Gender Segregation by Specialty during Medical School

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Over the past 30 years, the representation of women in the active physician workforce climbed from 6.8% in 1970 to 23.0% in 1997.[1] Moreover, women's presence in medicine will continue to grow, because 45.8% of all U.S. first-year medical students in 2000 were women.[2] By 2010, women physicians are projected to constitute 29.4% of U.S. physicians.[1] In spite of this dramatic progress, women physicians remain concentrated in relatively few, lower-income medical specialties[3] and are less likely than are men to hold tenured faculty positions.[4]

In addition to their effects on women physicians, gender disparities in medicine may have implications for patient care. Patients who desire providers of a specific sex but cannot access them may be more reluctant to seek medical care initially and less compliant when they ultimately end up with providers whom they do not trust. Having providers of a specific sex has been shown to influence the satisfaction of women seeking prenatal care,[5] and satisfaction has been associated with patients' compliance.[6] It follows that a similar preference for women physicians may exist for women seeking other types of sensitive care, such as treatment for breast cancer or urologic disorders. Although the supply of women obstetricians has grown substantially, the availability of women breast surgeons and urologists remains very low. Further, data suggesting that substantial numbers of women prefer women primary care physicians may imply that some women prefer to see women providers for all of their health care needs. In addition, a number of studies have suggested that women physicians differ from their men counterparts with respect to time spent with patients[7] and attention devoted to preventive health.[8] Women physicians may also treat certain conditions more aggressively.[9] Thus, the presence of women across a broad range of specialties may affect patient care in a number of different ways.

There is extensive literature investigating why men and women medical students pursue different specialties. These studies suggest that demographic characteristics, personal values, and/or unique family responsibilities are responsible for gender differences in specialty choice.[10–12]

Surprisingly, little effort has been made to assess the role of academic experience in promoting gender segregation across specialties. Coffin and Babbot found that the gender disparity in interest in pediatrics grew during medical school.[13] Several studies have documented an association between medical school experiences and specialty choices, and at least one study suggests that women and men have different experiences in medical school.[13,14]

In this study, we used the well-established sociologic concept of segregation to describe differences in distributions. We specifically examined how gender segregation across specialties has changed during the past 20 years and how gender segregation changes during medical school. In so doing, we began to assess whether the entry of women into medicine: (1) causes the profession to become woman-dominated; (2) exacerbates the concentration of women in a few, lower-income, specialties; or (3) encourages the equal representation of men and women in the profession.

This analysis sheds light on whether specialties are continuing to integrate, as Jacobs found for the 1970s and 1980s, or whether a process of resegregation by gender is occurring in the medical profession, as Reskin and Roos suggest.[15,16] The analysis also indicates whether the process of gender segregation is fixed at entrance to medical school, or reproduced during medical school.

Methods

The primary data for this study were from the Jefferson Longitudinal Study of Medical Education.[17] The study represents an annual panel of students entering Jefferson Medical College since 1964. It contains information about students prior to, during, and after medical school. We limited our analysis to the cohorts who began their medical education in 1975 or later and who graduated between 1979 and 2000. These cohorts have complete data on specialty plans as freshmen and seniors. They included 1,275 women and 3,037 men, for a total of 4,312 analytic subjects. The representation of women increased over the course of the study. Women constituted 26.7% of students in the entire sample. They were 18.9% of students matriculating between 1976 and 1980 and 37.1% of students matriculating between 1991 and 1995.

Recently, the characteristics of the Jefferson student body have closely resembled those of the national population of medical students in important respects, such as average Medical College Admission Test (MCAT) science score and scores on the U.S. Medical Licensing Examination.[2,18] Between 1995 and 1999, 43.0% of matriculants to medical schools were women and 18.5% were Asian. The corresponding figures at Jefferson were 36.7% and 19.5%. Finally, 7.6% of matriculants between 1995 and 1999 were Black. At Jefferson, the figure was lower, at 2.9%.

We used nationally representative data from medical students during the 1990s to assess the generalizability of trends at Jefferson. These data come from the Association of American Medical Colleges' (AAMC's) graduating student questionnaire (GQ), which is administered to all fourth-year medical students in the country. The key outcome of interest in this analysis was students' responses to questions about their intended specialties.

In this analysis, we collapsed choices into the following ten broad categories: (1) anesthesiology, pathology, and radiology, referred to as hospital-based specialties; (2) emergency medicine; (3) family practice; (4) internal medicine; (5) obstetrics–gynecology; (6) ophthalmology; (7) pediatrics; (8) psychiatry; (9) surgery; and (10) other. There were a total of 11 categories in our analysis because undecided students formed their own group. We used collapsed categories because of sample-size constraints. The sample did not allow an assessment of segregation among 25 specialties unless all the data were aggregated and time trends were ignored.

Collapsing detailed specialty characteristics inevitably results in some loss of precision. However, that loss was limited in this case. We found that our collapsed specialties captured over 90% of the segregation revealed by the 25 fields for Jefferson first-year students, Jefferson fourth-year students and AAMC–GQ fourth-year students.

Our analysis had two phases. First, we documented changes over time, and between the first and the fourth years, in the levels of gender segregation across specialties. We then examined the relative odds of women's representation in specific fields.

We used the standard measure of segregation, Duncan's index of dissimilarity (D), for the first phase of our analysis.[19] D is interpreted as measuring the proportion of men or women who would have to change specialties in order to produce an even distribution across all specialties. D measures the difference between the allocation of women across fields and the allocation of men across fields. For example, if 1% of all women intend to pursue surgery

Table 1. Gender Distribution at Jefferson Medical College as Depicted by the Index of Dissimilarity, Duncan's D*

Year of Matriculation	Segregation of All Students			Segregation of Students Who Elected a Specialty		
	D for All First-year Students	D for Fourth-year Students	Change in D: First- vs-fourth-year Students (%)	D for Decided First-year Students	D for Decided Fourth-year Students	Change in D: First- vs-fourth-year Decided Students (%)
1976–1995 combined	16.3	21.5	31.90	23.3	21.4	−8.2
Period 1—1976–1980	15.5	16.4	5.80	16.1	18.3	13.60
Period 2—1981–1985	16.9	24.8	46.70	27.2	27.5	1.10
Period 3—1986–1990	16.9	27.8	64.50	26	31.5	21.20
Period 4—1991–1995	24.2	27.4	13.20	40.2	29.3	−36.90

*The index of dissimilarity, or D, is the sum of half the absolute value of the difference between the percentages of women and men in each medical specialty. For example, between 1976 and 1980, 11.1% of female first-year students and 18.3% of male first-year students indicated that surgery was their preferred specialty. The absolute value of (18.3 − 11.1)/2 is 3.6, or the contribution of surgery to D between 1976 and 1980. Total D for first-year students between 1976 and 1980 equals the sum of each field's contribution to D.

and 10% of all men intend to pursue surgery, then the absolute value of the difference is 9%. D equals half of the sum of these individual differences.

We produced two sets of D for our analysis, one for all students and one for students who elect particular specialties as first-year students. We calculated the second set of Ds to determine whether the inclusion of first-year "undecideds" affected our results. Since the group of "undecideds" was large (36.5% first-year students overall and 40% of matriculants between 1991 and 1995) and generally integrated, they could have distorted the implications of D. (Women appeared among the "undecideds" roughly in proportion to their presence among students in general, especially since 1981.) Statistical analysis used the chi-square and jackknife tests to assess changes in the D statistic.

Results

Table 1 compares the indices of segregation for first- and fourth-year students between 1976 and 1995. Gender segregation across specialties increased during this time period for the first-year students. Between 1976–1980 and 1991–1995, the index of dissimilarity increased from 15.5 to 24.2 or 56.1% for first-year students. The upward trend was also evident among fourth-year students. D rose 67.1% for graduating students. Both chi-square tests and jackknife tests indicated that these changes in segregation were significant ($p < .01$).

The increase in segregation among fourth-year students at Jefferson mirrored national trends. Between 1981 and 1985, the segregation of fourth-year students at Jefferson was 24.8. The comparable figure for the 1991–1995 period was 27.4. Based on our analysis of the AAMC's graduating student questionnaire, between 1990 and 1999, segregation among all fourth-year students increased from 22.3 to 27.3.

We also found that the level of segregation was generally higher among fourth-year than among first-year students. This difference suggested that medical school experience is associated with an increase in the gender-based segregation of students by specialty. However, the absolute increase in D changed over time. The role of the medical school in determining D appeared to peak between 1986 and 1990 and then began declining.

The inclusion of undecided first-year students lowered the level of segregation significantly for these students. The second panel of Table 1 indicated that first-year students who reported intended fields were about as segregated by field in the first year as they were in the fourth year. Overall, when undecided students were excluded, segregation declined slightly between the first and fourth years, but when the data were divided into four periods, there was no consistent pattern. A first-year–fourth-year increase in 1976–1980 gave way to almost no change in 1981–1985, followed by a sharp increase in 1986–1990 and an even steeper decline in 1991–1995.

Thus, when undecided students were excluded, we found that students left medical school about as segregated as when they started their training. Nevertheless, there remained an important sense in which medical school contributed to the gender differentiation of specialties. Only about one fifth of the fourth-year students left medical school in the same specialties they had intended to pursue in the first year. As we have seen, over a third of the first-year students entered without firm plans regarding their specialties. Of those who did have intended specialties, majorities of both the men (65%) and the women (60%) switched their specialties by the fourth year. In all, 79% of the women and 75% of the men were either undecided initially or changed specialties during medical school. For the vast majority of students, the medical school experience had the potential to influence the choice of specialty. Thus, medical school was clearly implicated in the process of segregation even if D did not increase between the first and fourth years.

We found that increases in the index of dissimilarity were due to changes in the characteristics of students choosing six fields: surgery, hospital specialties, internal medicine, obstetrics–gynecology, pediatrics, and family practice. Over time, we found declines in the percentage of fourth-year women intending to pursue surgery, hospital specialties, and internal medicine. The most pronounced change occurred in surgery. Between 1976 and 1980, fourth-year men students were twice as likely as were fourth-year women students to select surgery as their preferred or intended specialty. Between 1991 and 1995, men were almost three times as likely as women to choose surgery. We also found increases in the percentages of fourth-year women intending to pursue pediatrics, obstetrics–gynecology, and family practice. The most pronounced change occurred in obstetrics–gynecology. Between 1976 and 1980, senior women students were 1.1 times more likely than were senior men students to choose obstetrics–gynecology. Between 1991 and 95, senior women are 2.7 times more likely then senior men to choose obstetrics–gynecology.

The specialties driving the increase in gender-based segregation at Jefferson were similar to the specialties responsible for segregation across the country. The increase in gender-based segregation among medical students nationally stems from increases in the proportion of men pursuing internal medicine and hospital specialties and increases in the proportion of women pursuing family practice and obstetrics–gynecology.

Thus, it appears that the substantial increase in segregation over time, evident from Table 1, was due to the increased concentration of men in predominantly "male" fields such as surgery and the i...

creased concentration of women in predominantly "female" fields such as obstetrics–gynecology. This conclusion holds for both first- and fourth-year students, and for the Jefferson data as well as the AAMC data.

Discussion

We found first, that there was a significant trend toward increased gender segregation among specialties between the 1980s and 1990s. This trend is explained by the increased concentration of men in surgery, hospital specialties, and internal medicine and the increased concentration of women in pediatrics, family practice, and obstetrics–gynecology. Furthermore, our analysis indicated that the trend toward increased gender segregation at Jefferson is representative of a larger national change in the physician workforce. This trend is consistent with the resegregation thesis advanced by Reskin and Roos[16] and may imply that the entry of women into medicine has exacerbated the concentration of women in a subset of specialties. This trend may also stem from differences in how men and women medical students react to changes in medical school curricula, changes in the organization and financing of medical care, or changes in the status of women more generally.

We also found an increase in gender-based segregation during medical school. This increase is attributable primarily to the large fraction of students who enter medical school without a specialty preference and ultimately distribute themselves across specialties in a segregated way.

The extent of segregation among students who have preferred specialties in the first year did not change significantly between the first and fourth years because this population remains equally segregated throughout medical school. Although the extent of segregation in this group is constant, choices remain highly dynamic. Since women and men leave their preferred fields in a segregated fashion and enter new fields in an equally segregated fashion, the flows of students who select specialties in the first year do not contribute to changes in segregation between the first and fourth years. The fluidity of specialty choices among individuals is consistent with Jacobs' revolving-door perspective on gender segregation.[15]

The trends noted in this analysis are unexpected and may be inconsistent with goals pertaining to a highly effective physician workforce.[20] Individual medical schools with workforce objectives may address these trends by offering counseling to undecided students early in medical school. We also note that Duncan's D provides a concise index for analysis of complex patterns of medical students' career decisions.

We intend to expand these findings in future research by examining the correlates of Jefferson students' choice of medical specialty. We will also assess institutional effects more fully, by investigating trends in the gender distribution by specialty for multiple medical schools.

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THE MOVEMENT OF PHYSICIANS BETWEEN SPECIALTIES

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ABSTRACT

While the specialty choice of physicians has been extensively studied, a companion topic, specialty change (or inter-specialty mobility), has been all but neglected. In this chapter we document age-specific rates of inter-specialty mobility. Data on over 500,000 physicians included in the AMA Physician Masterfile are analyzed. We compare the rates of movement obtained when different definitions of specialty change are employed, and report the proportion of movement which is attributable to sub-specialization. We develop and test four hypotheses regarding the age profile of specialty change. We also estimate a multi-variate model of the determinants of specialty change. We note the significance of physicians' career mobility for discussions of reform in the health care delivery system. These results provide a baseline for assessing the effects of health care reforms on physicians' careers.

INTRODUCTION

The recent discussion of health care policy reform has raised many issues, including appropriate size of the physician labor force (Ginzberg, 1996; Institute of Medicine, 1996, American College of Physicians, 1994; Cohen & Todd, 1994). Some have suggested the need to increase the share of generalists relative to specialists as part of an effort to reduce costs and improve access to

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quality medical care (Rivo & Kindig, 1996; Colwill et al., 1997). However, the degree to which practicing physicians may exhibit flexibility with respect to specialty and other practice characteristics has received little empirical scrutiny. The responsiveness of practicing physicians to policy reforms, whatever shape those reforms may eventually take, is an important but neglected aspect of policy discussions (Christakis et al., 1994). In this chapter we analyze data from the 1990s on the movement of physicians between specialties. These results will provide a baseline against which the consequences of reform may be measured, and will provide insights into the dynamics of physicians' careers.

Our analysis focuses on the age trajectory of career moves. We develop four partly competing hypotheses regarding the age patterns of specialty changes. The analysis documents rates of entry and exit for major specializations. We also examine the attributes of physicians that affect the likelihood of making a specialty change.

INTRA-PROFESSIONAL MOBILITY

The sociological study of occupational mobility has developed a range of statistical techniques for examining mobility patterns (Blau & Duncan, 1967; Erikson & Goldthorpe, 1992; Featherman & Hauser, 1978). The core research in this area has focused on inter-generational mobility patterns, with less emphasis devoted to intra-generational mobility, Studies of career mobility have generally conceptualized mobility as changing occupations, with considerably less attention paid to movement within specific occupations (Rosenfeld, 1992). Evans and Laumann (1983) have found significant exit rates from professional occupations, including law and medicine, although the incidence of exit from these fields was among the lowest of the professions examined. Less studied, however, is the extent of movement within professions. Our objective is to document the rate of migration between specialty areas after the initial specialty choice has been made.

A principal assumption in the extensive specialty choice literature is that physicians tend to remain in the specialties they train for and enter at the commencement of their careers (Colwill et al., 1997; Ernst & Yett, 1985). Studies of the physician labor force also assume that specialty choice tends to remain stable over the careers of physicians (Council on Graduate Medical Education, 1992). As a first approximation, this assumption is perfectly reasonable. Lengthy, arduous and expensive medical training ends with demanding residencies and fellowships, which lead physicians into their chosen specialties. Medical students choose specialties with great care (Murtha et al., 1997; Kassebaum & Szenas, 1994; Ernst & Yett, 1985). These choices are fateful because the nature of practice varies so widely across fields, with cognitive, lifestyle and financial implications, and because movement between fields is difficult.

Yet this first approximation can be improved upon. Some physicians do change their field of practice. Knowing the number of physicians who change, when they change, which fields they leave and which fields they enter will help us better understand medical staffing concerns and physicians' careers.

Studies of specialty choice have emphasized that prospective medical students settle on a specialty choice quite late in their medical school training (Mutha et al., 1997; Ramsdell, 1983). Only a small minority of medical students has settled on a particular field of practice at the start of medical school (perhaps as low as 10%), and a significant minority remain uncertain at the end of medical school (perhaps as many as 25%) (Ernst & Yett, 1985: 21–22). In addition, there is evidence indicating that over half of all medical school students switch their intended specialty during the medical school years (Ernst & Yett: 22) Medical education, after all, maintains a generalist orientation, with students exposed to a variety of different practice areas during their rotations. Thus, it is quite natural to suspect there will be continued change during the early part of physicians' professional development.

Several studies have considered the question of specialty change among medical graduates. Shaw et al. (1996) document substantial rates of career mobility among physicians in the Canadian province of Saskatchewan, but do not analyze these patterns in detail. For example, they do not report the ages at which these changes were made, nor do they indicate which fields grew in-size and which declined. Bunegener and Paicheler (1994) examine the social origin of French physicians, and provide a brief overview of specialty changes as well. Monk and Terris (1956), Weiskotten et al. (1961) and Weiss (1971) reported specialty changes among the medical graduates from the classes of 1915 through 1950. The principle concern in these investigations was the rate at which physicians were leaving general practice and entering specialized practice.

Holden and Levit (1978) found that 16% of a sample of medical school graduates from 1960, 1964 and 1968 changed their self-designated field of practice between 1971 and 1976. Eight percent of the 1960 cohort changed specialties during this period, as did 11% of the 1964 cohort and 29% of the 1968 cohort. Seven broad fields were considered in that analysis: internal medicine, pediatrics, general/family practice, obstetrics and gynecology, medical sub-specialties, surgical specialties, and other. Their inquiry focused on the outflow of physicians from primary care specialties. Erdmann, Jones and

Tonesk (1978) were for the most part concerned with the social psychological correlates of eventual specialty choice, but they also reported rates of mobility across ten major specialties for 1960 medical graduates.

The influential Graduate Medical National Advisory Committee (GMENAC) reports made efforts to incorporate the specialty changes of physicians during graduate medical training and during the early career stages in their model of physician supply. The GMENAC projections of specialty supply are based on a demographic model which reflects the number of physicians currently practicing in a specialty, plus the number of projected new entrants, minus the number projected to leave medicine through death or retirement. Yet, the assumption underlying the GMENAC model is that, after an initial shake-out period, physicians remain in their chosen specialties (GMENAC, 1981a; b). The discussion of the GMENAC approach to physician career mobility is worth noting:

> To predict specialty supply it is essential to incorporate post-GME changes. These changes are included on Table IV.2, which summarizes residency input specialty output distribution for the programs studied. Note that the distributions are always the stable percentages of self declared practice specialties reported subsequent to entering practice. Often these distributions have not become stabilized until 10 to 12 years after medical school, that is, as much as 8 years after GME is completed (GMENAC; Vol. 2. 1981: 258).

As we will see, physician career mobility continues well beyond this early period of the physician's career. We conduct a detailed examination of career mobility throughout the physician's professional career.

We build on previous research on specialty changes by physicians in several ways. First, we examine a much larger number of specialties than has previously been done. Holden and Levit (1978) studied movement across seven major fields; previous work was even more aggregated. Our analysis can provide reliable data on a more detailed set of specialties because the data base from which we draw is so large.

Second, we examine the age-profile of career changes of physicians. Previous studies have typically followed up medical school students a certain number of years after graduation. Hold and Levit, for example studied medical graduates 8, 12 and 16 years after graduation. We examine the entire age spectrum of practicing physicians. We can examine whether mobility rates drop sharply after a certain age, or whether a certain level of inter-specialty mobility continues throughout physicians' careers. Third, we examine variation in rates of change across several definitions of specialty. As we will see, moves between fields can be defined in a variety of ways, and the rates of movement observed vary with the precise definition employed. Fourth, we examine physician characteristics and practice settings that influence the rate of

specialty change. Therefore, our results can greatly broaden our understanding of medical careers.

The career mobility of physicians is intimately connected with all aspects of medical staffing levels. An understanding of the rates at which physicians cross specialties is fundamental to our understanding of the physician labor supply. The sensitivity of physicians in mid-career to economic pressures, institutional pressures, technological change and changes in interests and preferences will help us to evaluate how the supply of physicians is likely to adjust to the new economic environment facing the medical delivery system. If, for example, inter-specialty and geographic mobility remain quite high throughout physicians' careers, this may indicate the potential for physicians to adjust quite rapidly by moving from geographic areas and specializations which are saturated. On the other hand, the less career mobility we observe, the less such adaptations can be expected.

Another practical use for this analysis is in the assessment of medical education programs. The rates of specialty mobility can be thought of as an outcome measure for the medical education system. A number of studies have explored the persistence rates of students graduating from particular residency programs (Colwill et al., 1997) and in particular specialties (Perez et al., 1997). A comprehensive analysis of persistence rates across the spectrum of fields will provide a baseline against which the results of such studies can be compared.

Mobility and Age

There are many reasons to expect mobility to decline with age. From an economic point of view, the opportunity cost of change increases, as physicians' income rises in their increasingly established practices. Moreover, investing in new skills declines in attractiveness with age, as the time for return on investment diminishes. From a social-psychological point of view, the attachment of individual physicians to their choices should increase with time, and consequently physicians should become less inclined to make significant career departures as they grow older.

There are also social-structural reasons that would predict declining rates of mobility. The opportunity to change specialties may diminish with age due to diminished contacts with other specialties, along with diminished access to new training programs. This should be particularly true as physicians move from hospital-based residency programs to office-based practices. All these reasons lead to the following predictions:

Hypothesis 1. Mobility across specialties and the acquisition of new board certifications should be a downward sloping curve throughout the active professional careers of physicians.

On the other hand, there are also good reasons to expect mobility to continue with age. Medical practice is constantly changing. New procedures are developed while others fall into disuse. Staying in place requires change, as does movement to a new field. There may consequently be some minimum degree of movement which continues among older physicians.

Change is ubiquitous in medicine, and in this way medicine resembles the U.S. economy as a whole. Our economic system is a dynamic one, with no guarantees and a constant degree of flux. After steep declines at early ages, a degree of occupational mobility may continue throughout most of the life course. Another possibility, then, is that the age profile of physicians' career mobility may resemble that of inter-occupational mobility among workers in the rest of the labor force. This reasoning leads us to our second hypothesis, which is in partial competition with our first hypothesis.

Hypothesis 2. Physicians' movement between specialties declines with age until reaching a constant level.

An additional reason to expect continued inter-specialty mobility at relatively late ages is that there is substantial overlap between fields. The boundaries between specialties are often a bit fuzzy, and a given physician's practice may straddle two fields. Physicians may be reporting that they have changed their specialty when in fact they really changed the emphasis of their practice from one of their areas of specialty to another. Indeed, over one third of physicians in this analysis (36.3%) report having a second specialty. It would not be surprising to see such changes in emphasis occurring at relatively late ages. This reasoning leads us to our third hypothesis:

Hypothesis 3. Changes in emphasis that occur within a physician's existing repertoire of practice areas contribute to continuing mobility at older ages.

A focus on the specific attributes of particular fields of practice may give us further insight into patterns of specialty change. Some fields of practice may be "high burnout" fields – fields that are extremely physically and emotionally draining. For example, a specialty such as emergency medicine may be difficult to practice day after day for many years (Gallery et al., 1992; Keller & Koenig, 1989; Hall et al., 1992). The existence of a number of high turnover fields might contribute to continued turnover throughout physicians' careers.

Other fields may experience increased mobility with age. Some types of practice require physicians to perform many delicate procedures, and some

older physicians might worry that they have "lost their touch"(Green, 1988). For example, some especially delicate fields of surgery may experience attrition of older physicians. The lifestyle requirements of some specialties may also become increasingly burdensome as physicians age (Hardy, 1986; 302). For example, the field of obstetrics often involves waking up in the middle of the night to deliver a baby. It may be that some physicians tire of this after many years and shift their practice into related fields.

These considerations might lead physicians to retire early, were it not for the presence of fields which allow for relatively easy entry at later ages. It may be that some fields, such as general practice, with few specific entry requirements, enable physicians to switch fields while continuing to practice. We would expect few, if any, older physicians to move into neurological surgery, with its multiple certification requirements, while movement into general practice and other fields might be more common. This reasoning leads us to a fourth hypothesis:

Hypothesis 4. The age profile of mobility varies by specialty. We expect high burnout, procedurally intensive and lifestyle-challenging fields to lose physicians at later ages, while fields with limited certification requirements should receive the disproportionate share of new entrants at later ages.

Individual Correlates of Career Mobility

We estimate a logistic regression model of specialty change in order to identify those factors that promote or inhibit mobility. We divide factors into four categories: educational investments, practice type, practice location and individual attributes. As far as the level of investments is concerned, we expect that board certification should reduce physicians' propensity to change fields.

We explore the influence of medical schools on mobility by examining whether graduates of foreign medical schools change fields more than graduates of American medical schools. We expect no difference in mobility patterns between graduates of foreign and U.S. medical schools.

We expect that practice type may have significant effects on the likelihood of changing specialties. Physicians located in private practice should be less likely to change specialties, due in part to sunk costs in practice and in part to less exposure to other practices. In contrast, physicians whose practices are located in hospital settings should have more exposure to other types of practice than their own, and more opportunity to move.

Finally, we explore whether women have higher or lower rates of mobility than their male counterparts. While it is well established that women are concentrated in different specialties from men (Frank et al., 1997; Council on

Graduate Medical Education, 1995) the question here is whether they are more or less likely to move between specialties. We expect that women physicians will be more likely than men to change specialty because they are younger than men, on average (because women's entry into medicine is a relatively recent phenomenon). However, we expect that, after age, practice location and other factors affecting mobility rates are controlled, that there will be no gender differences in mobility.

Data

The data for this study were obtained from the American Medical Association Physician Masterfile, the most comprehensive body of physician and medical student data in the United States. It contains information on all physicians (M.D.s) whether or not they are members of the AMA, including graduates of United States medical schools who are temporarily practicing abroad and graduates of foreign medical schools (FMGs) who have met U.S. educational standards for recognition as physicians (Wunderman, 1979).

The AMA Physicians Masterfile actually consists of two connected files. Upon admission to medical school, or, in the case of FMGs, upon entry into the United States, a file is initiated on each physician. Initial data entered on the physician's record include selected demographic variables, such as sex, date of birth, medical school, and year and state of graduation. Information on such matters as residency training, state licensure, and board certification, which are not subject to constant change, become part of the historical portion of the Masterfile.

The current portion of the Masterfile, commonly referred to as the Physicians' Credentials Update, is based on a rotating census in which approximately one third of all physicians are surveyed each year (Pasko & Seidman, 1999). The data in this file identify physicians' major professional activities including patient care (office or hospital based) and non-patient care activities such as administration, medical teaching, and research. Physicians are asked to designate their primary and secondary specialization. The primary specialty reflects the area in which the doctor devotes the majority of his or her professional time (Eiler, 1984).

The analysis we planned required data from both the historical and current portions of the AMA Physician Masterfile. Thus, a match of historical and contemporary data concerning physicians was created. A second match was undertaken, in order to obtain contemporary data for both 1994 and 1998.

A comparison of contemporary data on practicing physicians in 1994 and 1998 forms the basis for the analysis in this study. A cohort of 510,275

physicians was created from the 723,387 physicians in the Masterfile in 1994 and 1998.

To identify physicians who were practicing in both 1994 and 1998 with accurate measures on essential variables, we undertook the following four selection procedures. First, we excluded physicians who had inconsistent data regarding their sex or birth year ($n=5,321$). Then, we excluded physicians from the 1994 sample who were labeled as: residents (99,907), inactive (2302), retired (43 229) semi-retired (8474), disabled (1037), temporarily not in practice (3093), inactive for other reasons (2665), and "no classification" (23 611). Next, we removed physicians who were classified in the 1998 file as: students of any kind (6561), retired (9630), semi-retired (1831), temporarily not in practice (329), inactive (14), disabled (153), inactive for other reasons (1062) and "no classification" (448). Finally, we removed all physicians whose primary specialty was classified as "flex resident" (176) or unspecified (3269) in either 1994 or 1998.

Defining Specialty Change

In discussing rates of movement across specialties, we must be careful in defining a change in specialty. There are three potential sources of confusion. First, we must define the specialties across which mobility will be computed. The AMA Masterfile includes data on 156 self designated specialties, yet for certain purposes a more aggregated list of fields may be more appropriate. The rate of mobility we observe will vary with the number of specialties employed. The more detailed the list of specialties, the greater the rate of change. For example, if a detailed list of specialties is employed, movement from oncology to immunology would constitute a change in specialty. On the other hand, if all sub-specialties within internal medicine were aggregated into one category, the above example would not be designated as a change in practice.

A second complication in the definition of specialty change stems from the fact that the AMA Masterfile contains physicians' first and second specialties. Some physicians who changed their primary specialty between 1994 and 1998 may have switched to a field which was their secondary specialty in 1994. In other words, a physician may have increased the time he or she spends on a secondary specialty so that it is now the primary specialty. We must decide whether to include such cases in our definition of a specialty change

Finally, some changes constitute sub-specialization while other moves are to different fields, although there may be many linkages in the nature of the practice. We may want to consider cases of sub-specialization, such as moves from general surgery into cardiovascular surgery, as distinct from moves

between unrelated specialties, such as a change from radiology to dermatology.

Rather than settle for a particular definition of specialty change, we have chosen to report the rates of mobility obtained when several different definitions of mobility are employed. We use three sets of specialties, ranging from detailed to intermediate to broad. The detailed specialties correspond to the 156 self-designated specialties reported on the AMA. The intermediate specialties correspond to the 40 specialties reported in most AMA publications. Finally, the fifteen broad fields represent broad areas of medical practice: general practice, surgery, internal medicine, neurology, obstetrics and gynecology, pathology, pediatrics, psychiatry, radiology, medical genetics, preventive medicine and other. The last of these categories, "other" is quite small, representing only 1.9% of the physicians in the sample.[1]

Another way of classifying moves contrasts two types of mobility: (a) complete specialty change, and (b) change in emphasis. We define a complete specialty change as the adoption of a first specialty in 1998 which differed from his or her primary and secondary specialty in 1994. A change in emphasis occurs when the physician's new primary specialty in 1998 is the same as his or her secondary specialty in 1994. In this case, the physician is devoting more time to an area already within his or her area of practice, with a secondary area of specialization now overshadowing a former principal interest. A change in emphasis represents an evolution of a physician's practice. It is consequently useful to distinguish this type of change from instances of complete specialty change.

A final measure of change is sub-specialization. Given the importance of specialization in modern medicine, we felt this type of movement deserved a separate measure. Appendix Table 1 indicates fields and their corresponding sub-specialties. For example, a general surgeon who moved to thoracic surgery would constitute a case of sub-specialization by this definition, as would an orthopedic surgeon who moved to orthopedic spine surgery.

RESULTS

1. An Overview of Specialty Change

Table 1 presents data on the rate of inter-specialty mobility by age. The rate of mobility varies with the definition of fields. The more detailed the units, the more movement is observed. Between 1994 and 1998 1.1% of physicians reported switching among the fifteen broad areas of practice. When the 40

Table 1. Rates of Inter-specialty Mobility, For Broad, Intermediate, and Detailed Specialty Classifications, 1994–1998.

	Total	Completely New Field	Change in Emphasis
A. 15 Major Fields	1.1	0.7	0.4
B. 40 Intermediate Fields	2.1	1.4	0.7
C. 156 Detailed Fields	3.4	2.8	0.6

Total = Primary Specialty in 1994 differs from Primary Specialty in 1998

Complete Specialty Change = Primary Specialty Change in 1994 differs from Primary and Secondary Specialties in 1998

Change in Emphasis = New Primary Specialty in 1994 is the same as the Secondary Specialty in 1998

intermediate fields of specialization are employed as the units of analysis, a total of 2.1% of physicians reported new principal specialties. Finally, when mobility across 156 detailed specialties is examined, a total of 3.4% of physicians reported a new specialty in 1998 compared with four years earlier. The level of movement across detailed specialties is one-third higher than movement across intermediate fields (3.4 vs. 2.1). Less than half (1.1 of 3.4) of the changes in this period crossed the fifteen broad specialties, such as a move from pathology to radiology, with the balance consisting of moves within these major areas, such as a switch from immunology to oncology, both of which are sub-specialties within internal medicine.

A second approach to analyzing moves compares complete specialty changes with changes in emphasis. The former involves a switch to previously unmentioned fields, while the latter involves changing the principal specialization to a field previously listed as a secondary field. Complete change in specialty accounts for roughly four-fifths of all specialty changes; changes in emphasis account for the remaining one-fifth. For example, 2.8% of physicians moved to a completely new detailed specialty, while another 0.6% changed emphasis among their existing repertoire of specializations. This pattern holds true irrespective of whether broad, intermediate or detailed units are examined.

Sub-specialization constitutes just over one quarter of the mobility we have documented: 0.8% of physicians moved into a sub-specialty as defined in Appendix 1, compared with 3.4% changing detailed specialties. Thus, the trend

toward increasing specialization and sub-specialization in medicine is not sufficient to account for the rates of career mobility we observe.

In summary, physicians are not completely locked into their specialties but do occasionally change fields of practice. They are more likely to switch to a related field within their broad area of expertise than to jump across the chasms that represent major divisions. Some move incrementally by changing emphasis within a preexisting set of interests, but these changes in emphasis constitute the minority of moves.

While these are relatively low rates of change for any given point in time, they nonetheless result in a significant cumulative chance that a physician will move at least once during his or her career, as we will document below.

2. *Age Patterns of Specialty Change.*

We now turn to the age pattern of specialty change. Figure 1 displays the rates of interspecialty mobility by age for three measures of specialty change. Movement across broad intermediate and detailed specialties are depicted. Figure 1 indicates a higher rate of specialty change for young physicians, which declines quickly and then remains relatively stable. For the detailed specialties, the four-year mobility rate declines from 6% at age 30 to 3.3% at age 32. By age 45, 3.2% are still changing specialties. Mobility across the fifteen broad divisions is evident throughout the life course, albeit at a lower level. At age 30, 2.8% of physicians changed their broad fields of practice in a four year period, which declines to 1.1% by age 42 and remains relatively stable thereafter.

We want to stress two prominent findings in Fig. 1. First, the same age profile of change is evident for moves between broad, intermediate and detailed specialties. The three curves have the same shape, and remain roughly proportionate to each other throughout physicians' careers. The extent of movement varies, as discussed above, but the age patterns of mobility are similar for these three measures.

Second, it is notable that physicians continue to change specialties throughout their careers. With the exception of a sharp decline during the early 30s, the rate of specialty change is essentially constant across the age spectrum.

Does the age-profile of specialty changes resemble other patterns of career mobility? In Fig. 2, we compare the rate of specialty change among physicians to occupational switches among professionals. One year retrospective data from the March 1997 Current Population Survey were examined for the non-physician comparison group. Figure 2 presents data for males only, because

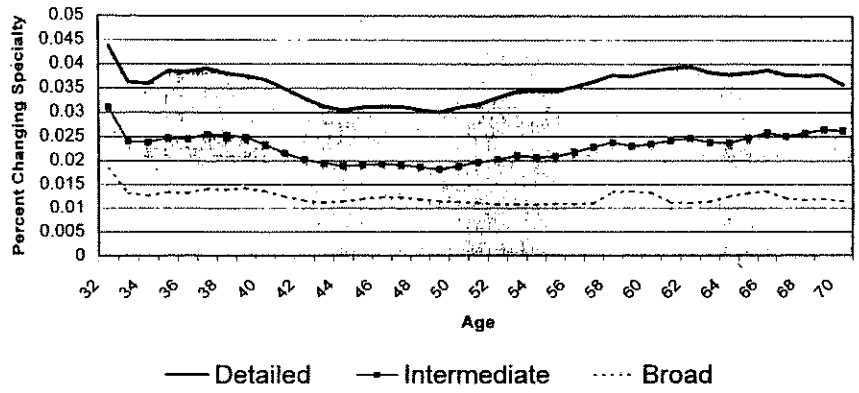

Fig. 1. Physician Mobility by Specialty Classification.
Note: Figures represent a three running year average.

the sex composition of the medical profession differs from that of the labor force as a whole.

There are key similarities between these curves. Both demonstrate a relative steep decline at young ages and experience a relative plateau between ages 35 and 65. We do not want to exaggerate the similarities between these curves. First, the occupational data are for a one-year period, while the physician data cover a four-year period. Consequently, the rate of occupational change in the

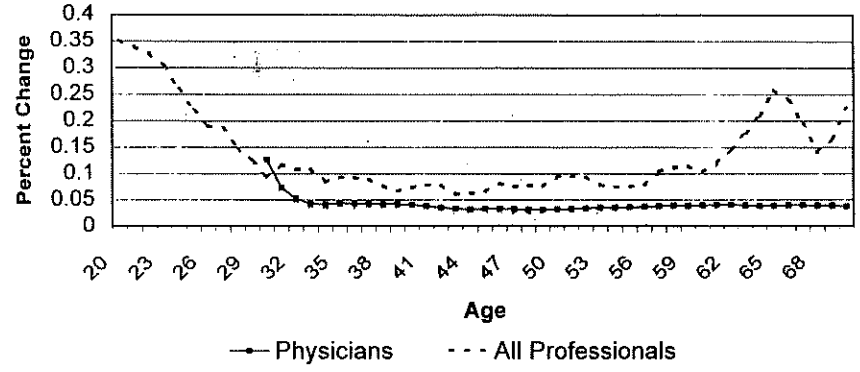

Fig. 2. Male Physician Mobility Compared to All Professionals.
Note: Figure represents three year running averages of data.

balance of the professional male labor force is much higher than is specialty change among male physicians. Second, the labor force curve has a substantial jump in mobility for those over 65. Apparently, down-shifting among older professionals is an option that some pursue as an alternative to retirement. Still, the similarity in the age profile of mobility is evident through the broad span of the age period of the early thirties through the early sixties.

The results in Figs 1 and 2 provide support for Hypothesis 2, the mobility-plateau hypothesis, and are at odds with the continual decline in mobility predicted by Hypothesis 1. The significance of these findings is brought into sharper relief by comparison with other findings that are more consistent with Hypothesis 1.

Figure 3 depicts the rate of acquisition of new board certification and geographical mobility across state lines. As summarized in Hypothesis 1, one might expect investment in new skills to decline continually with age. One might also expect geographical mobility to decline with age as families become more settled in their practices and communities. Both decline consistently with age without reaching a steady state. The rate of decline slows after age 40, but these types of moves become increasingly uncommon as physicians age.

We find the results in Fig. 3 to be revealing for two reasons. First, they highlight the distinctive age profile of inter-specialty moves. The plateau, or longer tail at higher ages, of specialty moves is distinctive compared with new formal educational investments and with relocations. What might account for the relatively high rate of specialty change at older ages?

As suggested in Hypotheses 3 and 4, certain types of moves might be more common at older ages, and these moves might account for the flat trajectory of movement after age 45. Figure 4 compares the age profiles of changes in

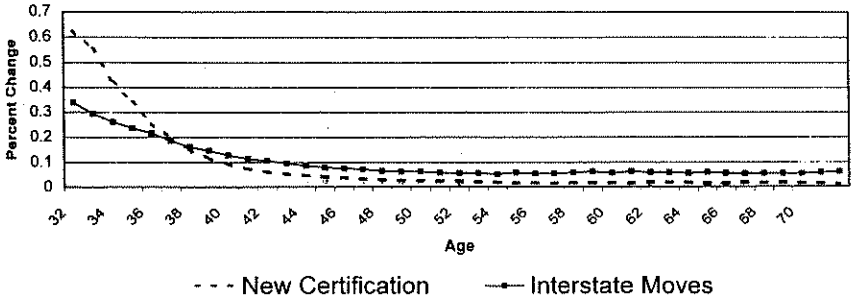

Fig. 3. New Board Certifications Compared to Geographic Moves.
Note: Figures represent a three year running average.

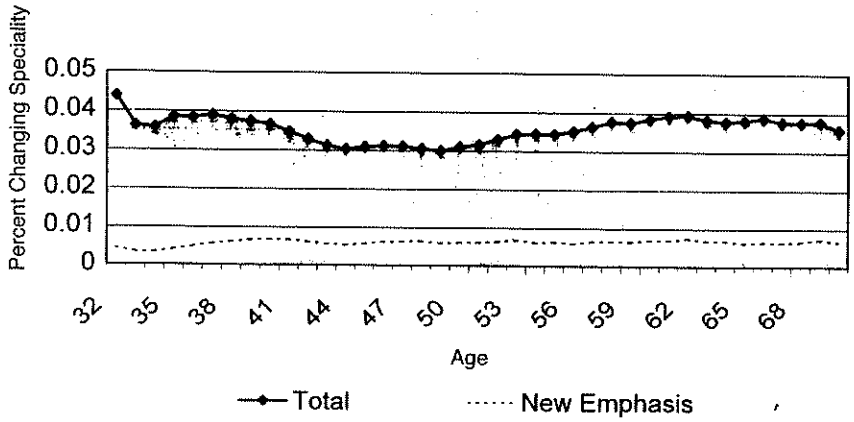

Fig. 4. Changes in Emphasis Compared to All Specialty Changes.
Note: Figures represent a three year running average.

emphasis to complete specialty change. The results indicate a difference between these two types of moves. Changes in emphasis are nearly constant throughout the professional lives of physicians. Entry into a completely new specialty, in contrast, declines until age 33, where it remains relatively stable, fluctuating between 3 and 4%. Complete specialty change declines from 6 percent at age 30 to 3% at age 33. Changes in emphasis, on the other hand, occur at roughly half a percent over a four year period from age 30 until age 70.

The results presented in Figures 1–3 are based on the rates of change over a four year period. We may prefer a measure of the annualized rate of change, i.e., the proportion of physicians who are likely to make each type of change in a one year period. Assuming a constant rate of change over the four year period, we can calculate the annual persistence from any of the results presented in Table 1 in two different ways: by taking 1/4th of the log of the rate of persistence, or by taking the fourth root of the 4 year persistence rate. These procedures produce nearly identical results for these data. We present the results for 1/4th of the log of the persistence rate, a standard demographic tool for estimating annualized, age-specific rates from data with a longer time interval.

The annual rates of change for the total sample during the period studied are as follows: A total of 0.99% of physicians acquired new detailed specialties in one year, 0.61% of physicians entered new intermediate specialities each year, and 0.31% enter new principal major specialties each year.

The annualized rate of change is an attractive measure because of its ease of interpretation. But this measure has another feature: it enables us to calculate the expected number of moves a physician is likely to make between specified ages. The expected number of changes is simply the sum of the annualized age-specific rates of change. For example, if a doctor had a constant 10% chance of moving per year between ages 30 and 39, between these ages he or she could be expected to move 1 time (0.1×10). To apply this procedure to the rate of physician specialty change, we first calculated the annualized rate of change, as described above for single years of age. We then sum the annual rate of change for each single year of age between 30 and 70 in order to calculate the number of moves a physician can expect to make over his or her career. We also report the expected number of moves for physicians from ages 30 through 39, 40 through 49, 50 through 59 and 60 through 70. Note that these figures represent the *expected number of moves, not the proportion of physicians who moved.* The latter can only be estimated by making assumptions about population heterogeneity, i.e. whether there is a small group which is responsible for a disproportionate number of moves. As we do not have complete career history data, we have avoided attempting any estimate of the cumulative proportion of physicians who changed specialties.

The expected number of specialty changes a doctor is likely to make over the course of his or her career is presented in Table 2. The results indicate that, if the rate of mobility during the mid 1990s is held constant over the entire duration of a physician's career, that doctor could expect to change detailed specialties 0.377 times between the ages of 30 and 70. Physicians can expect 0.241 intermediate and 0.123 broad specialty changes over the course of their careers.

The continuity of change of physicians throughout their forties, fifties, and sixties is notable. The data presented in Table 2 indicates that less than half of all changes occur while physicians are in their thirties. More than half of the specialty changes occur while physicians are in their forties, fifties and sixties. For example, just over 25% of doctors moves into new principal detailed specialties (0.101/0.377, or 26.9%), occur by age 39, the balance occur at a nearly even rate over the rest of physicians' careers.

Table 2 also presents the cumulative number of expected moves for a variety of other moves as well. As we have seen, sub-specialization, acquiring a new board certification, and migration between states declines throughout the careers of physicians. In each of these cases, the large preponderance of changes occur by age 40. In contrast, changes in emphasis occur at an essentially even rate throughout doctors' careers, and less than one-fifth of these moves have occurred by age 40.

Table 2. Expected Number of Inter-Specialty Moves of Physicians Based on extrapolation of Age-Specific Mobility Rates.

	Broad Fields	Intermediate Fields	Detailed Fields	Detailed Specialty: New Specialty	Detailed Specialty: Change in Emphasis	Sub-Specialization	New Board Certification	Interstate Moves
Total, 30–70	0.1227	0.2754	0.4306	0.3567	0.0717	0.1065	1.2845	1.2631
30–39	0.0340	0.0770	0.1160	0.1009	0.0146	0.0420	1.0666	0.6799
40–49	0.0293	0.0558	0.0912	0.0733	0.0175	0.0186	0.1122	0.2283
50–59	0.0291	0.0630	0.1029	0.0839	0.0184	0.0190	0.0520	0.1693
60–69	0.0303	0.0630	0.1116	0.0910	0.0200	0.0256	0.0500	0.1673
Moves 30–39/30–70	0.2772	0.2798	0.2693	0.2828	0.2033	0.3943	0.8303	0.5383

3. *Exit and Entry Rates by Specialty*

Our fourth hypothesis is that career mobility varies by specialty. The data presented in Table 3 will enable us to address this question. Table 3 presents exit and entry rates for each of the thirteen broad fields employed in our analyses. We also indicate whether the field experienced a net increase or decrease among practicing physicians.

Table 3. Rate of Mobility Across Broad Fields.

	Percent in Field	Percent Leaving	Percent Entering	Net Percent Change
Anesthesiology	5.3	0.6917	0.7474	0.0558
	(26892)	(186)	(201)	
Dermatology	1.5	0.6341	1.1333	0.4992
	(7412)	(47)	(84)	
Emergency Medicine	3.3	2.9263	3.8918	0.9655
	(16779)	(491)	(653)	
General Practice	14	1.3452	1.7982	0.4531
	(71514)	(962)	(1286)	
Internal Medicine	24.9	0.9185	0.7064	–0.2121
	(126837)	(1165)	(896)	
Neurology	1.9	1.0145	0.8890	–0.1255
	(9561)	(97)	(85)	
Obstetrics-Gynecology	6.1	0.3933	0.4764	0.0831
	(31275)	(123)	(149)	
Pathology	2.9	1.1216	0.5403	–0.5813
	(14622)	(164)	(79)	
Pediatrics	8	1.1507	1.0258	–0.1249
	(40846)	(470)	(419)	
Psychiatry	7.2	0.4001	0.4818	0.0817
	(36737)	(147)	(177)	
Radiology	5.2	0.5302	0.4437	–0.0865
	(26593)	(141)	(118)	
Surgery	17.3	0.6463	0.5071	–0.1392
	(88353)	(571)	(448)	
Other	1.9	9.6148	9.6662	0.0514
	(9735)	(936)	(941)	
Medical Genetics	0	5.5172	60.0000	54.4828
	(145)	(8)	(87)	
Preventive Health	0.6	9.0333	3.5667	–5.4666
	(3000)	(271)	(107)	

Note: Percent entering based on total number of specialists in 1994

These data indicate that fields do indeed differ in their turnover rates. Most fields have low exit and entry rates. However, there are some exceptions; most notably, emergency medicine, general practice, preventive health, medical genetics and other have higher rates of both entry and exit. It should also be noted that some fields are net exporters of personnel while others experience net gains in practitioners. For example, dermatology, emergency medicine and general practice all gained physicians, while pathology, internal medicine and surgery all experienced net losses.

Table 4 takes this analysis one step further by displaying exit and entry rates by age for each of the fifteen specialties. The results in Table 4 show that some fields are characterized by declining turnover by age. An example of this pattern is preventive health. Preventive health fits the prediction outlined in Hypothesis 1, namely that mobility declines with age, with declines continuing past age 50. Thus, the expectation that turnover should decline with age does fit some of the medical fields examined.

Some fields experience an increase in exit rates at older ages and even more significantly after age 60. After an initial period of high turnover, surgery turnover stabilizes. It then increases slightly after age 50 and even more significantly after age 60. Anesthesiology and radiology also fit this pattern.

Other fields experience an increase in entry rates at older ages. Most notably, with the exception of an initial high turnover period, the rate at which general practice gains practitioners increases steadily as physicians age.

Table 4 also reveals that whether a field exports or imports physicians sometimes varies by age. Some fields lose physicians who are younger than 40 while gaining older physicians. Other fields, in contrast, gain physicians at early ages and lose them at later ages. Pediatrics loses young doctors while gaining older ones. In contrast, emergency medicine and anesthesiology gain young doctors while losing older ones.

What can account for these shifts? One interpretation of these results is that some fields become harder to enter as one grows older. As we have seen, the propensity to acquire new board certification declines with age. Thus, entry into many fields that require elaborate residency training and board certification may become less attractive to older physicians seeking to change fields. However, these specialties are particularly attractive to young physicians who seek an alternative type of practice. The reverse tends to be true of generalist fields. These tend to lose physicians at early ages, while gaining them at older ages. Generalist fields thus accommodate those physicians who are seeking to

Table 4. Rate of Mobility Across Broad Fields by Age Group.

	Age 30–39	Age 40–49	Age 50–59	Age 60–69
Anesthesiology				
Leaving	0.6717	0.7545	0.5124	1.0045
Entering	0.9631	0.8041	0.4575	0.5952
Net Change	0.2915	0.0496	–0.0549	–0.4092
General Practice				
Leaving	1.4509	1.4676	1.4821	1.0939
Entering	1.6855	1.5816	2.2883	2.0499
Net Change	0.2346	0.1141	0.8062	0.9559
Dermatology				
Leaving	0.8772	0.4389	0.4585	0.7964
Entering	1.7544	1.2070	0.6113	1.0239
Net Change	0.8772	0.7681	0.1528	0.2275
Emergency Medicine				
Leaving	2.3815	2.8184	3.4520	4.7004
Entering	4.7407	3.5500	3.6299	3.5253
Net Change	2.3592	0.7316	0.1779	–1.1751
Internal Medicine				
Leaving	1.1441	0.8285	0.8402	0.9177
Entering	0.7962	0.6465	0.6951	0.7608
Net Change	–0.3479	–0.1820	–0.1451	–0.1569
Neurology				
Leaving	1.3225	0.9307	0.9641	0.8114
Entering	1.4242	0.8327	0.5697	0.7099
Net Change	0.1017	–0.0980	–0.3944	–0.1014
Obstetrics/Gynecology				
Leaving	0.4471	0.3338	0.3432	0.4766
Entering	0.4173	0.5053	0.4884	0.4085
Net Change	–0.0298	0.1714	0.1452	–0.0681
Pathology				
Leaving	1.8474	1.1830	0.7996	1.1694
Entering	0.5348	0.4338	0.6497	0.4149
Net Change	–1.3126	–0.7492	–0.1499	–0.7544
Pediatrics				
Leaving	1.4066	1.1136	1.0832	0.9007
Entering	0.9994	1.0171	1.0718	1.1441
Net Change	–0.4072	–0.0966	–0.0114	0.2434
Psychiatry				
Leaving	0.5198	0.5262	0.2758	0.2311
Entering	0.7425	0.4668	0.4291	0.4622
Net Change	0.2228	–0.0594	0.1532	0.2311

Table 4. Continued.

	Age 30–39	Age 40–49	Age 50–59	Age 60–69
Radiology				
Leaving	0.7032	0.3829	0.5819	0.4887
Entering	0.5181	0.5424	0.4099	0.1527
Net Change	–0.1850	0.1595	–0.1719	–0.3360
Medical Genetics				
Leaving	0.0000	9.5238	2.5641	7.1429
Entering	44.4444	65.07944	51.2821	78.5714
Net Change	44.4444	55.5556	48.7179	71.4286
Surgery				
Leaving	0.7515	0.5305	0.5122	0.7645
Entering	0.5684	0.4900	0.4235	0.5219
Net Change	–0.1831	–0.0405	–0.0887	–0.2426
Other				
Leaving	14.8205	10.6421	10.2058	6.8291
Entering	14.4385	11.8836	9.2196	5.6848
Net Change	–0.3820	1.2416	–0.9863	–1.1443
Preventive Health				
Leaving	16.8044	10.1803	8.9109	6.4103
Entering	8.2645	3.3934	2.2631	3.2967
Net Change	–8.5399	–6.7869	–6.6478	–3.1136

change their practice at older ages but who are unable or unwilling to enter a board-certified specialty.

Another interpretation of these results is that fields which normally require physicians to work as employees, i.e. radiology, anesthesiology, and emergency medicine, experience higher attrition at older ages because these practitioners face incentives and pressures to retire that are not experienced by physicians who own their own practices.

These results offer some support for each hypothesis. Physicians are less likely to change specialties as they grow older, as predicted in Hypothesis 1. Yet, the rate of change reaches a plateau early in life. This result conforms more closely to the prediction in Hypothesis 2. Moves among an existing repertoire of specialties continue throughout physicians' careers, as is predicted by Hypothesis 3. And specialties vary both in the rates of mobility and whether that mobility increases, as is predicted by Hypothesis 4.

4. *Determinants of Specialty Change*

Table 5 presents the results of a regression analysis designed to predict the rate of change across intermediate (40) specialties. We included two dummy variables to capture the non-linear pattern of movement by age: age less than 36, and age 36–41. The additional variables employed are age at graduation, sex (1 = women), and foreign medical graduate (1 = yes). We also included two dummy variables indicating whether a physician had board certification in 1994. The first variable equals one if the physician had no board certification; the second variable equals one if the physician had one board certification. The reference group is physicians with more than one board certification. In addition, we measured whether a physician acquired a new board certification between 1994 and 1998 (1 = yes), and the type of practice setting in which he or she most commonly worked.

The results indicate mobility does not decline sharply with age as several of our hypotheses predicted. Indeed, the age effect is slightly positive after dummy variables capturing the declines at the earliest ages are included in the analysis. In contrast, older age at graduation failed to be a significant predictor of specialty change.

The model also suggests that being a female and graduating from a foreign medical school are significant predictors of specialty change and thus contradict our initial hypotheses. In the bivariate analysis, female physicians are 73.8% as likely as male physicians to change specialties. In the multivariate analysis, the relationship becomes even stronger; women are 71.8% less likely to change specialties. It may be that men are more willing to take the risks involved in changing specialties and more interested in the additional challenges that specialty change entails. Women, in contrast, may be more careful in selecting a specialty. They may also be less interested in changing specialties if such changes are time consuming and further cut into the time that women physicians wish to spend with their families (Redman et al., 1994). The gender differential in specialty change is intriguing and warrants further scrutiny.

In contrast, foreign medical graduates are more likely to change specialties. The bivariate relationship indicates that foreign graduates are more than 2.5 times more likely to change specialties, while the multi-variate relationship is slightly weaker (odds ratio = 2.44). Often, foreign medical graduates seeking to practice in the United States face restricted choice of residency program. (FMGs must take a U.S. residency in order to practice in this country.) Thus, they may be forced to train in a field which is not their top choice, and, in turn, they may be more likely to change fields later in their careers.

Table 5. The Determinants of Specialty Change

Variable	Bivariate Odds Ratio	Multivariate Parameter	Multivariate Odds Ratio	Bivariate Odds Ratio	Multivariate Parameter	Multivariate Odds Ratio
Intercept		−2.479			−2.2982	
		(0.12)			0.26	
Age	1.005***	0.00863	1.009***	1.006***	0.0102	1.01***
		(0.00)			0.00	
Age between 36 and 41	1.351***	0.1622	1.176***	1.427***	0.2374	1.268***
		(0.03)			0.07	
Age less than 36	1.177***	0.191	1.21***	1.253***	0.2213	1.248*
		(0.04)			0.10	
Age at Graduation	1.005***	−0.0044	0.996	0.993	−0.0166	0.984*
		(0.00)			0.01	
Female	0.74***	−0.3353	0.715***	0.671***	−0.4294	0.651***
		(0.03)			0.07	
Foreign Medical Graduate	2.54***	0.8904	2.436***	2.589***	0.9607	2.614***
		(0.04)			0.08	
No Board Certification	0.274***	−1.528	0.217***	0.27***	−1.5629	0.21***
		(0.03)			0.07	
One Board Certification	0.148***	−1.9162	0.147***	0.153***	−1.8673	0.155***
		(0.03)			0.06	
Additional Certification	1.543***	0.2674	1.307***	1.751***	0.4636	1.59***
		(0.04)			0.09	
Solo Practice or Partnership	0.716***	−0.3072	0.735***	0.754***	−0.2453	0.782***
		(0.04)			0.09	
Group Practice	0.66***	−0.3513	0.704***	0.699***	−0.2929	0.746***
		(0.04)			0.09	
Government Clinic or Hospital	1.023	0.0648	1.067	1.055	0.1048	1.11
		(0.05)			0.11	

Table 5. Continued

Variable	Bivariate Odds Ratio	Multivariate Parameter	Multivariate Odds Ratio	Bivariate Odds Ratio	Multivariate Parameter	Multivariate Odds Ratio
Medical School	0.903*	–0.1288 (0.05)	0.879*	1.123	0.1078 0.11	1.114
No Classification	1.152***	0.1399 (0.04)	1.15***	1.208*	0.173 0.09	1.189*
Other – Patient Care	0.816*	–0.1737 (0.09)	0.841	0.743	–0.2277 0.21	0.796

Note:
Adjusted R Squared = 0.0543
Note: (n = 507333 for all models)
All observations which were missing from the multivariate analysis were excluded from the bivariate analysis

Note:
Adjusted R Squared = 0.0558
Note: (n = 101484 for all models)
All observations which were missing from the multivariate analysis were excluded from the bivariate analysis

The effect of board certification on specialty change is curvi-linear. The odds that a physician without a board certification will change specialties are 21.7% of those for a physician with two or three board certifications. This difference reflects the fact that the lack of board certification limits one's ability to move across specialties. Interestingly, relative to physicians with more than one certification, the odds that a physician with one board certification will change specialties are even less than those for physicians with no certification. Physicians with one board certification are likely to be committed to their specialty. Given the substantial time investment in obtaining a board certification, they appear to be less likely than others to switch fields. However, those with two or more board certifications are more likely to change fields. Perhaps physicians with multiple certifications are somewhat less committed to a particular field. Physicians who acquired an additional board certification between 1994 and 1998 were, not surprisingly, also more likely to change specialty.

Also consistent with the bivariate analysis are the effects of practice location. Physicians in a solo practice or partnership were less likely to change specialty than were those in non-governmental hospital settings (which serves as the reference group for this analysis). Physicians in group practices also demonstrated less relative mobility. This may be due to less opportunity to change specialties. The multi-variate analysis demonstrates that this pattern persists after controlling for age. Results indicate that physicians with practices in government hospitals or clinics may experience slightly higher odds of changing specialty; however the relationship is not significant. In contrast, physicians with practices based in medical schools are also less likely to change specialties, perhaps because of a greater emotional and intellectual commitment to their chosen specialty.

The model only explains a small fraction of the variance in mobility (the proportion reduction in Chi–2 was 0.054). Thus, the rate of inter-specialty change is not explained simply by the demographic and institutional factors we have examined.

SUMMARY

The matched 1994–1998 AMA Masterfile data have allowed us to explore a wide range of issues pertaining to the inter-specialty mobility of physicians. We have documented significant rates of inter-specialty change: 3.4% of physicians changed their detailed specialties over a four year period. Further, physicians can expect to change their detailed specialty at least 0.38 times during their career. We have documented the age pattern of these career changes: the entry

into new fields declines until physicians are in their forties, after which the rates of mobility remain remarkably constant over time.

The study documents the variation in mobility rates across specialties. Some fields, such as surgery, are net exporters of practitioners, while others, such as dermatology, are net importers. The age pattern of mobility also varied by field. For example, the rate of entry into emergency medicine was roughly constant across age groups, while the rate of entry into general practice increased with age.

We also explored individual heterogeneity in mobility patterns. Foreign medical graduates, those with practices located in institutional settings, those with multiple board certificates, and those acquiring new certificates are more likely to change specialties than other physicians.

The implication of these changes for the supply of physicians in particular fields are documented. Broad fields are only marginally affected by the career mobility of physicians, but the size of many of the intermediate fields are more substantially affected by the inflow and outflow of physicians during their careers. These rates of change must be acknowledged and incorporated into new estimates of the medical labor force.

These results underscore the need for further attention to physicians' careers. It will be fascinating to see how these patterns evolve as the medical profession adapts to the new political and economic environment. It will be useful to examine these changes with a broader range of measures, including HMO affiliation.

The analyses presented here suggest that stratification theory and research need to be broadened to tap mobility patterns occurring within occupations. The results presented for the medical profession are likely to generate hypotheses for further inquiry. For example, if changes of specialization occur even within the confines of a highly technical and regulated profession such as the medical profession, we would expect that changes in specialization would be likely to occur with greater frequency in many other fields with fewer barriers to mobility.

These analyses also suggest the need to develop ways of measuring hierarchy within professions. Can the mobility patterns described here arrayed in terms of the stratification of specialties? Are moves from lower-status fields to higher-status fields more difficult than is downward mobility? Answering questions like these would involve further analyses beyond the scope of this paper, and might well require the availability of additional independent measures of specialty status. The analyses conducted thus far set the stage for further inquiries into the career dynamics and stratification processes within the medical profession and other technical arenas.

NOTE

1. It is comprised of aerospace medicine, occupational medicine, addiction medicine, legal medicine, medical management, clinical pharmacology, palliative medicine, pain medicine, sleep medicine and "other specialty".

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Appendix Table 1 Detailed, Intermediate and Broad Specialties.

Broad Fields (15) Detailed Fields (156)	*Intermediate Fields (40)*
1 ***Anesthesiology***	
Detailed Fields	
1. Anesthesiology	1. Anesthesiology
2. Anesthesiology-Pain Management	
3. Anesthesiology-Critical Care	
2 ***Dermatology***	
Detailed Fields	
1. Dermatology	2. Dermatology
2. Dermatology – Diagnostic Lab	
3 ***Emergency Medicine***	
Detailed Fields	
1. Emergency Medicine	3. Emergency Medicine
2. Emergency Sports Medicine	
3. Emergency Medical Toxicology	
4. Pediatric Emergency Medicine (1)	
5. Pediatric Emergency Medicine (2)	
4. ***General Practice***	
Detailed Fields	
1. General Practice	4. General Practice
2. Family Practice	5. Family Practice
3. Family Practice – Sports Medicine	
4. Family Practice – Emergency Medicine	
5. Internal Medicine – Pediatrics	6. Internal Medicine – Pediatrics
5 ***Internal Medicine***	
Detailed Fields	
1. Adolescent Medicine	7. General Internal Medicine
2. Critical Care Medicine	
3. Disabetes	
4. Endocrinology	
5. Hematology	
6. Hepatology	
7. Hematology-Oncology	
8. IM – Cardiac Electrophysiology	
9. Infectious Disease	
10. General Internal Medicine	
11. Internal Medicine-Geriatrics	
12. Internal Medicine – Sports Medicine	
13. Nephrology	
14. Nutrition	
15. Oncology	

16. Pulmonary Critical Care Medicine
17. Rheumatology
18. Allergy — 8. Allergy and Immunology
19. Allergy and Immunology
20. Allergy and Immunology Diagnostic Lab
21. Immunology
22. Immunology Diagnostic Lab
23. Cardiovascular Disease — 9. Cardiovascular Disease
24. Gastroenterology — 10. Gastroenterology
25. Physical Medicine and Rehabilitation — 11. Physical Medicine and Rehabilitation
26. Spinal Cord Injury
27. Pulmonary Disease — 12. Pulmonary Disease

6 ***Neurology***
Detailed Fields
1. Child Neurology — 13. Neurology
2. Clinical Neurophysiology
3. Neurology

7 ***Obstetrics and Gynecology***
Detailed Fields 1. Gynecologic Oncology — 14. Obstetrics and Gynecology
2. Gynecology
3. Maternal and Fetal Medicine
4. Obstetrics and Gynecology
5. Obstetrics
6. Obstetrics-Critical Care
7. Reproductive Endocrinology

8 ***Pathology***
Detailed Fields
1. Anatomic Pathology — 15. General Pathology
2. Blood Banking
3. Clinical Pathology
4. Dermatopathology
5. Hematology-Pathology
6. Medical Microbiology
7. Neuropathology
8. Pathology -Chemical
9. Pathology -Cytopathology
10. Pathology-Immunopathology
11. Pathology -Immunopathology
12. Pediatric Pathology
13. Pathology – Anatomic-Clinical
14. Radioisotopic Pathology
15. Selective Pathology
16. Forensic Pathology — 16. Forensic Pathology

9 ***Pediatrics***
Detailed Fields
1. Adolescent Medicine — 17. General Pediatrics
2. Critical Care-Pediatrics
3. Neonatal-Perinatal Medicine
4. Pediatrics
5. Pediatric Allergy
6. Pediatric Endocrinology
7. Pediatric Infectious Diseases
8. Pediatric Pulmonology
9. Pediatric Medical Toxicology
10. Pediatric Gastroenterology
11. Pediatric Hematology-Oncology
12. Pediatric Diagnostic Lab-Immunology
13. Pediatric Nephrology
14. Pediatric Rheumatology
15. Pediatric Sports Medicine
16. Pediatric Cardiology — 18. Pediatric Cardiology

10 ***Psychiatry***
Detailed Fields
1. Addiction Psychiatry — 19. General Psychiatry
2. Psychiatry
3. Forensic Psychiatry
4. Psychoanalysis
5. Geriatric Psychiatry
6. Child Psychiatry — 20. Child Psychiatry

11 ***Radiology***
Detailed Fields
1. Nuclear Radiology — 21. General Radiology
2. Radiation Oncology — 22. Radiation Oncology
3. Nuclear Radiology — 23. Nuclear Medicine
4. Pediatric Radiology
5. Radiology
6. NeuroRadiology
7. Radiological Physics
8. Diagnostic Radiology — 24. Diagnostic Radiology
9. Vacular and Interventional Radiology — 25. Vascular and Interventional Radiology

12 ***Surgery***
Detailed Fields
1. Abdominal Surgery — 26. General Surgery
2. Critical Care Surgery
3. Cardiovascular Surgery
4. Cardiothoracic Surgery

5. General Surgery	
6. Head and Neck Surgery	
7. Hand Surgery	
8. Pediatric Surgery	
9. Surgical Oncology	
10. Traumatic Surgery	
11. Vascular Surgery	
12. Colo-Rectal Surgery	27. Colo-Rectal Surgery
13. Neurological Surgical Critical Care	28. Neurosurgery
14. Neurological Surgery	
15. Pediatric Neurological Surgery	
16. Opthalmology	29. Opthalmology
17. Opthalmology – Pediatrics	
18. Hand Surgery – Orthopedic Surgery	30. Orthopedic Surgery
19. Orthopedics (Foot and Ankle)	
20. Orthopedics Musculo-Oncology	
21. Orthopedic Pediatric Surgery	
22. Orthopedic Surgery	
23. Orthopedic Sports Medicine	
24. Orthopedic Surgery of Spine	
25. Orthopedic Surgery – Trauma	
26. Orthopedic Adult Reconstructive Surgery	
27. Otology	31. Otolaryngology
28. Otolaryngology	
29. Pediatric Otolaryngology	
30. Facial Plastic Surgery	32. Plastic Surgery
31. Hand Surgery – Plastic Surgery	
32. Plastic Surgery	
33. Thoracic	33. Thoracic Surgery
34. Transplant Surgery	34. Transplant Surgery
35. Urologic Surgery	35. Urologic Surgery
36. Pediatric Urology	

13 ***Preventive Medicine***

Detailed Fields

1. General Preventive Medicine	36. Preventive Medicine
2. Public Health	
3. Preventive Medical Toxicology	
4. Undersea Medicine	
5. Public Health – General Preventive Medicine	

14 ***Genetics***

Detailed Fields

1. Clinical Biochemical Genetics	37. Genetics
2. Clinical Cytogenetics	
3. Clinical Genetics	
4. Clinical Molecular Genetics	
5. Medical Genetics	

15 ***Other***

Detailed Fields

1. Addiction Medicine	38. Other
2. Legal Medicine	
3. Medical Management	
4. Other Specialty	
5. Pharmacology -Clinical	
6. Pallative Medicine	
7. Pain Medicine	
8. Sleep Medicine	
9. Aerospace Medicine	39. Aerospace Medicine
10. Occupational Medicine	40. Occupational Medicine

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