Specialty Choice Among Physicians

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Introduction

One of the hottest topics in health has been the shortage of primary care, which includes the specialties of family practice, internal medicine, and pediatrics. Between 1997 and 2005, the number of students electing to enter family practice residencies decreased by over fifty percent; and between 1998 and 2005, the percentage of third year internal medicine residents choosing to enter practice as general internal medicine doctors (primary care doctors) decreased from around 55% to 20% (Bodenheimer, 2006). Primary care doctors are an essential component of the healthcare system, acting as gatekeepers that regulate the traffic of patients being referred to specialists. Primary care physicians are indispensable for the provision of effective preventative care, the early management of health problems, and the reduction of unnecessary or inappropriate specialty care (Starfield, 2005). Because a higher number of primary care doctors relative to the number of specialists has been implicated in lower healthcare costs, an emphasis has been placed on the greater use of primary care doctors in the future. This, combined with the projected increase in demand for primary care services foreshadows a shortage of primary care physicians if no changes are made to the current system (Carrier, 2011). There are many different suggested solutions to this potential problem; but to implement the best solution, it is necessary to understand the factors that influence specialty choice of doctors. A wealth of research has already been published concerning the factors that influence specialty choice among medical students. It is the goal of this paper to further investigate and supplement the research shown in prior papers and to explore the possibility of using a combination of specialty characteristics and student characteristics to determine how certain profiles of students will, on average, select specialties as different aspects of specialties are modified. This paper differs from many of the previous papers in several ways. First, unlike many of the papers that have

been published, my paper does not rely on survey responses but on observed actions. When a respondent is answering a survey question, he or she may not necessarily be aware of his or her true answer to a the survey questions and/or be willing to answer the question in a truthful manner. Observed actions are much more reliable than survey responses because commitment to an action comes at a much higher cost than commitment to a survey response. Also, students may have certain specialty preferences but are not necessarily able to achieve their most preferred specialty. Secondly, this paper evaluates the effects of a number of specialty characteristics (income, liability premiums, number of hours worked per week, controllability of time spent on professional activities, length of residency training, and person vs. technique orientation[1]) and allows for heterogeneity of marginal utility based on different physician characteristics (race, gender, tier of medical school, and age at graduation).

I hope that the results of this study can be used to provide information for policy makers by evaluating physicians' marginal utility of different specialty characteristics. The values of these marginal utilities could be used to evaluate ways to incentivize students to go into primary care specialties. For example, the results of the analysis in this paper show that specialty choice is positively related to income, meaning that enacting policies to increase the income of primary care specialties could cause an increase in the utility a physician derives from choosing a primary care specialty, thus increasing the probability that a physician enters primary care. It is expected that, in a typical competitive industry, an improper distribution of skilled workers would be corrected naturally by a change in the relative wages of different occupations. However, the healthcare industry is heavily regulated and not price-competitive. The number of medical students is centrally governed by an accrediting organization. The number of students that are

[1] Person-oriented specialties focus on people and the whole patient, whereas technique-oriented specialties focus on technical skills, instruments, and techniques related to patient care.

able to enter each specialty is limited by the number of spots available, which is a function of the amount of federal funding different departments of teaching hospitals receive. Once physicians become board-certified to practice medicine, a large percentage of compensation is centrally determined by government run programs like Medicare and Medicaid. These programs have a fee-for-service pay schedule that determines the compensation that physicians receive for doing different services and procedures. These conventional payment systems tend to undervalue primary care services relative to specialty services. Advances in technology also allow for specialists to perform procedures more quickly and achieve higher incomes. Because the nature of primary care necessitates quality patient interaction, it is difficult for primary care doctors to increase patient volume to achieve higher incomes without compromising quality of care. If targeting certain characteristics that are common to primary care specialties, it might be possible to gradually change the distribution of doctors towards primary care specialties.

Literature Review

Much of the previous research on specialty choice falls into a few different categories focusing on either characteristics of particular medical specialties, characteristics of medical students, or both. The 2004 National Physician Survey was issued by the College of Family Physicians of Canada (CFPC), the Canadian Medical Association (CMA) and the Royal College of Physicians and Surgeons of Canada (RCPSC) to determine how physicians choose their specialty and asked questions about a number of factors including intellectual stimulation/challenge, doctor-patient relationship, workload flexibility/predictability, ability to pursue non-work-related interests, availability of training opportunities, teaching opportunities, influence of a mentor, earning potential, influence of family, prestige, research opportunities, and other factors. In his analysis of the survey, Baerlocher (2006) observed that second-year family medicine residents claimed

that the most important factors were the doctor-patient relationship and workload flexibility/predictability, whereas the least important factors were prestige, earning potential and research potential. Residents pursuing specialty certification claimed to have been influenced most by the level of intellectual stimulation/challenge, and prestige and earning potential were reported as more important for specialty residents than for family medicine residents.

Personality and values have been studied as influencing factors for how doctors choose their specialties. Taber, Hartung, and Borges (2011) conducted a study of personality and physician work values (i.e. prestige, service, autonomy, lifestyle) as predictors of medical specialty choice. First-year medical students responded to measures of personality and work values. Their post-graduation residency choices were then identified and used to evaluate the predictive quality of personality and values. Residency choices were classified into either person-oriented or technique-oriented. Person-oriented specialties are described as specialties with a focus on people and the whole patient. Technique-oriented specialties focus on technical skills, instruments, and techniques related to patient care. Specialties like family practice, internal medicine, obstetrics and gynecology, pediatrics, physical medicine and rehabilitation, and psychiatry were classified as person-oriented; specialties like anesthesiology, dermatology, emergency medicine, otolaryngology, pathology, radiology, and surgery were classified as technique-oriented specialties. Results indicated that personality traits did predict person-oriented or technique-oriented specialty choice. Medical students who entered person-oriented specialties tended to be more sensitive, display more warmth, and be more rule-conscious and apprehensive. Students who entered technique-oriented specialties tended to be more dominant, vigilant, and tense. These seven personality traits accurately classified 70% of specialty choices. Borges et al. (2009) found in a similar study that students pursuing person-oriented specialties

were moderately more likely to be influenced by their personal physician, school faculty, medical school activities, medical school offices and services, and less likely to be influenced by income expectations. Students pursuing technique-oriented specialties were slightly more likely to feel that they have high earning potential and that their medical school should have helped more in their specialty decision and slightly less likely to have had a role model during medical school.

Income has also been seen as an important factor in determining specialty choice among medical students. Wilder et al. (2010) observed that a gap of over $135,000 separates the median annual subspecialist income from that of a primary care physician. A subspecialist is a physician who focuses on a narrow field of study such as pediatric dermatology or orthopedic spine surgery, whereas a specialist would have a broader area of focus such as dermatology or orthopedic surgery. They find that because the income gap between subspecialists and primary care physicians has grown over the past 30 years, the odds of medical students choosing to go into primary care has decreased. The authors claim that policies aimed at decreasing the income gap could attract more students to primary care.

Although income has been shown to be a significant factor in influencing specialty choice, there are other lifestyle factors that many consider to be important. The controllability of one's lifestyle has been studied as a factor in recent years. Controllable lifestyle specialties allow the physician to control the number of hours devoted to practicing the specialty (Schwartz, 1990). Characteristics considered are the amount of personal time free from professional activities for leisure, family, and non-vocational interests and control of total weekly hours spent on professional activities (Dorsey, 2003). Schwartz et al. (1990) found that students choosing a controllable lifestyle (CL) specialty placed more emphasis on perceived lifestyle factors than

students choosing either primary care or surgery specialties. CL specialties were anesthesiology, dermatology, emergency medicine, neurology, ophthalmology, otolaryngology, pathology, psychiatry, and radiology. Noncontrollable (NCL) specialties were internal medicine, family practice, pediatrics, obstetrics-gynecology, and surgery. Dorsey et al. (2003) observed that students have been selecting specialties like radiology and anesthesiology, both CL specialties, in increasing numbers and general surgery and family practice, both NCL specialties, in decreasing numbers and noted that it has been suggested that controllable lifestyle is a determining factor of students' choices. Using data from the National Resident Matching Program (NRMP) and other sources, the authors found a strong association between controllable lifestyle and specialty preference.

The substantial differences in frequency of malpractice claims and amount of each claim between specialties have been subjects of growing concern. Jena et al. (2011) analyzed malpractice data from 1991 through 2005 for 25 specialties. They found that 7.4% of all physicians had a malpractice claim, with 1.6% having a claim leading to a payment. Some of the authors' notable findings on differences in percentage of physicians in different specialties facing a claim are 19.1% in neurosurgery, 18.9% in thoracic–cardiovascular surgery, and 15.3% in general surgery to 5.2% in family medicine, 3.1% in pediatrics, and 2.6% in psychiatry. Mean indemnity payments also differed widely, from $117,832 for dermatology to $520,923 for pediatrics. It is plausible that the vast differences in malpractice claims between specialties could be an influencing factor in specialty choice among medical students.

Kiker and Zeh (1998) used survey responses from the Association of American Medical Colleges' Medical School Graduation Questionnaire of students who graduated from medical school in 1995. Using a random utility model based on the multinomial logit regression they

found a number of factors that are correlated with certain specialty choice decisions. including financial factors, demographic factors, and academic and lifestyle factors. Financial factors include relative income expectations, cost of malpractice premium, length of residency, and whether financial aid was received while in school. Demographic factors include age at graduation, gender, race, and marital status. Academic and lifestyle factors that have been studied include MCAT science section subscores, predictability of working hours, prestige of selected field, whether medical school was public or private, and whether the expected place of practice is rural or not. They also placed specialties into different categories: general, medical, surgical, and support. The general category includes primary care specialties: general family practice, general internal medicine, and general pediatrics. Medical specialties include specialized family practice, specialized internal medicine, specialized pediatrics, dermatology, allergy, neurology, psychiatry, immunology, and diabetes. The surgery group includes obstetrics and gynecology and ophthalmology. The support category includes anesthesiology, emergency medicine, pathology, physical medicine, preventative medicine, and radiology. Notable findings include that selection of a surgical or support specialty is positively related to income (respondents who had a surgical or support specialty as their top choice were more likely to say that income was a factor in their decision), but selection of primary care and medical specialties is negatively related to income (respondents who listed a primary care or medical specialty as their top choice were more likely to say that income was not a factor in their decision). Concern about malpractice premium cost is negatively related to surgical selection and positively related to primary-care choice. They claim "policies that alter expected relative income, length of residency, desired location of practice, medical school attended, predictable working hours, and prestige of practice, rather than financial aid, may be appropriate for correcting a perceived

maldistribution of physicians among specialties." Although Kiker and Zeh (1998) found statistically significant results, the use of a survey has drawbacks. When respondents answer survey questions, they are required to consciously be aware of their true answer to the question and be willing to admit their answer to themselves. Some survey information is objective (i.e. Did you receive a military scholarship or National Health Corps Scholarship?), but some information is more subjective (i.e. Did relative income influence your specialty choice?). Surveys are less reliable than observed actions because actions do not always reflect statements. Their study also does not allow for heterogeneity in the effect of specialty characteristics on different demographics of medical students. However, I allow marginal utility of specialty characteristics to vary based on physician demographic information.

Data

The data in this paper includes both individual data and specialty data. The individual data comes from the Tennessee Department of Health's (TDH) Health Professional Licensing Reports (HPLR) dataset. The specific characteristics examined were gender, race, age at graduation, and whether the physician graduated from a top tier medical school. The analyzed data is limited to medical doctors who are both licensed to practice in Tennessee (TN) and whose offices are or were located there. The data on specialty characteristics comes from the American Medical Association's (AMA) Socioeconomic Monitoring System (SMS) surveys and includes data from 1982-1996. The AMA's SMS issued surveys on physician characteristics for a number of years and published these results in the Socioeconomic Characteristics of Medical Practice. This survey includes a broad range of numerical information on nine different medical specialties: family practice, internal medicine, general surgery, pediatrics, obstetrics-gynecology, radiology, psychiatry, and pathology. The availability of data limited the breadth of specialties included in

this paper to the previous nine mentioned. Specialty data utilized in this paper included median income, average number of hours worked per week, and average cost of malpractice liability premiums, controllable vs. uncontrollable lifestyle, person vs. technique orientation, and length of training. The controllability of lifestyle categorization was borrowed from Schwartz et al. (1990) and Dorsey et al. (2003) (see Table 1) and is included as a dummy variable (controllable = 1, uncontrollable = 0). Person vs. technique orientation was borrowed from Taber, Hartung, and Borges (2011) (see Table 1) and is also included as a dummy variable (person-oriented = 1, technique-oriented = 0). Length of training for each specialty was taken from the website of the American Association of Medical Colleges (AAMC).

Table 1. Controllable and Non-controllable Specialties

Specialty	Lifestyle	Orientation	Length of Training
Anesthesiology	Controllable	Technique	4
Family practice	Uncontrollable	Person	3
Internal medicine	Uncontrollable	Person	3
Obstetrics and gynecology	Uncontrollable	Person	4
Pathology	Controllable	Technique	4
Pediatrics	Uncontrollable	Person	3
Psychiatry	Controllable	Person	4
Radiology (diagnostic)	Controllable	Technique	5
Surgery (general)	Uncontrollable	Technique	5

Information on the ranking of medical schools was also collected from previous editions (years 1998, 2000, and 2002) of U.S. News and World Report and was used to assign tiers to the medical schools attended by individuals included in the sample as a proxy of academic ability. The 25 schools that had the highest average rank during the period of time analyzed by the model were assigned to the top tier, and all other schools were assigned to the lower tier. Using more than two groups would increase the number of demographic groups and make for a more detailed analysis. However, it is expected that most medical school applicants and medical

school students consider the top 20 or 25 schools to be the top tier and for most other schools to be lower tier. This method was chosen both for its simplicity and the degree to which it expected to reflect medical school applicant's perceptions, though the use of alternate methods of classifying schools could be explored for use in later analyses. One limitation of using the U.S. News and World Report rankings as a means of assigning tiers is that the ranking system for medical schools has only been in use since 1987. Because many of the physicians graduated before the report was issued or widely used as a means of comparing medical schools, it is possible that the ranking information is not completely accurate for all of the years represented in the physician data. Also, because historical rankings for medical schools have been difficult to acquire, only three years of data were collected; and because medical school rankings do change over time, the schools included in the top tier could not be representative of the top tier schools at the time the individuals in this paper graduated. Although there may be a better way of establishing the top tier, it will be assumed that the schools labeled as top tier were very reputable schools during the time period analyzed.

Once the data was acquired, it had to be organized and cleaned using SAS. First, a database was created with specialty characteristics including average compensation, liability premium, and hours per week by specialty and year. A second database was created with information on individual physicians. Specialty categories were then assigned to each of the individual physicians. Duplicate rows, undergraduate education information, observations without specialties, and observations with no race information were deleted. Race, specialty, and gender were then made into dummy variables. A dummy variable was made for those who were 28 or younger when they graduated from medical school. A two-tier system was then created for medical schools based on historical rankings and a dummy variable was created for graduates of

tier one schools. To merge the specialty data with the individual data, each individual's data was paired with specialty information from two years prior to his or her graduation year. It is hypothesized that individuals make their final decisions about their preferred specialties in the year prior to graduation from medical school. This decision is likely based on specialty information that they have had recent access to, namely information published the previous year. Because information published in the previous year includes data from the year prior to publication, students are likely using information from two years prior to their graduation year.

To give a rough overview of the distribution of different profiles of students that choose different specialties, a set of summary statistics can be seen below (Table 2). Reported are the percentages of total physicians, whites, males, graduates of tier 1 schools, and graduates with age equal to or less than 28 years in each of the nine specialties included in this paper. Also included are the average numbers of hours worked for each specialty for the time period. Although the median income and average malpractice premium levels have not been adjusted for inflation, they do show the relative differences between specialties. Some of the most interesting figures to compare are those that differ dramatically from the average for all physicians. For example, the percentage of surgeons in the sample that are white (91.26%) is greater than the percentage of all physicians that are white (80.12%), whereas the percentage of psychiatrists that are white (71.84%) is much lower. The percentage of males comprising different specialties varies widely from 43.95% in pediatrics to 88.64% in general surgery. Part of this difference can partly be explained by heterogeneous preferences between demographic groups. The results of this study show that white males have a higher marginal utility for technique-oriented specialties like surgery and radiology than for person-oriented specialties like pediatrics and psychiatry, whereas females and nonwhites show a higher marginal utility for person-oriented specialties. Also

notable are the differences in graduates from tier 1 medical schools in various specialties in the sample. Whereas 19.23% of surgeons are tier 1 graduates, only 4.41% of family practice physicians are.

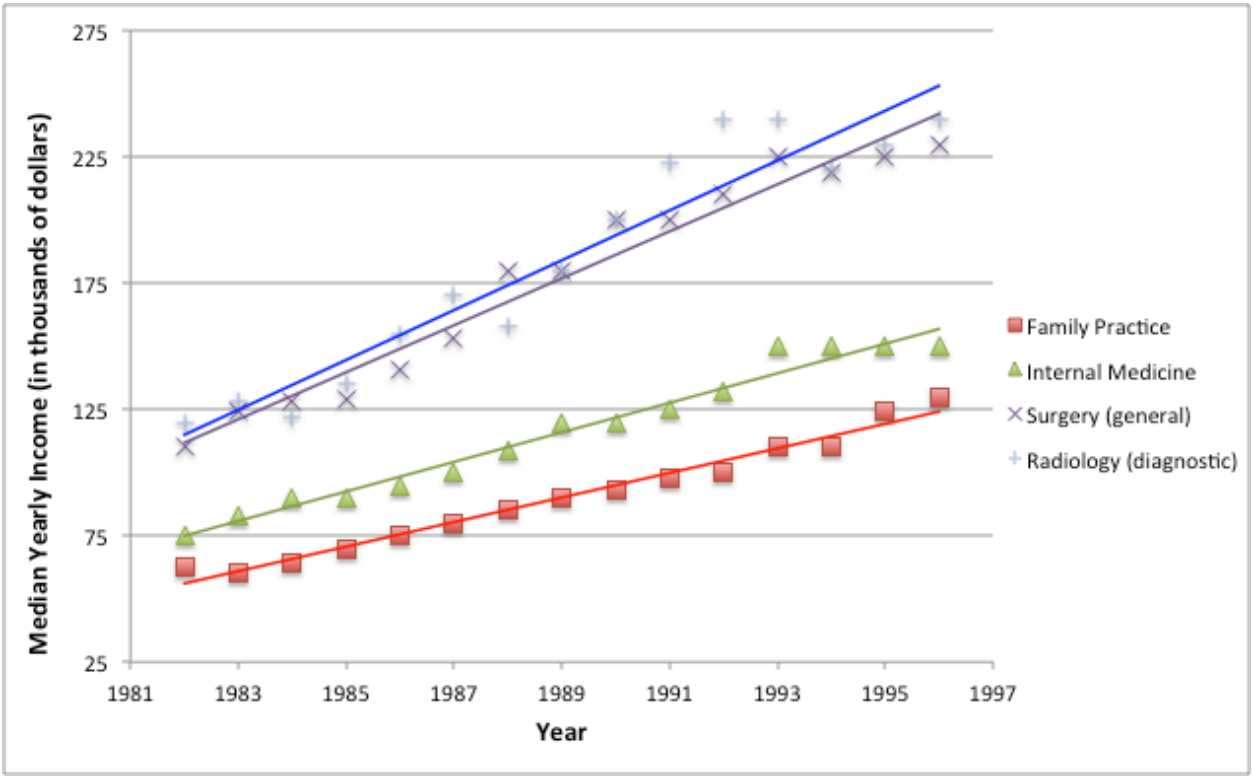
Table 2. Summary Statistics

	Total	White	Male	Top tier[a]	Young Grad[b]	Income[c]	Premium[d]	Hrs/wk[e]
Family Practice	17.61%	82.60%	69.60%	4.41%	63.66%	91.85	7.57	58.32
Internal Medicine	28.55%	69.36%	72.08%	11.41%	76.15%	116.02	7.55	60.93
Surgery (general)	15.54%	91.26%	88.64%	19.23%	79.78%	176.42	20.39	58.38
Pediatrics	11.87%	82.03%	43.95%	12.09%	83.66%	98.68	7.10	57.79
Obstetrics-Gynecology	6.52%	82.44%	47.62%	11.01%	72.92%	160.75	30.16	62.28
Radiology	6.23%	87.85%	80.69%	13.40%	76.95%	180.64	10.53	56.89
Psychiatry	4.75%	71.84%	55.92%	7.76%	64.49%	95.70	4.01	50.43
Anesthesiology	6.17%	85.53%	79.87%	10.38%	70.13%	168.07	17.77	60.21
Pathology	2.77%	83.92%	57.34%	13.99%	76.22%	134.16	5.03	50.53
All physicians	100.00%	80.12%	69.12%	11.40%	74.32%	128.77	11.55	58.71

[a] Graduated from a top tier school.
[b] Graduated at an age equal to or less than 28 years.
[c] Median income (in thousands of dollars)
[d] Average malpractice liability premium (in thousands of dollars)
[e] Average total number of hours in professional activities per week.

Figure 2 (shown below) shows median income for family medicine, internal medicine, surgery, and radiology from 1982-1996 (not adjusted for inflation). As can be seen in the graph below, there has been a large disparity in income levels between specialties that may explain part of the current distribution of physicians among specialties.

Figure 2. Median income (in thousands of dollars) of selected specialties (1982-1996)



Methods

This paper utilizes a conditional logit model (McFadden, 1973) to examine specialty choice among physicians. Each physician *i* has a choice of *J* specialties. The physician is assumed to select the specialty that maximizes his or her indirect utility. The choice of specialty is a function of each specialty's characteristics. The utility that physician *i* receives from a particular specialty *j* is expressed:

$$U_{ij} = X_j\beta_i + \varepsilon_{ij}$$

where X_j is a vector of specialty characteristics, β_i is a vector of marginal utility parameters for physician *i* and ε_{ij} is an error term that accounts for unobservable, idiosyncratic factors that change physician *i*'s utility for a particular specialty *j* relative to the observable characteristics. The individual-specific taste parameters (β_i) are assumed to be linear functions of observable

physician characteristics. More specifically, I assume β_i is a function of the physician's race, gender, tier of medical school attended, and age at graduation from medical school.

The probability that physician *i* chooses specialty *j* is the probability that U_{ij} is larger than U_{ik} for all $k \neq j$. In other words, the probability that a given physician chooses a particular specialty is the probability that the utility that physician would receive from that specialty is larger than the utility that physician would receive from any other specialty. Because it is assumed that the distribution of ε is extreme value, this probability can be expressed as follows:

$$\Pr(U_{ij} > U_{ik})\ \forall k \neq j = \Pr(y_i = j) = \ \Phi_{ij} = \frac{\exp\ (X_j \beta_i)}{\sum_k \exp\ (X_k \beta_i)}$$

If vector y_i is defined as a vector of indicators where y_{ij} = 1 if student *i* chooses *j* and zero if otherwise, then the likelihood function can be expressed:

$$L = \prod_i L_i = \prod_i \prod_k [\Phi_{ik}]^{y_{ik}}$$

The parameters of the model can then be estimated by maximizing the above likelihood function.

Results

I begin by reporting estimates for a simplified version of the model in which I assume that physicians have homogeneous preferences. These estimates are reported in Table 3 below. Specialty characteristics that I have included are annual income, annual malpractice liability premium, number of hours worked per week, uncontrollable vs. controllable lifestyle, length of residency, and person vs. technique orientation.

Table 3. Marginal Utility Parameters (Homogeneous Preferences)

	Income[a]	Malpractice Premium[b]	Hours/week[c]	Uncontrollable Lifestyle[d]	Length of Training[e]	Person-oriented[f]
Physician	0.0033***	-0.0597***	0.0948***	1.1768***	0.0717	-0.1485*
	(0.0012)	(0.0035)	(0.0079)	(0.0537)	(0.0525)	(0.0768)

* $p < .1$, ** $p < .05$, *** $p < .01$; (two-tailed test).

Note: *, **, *** refers to the level of significance of the conditional logit coefficients
( ) represents the standard error of the parameter

[a] Parameter to measure the marginal utility of increasing the median annual income (in thousands of dollars)
[b] Parameter to measure the marginal utility of increasing the average annual malpractice liability premium (in thousands of dollars)
[c] Parameter to measure the marginal utility of increasing the average total number of hours in professional activities per week
[d] Parameter to measure the marginal utility from changing an uncontrollable lifestyle to a controllable one. The dummy variable for lifestyle was assigned a value of 0 if the specialty's lifestyle was controllable and a value of 1 if uncontrollable.
[e] Parameter to measure the marginal utility of increasing the length of training
[f] Parameter to measure the marginal utility from changing a technique-oriented specialty to a person-oriented specialty. The dummy variable for orientation was assigned a value of 0 if the specialty was technique-oriented and a value of 1 if the specialty was person-oriented.

The coefficients for annual income, malpractice premium, and residency length are as expected. Table 3 (above) shows that physicians' choices are positively related to income. That is, as the income for a specialty increases, the utility that a physician derives from that specialty increases and the probability that a physician chooses that particular specialty therefore increases. However, both the malpractice premium and residency length are negatively related to physician specialty choice. It is interesting that hours per week is positively related to specialty choice and that person-orientation is negatively related. One would likely expect that as the number of hours worked per week increases that the probability a physician chooses that specialty would decrease. This surprising result could be because the number of hours worked per week is strongly correlated with income (Pearson correlation coefficient = .2054). One would also expect as the lifestyle associated with a particular specialty becomes more uncontrollable, the probability a physician chooses that specialty decreases. However, the parameter for the uncontrollable variable is positive, which proves difficult to explain. Although it is expected that a physician is likely to demand compensation in the form of additional income as his or her

lifestyle becomes less controllable, there is a strong negative correlation between income and uncontrollable lifestyle (Pearson correlation coefficient = -.2375) that indicates physicians are not compensated for uncontrollable lifestyle. Also, it is generally thought that physicians choose their profession because they enjoy patient interaction, so it would be expected that physicians derive some additional utility from the patient interaction found in person-oriented specialties. However, these numbers say otherwise. It is possible that an unaccounted for variable could explain this relationship. Perhaps person-oriented specialties are thought to be less prestigious or intellectually stimulating and, thus, less desirable. It is also very likely that the negative correlation between person-orientation and income (Pearson correlation coefficient = -.5944) could explain the negative parameter value for person-orientation.

In Tables 5a-5d below are the marginal utilities for different demographic types, which allows for some heterogeneity in physician's marginal utility parameters (a table including all demographic types together is available in the Appendix). Table 4 contains a key and explanation of the shorthand notation necessary for interpreting the data in Tables 5a-5d.

Table 4. Key and Explanation of Shorthand for Data Tables

Race	Gender	Tier of Medical School	Age at Graduation
N = Nonwhite	F = Female	L = Not top tier	O = age greater than 28 years
W = White	M = Male	T = Top tier	Y = age less than or equal to 28 years

In the following tables: *, **, *** refers to the level of significance of the conditional logit coefficients
* $p < .1$, ** $p < .05$, *** $p < .01$; (two-tailed test).
( ) represents the standard error of the parameter

[a] *Income* is a parameter to measure the marginal utility of increasing the median annual income (in thousands of dollars)
[b] *Malpractice premium* is a parameter to measure the marginal utility of increasing the average annual malpractice liability premium (in thousands of dollars)
[c] *Hours/week* is a parameter to measure the marginal utility of increasing the average total number of hours in professional activities per week
[d] *Uncontrollable Lifestyle* is a parameter to measure the marginal utility from changing an uncontrollable lifestyle to a controllable one. The dummy variable for lifestyle was assigned a value of 0 if the specialty's lifestyle was controllable and a value of 1 if uncontrollable.
[e] *Length of Training* parameter to measure the marginal utility of increasing the length of training
[f] *Person-oriented* is a parameter to measure the marginal utility from changing a technique-oriented specialty to a person-oriented specialty. The dummy variable for orientation was assigned a value of 0 if the specialty was technique-oriented and a value of 1 if the specialty was person-oriented.

Table 5a. Marginal Utility Parameters for White Males (Heterogeneous Preferences)

	Income	Malpractice Premium	Hours/week	Uncontrollable Lifestyle	Length of Training	Person-oriented
WMTY	0.011	-0.075***	0.099*	2.084***	0.058	-1.114**
	(0.0077)	(0.0217)	(0.0510)	(0.3576)	(0.3379)	(0.4766)
WMTO	0.011	-0.063***	0.073	1.671***	-0.065	-0.728
	(0.0072)	(0.0201)	(0.0476)	(0.3353)	(0.3163)	(0.4441)
WMLY	0.003	-0.069***	0.122***	1.477***	0.083	-0.789*
	(0.0066)	(0.0187)	(0.0439)	(0.3153)	(0.2906)	(0.4052)
WMLO	0.003	-0.057***	0.097**	1.064***	-0.039	-0.403
	(0.0060)	(0.0168)	(0.0400)	(0.2897)	(0.2652)	(0.3665)

* $p < .1$, ** $p < .05$, *** $p < .01$; (two-tailed test).

For white males malpractice premium, hours per week, controllability, and person-orientation were found to be statistically significant. The parameter for malpractice premium is negative, as expected. This means that as malpractice premiums increase for a particular specialty, the probability that a physician will choose that specialty decreases. The parameter values for hours per week, controllability, and person-orientation are not as expected. It is generally expected that as the number of hours worked per week increases, a physician is less willing to choose that specialty. It is also expected that as the lifestyle for a specialty becomes more controllable, a physician is more likely to choose that specialty. Physicians are also expected to be more likely to choose a person-oriented specialty, holding other factors constant, because it provides higher quality patient interaction. However, the values of the parameters indicate that these assumptions are not true. They show that as the hours per week increases or controllability decreases a physician is more likely to choose that specialty. It is interesting that the parameter values for person-orientation were statistically significant in only the demographic types for young graduates, suggesting white males have a preference for technique-oriented specialties.

Table 5b. Marginal Utility Parameters for White Females (Heterogeneous Preferences)

	Income	Malpractice Premium	Hours/week	Uncontrollable Lifestyle	Length of Training	Person-oriented
WFTY	0.007	-0.022	0.007	1.391***	-0.288	-0.066
	(0.0072)	(0.0202)	(0.0475)	(0.3324)	(0.3152)	(0.4453)
WFTO	0.007	-0.009	-0.019	0.978***	-0.410	0.320
	(0.0066)	(0.0185)	(0.0439)	(0.3083)	(0.2919)	(0.4104)
WFLY	-0.001	-0.016	0.030	0.784***	-0.262	0.259
	(0.0060)	(0.0170)	(0.0398)	(0.2864)	(0.2639)	(0.3679)
WFLO	-0.001	-0.003	0.005	0.371	-0.385	0.645**
	(0.0053)	(0.0149)	(0.0354)	(0.2580)	(0.2356)	(0.3248)

* $p < .1$, ** $p < .05$, *** $p < .01$; (two-tailed test).

The only parameters found to be statistically significant for white females were controllability and person-orientation. The values for the uncontrollable dummy variable parameters, as in white males, are all positive. This unexpected finding suggests that as controllability decreases, a physician is more likely to choose that specialty. The finding for person-orientation, however, does have a positive value as one would expect, suggesting that older white females who graduated from a lower tier school gain an additional utility by choosing a person-oriented specialty.

Table 5c. Marginal Utility Parameters for Non-white Males (Heterogeneous Preferences)

	Income	Malpractice Premium	Hours/week	Uncontrollable Lifestyle	Length of Training	Person-oriented
NMTY	0.025***	-0.129***	0.147***	1.587***	-0.073	0.350
	(0.0070)	(0.0196)	(0.0460)	(0.3193)	(0.3039)	(0.4297)
NMTO	0.025***	-0.116***	0.122***	1.174***	-0.196	0.736*
	(0.0064)	(0.0178)	(0.0422)	(0.2941)	(0.2797)	(0.3934)
NMLY	0.017***	-0.122***	0.171***	0.980***	-0.048	0.674*
	(0.0058)	(0.0162)	(0.0380)	(0.2711)	(0.2503)	(0.3488)
NMLO	0.017***	-0.110***	0.145***	0.567**	-0.170	1.061***
	(0.0050)	(0.0140)	(0.0333)	(0.2409)	(0.2203)	(0.3030)

* $p < .1$, ** $p < .05$, *** $p < .01$; (two-tailed test).

For nonwhite males income, malpractice premium, hours worked per week, controllability, and person-orientation were all found to be statistically significant. The parameters for income, malpractice premium, and person-orientation all had values that one would expect. They show

that as income increases or malpractice premium decreases for a specialty a nonwhite male gains additional utility from choosing that specialty. Nonwhite males (except those who are young and graduate from a top tier school) show a preference for person-oriented specialties.

Table 5d. Marginal Utility Parameters for Non-white Females (Heterogeneous Preferences)

	Income	Malpractice Premium	Hours/week	Uncontrollable Lifestyle	Length of Training	Person-oriented
NFTY	0.021***	-0.075***	0.055	0.894***	-0.418	1.397***
	(0.0064)	(0.0179)	(0.0421)	(0.2908)	(0.2785)	(0.3947)
NFTO	0.021***	-0.062***	0.030	0.481*	-0.541**	1.784***
	(0.0057)	(0.0160)	(0.0379)	(0.2629)	(0.2519)	(0.3549)
NFLY	0.013**	-0.069***	0.079**	0.287	-0.393*	1.722***
	(0.0050)	(0.0142)	(0.0331)	(0.2369)	(0.2187)	(0.3047)
NFLO	0.013***	-0.056***	0.053*	-0.126	-0.516***	2.108***
	(0.0042)	(0.0116)	(0.0277)	(0.2017)	(0.1836)	(0.2510)

* $p < .1$, ** $p < .05$, *** $p < .01$; (two-tailed test).

For nonwhite females each of the variables showed significance for at least two of the groups. Income, malpractice, hours worked per week, controllability of lifestyle, and person-orientation were the same as for nonwhite males. However, unlike for any of the previous groups, length of training was found to be statistically significant for three of the nonwhite female groups (not significant for young nonwhite females graduating from a top tier school), having a negative parameter value. This suggests that as the length of training for a specialty increases, nonwhite females are less likely to choose that specialty.

The tables above highlight a range of differences between different demographic groups. It was found that white males and nonwhites show a preference for specialties with lower premiums with nonwhite males showing the greatest preference, whereas white females were not found to have a significant preference for lower premiums. Nonwhites showed a statistically significant preference for higher incomes with those graduating from a top tier school showing the highest preference, but whites showed no significant marginal utility for changes in income. Nonwhite females were found to have a significant preference for specialties with a shorter

length of training (with the older groups showing the most preference), but no other group was found to have a significant marginal utility for longer or shorter lengths of training. White males, particularly those who graduated at a younger age, showed a higher preference for technique-oriented specialties. Older white females and all nonwhite groups, except for nonwhite males who graduated from a top tier school at a young age, were found to have a higher marginal utility for person-oriented specialties with nonwhite females showing the highest preference.

The results above show a number of notable findings. First, in the cases where the parameter for income was statistically significant, it was positively related to physician specialty choice for all demographic types. Also, in the cases where malpractice premium was statistically significant it was found to be negatively related to physician specialty choice across demographic types, as one would expect. However, hours per week was positively related and uncontrollable lifestyle was positively related in all demographic types, which was not expected. These are not predicted outcomes and may be an indication of some bias in the model or failure to include essential variables. Residency length was found to be negatively related to specialty choice, and was at a higher significance with demographic types that include older graduates, suggesting that older graduates more consistently place a high value on completing residency earlier. Concerning person vs. technique orientation, the combination of characteristics white and male are associated with a higher utility for technique-oriented specialties, whereas nonwhites and females are predicted to have a higher utility for person-oriented specialties. Income was also only found to be significant for nonwhites, suggesting that income is more of a factor for nonwhites than for whites.

Before any conclusions are made concerning the implications of these parameter values, I should note that it is quite likely there is some interaction among the variables. For example, the

total number of hours worked per week in a specialty is considered when determining whether the lifestyle for that specialty is controllable or not, leading one to believe that there is a correlation between the hours per week and controllability variables. There is also likely a correlation between hours worked per week and income and uncontrollability and income because physicians are likely to demand additional income as compensation for working for more hours or with a less controllable lifestyle.

Conclusion

The results of this paper have shown strong support for the idea that specialty choice is positive related to income and negatively related to malpractice premium cost. If policy makers hope to increase the supply of primary care doctors, enacting policies that enable primary care doctors to achieve higher incomes would be an advisable place to start. Income is an especially important target because it is where the greatest disparity exists between primary care doctors and non-primary care doctors. Enacting policies that decrease the cost of malpractice premiums for primary care doctors could also be an effective means of shifting the distribution of doctors. However, these are not new ideas. One of the more fascinating findings is the difference in income preference for whites and nonwhites. If it were found that race were correlated with financial stability in childhood, this would likely mean that as financial stability in childhood decreases a physician is more likely to show an increased preference for higher income. Another of the more interesting findings is the difference between whites males and other demographic types in their preference for specialty orientation. Because other demographic types show a higher preference for person-oriented specialties (of which, primary care comprises a large proportion) and older graduates show higher preference for shorter residencies (primary care residencies are on average shorter than non-primary care residencies), providing means for these

demographic groups to go to medical school may help to achieve a more suitable distribution of physicians. However, before enacting any policy changes, it is necessary to conduct further analysis using more recent data to either verify the consistency of these findings or to illustrate a change in marginal utilities for specialty parameters or demographic groups. To expand on this research, a more geographically broad and larger database should be used. This could provide information about how geography is associated with certain specialty choices and would likely provide more robust statistics. Also, including more recent data would be more likely to approximate the marginal utility parameters for today's population better. Lastly, performing a dynamic model to see if and how marginal utility parameters change over time for different demographic groups could be especially useful and could be used to determine the effects of certain policy changes on physicians' preferences.

Appendix

	Income	Malpractice Premium	Hours/week	Uncontrollable	Length of Training	Person
WMTY	0.011	-0.075***	0.099*	2.084***	0.058	-1.114**
	(0.0077)	(0.0217)	(0.0510)	(0.3576)	(0.3379)	(0.4766)
WMTO	0.011	-0.063***	0.073	1.671***	-0.065	-0.728
	(0.0072)	(0.0201)	(0.0476)	(0.3353)	(0.3163)	(0.4441)
WMLY	0.003	-0.069***	0.122***	1.477***	0.083	-0.789*
	(0.0066)	(0.0187)	(0.0439)	(0.3153)	(0.2906)	(0.4052)
WMLO	0.003	-0.057***	0.097**	1.064***	-0.039	-0.403
	(0.0060)	(0.0168)	(0.0400)	(0.2897)	(0.2652)	(0.3665)
WFTY	0.007	-0.022	0.007	1.391***	-0.288	-0.066
	(0.0072)	(0.0202)	(0.0475)	(0.3324)	(0.3152)	(0.4453)
WFTO	0.007	-0.009	-0.019	0.978***	-0.410	0.320
	(0.0066)	(0.0185)	(0.0439)	(0.3083)	(0.2919)	(0.4104)
WFLY	-0.001	-0.016	0.030	0.784***	-0.262	0.259
	(0.0060)	(0.0170)	(0.0398)	(0.2864)	(0.2639)	(0.3679)
WFLO	-0.001	-0.003	0.005	0.371	-0.385	0.645**
	(0.0053)	(0.0149)	(0.0354)	(0.2580)	(0.2356)	(0.3248)
NMTY	0.025***	-0.129***	0.147***	1.587***	-0.073	0.350
	(0.0070)	(0.0196)	(0.0460)	(0.3193)	(0.3039)	(0.4297)
NMTO	0.025***	-0.116***	0.122***	1.174***	-0.196	0.736*
	(0.0064)	(0.0178)	(0.0422)	(0.2941)	(0.2797)	(0.3934)
NMLY	0.017***	-0.122***	0.171***	0.980***	-0.048	0.674*
	(0.0058)	(0.0162)	(0.0380)	(0.2711)	(0.2503)	(0.3488)
NMLO	0.017***	-0.110***	0.145***	0.567**	-0.170	1.061***
	(0.0050)	(0.0140)	(0.0333)	(0.2409)	(0.2203)	(0.3030)
NFTY	0.021***	-0.075***	0.055	0.894***	-0.418	1.397***
	(0.0064)	(0.0179)	(0.0421)	(0.2908)	(0.2785)	(0.3947)
NFTO	0.021***	-0.062***	0.030	0.481*	-0.541**	1.784***
	(0.0057)	(0.0160)	(0.0379)	(0.2629)	(0.2519)	(0.3549)
NFLY	0.013**	-0.069***	0.079**	0.287	-0.393*	1.722***
	(0.0050)	(0.0142)	(0.0331)	(0.2369)	(0.2187)	(0.3047)
NFLO	0.013***	-0.056***	0.053*	-0.126	-0.516***	2.108***
	(0.0042)	(0.0116)	(0.0277)	(0.2017)	(0.1836)	(0.2510)

Race	Gender	Tier of Medical School	Age at Graduation
N = Nonwhite	F = Female	L = Not top tier	O = age greater than 28 years
W = White	M = Male	T = Top tier	Y = age less than or equal to 28 years

In the following tables: *, **, *** refers to the level of significance of the conditional logit coefficients
* $p < .1$, ** $p < .05$, *** $p < .01$; (two-tailed test).
( ) represents the standard error of the parameter

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