Practice Location Choice by New Physicians: The Importance of Malpractice Premiums, Damage Caps, and Health Professional Shortage Area Designation

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Objective. To understand the factors affecting the choice of initial practice location by new physicians.

Data Sources/Study Setting. A unique survey of exiting medical residents in New York State from 1998 to 2003.

Study Design. We estimate conditional logit models to examine the factors affecting the choice of initial practice location by new physicians.

Data Collection/Extraction Methods. We identify all physicians completing their training in obstetrics/gynecology or surgery and primary care physicians (PCPs) (general internal medicine, pediatrics, and family medicine) who had accepted a job in patient care and who provided the location (zip code) of their job. This resulted in 3,758 physicians in our sample.

Principal Findings. Our results indicate that malpractice insurance premiums are a significant deterrent for surgeons, but they do not appear to deter OB/GYNs or PCPs from locating in particular areas. In addition, caps on malpractice damage awards attract surgeons to areas. Shortage area designations attract PCPs without education debt yet deter PCPs with debt, suggesting that subsidies do not outweigh the perceived costs of locating in underserved areas.

Conclusions. In general our results highlight that new physicians are sensitive to the characteristics of the locations in which they could potentially locate when beginning their careers in patient care.

Key Words. Malpractice insurance, health professional shortage area, medical residency training, location choice

Physician location decisions have long-lasting effects on the supply of health care available in a given market. Once a physician decides on his or her initial location, it is costly to relocate because acquiring a panel of patients and

getting credentialed at area hospitals is time consuming for most physicians. Our study is aimed at understanding the factors affecting the choice of initial practice location by new physicians. Three aspects of the physician market are of particular interest: (1) the impact of malpractice insurance premiums, (2) state damage award caps, and (3) federal policies aimed at encouraging physicians to practice in underserved areas. The study of *newly graduated* physicians represents a distinct advantage over prior research, as understanding the factors that affect initial location choice for physicians is particularly important because of the long-lasting labor force implications of the decision.

The literature regarding physician practice location has shown that location and personal characteristics can influence the choice of practice location. A number of location factors and personal characteristics have been studied previously, including population density, hospital location, demographics, and financial factors (Newhouse et al. 1982; Escarce et al. 1998; Polsky et al. 2002). Krist et al. (2005) showed that Title VII funding for health professionals was significantly associated with the number of family physicians working in rural and low-income areas.

Previous studies, however, have not examined the relationship between location choice by new physicians and area characteristics such as malpractice insurance premiums and federal programs, nor have they looked at the potentially interactive effect on location choice of factors including personal characteristics, local characteristics, and malpractice insurance premiums. Considerable attention has focused on the role of malpractice insurance premiums in influencing physicians' decisions to continue to practice in particular areas, alter their medical treatment practices, and retire early; this situation has been termed a "crisis" in both the popular press and the scientific literature (see, e.g., Mello, Studdert, and Brennan 2003; Tabarrok 2006). Despite the widespread attention there has been little empirical research documenting the impact of recent increases in malpractice insurance premiums on physician behavior. An exception to this is work by Kessler, Sage, and Becker (2005) who found that state tort reform laws intended to restrict the growth of malpractice insurance premiums led to an increase in

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high-malpractice-premium specialty physicians due to reduced retirements and increased entry into practice. Along with unease regarding malpractice insurance premiums, concern has been raised regarding the inadequate supply of physicians in medically underserved areas. Despite federal and state government programs such as the National Health Service Corps (NHSC), which attempt to address the perceived maldistribution of primary and specialty physicians by encouraging physicians to work in underserved areas, research examining the impact of these federal programs is limited.

Previous studies often have been restricted to examining the “stock” of physicians in a given state or city as opposed to the “flow” of new physicians entering a given market. This limitation, consequently, makes it difficult to understand how physicians entering the field make choices regarding their practice locations. In addition, much of the prior research has used the AMA Physician Masterfile, which has some notable shortcomings. The AMA data do not adequately gather information on race and ethnicity, and they provide imprecise location information. Konrad et al. (2000), for example, found that the Masterfile overestimates rural physician supplies by 20 percent.

Our study uses a unique dataset to examine the factors affecting the practice location choice of new physicians. Our results indicate that higher malpractice insurance premiums do not appear to be a deterrent to locating in a particular area for obstetrician–gynecologists (OB/GYNs), though they appear to be a significant factor for surgeons. State malpractice damage award caps appear to attract high medical malpractice specialties such as OB/GYNs and surgeons. Health professional shortage area (HPSA) designation appears to attract only those OB/GYNs and primary care physicians (PCPs) without education debt, which would suggest that subsidy and loan repayment programs are not necessarily outweighing the perceived costs of locating in areas designated as underserved.

CONCEPTUAL FRAMEWORK AND ANALYTIC APPROACH

We model the choice of initial practice location using a random utility model (McFadden 1981). The utility, U , derived by individual physician i from choosing location j is given by

$$U_{ij} = \beta X_{ij} + \varepsilon_{ij}; \quad i = 1, 2, 3, \dots, I; \quad j = 1, 2, 3, \dots, J \quad (1)$$

where X_{ij} represents a set of location attributes, β is a vector of parameters, and ε_{ij} is an error term. Assuming that physicians choose the option for which each

obtains the maximum utility, the probability that physician i chooses option j is $\Pr(U_{ij} > U_{ik})$ for all $k \neq j$ (Greene 2003). Put differently, we assume that utility has a random component leading to a probabilistic representation of individual choice behavior.

We use a conditional logit model to empirically estimate the random utility model. Hence we express the probability of individual i choosing option j as

$$\Pr(Y_i = j) = \frac{e^{\beta X_{ij}}}{\sum_{j=1}^J e^{\beta X_{ij}}} \quad (2)$$

A well-known aspect of the conditional logit model is that individual-specific characteristics that do not vary over the location choice set are not identified in the model. Consequently, the effect of individual characteristics can only be estimated insofar as their effect might differ based on differences in area characteristics; such effects can be modeled by including interaction terms between individual characteristics and location characteristics.¹

Because we observe location decisions for new cohorts of graduating residents over a 6-year period, we are afforded the opportunity to include metropolitan statistical area (MSA) fixed effects in order to control for numerous unobservable factors that might influence physician location choice. The presence of MSA fixed effects restricts the identifying variation of location attributes to *changes within-location over time*, which represents a stronger identification strategy but is also more demanding of the data as any time-invariant area effects are subsumed by the location fixed effect. One distinct benefit of MSA fixed effects is that, as we describe in the next section, our data come from medical resident surveys conducted at residency programs in New York State, a state that trains more physicians than any other. Because graduating residents are likely to remain in the same area in which they trained, regression models that do not control for MSA fixed effects could lead to potentially biased coefficient estimates, as this important individual-specific effect (location of training) is potentially confounded with area characteristics. By including location fixed effects we can control for much of the propensity to remain in the location in which the physician trained because the effect is essentially a fixed attribute of areas in New York.

Previous studies, though certainly not all, have used state as the unit of analysis for location choice (e.g., Hellinger and Encinosa 2003). However, for most states there exists substantial within-state variation in malpractice insurance premiums, cost of living, and physician-to-population ratios, for exam-

ple. There are also substantial practice cost variations within most states (Zuckerman, Welch, and Pope 1990). Thus, state may be too large a unit to effectively distinguish the effect of location characteristics on practice location choice. We follow Polsky et al. (2002) and use MSAs and the nonurbanized (rural) areas of each state as our choice set for the location decision. To define the nonmetropolitan areas of states, we create for each state a location that encompasses all nonmetropolitan counties of the state. The location options, J , to be used in the study are the 357 MSAs and nonmetropolitan areas within the United States.²

DATA

The data on new physician practice location choice come from the Center for Health Workforce Studies of the State University of New York at Albany, which has conducted the Annual Survey of Residents Completing Training each May and June for New York since 1998. Physicians are surveyed once and there is no subsequent follow-up. We obtained data on graduating residents from 1998 to 2003 for New York State. The dataset provides information on demographics, educational debt, education, residency training, specialty, practice setting and location (zip code), future job plans, and other variables on a new cohort of graduating residents each year of the survey (Center for Health Workforce Studies 2004a, b). Because we are interested in location choices for physicians beginning their professional career in patient care we did not include observations for graduating residents pursuing fellowship training or non-patient-care-oriented positions, which represented 55.1 percent of the total sample of 17,890 physicians. Physicians who at the time of the survey had not yet accepted a job, failed to report the practice location, or entered an invalid zip code or misspelled city names also were excluded from the sample (approximately 27 percent of the 9,854 entering patient care fields). After these exclusions the remaining sample consisted of 7,212 physicians.

Resident survey data are supplemented with malpractice premium data from the Medical Liability Monitor (MLM). Since 1991, the MLM has conducted an annual national rate survey of physician malpractice insurance premiums of major professional liability insurance companies. The MLM data report premiums for three specialties: internal medicine, general surgery, and obstetrics-gynecology. Annual premium information is presented as the average charged by each company for an entire state, regions within a state, counties, or metropolitan areas, though in most cases (34 states in 2003) the

Figure 1: Weighted Mean of Annual Malpractice Premiums by Specialty and Year

premium information is available only as a statewide average. Using the most geographically appropriate level of detail available in the MLM survey we calculate MSA and non-MSA average premiums for the three specialties contained in the data. For cases in which an area has multiple insurance companies we calculate the simple mean of the premiums. This is a limitation because a more appropriate measure would be the weighted average of premiums based on enrollment, but information on enrollment is unavailable.

Figure 1 displays population weighted averages of malpractice insurance premiums over time. Premiums grew quite slowly between 1998 and 2000, but they increased rapidly after 2000, with OB/GYN premiums increasing roughly 50 percent by 2003 and surgeon and internal medicine premiums increasing over 70 percent by 2003. In 2003 OB/GYN premiums were still nearly 1.5 times greater than premiums faced by surgeons and nearly five times greater than premiums faced by internal medicine.

In order to most appropriately match physicians to the malpractice insurance premiums they would likely face in different locations, we limit the sample of physicians to three groups: OB/GYNs, surgeons, and physicians who are plausibly likely to face premiums best approximated by those for internal medicine. We term this last group “primary care physicians,” which includes general internal medicine physicians, general pediatricians, and family physicians (Cooper 1994). Of the full 7,212 sample of physicians, 7

Table 1: Summary of Survey Response Rate and Sample Sizes and Patient Care Percentage by Year and Specialty

<i>Survey Response Rate</i>		<i>OB/GYNs</i>		<i>Surgeons</i>		<i>PCPs</i>	
<i>Year</i>	<i>%</i>	<i>n</i>	<i>%*</i>	<i>n</i>	<i>%*</i>	<i>n</i>	<i>%*</i>
1998	66	101	88	144	45	486	55
1999	73	91	79	121	46	480	52
2000	65	84	80	122	51	413	53
2001	65	78	80	123	46	387	49
2002	69	88	80	117	41	393	48
2003	64	65	71	97	38	368	50
Total	67	507	80	724	45	2,527	51

*Represents the percentage of the total residents pursuing patient care positions versus alternatives such as subspecialty training.

PCPs, primary care physicians.

percent of the sample members are OB/GYNs, 10 percent are surgeons, and 35 percent are PCPs. Thus, our final sample consists of 3,758 physicians.

Table 1 presents information on the sample by year and specialty. Note that for all three specialty groups in New York the absolute number of graduating residents entering patient care is falling over time, despite the fact that the overall survey response rate stayed roughly constant over the period. Because it is possible that there was a trend toward seeking greater subspecialty training or otherwise postponing entry into patient care fields, we examined the response to the question "What do you expect to be doing after completion of your current training program?" (presented in Table 1). A downward trend in the fraction of graduates entering patient care is evident, but it is not large enough to explain the decrease in the number of graduating residents going into patient care.³ While the overall response rate to the survey is a respectable 67 percent, we are nonetheless concerned about potential biases that might result from the somewhat low response rate. However, we have no reason to suspect that lack of response to the survey would be correlated with location choice; hence, we believe the extent of any selection bias to be minimal.

Information on the enactment of state medical liability law limiting noneconomic damage awards in malpractice cases was also acquired for our analysis (Hellinger and Encinosa 2003; Encinosa and Hellinger 2005). By 2003, 25 states enacted legislation capping the awards on noneconomic damages. The amount of the cap for noneconomic damages varies across these states, ranging from US\$250,000 to US\$750,000 (Studdert, Yang, and Mello

2004). Because our empirical model contains location fixed effects, only the five states that changed their laws regarding damage award limits during the period of our analysis (1998–2003) provide identifying information in our model. The five states that enacted laws were Mississippi and Nevada in 2002, and Florida, Ohio, and Texas in 2003. Research by Kilgore, Morrissey, and Nelson (2006) has demonstrated that malpractice insurance premiums are responsive to the enactment of damage caps. By including both premium information and damage award caps in our model we are in effect hypothesizing that new physicians might view the enactment of a damage cap as a signal that the state represents a more “friendly” medico-legal environment to physicians (or vice versa) above and beyond the effect of the current level of malpractice insurance premiums.

To account for federal policies designed to encourage physicians to practice in areas with perceived shortages, which are federally designated HPSAs, we use the coding available in the area resource file (ARF).⁴ Scholarship and loan repayment programs through the NHSC, rural Health Clinic reimbursements, and Medicare incentive payments for physicians are available for primary care (including OB/GYN) physicians willing to locate in designated HPSAs.

A number of additional local market characteristics were obtained from the ARF. These variables include the ratio of physicians to population, hospitals per capita, hospital beds per capita, total medical residents per capita, total births per capita, per capita income, area population, and the unemployment rate. In order to control for the possibility that salaries might compensate for high malpractice insurance premiums, we obtained information on average physician hourly wages at the MSA level from the 1998–2003 Occupational Employment Statistics Survey conducted by the Bureau of Labor Statistics. The physicians’ hourly wage in 1999–2003 was calculated for eight specialties, including internists, generalists, obstetricians and gynecologists, and surgeons.⁵ Because the dataset does not include hourly wages for non-MSA areas, we used the average physician hourly wage by state as a proxy for the hourly wage in the non-MSA regions of the state.

Several interaction effects are included in the model. To determine whether physicians with relatively high educational debt are more likely to practice in an HPSA than in a non-HPSA, we include an interaction term between our HPSA measure and educational debt. To examine the effect of the ethnic composition of the practice area, an effect documented in Polsky et al. (2002), interaction terms were created between variables for the physicians’ own race and the corresponding proportion of the population who were white, black, Asian, or Hispanic.

RESULTS

Table 2 provides descriptive statistics for physician demographic information and the characteristics of locations chosen by physicians in our sample, stratified by the three specialty types. OB/GYNs and surgeons are similar in several regards, though surgeons are more likely to be white and are much more likely to be men: among new surgeons, 85 percent are men while a third of new OB/GYNs are men. PCPs differ from OB/GYNs and surgeons in that PCPs are less likely to be U.S. citizens and are much more likely to have attended a medical school outside of the United States. PCPs are nearly evenly split between men and women.

The bottom half of Table 2 displays characteristics of the location chosen by physicians in the survey. Malpractice insurance premiums average nearly US\$70,000 annually for OB/GYNs and roughly half that figure for surgeons. PCPs by contrast faced premiums of roughly US\$13,000 per year. Beyond the striking difference in malpractice insurance premiums, location differences between the three specialist types were not readily apparent. Surgeons appeared somewhat more likely to locate in states with malpractice damage award caps. OB/GYNs tended to locate in areas with relatively more births per capita and with more total physicians per capita as compared with surgeons and PCPs. However, it is difficult to infer what factors had the most influence on new physician location decisions from descriptive statistics because they do not account for the alternative options available to physicians. Our regression models allow us to control for the characteristics of other options available to physicians.

Table 3 displays the most common locations (MSAs) in which survey respondents chose to work. Not surprisingly New York City was the most frequently chosen option for all three specialty groups; roughly one-fifth to one-third of physicians in the sample located in New York City. The second most common location was Nassau-Suffolk Counties, NY (Long Island). The only non-New York State location in the top 5 was Boston for OB/GYNs and Bergen-Passaic, NJ for surgeons. The only nonmetropolitan area in the top 5 for any specialty group was rural New York State for PCPs.

Table 4 displays the estimated regression results of the conditional logit model. The first row shows the impact of malpractice insurance premiums on location choice. The impact of malpractice insurance premiums on location choice for OB/GYNs is positive though not statistically significant, while for surgeons the coefficient is negative and significant; the coefficient estimate for PCPs is not statistically significant. The coefficient estimates for state damage

Table 2: Summary Statistics of Personal Characteristics and Characteristics of Locations Chosen by Physicians Trained in New York, 1998–2003

<i>N</i>	<i>OB/GYNs</i>		<i>Surgeons</i>		<i>PCPs</i>	
	507		724		2,527	
<i>Variable</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
<i>Personal characteristics</i>						
Age	32.29	3.93	33.42	3.08	32.98	5.17
U.S. citizen	0.95	—	0.97	—	0.80	—
Non-U.S. medical school	0.12	—	0.11	—	0.49	—
Race and ethnicity						
White	0.56	—	0.67	—	0.46	—
Black	0.14	—	0.04	—	0.08	—
Asian	0.20	—	0.19	—	0.33	—
Hispanic	0.04	—	0.05	—	0.07	—
Other	0.05	—	0.04	—	0.04	—
Gender (male)	0.33	—	0.85	—	0.53	—
Educational debt						
US\$0	0.19	—	0.26	—	0.41	—
< US\$100,000	0.43	—	0.43	—	0.31	—
≥ US\$100,000	0.36	—	0.30	—	0.27	—
<i>Location characteristics</i>						
Malpractice premiums	69,139.78	27,859.74	33,922.87	17,864.44	12,793.46	6,203.57
State with malpractice damage cap	0.17	0.38	0.23	0.42	0.17	0.37
Physician hourly wage	66.93	11.94	71.14	12.20	57.24	12.23
Health professional shortage area	0.13	0.10	0.12	0.10	0.14	0.13
Unemployment rate	0.05	0.02	0.05	0.01	0.05	0.02
Per capita income	35,007.72	6,747.51	33,267.66	7,602.51	32,904.18	7,739.83
Proportion of population by age						
0–14 years old	21,013.01	1,436.42	21,000.92	1,719.94	20,976.86	1,628.03
> 65 years old	12,543.52	1,947.79	12,833.66	2,682.51	13,091.68	2,319.91
Proportion of population by race						
White	60.93	20.59	65.37	19.66	64.86	21.09
Black	18.26	11.03	15.74	10.43	16.01	10.93
Asian	6.12	4.15	5.41	5.64	5.40	5.12
Hispanics	16.05	11.90	14.18	12.16	14.64	12.72
Other	0.70	1.68	0.70	1.84	0.79	1.91
Births per 100,000 population	1,428.65	174.79	1,406.30	196.91	1,399.77	201.65
Same-specialty physician per 100,000 population	15.90	5.26	22.69	38.67	36.88	25.67
All physicians providing patient care per 100,000 population	319.14	96.98	284.80	108.23	286.92	111.86
Resident physicians per 100,000 population	65.72	40.54	51.04	41.83	54.35	41.70
Hospital beds per 100,000 population	402.26	109.67	389.56	118.01	400.83	108.27
Number of hospitals per 100,000 population	1.53	0.96	1.65	1.06	1.75	1.19

PCPs, primary care physicians.

Table 3: Top 5 Locations Chosen by New Physicians for Initial Practice Location, 1998–2003

<i>Number of Locations Chosen</i>	<i>OB/GYNs</i>		<i>Surgeons</i>		<i>PCPs</i>	
	<i>N = 507</i>		<i>N = 724</i>		<i>N = 2,527</i>	
	<i>103</i>		<i>190</i>		<i>258</i>	
	<i>Rank</i>	<i>%</i>	<i>Rank</i>	<i>%</i>	<i>Rank</i>	<i>%</i>
New York, NY, PMSA	1	37.87	1	22.93	1	30.91
Nassau-Suffolk, NY, PMSA	2	8.68	2	5.25	2	8.9
Buffalo-Niagara Falls, NY, MSA	5	2.37	4	2.35	3	4
Rochester, NY, MSA	3	3.75	—	—	4	2.97
New York State, Non-MSA	—	—	—	—	5	2.89
Syracuse, NY, MSA	—	—	5	2.35	—	—
Bergen-Passaic, NJ, PMSA	—	—	3	2.62	—	—
Boston, MA-NH, PMSA	4	2.76	—	—	—	—
Median probability		4.12		1.11		2.82

PMSA, primary metropolitan statistical area; MSA, metropolitan statistical area; PCP, primary care physician.

award caps are both positive for OB/GYNs and surgeons though only the surgeon coefficient is statistically significant. The coefficient for PCPs is small and not statistically significant.⁶

The next set of coefficients estimates refer to the estimated fraction of the MSA defined as an HPSA. In order to test whether certain physicians might be more likely to respond to HPSA incentives, we include interaction terms between physician debt levels (debt greater than zero but below US\$100,000 and debt above US\$100,000 [no debt omitted category]) and the HPSA index. The results show OB/GYNs and surgeons are generally unresponsive to shortage areas regardless of debt level. However, the results indicate that PCPs with no debt are significantly more likely to locate in areas with higher HPSA values. By contrast, PCPs with higher levels of debt are significantly less likely to locate in designated shortage areas.

Other results in Table 4 indicate interaction terms between a physician's own race/ethnicity (black, Hispanic, Asian, and other [white omitted]) and the corresponding proportion of the population that is black, Hispanic, Asian, or other. The results suggest that in most instances the likelihood of locating in an area increases with the fraction of the population that reflects a physician's own race/ethnicity.

To appreciate the magnitude of the effect sizes from the conditional logit models, in Table 5 we transform selected coefficients into relative risks in

Table 4: Conditional Logit Model Results for Physician Location Choice

	<i>OB/GYNs</i>	<i>Surgeons</i>	<i>PCPs</i>
Malpractice premiums (US\$1,000s)	0.0076 (0.0087)	− 0.0235 (0.0073)**	0.0264 (0.0158)
Damage award cap	0.1482 (0.6248)	1.3004 (0.4051)**	0.0561 (0.2417)
Health professional shortage area	0.4580 (1.4424)	− 0.8410 (1.0801)	1.2158 (0.3798)**
Educational debt > 0, < US\$100,000 *HPSA	− 1.9821 (1.3061)	− 0.2624 (1.1526)	− 2.2636 (0.4406)**
Educational debt ≥ US\$100,000 *HPSA	− 0.7178 (1.2287)	1.5073 (1.0691)	− 4.0567 (0.5963)**
Physician hourly wage	0.0216 (0.0321)	0.0372 (0.0248)	− 0.0100 (0.0107)
Unemployment rate	− 3.0219 (12.8860)	8.4512 (9.7231)	4.5856 (5.2664)
Per capita income in thousands of dollars	0.0378 (0.0855)	0.0466 (0.0676)	0.0886 (0.0442)*
Proportion of population age 14 or younger	− 0.0005 (0.0003)	0.0001 (0.0002)	− 0.0001 (0.0001)
Proportion of population age 65 or order	− 0.0001 (0.0003)	− 0.0003 (0.0002)	0.00005 (0.0001)
Proportion of black population	− 0.0915 (0.1059)	0.0031 (0.0779)	0.0731 (0.0470)
Proportion of Asian population	− 0.1651 (0.1808)	0.1152 (0.1205)	0.0212 (0.0655)
Proportion of Hispanic population	0.2072 (0.1001)*	− 0.0714 (0.0671)	0.0218 (0.0347)
Proportion of other population	− 0.7533 (0.7386)	− 0.1199 (0.5863)	− 0.0152 (0.2423)
Births per 100,000 population	0.0012 (0.0023)	− 0.0025 (0.0015)	0.0002 (0.0009)
Same-specialty physicians per 100,000 population	0.0448 (0.0474)	0.0017 (0.0024)	0.0016 (0.0024)
All patient care physicians per 100,000 population	− 0.0161 (0.0135)	− 0.0018 (0.0075)	− 0.0059 (0.0061)
Resident physicians per 100,000 population	0.0042 (0.0203)	0.0233 (0.0178)	0.0007 (0.0117)
Hospital beds per 100,000 population	0.0025 (0.0033)	0.0011 (0.0022)	0.0028 (0.0013)*
Number of hospitals per 100,000 population	0.0447 (0.7195)	− 0.6285 (0.4794)	− 0.3825 (0.3162)
Proportion of black population × black physician	0.0427 (0.0135)**	0.0197 (0.0199)	0.0633 (0.0085)**
Proportion of Asian population × Asian physician	0.0722 (0.0316)*	0.0396 (0.0190)*	0.0171 (0.0197)

continued

Table 4. *Continued*

	<i>OB/GYNs</i>	<i>Surgeons</i>	<i>PCPs</i>
Proportion of Hispanic population $\times$ Hispanic physicians	0.0603 (0.0173)**	0.0389 (0.0134)**	0.0325 (0.0058)**
Proportion of other population $\times$ other race physician	-0.4752 (0.7423)	-0.7886 (0.7546)	0.0629 (0.0318)*
Observations	43,792	99,382	341,859
Number of physicians	507	724	2,527

Robust standard errors in parentheses. Regressions control for location fixed effects.

*Significant at 5%.

**Significant at 1%.

order to make hypothetical comparisons between locations that differ in specific ways. In the case of malpractice insurance premiums we calculate the difference in the relative risk of locating in a county with a 20 percent higher malpractice premium, all else constant. We observe in Table 5 that surgeons are roughly 15 percent less likely to locate in an area with a 20 percent higher malpractice premium (roughly US\$6,000 per year). The second row of Table 5 indicates relative risks associated with the presence of a state damage award cap. We observe considerable response on the part of surgeons to state damage caps: given two otherwise identical counties, a new surgeon is more than three times as likely to choose the location that features a state damage award cap.

The last rows of Table 5 indicate the relative risks associated with locating in an HPSA area stratified by the level of educational debt. The results

Table 5: Relative Risks of Physician Location Choice from Conditional Logit Models

	<i>OB/GYNs</i>	<i>Surgeons</i>	<i>PCPs</i>
Malpractice premiums (20% change)	1.111	0.852**	1.070
Damage award cap	1.160	3.671**	1.058
Health professional shortage area	1.581	0.431	3.373**
Educational debt greater than 0 but less than US\$100,000 $\times$ HPSA	0.138	0.769	0.104**
Educational debt US\$100,000 or more $\times$ HPSA	0.488	4.515	0.017**
Observations	43,792	99,382	341,859
Number of physicians	507	724	2,527

Estimates calculated from results displayed in Table 4.

**Significant at 1%.

HPSA, health professional shortage area.

for PCPs suggest that for a physician with no debt (the omitted debt category) he or she would be three times more likely to locate in the MSA that is a shortage area, all else constant. However, the presence of any educational debt leads a physician to be far less willing to locate in the shortage area. The pattern observed for PCPs is similar for OB/GYNs though the estimates are not statistically significant.

DISCUSSION

Our study examined the impact of local characteristics on the practice location choices for newly trained physicians between 1998 and 2003. By examining the behavior of new physicians we are able to isolate the effects of policies on a group of physicians that have the greatest discretion over their location decision and whose decisions have long-lasting effects on local health care markets. A number of important findings emerge from our analysis. First, the widely reported recent increases in malpractice insurance premiums do not appear to be an important factor affecting the location decision for OB/GYNs. By contrast, malpractice insurance premiums are found to have a statistically significant and economically meaningful effect on practice location for surgeons.

It is not immediately obvious why new OB/GYNs are not sensitive to changes in premiums. A possible explanation is that the OB/GYN labor market might be better able to pass on increases in malpractice insurance premiums in the form of either higher salaries or higher reimbursement rates for procedures, though it is not clear why this would not be true for other specialties. Indeed, Rodwin, Chang, and Clausen (2006) examined data from an AMA physician survey and found practice revenue declined nationally for specialties except for OB/GYNs. Their study also shows that malpractice insurance premiums are only a small proportion of practice expenses for OB/GYNs. However, their data only cover the period between 1996 and 2000, which might not capture the effect of the more recent steep rise in malpractice insurance premiums. Other previous research on the general topic has been somewhat mixed: Mello and Kelly (2005) found that malpractice insurance premiums were important determinants of physician location decisions, yet Baicker and Chandra (2004) and Robinson et al. (2005) did not find malpractice insurance premiums to be an important determinant. None of the previous research, however, focused on the behavior of new physicians.

The second key finding of our study is that surgeons appear significantly more likely to locate in areas with a cap on malpractice damage awards. Our

findings are in line with previous research that has suggested that damage caps have a positive effect on location decisions (Hellinger and Encinosa 2003; Klick and Stratmann 2004; Kessler, Sage, and Becker 2005). The result suggests that states can at the margin influence the location decision of some specialists by presumably making the medico-legal environment in the state more inviting.

The third important finding of our study is that we are the first to directly consider HPSAs as a factor potentially influencing new physician location choice. The empirical results suggest that OB/GYNs and PCPs without educational debt are attracted to HPSAs, though only the result for PCPs is statistically significant. The limited prior research on the topic has not examined the role of educational debt in the location choice decision. Despite the available incentive programs, our results suggest that physicians with significant amounts of debt do not perceive the potential benefits from subsidy programs such as these to make up for other aspects of working in an HPSA. Our findings suggest that policy makers may need to reconsider the programs in terms of financial incentives for physicians.

One potential concern regarding the HPSA finding is that some financial assistance programs for medical students and physicians beginning their career are in exchange for a commitment to work in an HPSA. Thus, *lower* debt from receipt of previous or contemporaneous debt reduction could be correlated with locating in an HPSA, consistent with our finding. Unfortunately, the survey data do not allow us any greater specificity in debt measurement to discern whether the reported amount is before or after any loan repayments (intended or received). Incentive programs for physicians and medical students can be broadly classified as either scholarship programs for medical students and loan repayment assistance after graduation (Pathman et al. 2004). Both are predicated on physicians committing to work in designated shortage areas. Of the two, scholarship programs have the greater potential to create the potential bias feared in our analysis (debt reduction resulting in an increased likelihood of working in an HPSA); loan repayment programs by contrast are based on service *after the fact*, meaning that the programs are structured such that each year of practice in a shortage area results in debt repayment of up to US\$25,000 per year for the NHSC. However, scholarship programs are quite small: for example, in 2003 the NHSC spent US\$31.4 million in loan repayments to 320 physicians and scholarship awards for 70 medical students (Silva 2004). Given that in 2004 there were nearly 15,000 graduating medical students who applied for residency programs it is likely that the extent of any bias from this mechanism is quite small, though

there remains the possibility that our estimates overstate the true relationship between debt and HPSA location choice.

Our research while informative along a number of dimensions has some important limitations. The first is the fact that data are only from one state. The state in question, New York, trains more residents than any other state, but location choices from graduating residents in the two states may not accurately reflect location decisions nationally. We also are selecting the subsample of graduating residents that choose to begin their careers in patient care, for only three specialties, versus continuing their training. While we feel these sample restrictions were justified based on the availability of malpractice premium data and the lack of an obvious manner in which the choice to pursue more training versus begin practicing could be integrated into the analysis, we recognize that the location choices of the omitted individuals may differ from the choices of the physicians we studied. Finally, it is possible that unobserved time varying area characteristics might be correlated with both the decision to locate in a given area and the malpractice premiums, leading to potentially biased coefficient estimates.

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NOTES

1. It should also be noted that year dummies and time trends represent person-specific characteristics that are not identified in the conditional logit model.

We re-estimated our models with year dummies interacted with the malpractice premium and did not find any statistically significant differences between coefficients over time.

2. Because we know the zip code associated with the practice location for new physicians in the case of MSAs that cross state borders we are able to define the state-appropriate portion of the MSA and assign the correct malpractice premium and damage cap regime.
3. It is possible that medical students might be selecting alternative specialties over the time period of our study; however, specialty choice is beyond the scope of this analysis.
4. The ARF coded counties on the basis of whether none, all, or part of the county was an HPSA. For cases in which part of the county was an HPSA, lacking specific information on what fraction of the county was an HPSA, we proxied with the percentage of persons in poverty in the county. Then, to obtain an MSA-level measure reflecting the degree to which the MSA was an HPSA, we aggregated across the counties making up the MSA weighting by population and the HPSA fraction (0, 1, or the percentage of the population in poverty proxy measure).
5. In 1998, physician wages were not categorized into specialties. We did a linear extrapolation for each MSA in 1998 using the 1999–2003 data to derive physician hourly wage for each specialty in 1998.
6. The findings for damage award caps in particular highlight the importance of controlling for location fixed effects. Recall that many new physicians in our data set choose to locate in New York State, presumably because they trained there. But New York is also a state without a damage cap. Hence, a spurious correlation results whereby the propensity to locate in an area without a damage cap leads to the appearance of a negative relationship between damage caps and location choice [results without fixed effects not displayed but available upon request of the authors]. When fixed effects are included in the regression the identifying variation in damage award caps is restricted to within-location changes over time. Thus, the lack of damage caps in New York State throughout the period, for example, does not represent a change that might be observed to alter choice behavior. In contrast, the five states that implemented damage caps during the period provide the identifying variation on which the fixed effects estimated coefficients are based.

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SUPPORTING INFORMATION

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Appendix SA1: Author Matrix.

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