative effect in the case of inner-city practice.

In a cohort study of nearly 2,000 physicians, Horner, Samsa & Ricketts (1993) examined how many physicians entered primary care practice in rural and urban counties

of North Carolina. Researchers found that physicians in rural practice were slightly older and more likely to be male, compared to physicians in urban practice. They did not find any significant differences between rural and urban physicians regarding their race or ethnicity. A study by Rabinowitz, et al. (1999) used multiple logistic regression model using variables that were univariately correlated with rural practice. Although rural background was overwhelmingly the most important independent predictor of rural practice, age, gender, race or ethnicity were not predictive of rural practice for the study.

Just as physicians who come from a rural background are more likely to practice in rural areas, research indicates that rural background is one of the most widely reported factors associated with primary care specialty choice (Bennett & Phillips, 2010; Bland, et al., 1995), particularly family medicine (Avery, et al., 2009; Bennett & Phillips, 2010; Kassebaum, et al., 1996; Phillips, et al., 2009; Senf, et al., 1997). A comprehensive study by the Robert Graham Center used nearly 20 years of survey data from graduating medical students to study multiple factors along the training path and how they result to what specialty and where physicians practice. Researchers found that measureable student characteristics that increased the likelihood of choosing primary care included rural birth (Phillips, et al., 2009). As one of the four basic "truths" in rural health literature, students with a rural background are more likely to train in primary care (Hart, et al., 2002), particularly in family medicine compared to their non-rural counterparts.

Rural origin has been shown by others to be predictive of primary care specialty choice as well. An earlier study investigated factors influencing career choices of 474 University of California, San Diego School of Medicine alumni found that respondents who came from a small town or rural area were significantly more likely to enter primary

care (Schieberl, 1996). In fact, respondents who spent most of their time before medical school in a small town or rural area chose primary care 70% of the time. This was triple the percentage compared with alumni who were from a large city. Seventy-five percent (75%) of alumni who were from a large city specialized in a non-primary field compared with 30% of those from a small town/rural. In addition, 64% of physicians from a suburb of a large city specialized in a non-primary care field.

The effect of rural background is even stronger for those who choose to specialize in family medicine (Hyer, et al., 2007). Based on a review of the literature to determine factors related to family medicine specialty choice, Senf, et al., (2003) concluded that rural background was related to choice of family medicine. A study by Pretorius, et al. (2008) studied the influence of rural background on the entry of a New York medical student into a residency in family medicine, independent of other variables. A retrospective control-design was used consisting of two groups: a study group and a control group. The study group was graduates of the medical school at the University of Buffalo and the control group was an equal number of graduates who entered any specialty other than family medicine over the same period. The sizes of the cities in which the students' high school was located were divided into four groups: rural (population up to 10,999), small (11,000-60,000), urban (2^{nd}, 3^{rd}, 4^{th}, and 5^{th} largest cities in the state), and metropolitan (NYC metro area). Statistical calculation was performed using an odds ratio, a measure of the strength of association between the independent (size of city) and dependent (selection of family medicine residency) variables (Pretorius, et al., 2008). Results indicated students from rural areas were over twice as likely to enter into a family medicine residency (OR 2.27, $p<.01$) over other disciplines. Students

from small cities and urban areas were equally as likely to go into family medicine as another specialty. Students from metropolitan areas were one-third *less* likely to go into family medicine (OR .064, $p < .08$).

Specialty choice is the most powerful predictor of choosing a rural practice location with family medicine physicians being much more likely than other specialists to practice in a rural area (Hart, et al., 2002). Of the three major primary care specialties, family medicine was most prevalent in rural areas, representing 50% of all physicians practicing in small or isolated areas (Rural Health Research Center, 2007). To add fuel to the fire, fewer medical students are opting to go into family medicine (Avery, et al., 2011), which has significant implications because approximately 42% of outpatient visits in rural areas are made to family physician offices, compared with the national average of 23% (AAFP, downloaded on 3/2/12).

Given the literature on rural background on specialty choice and practice location, rural background was included as an independent variable in my study to determine whether it had any effect on specialty choice and practice location of graduates of the medical school. Since specialty choice has been shown to be a powerful predictor of choosing rural practice location (Hart, et al., 2002), it was also included as a variable in my analysis to predict graduates staying in Kansas and practicing in a medically underserved area.

Summary

The literature about medical students' inputs at matriculation to medical school and how they relate to student specialty choice and practice location has shown that

the most widely reported factors associated with primary care specialty choice were female gender, rural background, and being older at matriculation and to a lesser extent, underrepresented minorities and those with lower MCAT science scores.

In reviewing the literature of what input characteristics influence physicians practicing in state after their medical education, there is some evidence that indicates location where the physician completed their graduate medical education (residency) was a predictor in eventual practice site. Females are more likely than males to stay in state, and there is some evidence to indicate that physicians who tend to practice in the state where they completed their medical education tend to be older.

For rural practice, research has consistently found that rural upbringing was positively associated with physicians' practicing in rural areas. Research also indicates that females are less likely than men to practice in rural settings. Physicians who grew up in rural areas also tend to specialize in primary care more often than their peers who grew up in metropolitan areas. In addition, specialty choice was also a strong predictor in practice in rural areas. Understanding how individual characteristics influence medical graduates' decision on specialty choice, and whether or not to practice in state, and in rural or non-rural areas represents a critical link between academic research and policy outcomes (Jones, Humphreys, & Prideaux, 2009). This is all the more important when policies target considerable public resources to facilitate outcomes deemed to be in the public interest, such as the overall health and well-being of the state of Kansas, especially the rural population.

Based on the review of the literature, we would expect the following factors to predict primary care specialty choice: being female, being an underrepresented minority,

being older at matriculation, having lower MCAT sum scores, having a preference for primary care at matriculation, having an undergraduate major in humanities, and having a rural background. Given this research, these variables will be included in the logistic regression analysis.

In addition, based on the review of the literature, we would expect the following factors to predict state of practice: location of residency, with physicians who trained in state eventually practicing in that state. In addition, females were more likely to stay in state, as well as older physicians and underrepresented minorities. Since research has shown that these factors have been associated with practice location, these variables will be included in the logistic regression analysis. Lastly, based on the review of the literature regarding practicing in rural or medically underserved areas, we would expect the following factors to predict practicing in rural, medically underserved areas: rural upbringing, being male, not being an underrepresented minority, practicing in a primary care specialty and being older. These factors will be included in the logistic regression analysis.

CHAPTER THREE

Methodology

This section provides a summary of the procedures and the methodology used in this study. This is a retrospective, single institution study using archival data that describes graduates from the medical school and investigates factors that predict specialty choice and practice location of graduates. The methods applied for this research were quantitative. Given the data set, quantitative methods allow more for detailed analysis of the variables than qualitative methods. Descriptive statistics were used to describe the composition of the graduates of KU SoM with regards to gender, race/ethnicity, age at matriculation, undergraduate major, preferred career choice at matriculation, average MCAT score, home state, and rurality. Descriptive statistics was also used to detail the actual practice specialty and location of practice for the graduates. Any differences between gender and race/ethnicity in terms of practice specialty and practice location was investigated. In addition, logistical regression analysis was used to determine which factors predicted specialty choice, practice location, and practicing in medically underserved areas in Kansas. SPSS statistical software package was used to analyze the data. The next section outlines data sources, sample, variables, and methods for data analysis.

Data sources

The data for this study came from the University of Kansas School of Medicine's Office of Medical Education, Assessment and Evaluation and the Admissions Office. Data were derived from the Kansas Board of Healing Arts (KBHA) License database and the most recent Kansas Health Care Resource Questionnaire for Medicine and Surgery to

identify the practice location for each physician. According to the KBHA License database, practice location in Kansas was defined as a primary mailing address in Kansas in the license database and/or a Kansas address in at least 1 practice site on the Kansas Health Care Resource Questionnaire. If there were more than one location for a physician, the practice site that had the most work hours associated with it was the primary practice location. If no practice location was available, then primary mailing address indicated the location Preadmission data, which were derived from application materials included demographic information including gender, date of birth (month/date/year), race/ethnicity, primary undergraduate major, age at matriculation, year of entry into medical school, home state, and home county. Practice information for graduates included year graduated from medical school, residency specialty, Kansas Medical License number, specialty choice according to the Kansas Board of Healing Arts, and state of practice. For specialty choice, first year residency specialty choice was listed as well as current specialty choice and practice location including state of practice and if they are practicing in Kansas, zip code and county were provided.

Sample

A retrospective cohort of 1895 medical students who graduated from a single state institution (University Kansas Medical School) in an eleven-year period from 1997 to 2008 made up the subjects of the study. Archival data were available for students who graduated from the medical school between the years of 1997-2008 (matriculated years 1993-2004). Prior to the year 1995, applicant/student data were not kept in an electronic format; therefore, data were not accessible. The cutoff year 2008 was used to account for the minimum 3-4 years of residency required for the primary care physicians. Current

medical students and recent graduates were not selected since the intention was to analyze data about the subject's postgraduate specialty choice and location.

Student subjects consisted of the 1997 through 2008 graduates at the University of Kansas Medical School. A total 2,351 subjects were included in the original data file from the Office of Medical Education, Assessment and Evaluation. Due to missing data for the graduating class of 1995 and 1996, graduates from those two classes were omitted from the data (*n*=201). Of the remaining 2,122 subjects, 139 subjects did not graduate from the medical school, 8 subjects were deceased, 4 had their licenses suspended, and 5 were practicing outside of the U.S. These subjects were omitted from the data. After an extensive search, practice specialty and/or practice location were not available for 99 subjects. The 99 subjects were also omitted from the final data set. Deleting missing data without severely reducing the cases available is an acceptable way of data preparation used by many researchers (Creswell, 2005). The researcher determined that deleting the 99 cases that had incomplete responses would still leave 1,895 complete set of cases; these would be a large enough sample to conduct analysis. A final tally of 1,895 students were included in the final data set (N=1,895). Sample sizes vary slightly across different statistical analyses because of missing data.

Procedures

Before the request for these data from the Office of Medical Education, University of Kansas Medical School, a proposal for this study was presented and approved by faculty dissertation committee members. An application for this study was also submitted and approved by the Institutional Review Board for Research Using Human Subjects at the University of Kansas Medical Center (see Appendix B).

In the original data set from the Office of Medical Education, practice location and specialty were only available for those who were licensed in the state of Kansas. Approximately 1,400 physicians were practicing out of state. In trying to determine specialty choice and practice location of those graduates who were practicing out of state, an internet search was conducted for each individual doctor's first name, last name and/or middle name or initial. The initial step was to search for each individual graduate by name through the search engine www.Google.com to determine where (state) and what specialty the graduate was practicing. Other websites utilized in the internet search also included www.healthgrades.com and www.vitals.com which provided specialty, practice location of physicians, medical school and year of graduation from medical school. After checking on www.Google.com, www.healthgrades.com and/or www.vitals.com, practice specialty and location were noted after checking the consensus of the data.

After determining what the location of practice was for the graduate, the next step was to go to each individual state medical licensing board to determine whether or not the physician had a valid license in the state. The Administrators of Medicine (AIM) Association of State Medical Board Executive Directors site (http://www.docboard.org/docfinder.html) provided physician license data for 18 states with links to the remaining individual states' medical licensing boards. If the physician had a valid license in the state, physician specialty and practice location (city, state, zip code) was recorded for each graduate in the data set. In instances where there were differing information for city or zip code, information on state medical licensing board was recorded in the data set. In instances where there was a name change (i.e. after marriage), an exhaustive internet search was done for marriage records or announcements

to validate the name change. In instances where conflicting information or no information was available, data were not recorded for that graduate (n = 99). Data had to corroborate with both the internet search and the individual state medical licensing board to be included in the data set.

Variable specification

Independent variables

This study examined the effect of various student demographic characteristics on career specialty choice, practice location, and practicing in a medically underserved area (MUA) (rural). The student demographic characteristics served as the independent variables:

a) Gender
b) Race/ethnic background – recoded to reflect underrepresented in medicine and not underrepresented in medicine.
c) Undergraduate major – recoded to reflect traditional science for medical education and all others
d) MCAT sum score (continuous variable)
e) Rural background – recoded to reflect two categories: urban/semi urban and densely settled rural/rural/frontier
f) Age at graduation (continuous variable)
g) Graduation year (continuous variable)
h) Specialty choice at matriculation – recoded to reflect two categories: primary care and non-primary care. Primary care is typically used to

denote fields of general practice, family practice (medicine), general internal medicine, or general pediatrics and medicine-pediatrics without advanced training in subspecialty areas (Grumbach, et al 1995). Non-primary care career choice and non-primary care was all other specialties.

i) Residency location – Kansas or Not Kansas

j) Practice specialty choice - recoded to reflect two categories: primary care and non-primary care. . Primary care is typically used to denote fields of general practice, family practice (medicine), general internal medicine, or general pediatrics and medicine-pediatrics without advanced training in subspecialty areas (Grumbach, et al 1995). Non-primary care career choice and non-primary care was all other specialties.

Dependent variables/outcome

Practice specialty and location was provided by KBHA and were self-reported by graduates at the time of application/reapplication for state licensure. According to the Director of Assessment and Evaluation, data for KBHA was exported in January of 2013 and reflected data as of December 31, 2012. Tracking of practice specialty and practice location of graduates who practiced out of state occurred during a three month period between August – October of 2013. Data from KBHA and internet search data provided a snapshot at a point in time and might not reflect changes of location or practice after the time period.

a) Practice specialty choice - recoded to reflect two categories: primary care and non-primary care. Primary care was defined as family medicine,

general internal medicine, general pediatrics, and medicine-pediatrics. Non-primary care career choice and non-primary care was all other specialties.

b) Practice state – dichotomous variable of Kansas or Not Kansas

c) Of those who are practicing in the state of Kansas, location of practice was recoded to reflect the dichotomous variables: medically underserved and not medically underserved. In determining whether the location of practice is medically underserved, the study used the Governor-Designated Medically Underserved Areas criteria detailed further below.

Data Analysis

Data Preparation

Data were coded and analyzed using SPSS for Windows® software, Release 20.0. Descriptive statistics were calculated to give a general overview of the background characteristics of graduates including gender, age at matriculation, race/ethnicity, undergraduate major and average MCAT scores. A description of how practice specialties of graduates vary by gender and race/ethnicity was also calculated. The study also describes how practice specialties of graduates vary by race/ethnicity.

In the data set race/ethnicity was reported according to the American Medical College Application Service (AMCAS) guidelines. There was a change of coding in the system for the entering years after 2002. The Office of Admissions provided a listing of the codes used prior to 2002 and codes used after 2002 (See Appendix A). Graduates were allowed to report more than 1 racial or ethnic category. Graduates who reported more than 1 ethnicity group were assigned a single ethnic group based on the following

algorithm: graduates who reported they were Black/African American, Mexican-American, Native American (including American Indian, Alaskan Native, Native Hawaiians) and mainland Puerto Ricans in either or any of the race or ethnicity or subcategories were coded as URM. All other responses were categorized and recoded as Not URM.

Data were recoded to parallel the AAMC's definition of URM. The AAMC's definition includes racial and ethnic populations that are underrepresented in the medical profession, relative to their numbers in the general population. The four racial/ethnic groups are Blacks, Mexican-Americans, Native Americans (American Indians, Alaskan Natives, and Native Hawaiians), and mainland Puerto Ricans (AAMC, n.d.) The race/ethnicity variable was collapsed into 2 groups: "Not Underrepresented in Medicine" (not URM) and "Underrepresented in Medicine" (URM).

For the descriptive portion of the data, legal county was used to determine where the graduates were from. For the graduates that were from Kansas (*n*=1683), legal county was recoded to reflect criteria used in the Kansas Population Density Peer Groups, 2010 Census (KDHE, 2011). There are five Kansas Population Density Peer Groups: Urban, Semi-Urban, Densely-Settled Rural, Rural and Frontier. To be classified as an Urban County, the population has to be 150 or more persons per square mile; Semi-Urban 40.0 – 149.9 persons per square mile; Densely-Settled 20.0 – 39.9 persons per square mile, Rural 6.0-19.9 persons per square mile and Frontier less than 6.0 persons per square mile. Rural or Frontier counties are not necessarily located in a medically underserved area. A total of 52 counties in Kansas meet the medically underserved area (MUA) criteria as defined by the Kansas governor. For the purposes of this study,

classification of MUAs in Kansas followed the Kansas Methodology for evaluation of physician supply guidelines which is based upon the adoption of a medically underserved standard that is 45% below the optimal standard. In determining which service area is underserved, the following criteria were used: population divided by (FTE-1) equals the provider-to-population ratio; 1 physician per 2,695 population (37.1 physicians/100,000 persons). This guideline determines an area as medically underserved if there are fewer than 37.1 physicians/100,000 (Kansas Department of Health and Environment, 2011). A new variable was created to reflect whether or not the graduate was from a county that was a MUA to reflect 1 as being from a MUA and 2 as not being from a MUA.

For career choice at matriculation, per the Director of Assessment and Evaluation, data for the classes prior to 2000 and for the classes of 2002 and 2004, were not available. Data presented only for the matriculating classes of 2000, 2003 and 2005-2008. Based on previous studies, responses from 60 possible specialty choices were collapsed into two categories: primary care (family medicine, general internal medicine, general pediatrics, medicine-pediatrics, or any combination of the three) and all others as (non-primary care).

A variable that is being investigated with regards to its relationship to graduates decision to practice primary care includes their undergraduate major. Classifying groups for undergraduate majors was modeled after a study which investigated whether nonscience undergraduate preparation was a handicap for medical training (Yens & Stimmel, 1982). Undergraduate majors were categorized into four categories: (a) traditional science for medical preparation; (b) other sciences that utilize the scientific method; (c) business, arts and humanities; and (d) health-related nonscience majors. In

determining undergraduate major, any graduate who had majored in biological sciences, chemical and physical sciences, mathematics, engineering, natural sciences, nursing, pharmacy, premedical and zoology was classified as traditional science for medical preparation. This group was recoded to 1. Graduates with undergraduate majors in other sciences that utilize the scientific method included anthropology, psychology, social sciences and sociology were coded as 2. Graduates with undergraduate majors in humanities, arts and business were classified as humanities. In following with the Yens & Stimmel study (1982), double majors who majored in a science and nonscience degree was categorized in the traditional science for medical preparation group. Those with indeterminate majors were excluded from data analysis. The four categories were further collapsed into two categories: traditional science for medical preparation as one category and the three other categories as non-traditional.

In determining specialty choice, primary care career choice was defined in the same manner as for career choice at matriculation (i.e., family medicine, general pediatrics, general internal medicine or any combination of the three is primary care). Graduates with specialty choices other than those were classified as non-primary care physicians. Practice specialties of graduates were computed and then collapsed into two categories (primary care and focus specialty).

Actual practice state of graduates was compiled and was collapsed into practicing in Kansas and not practicing in Kansas. Practice location (Kansas and not Kansas) was explored as how it varies by gender and race/ethnicity. Of the graduates who are practicing in Kansas, calculations of the number and percentage who are practicing in medically underserved areas (MUAs) was also investigated. A total of 52 counties in

Kansas meet the underserved area criteria. In the data set, for the graduate who was practicing in Kansas, the KBHA listed the county in which the graduate was practicing in. For those graduates who were practicing in the state of Kansas, a new variable for MUA was created. Those who were practicing in MUA were coded as 1 and those who were not were coded as 2.

CHAPTER FOUR

Results

The purpose of this study was to examine which demographic factors may predict specialty choice and practice location of graduates of a medical school. The independent variables included gender, race/ethnic background, undergraduate major, MCAT sum score, age at graduation, rural background, graduation year, location of residency of graduates and specialty choice while dependent variables were specialty and location of practice.

Data were analyzed using SPSS 20.0 software for the following: descriptive statistics, comparisons of means and logistic regression. Results for these analyses are outlined in this chapter. The first section outlines the descriptive statistics for both the independent and dependent variables; the second section outlines the comparisons of means with regards to gender, race/ethnicity and what and where the graduates practice. The third section outlines the logistic regression results.

Descriptive statistics

Demographics

The sample for the study consisted of graduates of the University of Kansas Medical School between the years of 1997 through 2008. After data cleaning, a total of 1,895 graduates were included in the final data set (N=1,895). Sample sizes vary slightly across different statistical analyses because of missing data. Of the 1,895 graduates, 8.3% (*n*=157) graduated in 1997, 8.2% (*n*=155) in 1998, 8.7% (*n*=165) in 1999, 8.1% (*n*=154) in 2000, 7.5% (*n*=157) in 2001, 7.7% (*n*=162) in 2002, 7.3% (*n*=154) in 2003, 7.2%

(*n*=150) in 2004, 7.5% (*n*=158) in 2005, 7.7% (*n*=162) in 2006, 7.4% (*n*=156) in 2007 and 7.9% (*n*=165) in 2008. A visual presentation of the results is presented in Table 1.

TABLE 1: Frequencies and Percentages for Graduation Year

Year	Frequency	Percentage %
1997	157	8.3
1998	155	8.2
1999	165	8.7
2000	154	8.1
2001	157	8.3
2002	162	8.5
2003	154	8.1
2004	150	7.9
2005	158	8.3
2006	162	8.5
2007	156	8.2
2008	165	8.7
Total	1895	100.0

The vast majority of graduates (89.2%) were from the state of Kansas (*n*=1691). Other states with notable numbers of graduates were Missouri 2.2% (n=41), California 2.0% (*n*=38) and Colorado 1.1% (*n*=21). To get a better picture of where the graduates who were from Kansas were from legal county was used for descriptive statistics. For the graduates who were from Kansas (*n*=1691), legal county was recoded to reflect criteria used in the Kansas Population Density Peer Groups, 2010 Census as detailed in the Methods section. Sixty-six percent (66.4%) of graduates who were from Kansas were from Urban counties (*n*=1123), 13.0% Semi-Urban (*n*=219), 11.0% Densely-Settled Rural (*n*=186), 6.1% Rural (*n*=103) and 3.5% Frontier (*n*=59). When data were collapsed to reflect MUA status, 8.9% (*n*=150) were from MUAs. Table 2 depicts these results.

TABLE 2: Frequencies and Percentages for Graduates from Kansas: Legal County/Medically Underserved Areas

Type of County	Frequency	Percentage %
Urban	1123	66.4
Semi-Urban	219	13.0
Densely-Settled Rural	186	11.0
Rural	103	6.1
Frontier	59	3.5
Medically Underserved Area	150	8.9
Not Medically Underserved Area	1540	91.1

N= 1690

Descriptive statistics were computed for gender, revealing that 57.6% (*n*=1092) of the sample were male and 42.4% (*n*=803) were female. Demographic characteristics also included the ethnic/racial status of the students. During the application process, students were asked to identify their ethnic/racial status. For descriptive analyses race/ethnicity was recoded to reflect the following categories: White (non-Hispanic), Asian, Black or African American, Mexican American, Puerto Rican Mainland, American Indian/Alaska native, and Other. Descriptive statistics revealed that White (non-Hispanic) students comprised 75.9% of the sample, Asians 11.5%, Black or African American 5.4%, Mexican American 3.0%, Other 1.8%, Native American/Alaska Native 1.7%, Puerto Rico Mainland .5% and Native Hawaiian/Pacific Islander .3%. When race categories were collapsed into two categories to represent those who were underrepresented in medicine and those who were not, results indicated that 11.5% of the sample were from racial/ethnic backgrounds that were underrepresented in medicine. A visual presentation of these statistics is outlined in Table 3.

TABLE 3: Frequencies and Percentages for Race/Ethnicity

Ethnic/ Race	Frequency	Percentage %
White (non Hispanic)	1438	75.9
Asian	217	11.5
Black or African American	103	5.4
Mexican American	56	3.0
Other	34	1.8
Native American/ Alaska Native	32	1.7
Puerto Rican Mainland	9	.5
Native Hawaiian/ Pacific Islander	5	.3
Underrepresented in Medicine	218	11.5
Not Underrepresented in Medicine	1675	88.5

N= 1894

The physicians' age at matriculation was derived by subtracting the year of birth from the year of entry into medical school and the year of birth from the year of graduation was used to derive graduation age. The matriculation-age distribution ranged from 19-48 and the average age for entering students was 24.52 years (*SD*=3.70). The graduation-age distribution ranged from 23-53 with the average age for graduating students being 28.65 years (*SD*=3.78). Using 30 as the age separating the older graduates from the usual-aged graduates, there were 1468 graduates (77.5%) from the usual-aged graduates and there were 427 (22.5%) physicians in the older group. The AAMC surveyed graduates at the 130 U.S. medical schools accredited by the Liaison Committee on Medical Education (LCME) who were graduating. Just as a reference point, for graduation year 2013, nationally 83.7% of graduates were traditional aged (29 or younger) and 16.3% were 30 years or older. Overall, there were a higher percentage of graduates who were older than age 30 for KU SoM compared to the national average.

When a student takes the MCAT (Medical College Admission Test), they receive scores for three multiple-choice sections (Physical Sciences, Biological Sciences, and

Verbal Reasoning). In addition, they will also receive a total score computed by taking the sum of the three scored multiple-choice sections (AAMC, n.d.) The three sections on the MCAT are scored between 1 and 15 (with 1 being the lowest and 15 being the highest). The lowest total MCAT score you can receive is a 3 and the maximum is 45. To further understand the sample, means (*M*) and standard deviations (*SD*) were computed for three sections of the MCAT and total of the three sections for the graduates. If graduates took the MCAT more than once, the highest score for each section was used. The average score for Physical Sciences was 8.89 (*SD* = 1.72), Biological Sciences was 9.22 (*SD* = 1.50), Verbal Reasoning was 9.14 (*SD* = 1.72) and the total MCAT was 27.25 (*SD* = 3.92). The results are shown in Table 4.

TABLE 4: Means and Standard Deviations for MCAT Scores

	Mean	SD	Min	Max
Physical Sciences	8.89	1.72	4.00	14.00
Biological Sciences	9.22	1.50	3.00	15.00
Verbal Reasoning	9.14	1.72	3.00	14.00
Overall Score	27.25	3.92	13.00	41.00

N=1890

Career choice at matriculation was also investigated. Table 5 depicts the frequency and percentages of the different career specialty fields the graduates choose at matriculation. Specialties were collapsed to reflect primary care and other focused specialties. Frequencies and percentages of those two categories are also presented in Table 5. For the graduates that data was available for (n=955), 41.7% of the graduates (n=396) selected a primary care specialty as their specialty choice at matriculation. A total of 58.3% of the graduates (n=554) selected a non-primary care. Five people who were undecided about a specialty were excluded from the data.

TABLE 5: Frequencies and Percentages for Specialty Preference at Matriculation

Specialty	Frequency	Percent
Adolescent Med	1	.1
Allergy & Immunology	5	.5
Anesthesiology	11	1.2
Cardiovascular Disease	25	2.6
Child psychology	3	.3
Dermatology	16	1.7
Emergency medicine	77	8.1
Endocrinology & diabetes	5	.5
Family Medicine	214	22.4
Gastroenterology	3	.3
Internal Medicine	65	6.8
Pediatrics	93	9.7
Psychiatry	10	1.0
Surgery	63	6.6
Vascular Surgery	3	.3
Geriatrics	8	.8
Hema/Onc	17	1.8
Infectious Disease	16	1.7
Genetics	6	.6
Med-Peds	16	1.7
Neonatal Med	3	.3
Nephrology	2	.2
Neurology	17	1.8
Neurosurgery	11	1.2
Ob-Gyn	40	4.2
Opthalmology	11	1.2
Orthopedic surgery	61	6.4
Otolaryngology	4	.4
Pathology	8	.8
Pediatric – Sub specialties	42	4.3
Physical & Rehab Med	2	.2
Plastic Surgery	9	.9
Public health/Preventive med	9	.9
Radiation Oncology	3	.3
Radiology	20	2.1
Sports Med	20	2.1
Surgical Critical care	5	.5
Thoracic Surgery	19	2.0
Trauma	1	.1
Urology	1	.1
Other	5	.5
Primary Care	396	41.7
Non-primary care	554	58.3

N=950

In looking at the graduates' undergraduate majors, 83.8% (*n*= 1315) majored in a field that was traditional science for medical preparation, 4.9% (*n*=77) majored in other

sciences that utilized the scientific method, 7.1% (*n*=112) majored in business, arts and humanities and 4.2% (n=66) majored in health-related nonscience majors. Fifty-six (56) majors could not be classified and were not included in the analysis.

The state in which graduates did their residency was also investigated. A total of 39.5% of graduates (*n*=703) completed their residency in Kansas and the remaining 60.5% (*n*= 1078) completing their residency out of state. Location of residency is depicted in Table 6.

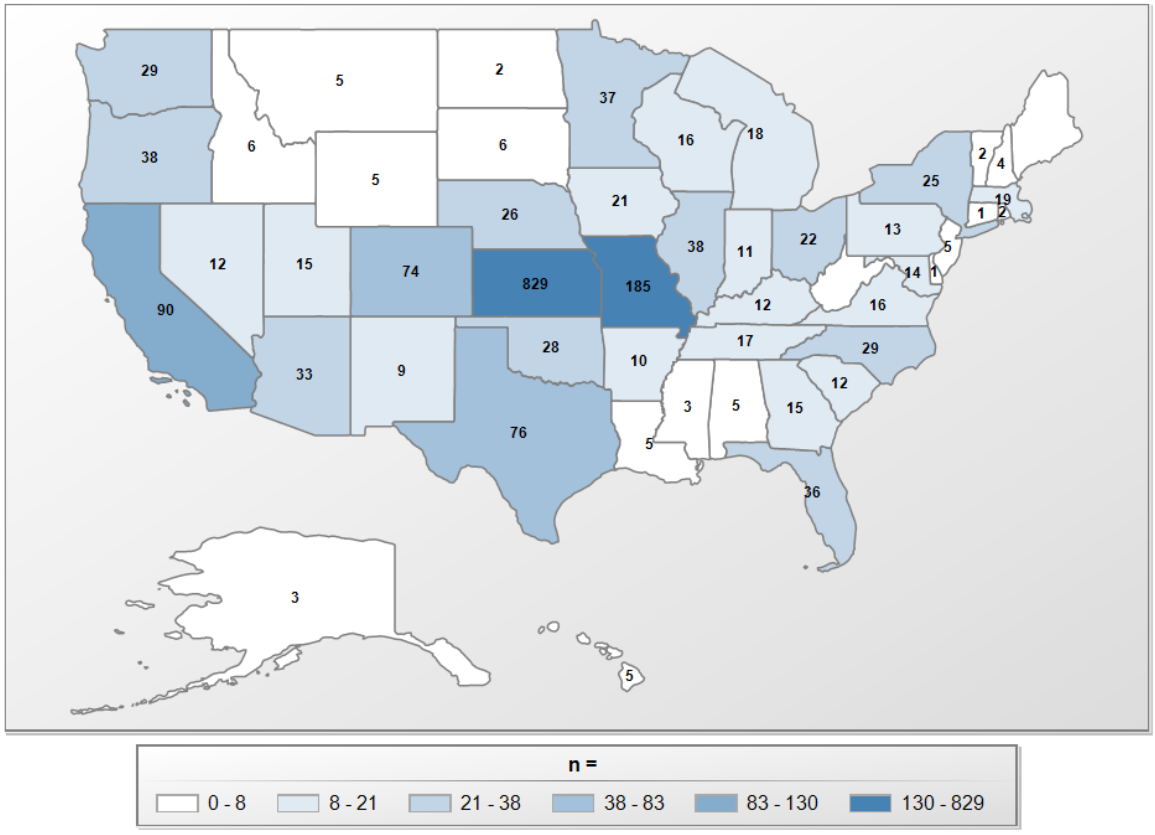
TABLE 6: Frequencies and Percentages for Location of Residencies

State	Freq	%	State	Freq	%	State	Freq	%
AL	8	0.4	LA	9	0.5	OK	23	1.3
AR	11	0.6	MA	21	1.2	OR	22	1.2
AZ	35	2	MD	10	0.6	PA	18	1
CA	54	3	ME	5	0.3	RI	10	0.6
CO	43	2.4	MI	36	2	SC	18	1
CT	6	0.3	MN	58	3.3	SD	1	0.1
DC	11	0.6	MO	160	9	TN	25	1.4
DE	1	0.1	MS	3	0.2	TX	90	5.1
FL	33	1.9	NC	41	2.3	UT	13	0.7
GA	19	1.1	NE	21	1.2	VA	19	1.1
HI	4	0.2	NH	4	0.2	VT	3	0.2
IA	39	2.2	NJ	3	0.2	WA	10	0.6
IL	58	3.3	NM	7	0.4	WI	25	1.4
IN	25	1.4	NV	2	0.1	WV	2	0.1
KS	703	39.5	NY	24	1.3	N=1781		
KY	11	0.6	OH	37	2.1			

A total of 53.0% of graduates (*n*=950) went into primary care at the first year of residency. Of the 950 graduates who went to primary care, a total of 20.1% went into family medicine (*n*= 380), 15.8% internal medicine (*n*= 300), 8.7% pediatrics (*n*= 165) and 5.6% in general practice, internal medicine/pediatrics, medicine primary or preliminary (*n*= 105). At the start of their residency, 47.0% (*n*= 844) of graduates specialized in other focused specialties.

In looking at actual practice specialty of graduates, 41.6% of graduates (n=788) were practicing in primary care and 58.4% (n=1107) were practicing in non-primary care fields. Within primary care, 49.7% (n = 392) were practicing family medicine, 24.1% general internal medicine (n = 190), 18.8% general pediatrics (n = 148) and 7.4% (n = 58) combination of primary care specialties. In investigating practice location of graduates, 43.8% of the graduates were practicing in the state of Kansas (*n*=829) with the remaining 56.2% practicing in a total of 48 other states (*n* = 1062). Figure 1 details the geographical location of graduates practicing in the different states.

FIGURE 1: Geographical Practice Location of Graduates

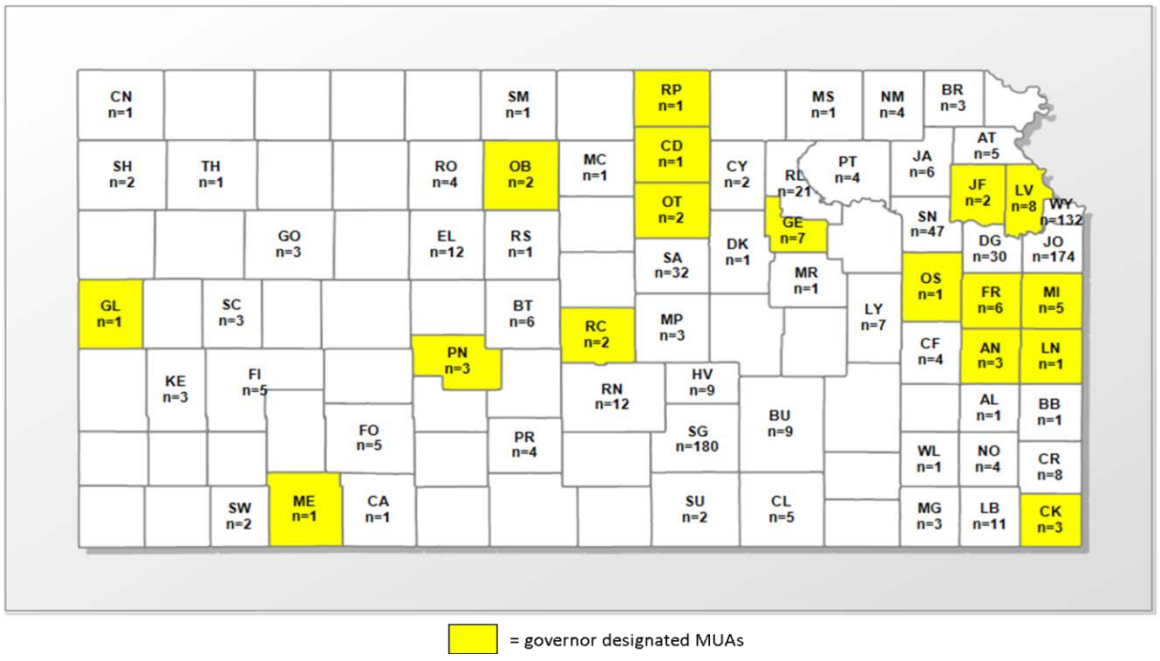


States, besides Kansas, which had sizable numbers of graduates practicing include Missouri (9.8%), California (4.8%) and Texas (4.0%). Of the 703 graduates who

completed their residency in Kansas, 67.7% (*n*=476) continued to practice in the state. Location of practice for graduates is presented in Figure 1.

Of the 829 graduates who were practicing in the state of Kansas, only 6.0% (*n*=50) of graduates were practicing in a medically underserved area with an overwhelming 94.0% (*n*=783) practicing in areas which were not MUAs. A more detailed look at graduates who were practicing in MUAs showed that 5.3% (n=44) were practicing in primary care compared with 0.7% (n=6) in non-primary care fields. In looking at the gender breakdown of graduates practicing in MUAs, 52% (n=26) were males compared with 48% (n=24) females. Figure 2 depicts which counties in Kansas the graduates are practicing in.

FIGURE 2: Graduate Practice Location by County in Kansas



To determine whether or not a graduate changed their specialty after residency from primary care to focused specialties or vice versa, specialty choice at residency,

coded as either primary care or non-primary care, was compared with practice specialty, also coded as either primary care or non-primary care. Data showed the majority of the graduates (86.6%, *n*=1552) did not change their specialty from residency to practice. A total of 12.2% of students (*n*=219) who specialized in primary care at residency changed their specialty to non-primary care and 1.2% (*n* = 22) switched from a non-primary care at residency to practice in primary care. Table 7 depicts residency and practice specialty statistics by whether or not the graduate was practicing in Kansas or not.

TABLE 7: Frequencies and Percentages for Residency and Practice Specialties

			Kansas	Not Kansas	Total
Residency	Primary Care	Freq	497	453	950
		%	62.6	45.4	
	Non-primary care	Freq	297	544	844
		%	37.4	54.6	
Practice	Primary Care	Freq	436	352	1107
		%	52.6	33.1	
	Non-primary care	Freq	393	711	788
		%	47.4	66.9	

Comparison of Means

For comparison of means, practice state was collapsed into a dichotomous variable with those who were practicing in Kansas coded as 0 and those practicing outside of Kansas coded as 1. Practice specialty was collapsed into two categories with those who were practicing in Primary Care coded as 1 and those who were practicing in a Non-primary care specialty coded as 0. Graduates who were practicing in a MUA was coded 1 and those who were not practicing in a MUA were coded 0.

Comparison of means by gender

Males were coded as 0 and females were coded as 1. To find out whether there were any significant differences between the means for gender, an independent-samples *t*-test was computed. Results revealed that differences in means were statistically different for males and females in specialty choice (t=6.782, p=.000), but were not statistically significant for whether they practiced in state or whether they practice in a MUA. With regard to specialty choice, females (M=0.50, SD.50) specialized in primary care more often than did males (M=0.35, SD=.48). Table 8 presents means and standard deviations for males and females for each category, the corresponding *t*-test comparison value between means, and the significance levels per gender in each category as well.

TABLE 8: T-Test for Males and Females in Practice Location, Specialty Choice and MUA

	Gender	Means	Standard Deviation	T-Test value	Significance Level
Specialty	Male	0.35	.48	-6.782	**.000***
	Female	0.50	.50		
In State	Male	0.44	.50	-.097	.923
	Female	0.44	.50		
MUA	Male	0.94	.23	-.680	.497
	Female	0.93	.25		
N	Male	1092			
	Female	801			

*The mean difference is significant at the .05 level

Comparison of means by underrepresented in medicine category

An independent-samples t-test was also computed to compare means by race/ethnicity. Race/ethnicity was collapsed into two categories with those who were not URM coded as 1 and those who were URM coded as 0. This allowed for conclusions as to whether the practice state and specialty differed for those who were URM and not URM. Results indicated that there were statistically significant differences in means

between those who were URM and those who were not URM with regards to practice in Kansas and in specializing in primary care. No significant differences emerged for MUA status. On average, those who were URM tended to specialize in primary care more often (*M*=0.51, *SD*=.50) than their counterparts (*M*=0.40, *SD*=.49). In addition, graduates who were URM practiced outside the state of Kansas more often (*M*=0.33, *SD*=.47) compared with those who were not URM (*M*=0.45, *SD*=.50). T-test results for each category are shown in Table 9.

TABLE 9: T-Test for URM in Practice Location, Specialty Choice and MUA

	Status	Means	Standard Deviation	T-Test value	Significance Level
Specialty	Not URM	0.40	.49	-2.988	**.003***
	URM	0.51	.50		
In State	Not URM	0.45	.50	3.576	**.000***
	URM	0.33	.47		
MUA	Not URM	0.94	.06	-1.333	.183
	URM	0.90	.10		
N	Not URM	1676			
	URM	218			

*The mean difference is significant at the .05 level

Logistic Regression Analysis

Unlike the more common multiple regression techniques, logistic regression is suitable for dichotomous criterion variables that do not have normal distributions, an assumption of multiple regression (Peng & So, 2002); instead, the logistic function is a sigmoid or S-shaped curve that bends approaching the 0 and 1 bounds (Peng & So, 2002). In addition, dichotomous criterion variables violate the assumption of homoscedasticity (i.e., equal variances), because the variance in errors is different near the floor and ceiling of the curve where the line approaches 0 and 1. Thus, the standard

errors in the presence of heteroscedasticity will be incorrect and tests of significance will be invalid (Peng & So, 2002). Logistic regression uses the natural logarithm of the odds—the logit or logged odds—to account for the decreasing effects of X as Y approaches 0 and 1.

Logistic regression is a method of linearizing the inherent nonlinear relationship between X and the probability of Y (Peng & So, 2002), which results in a linear function with optimally weighted coefficients for each predictor variable such that the linear combination makes observed outcomes in the criterion variables most probable. Logistic regression procedures result in odds ratios, enabling statements about how much more or less likely it is for outcomes to occur for each predictor. For example, an odds ratio of 1 implies no relationship between the variables, an odds ratio of 4.0 suggests that the criterion variable is four times more likely to occur when the predictor variable is present, and an odds ratio of .25 suggests that the criterion variable is four times less likely to occur when the predictor is present. According to Pampel, significance testing for logistic regression is similar to that of multiple regression: the basis for tests in both is the size of the coefficient relative to its standard error (Pampel, 2000). Logistic regression commonly uses the Wald statistic, which applies the chi-square distribution in comparing the square of the ratio of the coefficient divided by its standard error. In contrast to multiple regression, which requires the calculation of a standardized coefficient to estimate effect sizes, logistic regression provides effect sizes that are readily interpretable from the odds ratio.

Three separate logistic regression models were conducted. The first logistic regression was conducted to assess whether the nine predictor variables, gender, race, age

at graduation, rural background, undergraduate major, MCAT total sum score, career choice at matriculation, graduation year and residency location, significantly predicted whether a graduate practiced in primary care. The second regression model included regressing seven variables against practice location (Kansas/Not Kansas). The last regression model included regressing the seven variables on practice in medically underserved areas (MUA/Non MUA). An alpha value of .05 was the criterion for establishing the statistical significance of the independent t-tests and the logistic regression models and independent variables.

Logistic Regression for research question 1: What factors predict whether or not graduates of the medical school practice primary care?

A simultaneous method logistic regression was conducted to predict practice specialty of graduates using gender, race, age at graduation, rural background, undergraduate major, MCAT total sum score, career choice at matriculation, graduation year and location of residency as predictors. For the logistic regression analysis, males were coded as 0 and females were coded as 1. URM (coded 1) and not URM (coded 0) were used to for race/ethnicity. For rural background, legal county was originally recoded to reflect the five Kansas Population Density Peer Groups. Urban and Semi-Urban counties were combined to reflect the Urban group (coded 0). Rural, Frontier and Densely Settled Rural counties were also combined to make the Rural group (coded 1). For the undergraduate major variable, graduates who majored in other sciences that utilized the scientific method, business, arts and humanities and health-related nonscience majors were recoded to reflect one category (Other degrees – coded 1) and the traditional majors for medical preparation was left as one group (coded 0). For career choice at

matriculation, graduates who chose primary care were coded as 1 and those who chose other focused specialties were coded 0. For state in which graduates completed their residency, those who completed residency in Kansas were coded as 1 and those who did their residency outside of Kansas was coded as 0. MCAT sum scores, graduation age, and graduation year were left as continuous variables.

Table 10 shows the results of the logistic regression model for predicting practice in primary care. The table lists the coefficients, standard errors, odds ratios, and 95% confidence intervals. The chi-square from the omnibus test for this model suggested that the nine predictors significantly predicted those who practiced in primary care from those who practiced in non-primary care ($\chi^2 = 109.27$, df = 9, N = 731, $p < .001$). The classification table indicated that the model correctly classified 66.9% of the cases (77.1% for non-primary care and 52.5% for primary care) which was an improvement over the intercept-only model of 58.5%. An intercept-only model serves as a good baseline because it contains no predictors. A logistic model is said to provide a better fit to the data if it demonstrates an improvement over the intercept-only model (Peng, Lee & Ingersoll, 2002).

Goodness-of-fit statistics assess the fit of a logistic model against actual outcomes (Peng, et. al., 2002), in this instance practice in primary care. The inferential goodness-of-fit test is the Hosmer-Lemeshow (H-L) test that yielded a χ^2 (9) of 6.973 and was insignificant ($p = .540$), suggesting that the model was fit to the data well. In other words, the null hypothesis of a good model fit to data was tenable. The pseudo R^2 (Nagelkerke) was .187 which suggests that the nine independent variables in the logistic

model together account for 18.7% the explanation for why a graduate student practices in primary care or not.

TABLE 10: Predictors of Practice in Primary Care

Predictor	B	SE	Odds Ratio	95% C.I for Odds Ratio
Gender				
Female	.282	.169	1.326	.952 – 1.847
Race				
URM	.513	.323	1.670	.888 – 3.142
Graduation Age	.034	.023	1.035	.989 – 1.082
Rural Background				
Rural	.002	.200	1.002	.677 – 1.483
Undergrad Major				
Non Trad Med Prep	.149	.221	1.160	.752 – 1.791
MCAT Sum Score	-.002	.024	.998	.952 – 1.047
*Choice at matriculation***				
Primary Care	1.387	.171	4.001	2.861 – 5.596
*Location of Residency****				
Kansas	.611	.167	1.842	1.327 – 2.558
*Graduation Year****	.117	.031	1.124	1.059 – 1.194

(N = 1278)
Notes: *< .05, **< .01, ***p < .001

The statistical significance of individual regression coefficients (i.e., βs) is tested using the Wald chi-square statistic. Several independent variables were implicated significantly with primary care choice. The Wald chi-square statistic demonstrated that specialty choice at matriculation (p<.001), graduation year (p < .001) and residency location (p< .01) made significant contributions to the prediction of whether the graduate practiced in primary care. Race/ethnicity, gender, age at graduation, undergraduate major, rural background and MCAT sum scores were not significant predictors.

Controlling for differences in race/ethnicity, gender, undergraduate major, location of residency, specialty choice at matriculation, and rural background, the likelihood of practicing in primary care was significantly higher for those graduates who selected primary care as their preferred career choice at matriculation (OR=4.001, $p <$ .001). In other words, graduating students who had expressed interest in primary care specialty at matriculation were 4 times more likely to practice in primary care than those who did not select primary care.

Results indicate that graduation year was also a significant predictor. After controlling for the other independent variables in the model, for each year increase in graduation year, graduates were 1.124 times more likely to practice in primary care ($p <$ .001). The odds ratio for graduates who completed their residency in Kansas was 1.842 ($p < .001$), which suggests that this group was 1.8 times more likely to practice in primary care than those who did their residency out of state. Although the odds ratio for URM (OR =1.670) students suggested that they were more likely than those who were not URM group to practice in primary care, the value did not reach statistical significance.

Logistic Regression for research question 2: What factors predict whether the graduates of the medical school practice in the state of Kansas?

A logistic regression was conducted to predict whether or not graduates practiced in the state of Kansas using gender, race/ethnicity, age at graduation, rural background, graduation year, residency location and specialty choice as predictors. For this logistic regression analysis, males were coded as 0 and females were coded as 1. For the race/ethnicity variable, URM was coded 1 and not URM was coded 0. For rural

background, the Urban/Semi-Urban group was coded 0. Rural group was coded 1. For state in which graduates completed their residency, those who completed residency in Kansas were coded as 1 and those who did their residency outside of Kansas was coded as 0. Specialty choice was collapsed into two groups, primary care coded 1 and non-primary care coded as 0.

A test of the full model against a constant only model was statistically significant, indicating that the predictors, as a set, reliably distinguished between those who practiced in Kansas and those who practiced outside of Kansas ($\chi^2 = 286.572$, df = 7, N = 1596, $p <$ .001). The classification table indicated that the model correctly classified 69.4% of the cases (62.2% for Kansas and 75.7% for out of state) which was an improvement of 30% over the intercept-only model with no variables (53.1%).

The inferential goodness-of-fit test is the Hosmer-Lemeshow (H-L) test that yielded a χ^2 (8) of 12.064 and was insignificant (p = .148), suggesting that the model fit to the data well. The pseudo R^2 (Nagelkerke) was .219 which suggests that for this logistic regression model, the seven independent variables together account for 21.9% the explanation for why a student practices in Kansas. Table 11 shows the coefficients, standard errors, odds ratios, and 95% confidence intervals.

TABLE 11: Predictors of Practice in State

Predictor	B	SE	Odds Ratio	95% C.I for Odds Ratio
Gender				
Female	-.080	.114	.923	.738 – 1.154
Race				
URM	-.310	.201	.734	.495 – 1.088
*Graduation Age**	-.037	.015	.963	.935 - .993
*Rural Background***				
Rural.	.417	.137	1.517	1.159 – 1.986
*Location of Residency****				
Kansas	1.555	.114	4.734	3.790 – 5.914
*Practice Specialty****				
Primary Care	.707	.114	2.027	1.621 – 2.534
*Graduation Year**	.036	.016	1.037	1.004 – 1.071

(N = 1596)
Notes: *p < .05, **p < .01, ***p < .001

The Wald criterion demonstrated that, controlling for all other variables, age at graduation ($p < .05$), rural background ($p < .01$), graduation year ($p < .05$), residency location ($p < .000$) and specialty choice ($p < .000$) made significant contributions to the prediction of whether graduates practiced in Kansas. Gender and race/ethnicity were not significant predictors in this model. One variable was especially powerful: the odds ratio for graduates who did their residency in Kansas was 4.734 ($p < .001$), meaning that controlling for differences in gender, race, age at graduation and rural background, graduation year, graduates who did their residency in Kansas were 4.7 times more likely to practice in Kansas than those who did their residency out of state. The likelihood of practicing Kansas were significantly higher for those who were from rural areas (OR= 1.517; $p < .01$). Results suggest that graduates who were from rural backgrounds were 1.5 times more likely to practice in Kansas. Graduates who were older were also less

likely to practice in Kansas (OR=.963, $p < .05$). In other words, for every year increase in a graduate's age, the likelihood of them practicing in Kansas decreases slightly (by 3.2%). More recent graduates were also more likely to practice in state (OR = 1.037, $p < .05$). For every year increase in year, the likelihood of them practicing in Kansas increased 1.037 times. Lastly, graduates who specialized in one of the three primary care fields were two times as likely to practice in state (OR=2.027; $p < .001$) compared with those who specialized in a non-primary care field.

Logistic Regression for research question 3: Among those graduates who practice in the state of Kansas, what factors predict whether they practice in medically underserved areas?

The third criterion variable under consideration was likelihood of the graduates who were practicing in Kansas practicing in a medically underserved area. Based on the review of the literature regarding practicing in rural or medically underserved areas, it would be expected that the following factors would predict practicing in rural, medically underserved areas: rural upbringing, being male, not being an underrepresented minority, and being older at graduation. In addition to these factors, graduation year, location of residency and specialty choice was also included in the logistic regression analysis.

For this logistic regression analysis, males were coded as 1 and females were coded as 0. For the race/ethnicity variable, URM was coded 1 and not URM was coded 0. For rural background, the Urban/Semi-Urban group was coded 0. Rural group was coded 1. Location of residency, graduates who completed residency in Kansas were coded as 0 and those who did their residency outside of Kansas was coded as 1. For specialty choice, primary care was coded as 1 and non-primary care was coded as 0.

Table 12 depicts the coefficients, standard errors, odds ratios, and 95% confidence intervals. The chi-square from the omnibus test for this model suggested that the seven independent variables significantly predicted those who were practicing in MUAs (χ^2 = 42.912, df = 7, N = 752, $p < .001$). The classification table indicated that the model correctly classified 93.5% of the cases. The inferential goodness-of-fit test is the Hosmer-Lemeshow (H-L) test that yielded a χ^2 (8) of 8.040 and significant ($p = .430$) which suggests the data fit the model well. In The pseudo R^2 (Nagelkerke) was .145 which suggests that for this logistic regression model, the six independent variables together account for 14.5% the explanation for why a student practices in MUAs.

The Wald criterion demonstrated that, controlling for all other variables, age at graduation ($p<.05$), location of residency ($p<.05$) and specialty choice ($p<.001$) made significant contributions to the prediction of whether the graduate practiced in MUAs. Race/ethnicity, gender, rural background, and graduation year were not significant predictors. Results indicate graduates who were older at graduation were also more likely to practice in MUAs (OR=1.068, $p < .05$). After controlling for the other independent variables in the model, for each year increase in age, graduates were 1.068 times more likely to practice in a MUA. The likelihood of practicing in a MUA was significantly higher for those who did not complete their residency in the state of Kansas (OR=2.144, $p < .05$) with graduates who completed their residency outside of Kansas being over two times as likely to practice in MUAs. The last variable that made a significant contribution to the prediction of practice in a MUA was practice specialty. Graduates who were practicing in primary care were over 7 times more likely

(OR=7.343, $p < .001$) to practice in a MUA compared to those who specialized in a non-primary care field.

TABLE 12: Predictors of Practice in MUAs

Predictor	B	SE	Odds Ratio	95% C.I for Odds Ratio
Gender				
Males	.079	.314	1.082	.585 – 2.002
Race				
URM	.770	.460	2.159	.877 - 5.313
*Graduation Age**	.066	.032	1.068	1.003 – 1.137
Rural Background				
Rural.	.454	.335	1.575	.817 – 3.038
*Location of Residency**				
Not Kansas	.763	.311	2.144	1.165 – 3.945
*Practice Specialty***				
Primary Care	1.994	.454	7.343	3.014 – 17.885
Graduation Year	.033	.046	1.034	.944 – 1.132

(N = 752)
Notes: *< .05, **p < .01, ***p < .001

Summary

This chapter outlined the statistical analyses used in this study. Analyses presented in this chapter involved descriptive statistics, comparisons of means for gender and race with regard to primary care practice and location of practice, and logistic regression. When means were examined, results indicated that males tend to specialize in non-primary care more often than females. Also, URM graduates tend to practice more out of state than their non URM peers. In addition, URM graduates practice primary care more often than their non URM peers.

Results of logistic regression analyses were presented. The predictive value of the independent variables differed depending on the outcome being considered. Results in the first logistic regression model predicting practice in primary care career choice at matriculation was significant in predicting primary care practice, with graduates who chose primary care at matriculation being 4 times more likely to practice in primary care. Graduation year was significant in predicting primary care practice, with more recent graduates more likely to practice in primary care. For every year increase, the likelihood of them practicing in Kansas increased 1.124 times. Location of residency was also significant in predicting primary care practice, with graduates who completed their residency in Kansas 1.8 times more likely to practice primary care.

The second logistic regression model predicting practice in Kansas indicated five of the seven independent variables made significant contributions to prediction of in state practice. Location of residency was significant in predicting whether a graduate practiced in the state of Kansas, with those who completed their residency in Kansas being almost 5 times more likely to practice in Kansas. Having a rural background was also significant in predicting whether the graduate practiced in Kansas. Graduates who were from rural backgrounds were 1.5 times more likely to practice in Kansas. In addition to those factors, age at graduation was also significant in predicting practice in Kansas, with older graduates being less likely to practice in Kansas. For every year increase in a graduate's age, the likelihood of them practicing in Kansas decreased slightly. Graduation year was also significant in predicting practice in Kansas, with more recent graduates more likely to practice in Kansas. For every year increase, the likelihood of them practicing in Kansas increased 1.037 times. Lastly, practice specialty

was also significant in predicting practice in state with those who were practicing in primary care fields two times as likely to practice in state compared with those in non-primary care fields.

The third logistic regression model predicting practice in MUAs indicated three of the seven independent variables made significant contributions to prediction of practice in MUAs. Location of residency was also significant in predicting whether a graduate practiced in a MUA in the state of Kansas, with graduates who completed their residency outside of Kansas being over 2 times more likely to practice in MUA. Age at graduation was also significant in predicting practice in Kansas, with older graduates more likely to practice in MUAs. For every year increase in a graduate's age, the likelihood of them practicing in a MUA increased by 1.1 times. Lastly, practice specialty was a very strong predictor of practicing in MUAs. Graduates who were practicing in a primary care field were 7.3 times more likely to be practicing in MUAs.

Chapter five will discuss the specific findings of the study, summarize implications, study limitations, and outline possible directions for further research in this topic.

CHAPTER FIVE

Discussion

This chapter provides an interpretation and further discussion of the results highlighted in chapter four. This chapter is divided into four sections. The first section provides a summary of the research questions as first outlined in chapter one. The second session outlines and explains findings of the study in light of the larger body of literature relevant to this study. The third section addresses study limitations and policy and practical implications and future directions for the physician workforce for the state of Kansas. The fourth section provides concluding remarks.

Summary of research

Primary care physicians provide the majority of care to underserved populations, especially in rural communities. Primary care physicians disproportionately serve where access needs are the greatest, therefore increasing the number of primary care physicians in Kansas would be beneficial to the health of the public (Bennett & Phillips, 2010). Being able to determine specific characteristics of students who have the propensity to specialize in primary care and practice in state and in rural areas would be beneficial to the overall health of the citizens of Kansas by increasing access to care to those who currently don't readily have access to healthcare.

One purpose of this study was to provide descriptive information about the medical school graduates of the University of Kansas Medical School and compare how specialty choice and location of practice vary by gender and race and ethnicity. The second purpose of this study was to identify which variables explain student specialty choice for graduates, particularly for primary care. A third purpose of this study was to determine which variables predict which

graduates decide to stay and practice in Kansas. The final purpose was to determine, among those who practice in Kansas, what factors predict if they practice in a medically underserved area.

Key Findings

Descriptive statistics show that the majority of graduates are practicing in non-primary care fields. In addition, the majority of graduates from the medical school are practicing outside the state of Kansas and only a small fraction of graduates who were practicing in state are practicing in a medically underserved area.

Comparisons of Means for Gender

The results of this study suggest that males are more likely to practice in non-primary care fields compared to females. This observation is consistent with findings in other studies that indicate that there is an association between gender and primary care career choice; specifically, females are more likely to choose primary care than males (Bland, et al, 1995; Kassebaum, Szenas & Schuchert, 1996; Senf, Campos-Outcalt & Kutob, 2003). The results of this study may be useful for University of Kansas School of Medicine admissions because since females have been found to enter into primary care in significantly greater numbers than men (Schieberl, et al, 1996), admitting a higher proportion of females could have the greatest influence on increasing the number of graduates in primary care.

Differences between males and females with regard to state of practice and practice in medically underserved areas were also investigated. Results indicated no statistical differences between males and females regarding whether or not they practiced in Kansas or in MUAs. No statistical significance between males and females for practice in a medically underserved area was somewhat surprising since prior research suggests gender was highly predictive of a

physician practicing in a MUA (Rabinowitz, et al, 2001; Xu, et al, 1997). One reason for this finding may be that the sample size for graduates who were practicing in medically underserved areas in my study was too low for differences to emerge due to small sample sizes and inadequate statistical power.

Comparisons of Means for Race/Ethnicity

Results of this study indicate URM graduates tend to specialize in primary care fields more often than those who were not URM. My results are somewhat surprising because prior literature concluded that the evidence either does not support an association between race and ethnicity and specialty choice or there is a tenuous association (Bazargan, et al, 2006; Bland, et al, 1995; Jeffe, et al, 2010; Meurer, 1995; Newton, et al, 1998). One explanation for the results of my study could be that the effect of the schools' mission on students' specialty choice is likely to have some effect on specialty choice of students and for URM students. Although individual student's characteristics and preferences drive specialty choice decisions, the prevailing primary care culture at a school also plays a role (Erikson, et al, 2013). Schools that have primary care missions, such as KU SoM, are more likely to encourage their students to pursue primary care specialties (Phillips, et al, 2009; Senf, et al, 2003).

Results of this study also indicate that graduates who were underrepresented in medicine were more likely to practice outside of Kansas compared to those who were not underrepresented in medicine. The results of my study are counter to a study investigating migration patterns of URM Californians in medicine (Coffman et al, 2001). The study found that compared to white students, underrepresented minorities who attended California medical schools were more likely to remain in California to practice (Coffman et al, 2001). A difference between the study by Coffman, et al (2001) and my study is California was rated as number one for physician retention

from undergraduate medical education in the US (AAMC, 2011). California had a physician retention rate from medical school of 61.9%. In contrast, Kansas was rated 27th overall (36.5%) in the US for physicians retained from medical school.

In delving deeper into my data, 72.6% of URM graduates listed their legal state as Kansas compared with non URM graduates of 91.8%. Furthermore, 59.8% of URM graduates listed their home state as Kansas compared with 86.5% for graduates who were not URM. In a qualitative study investigating influences on physicians who choose to stay in rural practice indicated that one of the strongest influences on their choice of practice location were where their family of origin lived (Quinn & Hosokawa, 2010). One explanation for my results is that more URM graduates were not originally from Kansas and returned to their home state to practice. There is some literature that suggests significant associations between physician hometown and current practice location, with physicians from nonmetro hometowns more likely to locate their practice in a nonmetro location as compared to their peers from metro hometowns. Similarly, family physicians from nonmetro hometowns were also more likely to choose a nonmetro practice location (Wade, et al, 2007).

What factors predict whether or not graduates of the medical school practice primary care?

Career choice at matriculation was significant in predicting primary care practice, with graduates who chose primary care at matriculation being 4 times more likely to practice in primary care. The finding is not surprising since interest in primary care at matriculation has been found to be one of the strongest predictors of primary care choice (Bland, et al, 1995; Meuer, 1995; Senf, et al, 1997). The results of the present study support the conclusion that interest at matriculation is positively associated with an eventual choice of primary care practice.

It is not surprising since students who have already developed a strong interest prior to medical school, their interest will be less likely to change compared to those who do not have such interest.

Location of residency was also significant in predicting primary care practice, with graduates who completed their residency in Kansas being 1.8 times more likely to practice primary care. This is not surprising since the School of Medicine is renowned for graduates specializing in primary care, especially in family medicine. The University of Kansas School of Medicine ranks number two in a study of medical schools' production of graduates who go into family medicine, with 20.8 percent of its graduates in family medicine residencies (Martin, 2013). This may be a function of the influential factor in preferences for primary care in the environment at the medical school. Since KU SoM has a pro-primary care orientation, which has been found to be important in affecting specialty choice (Colquitt, 1996), this may be a mitigating factor in graduates who completed their residency in Kansas being more likely to practice in primary care. Furthermore, studies have shown that the prevailing primary care culture at a school plays a role in student specialty choice (Erikson, Danish, Jones, Sandberg & Carle, 2013) whether it is positive or negative.

Graduation year was included in the logistic regression analysis. The results of this study suggest that graduates who graduated more recently were also more likely to practice primary care. For every year increase in graduation year, the likelihood of graduates practicing primary care increased 1.124 times. One explanation for this result may be due to a grant program that was initiated in the 1990's. Beginning in the mid 1990's, the Kansas Health Foundation provided more than $15 million for a project at the University of Kansas School of Medicine that aimed to increase the number of primary care physicians in Kansas and improve the distribution

of health care services (Kansas Health Organization, n.d.). Graduates in this study included those who graduated beginning in 1997 to 2008. The earlier classes would've not been a part of the push toward primary care. The results of our study seem to validate that implementation of programs encouraging graduates to specialize in primary care are effective as time progresses.

Results in the first logistic regression model predicting practice in primary care indicated that females were 1.3 times more likely to practice in primary care than males but results did not reach statistical significance. These results are very surprising because it is contrary to studies that support an association between gender and primary care career choice (Bland, et al, 1995; Senf, et al, 2003). For my analysis, I combined general internal medicine, family medicine and general pediatrics into primary care and this approach may have limited the statistical effect because research has shown that physicians within these three fields may not be a homogeneous group (Lawson & Hoban, 2003). In prior studies researchers postulated that the reason why gender was a significant predictor of primary care residency choice overall was most likely accounted for by the strong relationship with pediatrics residency choice (Lawson & Hoban, 2003; Lawson, Hoban & Mazmania, 2004). When you look into how each separate discipline relates to career specialty choice, female students were approximately four times more likely to choose a pediatric residency than male student. Surprisingly though, this relationship did not attain statistical significance for the individual disciplines of family medicine or internal medicine (Lawson, Hoban & Mazmania, 2004). For my sample, females accounted for 71.6% of graduates practicing in pediatrics, 46.8% in general internal medicine and 47.2% family medicine. One explanation for the non significant finding of gender could be the relationship between females and pediatric specialty choice was not as strong as in previous studies.

Race/ethnic background was also included in this logistic regression analysis based on factors previous literature indicated may be associated with primary care. Although the odds ratio value did not reach statistical significance for this study, it is worthy to note that results of this study suggest URM were 1.67 times more likely to practice primary care than their counterparts. These results are contrary to what research has previously shown. In a study by Rosenblatt & Andrilla (2005) URM groups had a very distinctive preference pattern showing less interest in family medicine. For the study minority groups were grouped in subgroups (i.e., Whites, Latinos, African Americans, etc.). African Americans were also less interested in pediatrics. In a more recent study describing trends in specialty choice and predicting primary care, compared with Whites, URM graduates were less likely to choose general internal medicine, general pediatrics, and family medicine. Unfortunately for the current study, individual racial/ethnic groups could not be studied individually because of low sample sizes.

What factors predict whether or not graduates of the medical school practice in Kansas?

Age at graduation, having a rural background, graduation year, location of residency and practice specialty were all significant in predicting practice in Kansas. For the present study, the factor with the strongest association with practice in state was location of residency, with graduates who completed their residency in Kansas being almost five times more likely to stay and practice in Kansas. The results are consistent with prior studies which also demonstrate that the state where primary care physicians completed their residency training is an important predictor of eventual practice location (Owen, Hayden & Bowman, 2005). Literature and results of this study suggests that the location of a graduate's residency exerts a more powerful influence on subsequent practice location than does the location of medical school. Decades of studies have shown that residency graduates are most likely to practice within short geographic

distances from the site of their residency training sites (Greiner, et al., 2007). It shouldn't be surprising since this study and prior literature supports the hypothesis of "prior contact" in which it is posited that physical residence or subsequent tenure in an area during education and training is a strong predictor of physician practice location (Ricketts, 2013).

Not only is the location of a physician's practice heavily influenced by the location of his or her residency but where the person grew up is also influential (Ricketts, 2013). Another important predictor of graduates staying to practice in state includes rural background. Results of this study suggest that graduates who were from rural backgrounds were 1.5 times more likely than graduates who were from an urban background to practice in Kansas. There is a paucity of research that investigates rural background of students and its effect on in state practice. Extrapolating from the literature regarding practicing in rural areas, the theory of prior contact also applies in this instance. Identity in a place emerged as a vital experience in practicing medicine in the same state they were from. Growing up, the graduates' background self-concepts included and were shaped by the community, the practices, the culture, and the people. A theory of why graduates may return to state that they were from was it fulfilled some aspect of their identity by choosing to practice in their hometown or a place similar to their hometown.

The results of this study suggest that graduates who were older were also less likely to practice in Kansas. For every year increase in a graduate's age, the likelihood of them practicing in Kansas decreases slightly (by 3.2%). The literature on age and practice location is unclear. The results of the present study are counter to what one previous study found. In a study that investigated the location of medical education of graduates and the choice of location of practice found that older physicians were more likely than other age groups to have been trained in the state where they practiced (Burfield, et al, 1986). Taking a more detailed look into the present

study's data, 18.7% of the older age group graduates had a home state of Kansas compared with 38.7% of the older age group of graduates who had a home state outside of Kansas. One possible explanation for my results is that the older graduates who were not from Kansas ended up practicing in areas closer to their original home state. Physicians tend to locate their home and practices in communities similar in size to where they were raised (Leonardson, Lapierre & Hollingsworth, 1985). It is not immediately obvious why older graduates were less likely to practice in Kansas.

Graduation year was included in the logistic regression analysis. The results of this study suggest that graduates who graduated more recently were also more likely to practice in the state of Kansas. For every year increase in graduation year, the likelihood of graduates practicing in Kansas increased 1.037 times. One explanation for this result may be that loan forgiveness/stipends and programs may be working to keep graduates practicing in the state. Programs such as the Kansas Medical Student Loan Program (KMSL) which was established by the State of Kansas to encourage students attending the University of Kansas School of Medicine to practice primary care medicine in areas of need in the state of Kansas, may be working to retain graduates to practice in state.

Lastly, practice specialty was also a significant predictor of graduates practicing in Kansas, with those who were practicing in primary care two times more likely to be practicing in Kansas. The results of the study do correlate with what prior research and literature has found (Burfield, et al 1986; Seifer, et al, 1995). A study determining the relationship between graduate medical education and physician practice location found that physicians who practice in general practice were more likely than specialists to remain in their state of residency (Seifer, et al, 1995). More importantly, the same study indicated that generalist physicians were more likely

than specialists to remain in the state. The results of the current study and prior literature suggest that practice specialty have an association with in state practice. Since KU SoM is one of the leading programs graduating family medicine physicians, the results of more primary care physicians staying to practice in Kansas is not a surprise.

In addition, there are many programs that provide monetary incentives for physicians to practice in state, such as the Kansas Medical Student Loan Program (KMSL). KMSL assists students with costs associated with attending medical school in exchange for agreements to practice primary care in Kansas after residency (KUMC, n.d.). Out of the 365 recipients of the KMSL program, 67% (n=246) are still practicing in Kansas. Of the 246 who are practicing in Kansas, 67% (n=110) are still practicing in the same county where they completed their obligation (Paolo, 2013). The KMSL program may also be a factor in attracting and retaining primary care physicians to practice in Kansas.

Among those graduates who practice in the state of Kansas, what factors predict whether they practice in medically underserved areas?

The shortage of physicians in medically underserved areas has been an issue of continuing concern to policymakers for the past few decades. The results of this study indicate that age at graduation, location of residency and specialty choice were all significant predictors of graduates practicing in MUAs.

Just as location of residency was significant in predicting graduates practicing in Kansas, it was also significant in predicting whether a graduate practiced in a MUA in the state of Kansas. The results of my study suggest graduates who completed their residency outside of Kansas were 2.1 times more likely to practice in MUA. This result is counter to what one study found though. A study investigating factors influencing primary care physicians' choice to

practice in a medically underserved area found that graduate medical training (residency) experiences and location were not associated with their choice to practice in underserved areas (Xu, et al, 1997). A difference between that study and this study was that in their definition of underserved areas included both rural and inner-city locations, whereas for the present study, it was based on rural only. Although the results of the present study is counter to what previous research has indicated, schools who have rural missions are more likely to graduate students who go into rural practice than schools who do not have a rural mission (Geyman, Hart, Norris, Coombs & Lishner, 2000). Furthermore, training that includes rural rotations and other rural curricular elements in medical school and residency training are critical to keeping students who have an interest in rural practice from looking elsewhere.

At KU SoM, there is a program called the Kansas Bridging Plan (KBP), a loan forgiveness program (up to $26,000) offered to physicians in Kansas residency programs of Family Practice, Internal Medicine, Pediatrics and Medicine/Pediatrics. Participants agree to practice medicine full-time in a rural community for 36 continuous months upon completion of their residency program this program may have had an instrumental part in encouraging residents to stay in Kansas to practice in a MUA.

Age at graduation was also significant in predicting practice in MUAs, with older graduates more likely to practice in MUAs. For every year increase in a graduate's age, the likelihood of them practicing in a MUA increased by 1.1 times. These findings are congruent with what previous literature has shown (Horner, Samsa & Ricketts, 1993; Wayne, Kalishman, Jerabek, Tim & Cosgrove, 2010). A study investigating the characteristics of medical students that are identifiable on entry to medical school that influence subsequent practice in medically underserved communities found that physicians who began medical school at age 25 or older

were almost twice as likely to report working in an medically underserved community than those matriculating at a younger age (Wayne, et al, 2010). Since medical school is four years, those graduates aged 29 and above would be equivalent.

Studies of medically underserved areas or communities are hampered by definitions. Underserved communities are those that lack sufficient numbers of physicians or those where obtaining care is difficult because of economic circumstances. Much research has equated rural with underserved, and although most rural communities are underserved, this definition excludes the substantial underserved populations living in urban areas. Among studies that include both urban and rural areas in their definition of medically underserved area, definitions are not uniform or standardized which makes comparison difficult.

Specialty choice was also significant in predicting practice in MUAs, with graduates who were practicing primary care 7.5 times more likely to practice in MUAs compared to those who were practicing in non-primary care fields. This result is congruent with what previous research has shown (Chen, Fordyce, Andes & Hart, 2010; COGME, 1998). For instance, in a study examining the training of the rural physician workforce in the U.S. a national cross-sectional analysis of the 2005 AMA and AOA Masterfile physician data were performed. Results indicated primary care physicians were more likely to practice in rural areas compared to specialty physicians (Chen et al., 2010). Similarly, the Council on Graduate Medical Education (COGME) concluded that specialty choice was the most powerful predictor of rural practice location, with family practitioners being much more likely than other specialties to locate in rural areas (COGME, 1998). The powerful association of the present study's results reiterates what previous studies have shown.

A surprising result of the present study was rural background was found *not* to be a significant predictor in the logistic regression model predicting practice in MUAs. The results are extremely surprising since in previous studies and literature it is generally accepted that medical students from rural hometowns are more likely to practice in rural areas after graduation than non-rural students (Hyer, et al, 2007; Laven, & Wilkinson, 2003; Rabinowitz, et al, 2001; Wade, et al, 2007). One explanation might be that programs created to recruit graduates to practice in rural, medically underserved areas are working to recruit graduates collectively, not just those with rural backgrounds. Kansas Recruitment and Retention Center is a health care career service for medical professionals, including physicians, that recruit and facilitate medical professionals to find a place to practice in Kansas (KRRC, n.d.). According to the Kansas Recruitment and Retention Center, since 2004, the KRRC has helped more than 163 health care providers find a place to practice in Kansas. Perhaps these programs have played an integral part in recruiting physicians from all backgrounds to practice in medically underserved areas.

Gender was included in the predictive model of practice in a MUA because of prior literature implicating an association (Chen et al, 2010; Ellsbury, Doescher & Hart, 2000). It was very surprising that gender was not associated with MUA practice in the current study. In prior research and literature, gender was highly predictive of a physician practicing in a MUA (Rabinowitz, et al, 2001; Xu, et al, 1997). Historically, women have been much less likely to go into rural practice compared to men (AAFP, n.d.). In a systematic review of the literature regarding background for physicians who practice in rural areas, five studies found that physicians who practice in rural areas were more likely to be male (Laven & Wilkinson, 2003). Although the proportion of the graduates of KU SoM who are practicing in MUA is low (6.1%), in comparing the percentages of females who were practicing in MUA with males, 6.8% of

females compared with 5.6% of males were practicing in MUAs in Kansas. A study investigating rates of physicians practicing in rural areas noted a trend of an increasing proportion of female physicians entering rural practice (Chen, et al, 2010). A theory of why my results were not statistically significant may be that KU SoM may be a part of the trend of increasing proportion of female students entering rural practice.

Implications for Practice

In response to the outcry of a predicted physician shortfall, the American Association of Medical Colleges has proposed increasing enrollment in medical schools by 30 percent by 2015 through expanding existing medical education programs, as some medical schools have already done, and creating new programs. Creating new or increasing the size of existing programs would appear to be a logical response to the study findings but that in itself would not solve the problem of maldistribution of the physician workforce for the U.S or for Kansas. Simply increasing the supply of physicians will not solve the problem. I hypothesize that knowledge of the factors associated with primary care choice can be more effectively translated into interventions to build the primary care workforce.

Results of the study add to the body of literature on physician background variables that affect primary care choice, practice in Kansas and practice in MUAs specific for the state of Kansas. The study brings to light major implications that are worth highlighting. The findings of this study have implications for the medical school admissions policies and procedures that focus on recruitment of students from rural communities and who have stated an interest in primary care at matriculation. Since background characteristics were major variables related to the graduates' choices to practice in primary care, in Kansas, and in underserved areas, the

school's admission policy is the key to increasing the number of its graduates who are likely to practice in underserved areas. The selection process is one method by which a medical school can influence the geographical location and future specialty choice of its graduates.

According to this study, the greatest impact by far will be achieved by developing strategies that increase the selection of medical school matriculants who have a stated interest in primary care at matriculation and are from rural areas. The framework from this study can be used to better understand which students accepted into medical school are more likely to choose primary care. This may translate into more physicians practicing in Kansas and in MUA as my results indicate graduates' practicing in primary are over two times as likely to practice in Kansas and 7.3 times more likely to practice in MUAs. Increasing the number of physicians who will remain and practice in Kansas and practice in MUAs will be a major issue in the near future, especially with the passage of the Affordable Care Act. It is widely believed the ACA will further drive demand for more physicians as approximately 90% of the 350,000 Kansans who are currently uninsured could meet the income guidelines to qualify for subsidies or Medicaid (KHI, 2011)

In addressing factors that may predict more primary care physicians staying to practice in Kansas and in medically underserved areas, variables that are associated with increasing primary care doctors and those who stay to practice in Kansas are not mutually exclusive of each other. According to prior research, nothing affects the location decision of physicians more than specialty (Chen, et al, 2010; COGME, 1998). The more highly specialized the physician, the less likely he or she will settle in a rural area. As a consequence, the growth of specialization is a major contributor to the geographic maldistribution of physicians. Geographic maldistribution is related to a large extent to the career choices of U.S. medical school graduates. Physicians who

enter into the primary care disciplines—and particularly those who choose to be become family physicians --- are much more likely to practice in underserved areas than their peers who enter narrowly defined specialties. Educational interventions designed to increase the proportion of medical students choosing primary care disciplines in general medicine, and in particular family medicine, are a critical component of any strategy to address the geographic maldistribution of physicians.

Unfortunately just simply increasing the number of students entering medical school who may have a higher likely good of practicing in primary care, in Kansas and in rural areas is not enough. Having completed residency in Kansas was significant in predicting primary care practice, practice in Kansas and practicing in a medically underserved area in the current study. Prior research and the results of my study indicate that perhaps the biggest impact of keeping physicians in state and practicing in medically underserved areas is to focus on increasing funding for more graduate medical education (residency) positions in primary care fields for the state of Kansas.

Graduate medical education plays a huge role in shaping the physician workforce on a national and state level. Approximately 112,000 residents and fellows train in 150 sites across the country. Federal and state government (i.e., Medicare, Medicaid) and other sources provide $13 billion in public funding for this graduate medical training annually (Bruce & Martin, 2013). Ironically, the bulk of federal funding for residencies is directed to institutions that produce the fewest primary care doctors. Between 2006 and 2008, the top-20 producing medical schools received $292 million in GME funding, while the 20 schools with the fewest primary care graduates received $842 million (Bruce & Martin, 2013). Given the significant amount of taxpayer financial investment, the system needs to do a better job of addressing the public's

health needs, specifically in producing more primary care providers practicing in needed areas. According to my study, graduates who completed their residency in Kansas were almost five times more likely to stay and practice in Kansas than those who did residency out of state. Moreover, they were also over two times more likely to practice in MUAs as well. Increasing funding for more residency slots would increase the likelihood of keeping physicians we train in state and practicing in medically underserved areas. There is some evidence to suggest states with large residency programs tend to retain large numbers of their graduates as practicing physicians (Seifer, et al, 1995).

For 2013, a total of 195 graduating medical students were matched to different residency programs in Kansas. Of the 195, approximately 49.7% (n=97) of the residents were going into residencies in the primary care field. There's a caveat to this preliminary number though. Of the total of 195 residents going into primary care fields, 46 residents were going into internal medicine residencies. Studies have shown that internal medicine residents have a higher propensity than their other primary care counterparts to subspecialize once they are in practice (Compton, et al, 2008). Studies have estimated only 20% to 25% of internal medicine residency graduates pursue general medical careers (West & Dupras, 2012). An implication of this study is the extent to which graduate medical education affects the physician workforce of Kansas. Not only should the federal government and the state increase funding for more residency slots but they also need to purposefully focus those slots to accelerate physician workforce alignment with population and health delivery needs of the citizens of Kansas and of the US. GME funding should be directed toward high priority specialties such as family medicine, general internal medicine and pediatrics.

Criteria for recruiting graduate medical education (residency) training requirements should be revised to align with development of a physician workforce that meets the health care needs of Kansans. Selection of primary care residency applicants who attended medical school in Kansas and/or were from a rural background may result in higher proportion of residency graduates establishing practices in Kansas, hopefully in medically underserved areas years later whereby improving the health care system and the health of Kansans.

Finally, in conducting this study, data collection was difficult and limited. Data came from different sources, including the Kansas of Board of Healing Arts, Office of Admissions, Office of Medical Education and also internet searches. A more integrated system of data collection and management should be created to track graduates of the school. Although tracking of graduates who practice in Kansas was done by the Kansas Board of Healing Arts, tracking graduates who were not practicing in Kansas was problematic. Data regarding practice location and specialty had to be conducted individually in internet searches which was time consuming and not an exact science. A more integrated, seamless data system needs to be created and maintained to allow for data to be tracked from undergraduate medical education, graduate medical education and into practice. Although a Masterfile of physician data exists for physicians on a national level, it is extremely expensive. Perhaps if different departments pool resources, this data could be purchased.

Limitations

This study has several important limitations. First, since this study is non-experimental research, interference from confounding variables is always a possibility, no matter how much they are controlled for statistically (Carini et al., 2006). There well may be an inter-play

between career specialty preference and the students' background and/or characteristics and therefore make it difficult for pure experimental research.

Secondly, these data refer to only graduates of one medical school in a specific region. Whether these data can be extrapolated to other graduates from other states and other schools, is uncertain. The results may only be specific to this institution and not be generalizable to other institutions; therefore, the results of the study cannot be taken as representative of students in medical education programs as a whole.

The study sample is relatively large, but the numbers in certain subgroups are relatively small (i.e., race/ethnicity, undergraduate major, graduates practicing in MUAs) limiting the power to detect differences as statistically significant and to employ multiple variable techniques effectively. Estimated likelihood of practice in Kansas, specialty choice and MUA for certain subgroups is not precise for the smaller groups.

Although it is common practice to lump general internal medicine, family medicine, and general pediatrics together as primary care, this may limit the value of the findings because research has shown that physicians within these three fields may not be a homogeneous group (Senf, et al., 2002). Combining graduates in these specialties into one category may obscure important differences among them, leading to inaccurate conclusions about factors that are important predictors (Senf, et. al, 2004). On the other hand, results of studies that analyze factors associated with only one primary care specialty are not necessarily generalizable to other primary care specialties.

In the current study, I look at factors contributing to KU SoM graduates' choice of specialty and practice location. Specialty choice decisions are complex and multifaceted for medical students and physicians because they often must incorporate multiple personal,

academic and employment-related factors into their decisions. These decisions are made to fit within their realities of their own context. It is important to keep in mind, sometimes the decisions are made with various constraints. Embodied in each decision are personally unique goals, needs and aspirations, as well as particular constraints that may have qualified or limited the realization of the preferred specialty choices of the graduates. Virtually every graduate is subject to constraints. Grades and USMLE test scores, for example, can be limitations for some graduates in attaining their preferred specialty choice. A limitation of this study is although I try to determine what factors predict primary care choice, I cannot definitely determine if this was the graduate's preferred specialty choice or because it was out of necessity.

A final limitation of the study was that it only included demographic and entry variables of graduates to predict primary care practice, staying in Kansas and serving in medically underserved areas. It is likely that a balance of factors operating before, during and after medical school is involved in any individual career decision (Morrison, 2004). Most likely there are other important factors not included in this study (e.g., curricular components, spouse background and preference, loan repayment participation, pre-matriculation programs) but due to not being able to access the data, these potentially important predictor variables could not be assessed. Research has shown that important curricular experiences may increase interest in primary care (Meurer, 1995). Excluding the vital components comprising of the medical school environment element in the specialty choice and practice location puzzle is a limitation of the study.

Future research directions

In only including demographic and entry variables in the current study limited the study's findings. Future studies may include the "Environment" components as additional variables to

investigate specialty choice and practice location of graduates. As stated above, it is likely there are multiple factors that play a part in the decision making process of medical students. Future studies including factors that students encounter during their medical education and residency may provide a fuller picture in the decision making process. Important medical school experiences and curricular features such as influence of faculty members/mentors/role models/academic societies and clerkships could be investigated.

The state of Kansas has several loan forgiveness and repayment programs that it offers to entice students and graduates to practice in primary and to practice in rural areas. Future research could investigate whether loan forgiveness and repayment programs are effective in recruiting and retaining physicians to practice primary care, stay in Kansas and practice in medically underserved areas. In determining whether the programs like the Kansas Bridging Plan, Kansas State Loan Repayment Program and the National Health Service Corps are effective in getting physicians to practice primary care in Kansas could help in a more direct way of influencing physicians. These resources could be used to more aggressively target the recruitment and retention of physicians if more input is given of the programs' effectiveness.

Considerable research has been conducted regarding background variables making physicians more likely to practice in rural areas, including the results of this study but investigating what factors might have influenced why graduates of KU SoM stay to practice in those areas would be an interesting piece of the puzzle. Getting physicians to practice in rural Kansas is only the first step, retention of rural physicians is yet another piece of the puzzle. A qualitative study on why graduates selected their specialty choice, why they selected their practice location and why they stay would provide more a more in depth understanding of the

reasons why they do what they do may help policymakers make changes necessary to increase and retain primary care physicians and rural physicians.

KU SoM created satellite campuses in Salina and Wichita to help ease the rural physician workforce problems in the state. Significant financial resources were deployed in this endeavor. Financial support for the Salina campus comes from a $1 million dollar gift from Salina Regional Health Center, $225,000 from the Salina Regional Health Foundation and $75,000 from a private donor. Nearly $3 million was raised for the expansion of the Wichita campus (Dodge City Daily Globe, 2011). Although it may be a few years down the road, future research could investigate whether the graduates of these satellite campuses were more likely to practice in primary care, in Kansas or in a medically underserved area.

In addition, the results of this study combined general internal medicine, pediatrics and family medicine into one category of primary care. As stated in the limitation section, combining these three specialties together could mask differences between the specialties. Future research could focus on studying each individual field separately to determine whether the graduates from the different specialties differ in their preferences of location of practice and MUA status. In prior studies, family medicine physicians were more likely to practice in medically underserved areas (Senf, et al, 2003).

In my study I included graduation year as an independent variable which was significant in predicting practice in primary care and practice in Kansas. Future research exploring more in depth reasons why graduating year makes a difference in primary care and practice in Kansas would be useful to determine if all the investments made to increase primary care doctors in Kansas was significant.

Lastly the samples for the individual ethnic/racial groups were too small for any powerful statistical analysis. Future research may investigate whether the individual ethnic/racial groups (i.e., Hispanic/Latinos or African Americans) were more likely to practice primary care, stay in state and practice in MUAs. Research findings indicated that significantly more graduates who were participating in a pre-matriculation program for a medical school in California were from underrepresented in medicine racial ethnic groups (African American, Latino, Native American/Alaska Native) compared with control physicians (Lupton, et al., 2012). A greater percentage of the alumni than the control group of physicians worked in a primary care specialty and a greater percentage of URM alumni than the control physicians were practicing medicine in California. Perhaps a similar study could be conducted for the medical school.

Conclusion

In 2007, nearly 45 million persons in the United States lacked health insurance, more than 96 million people lived in medically underserved areas, and nearly 64.5 million resided in a Health Professional Shortage Area (Rosenbaum, Jones, Shin, Ku, 2009). Sufficient workforce capacity is essential to providing health care in medically underserved communities and one key to increasing capacity is the ability to identify characteristics of physicians likely to work in underserved areas. If these characteristics can be identified as early as application to medical school, institutions whose missions include addressing the needs of MUAs would benefit. The lack of doctors in those places has dramatic consequences for access to medical care. It can mean longer waits in busier doctors' offices, increased travel times to see physicians, less exposure to preventive strategies and poorer outcomes following traumatic injuries and illnesses. The dual problem of physician shortages and maldistribution of doctors are complex public health policy issues.

Nothing affects the location decision of physicians more than specialty. The more highly specialized the physician, the less likely he or she will settle in a rural area. As a consequence, the growth of specialization is a major contributor to the geographic maldistribution of physicians. The present study sought to determine what factors may predict graduates practicing in primary care in Kansas and in medically underserved areas. Study results suggest females, preference for primary care at matriculation and completing a residency in Kansas as being associated with a higher likelihood of practicing in primary care. Graduates from a rural area, practicing primary care and completing a residency in Kansas were more likely to stay in Kansas and practice in a medically underserved area. Adjusting admissions and selection policies to admit more students from these specific background characteristics could potentially increase the number of physicians who practice primary, stay in Kansas and practice in rural areas. The vexing problem in health care policy and physician workforce planning is getting the right number of physicians in the right specialties in the right locations at the right times. Although the statement sounds quite simple to do, it is much harder to implement in reality as shortages in primary care physicians and those who practice in rural areas have not been resolved, even after decades of trying.

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APPENDIXES

Appendix A

A copy of the Race and Ethnicity Code use by Admissions

AMCAS Race and Ethnicity Code Descriptions, 2006-2012

Hispanic	
Ethnicity Code	Ethnicity Description
C	Cuban
D	Decline to Respond
M	Mexican, Mexican American, Chicano/Chicana
N	Not Spanish/Hispanic/Latino/Latina
O	Other
P	Puerto Rican
U	Spanish/Hispanic/Latino/Latina

Race			
Race Code	Race Description	Category	Category Description
A	Asian	A	Asian
AC	Chinese	A	Asian
AF	Filipino	A	Asian
AI	Asian Indian	A	Asian
AJ	Japanese	A	Asian
AK	Korean	A	Asian
AO	Other Asian	A	Asian
AP	Pakistani	A	Asian
AV	Vietnamese	A	Asian
E	Indian/Pakistan	A	Asian
B	Black or African American	B	Black or African American
II	American Indian or Alaska Native	I	American Indian or Alaska Native
D	Decline to Respond	O	Other
O	Other	O	Other
UN	Unknown	O	Other
PG	Guamanian or Chamorro	P	Native Hawaiian or Other Pacific Islander
PH	Native Hawaiian	P	Native Hawaiian or Other Pacific Islander
PO	Other Pacific Islander	P	Native Hawaiian or Other Pacific Islander
PS	Samoan	P	Native Hawaiian or Other Pacific Islander
W	White	W	White
Y	Puerto Rican	W	White

AMCAS 2002-2005 ETHNICITY AND RACE CODES AND CATEGORIES

Ethnicity Codes:

1 = Mexican; Mexican/American; Chicano/Chicana
2 = Puerto Rican
3 = Cuban
4 = Other Hispanic

Race Codes:

A = Other Asian
B = Black or African American
C = Chinese
E = Asian Indian
F = Filipino
G = Guamanian or Chamarro
H = Native Hawaiian
I = American Indian or Alaska Native
J = Japanese
K = Korean
N = Other Race [Used only for 2002 and 2003 entering classes; then discontinued]
O = Samoan
P = Pakistani
T = Other Pacific Islander
V = Vietnamese
W = White

Race Categories and Race Codes that fall within:

B = Black: B
W = White: W
I = American Indian or Alaska Native: I
A = Asian: A, C, E, F, J, K, P, V
H = Native Hawaiian or Pacific Islander: G, H, O, T
O = Other: N

URM Indicators

Ethnic Codes	1	Mexican		Yes
	2	Puerto Rican		No
	3	Cuban	No	
	4	Other Hispanic		No
Race Codes	A	Other Asian		No
	B	Black	Yes	

C	Chinese	No
E	Asian Indian	No
F	Filipino	No
G	Guamanian	No
H	Native Hawaiian	Yes
I	American Indian/Alaska Native	Yes
J	Japanese	No
K	Korean	No
N	Other Race	No
O	Samoan	No
P	Pakistani	No
T	Other Pacific Islander	No
V	Vietnamese	No
W	White	No

AMCAS SELF-DESCRIPTION CODES, Prior to 2002 Entering Class

A = Other Asian
B = Black or African American ***
C = Chinese
E = Asian Indian or Pakistani
F = Filipino
H = Other Hispanic (including Cuban)
I = American Indian ***
J = Japanese
K = Korean
L = Alaska Native ***
M = Mexican American ***
N = Native Hawaiian ***
P = Puerto Rican Mainland ***
R = Puerto Rican Commonwealth
S = Southeast Asian, other than Vietnamese
T = Other Pacific Islander
V = Vietnamese
W = White
Z = no self-description given

*** URM (under-represented minority group)

Appendix B

University of Kansas Medical Center, HSC #13321 Research Approval

The University of Kansas Medical Center

Human Research Protection Program

August 2, 2012

Project Number:	13321
Project Title:	Factors Contributing to the Choice of Specialty and Practice Location of KUMC Medical Students
Sponsor:	None
Protocol Number:	N/A
Primary Investigator:	Emma Nguyen, M.S.
Department:	Office of Medical Education
Meeting Date:	07/03/2012
HSC Approval Date:	07/27/2012
Type of Approval:	Exempt b (4)

Dear Investigator:

This is to certify that your research proposal involving human subject participants has been reviewed and **approved** by the KUMC Human Subjects Committee (HSC). This "exempt" approval is based upon the assurance that you will notify the HSC prior to implementing any revisions to the project. The HSC must determine whether or not the revisions impact the risks to human subjects, thus affecting the project's "exempt" status. Projects that do not meet the "exempt" criteria must comply with all federal regulations regarding research.

If you have any questions regarding the human subject protection process, please do not hesitate to contact our office.

Very truly yours,

Daniel J. Voss, M.S., J.D.
IRB Administrator