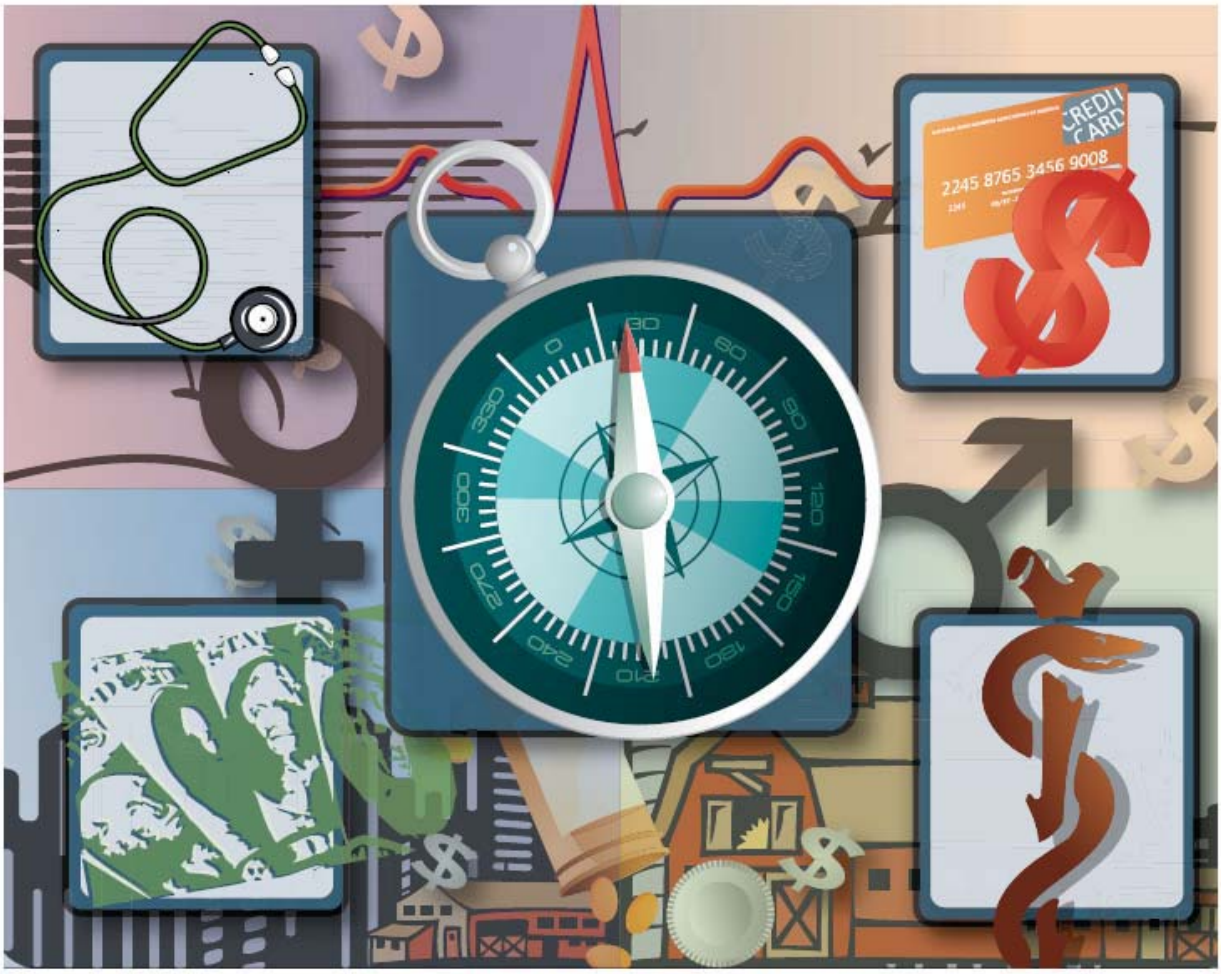

Specialty and Geographic Distribution of the Physician Workforce:

What Influences Medical Student & Resident Choices?

Funded by the Josiah Macy, Jr. Foundation

JOSIAH MACY JR FOUNDATION

ROBERT GRAHAM CENTER

AAFP Center for Policy Studies

Specialty and Geographic Distribution of the Physician Workforce:
What Influences Medical Student and Resident Choices?

The Robert Graham Center: Policy Studies in Family Medicine and Primary Care

Robert L. Phillips, Jr., MD MSPH
Martey S. Dodoo, PhD
Stephen Petterson, PhD
Imam Xierali, PhD
Andrew Bazemore, MD MPH
Bridget Teevan, MS
Keisa Bennett, MD
Cindy Legagneur, BS
JoAnn Rudd, MA

and

Julie Phillips, MD MPH
Michigan State University College of Human Medicine

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The Robert Graham Center
Washington, DC

With Support From:
The Josiah Macy, Jr. Foundation

Collaborators

Advisory Board

Candice Chen, MD MPH
George Washington University
Medical Education Futures Study

George E. Fryer, Jr., PhD
University of Arkansas for Medical Sciences

Diane R. Rittenhouse, MD MPH
University of California San Francisco

Scott Shipman, MD MPH
Dartmouth Medical College

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Bob Edsall
American Academy of Family Physicians

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The Robert Graham Center:
Policy Studies in Family Medicine and Primary Care

The Robert Graham Center is a research center that exists to improve individual and population health by enhancing the delivery of primary care. The Center aims to achieve this mission through the generation or synthesis of evidence that brings a family medicine and primary care perspective to health policy deliberations from the local to international levels. It is a functioning division of the American Academy of Family Physicians that operates with editorial independence.

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The information and opinions contained in research from the Graham Center do not necessarily reflect the views or policy of the AAFP.

Executive Summary

Unlike many Western nations, the United States does not manage or actively regulate the number, type, or geographic distribution of its physician workforce. As a result, medical trainees choose how and where to work. As with most free markets, equitable distribution is at risk without well-informed, evidence-based policies and incentives capable of promoting equitable access to appropriate care. This study contributes to understanding of important policy options and incentives by identifying factors that influence medical student and resident choices about medical specialties and location of practice. Specifically, it identifies factors that are associated with choice of primary care specialties, particularly family medicine, and with caring for rural and underserved populations.

Prior studies of the impact of debt on student specialty choice have revealed mixed effects. Recent studies suggest that physician payment disparities and the medical school learning environment are potent factors for specialty choice, and that exposure to Federal Title VII grant-funded programs during medical school and residency is associated with higher likelihood of students choosing primary care specialties and practice in underserved settings. Most studies of specialty choice or practice location focus on the decisions students make at graduation or immediately thereafter. This study is perhaps the most comprehensive to date, as it examines multiple factors along the training path and how they relate to the end result, which is specialty of physician practice and where they practice.

This study incorporates nearly 20 years worth of survey data from graduating medical students about their experiences, their debt, their beliefs, and their intentions. It includes historical files over the same period of exposure to Title VII funds during training, and of participation in National Health Service Corps (NHSC). It includes cross-sectional data about physicians' current specialties and practice locations, and a five-year cross-section of service in Rural and Federally Qualified Health Centers. All of these data about individual physicians were brought together to test for associations between student characteristics and training influences that may have policy relevance for a more purposefully produced health care workforce.

Findings:

The income gap between primary care and subspecialists has an impressively negative impact on choice of primary care specialties and of practicing in rural or underserved settings. At the high end of the range, radiologist and orthopedic surgeon incomes are nearly three times that of a primary care physician. Over

a 35-40 year career, this payment disparity produces a $3.5 million gap in return on investment between primary care physicians and the midpoint of income for subspecialist physicians.

There are measurable student characteristics, intentions, and training experiences that are significant predictors of our study outcomes. Rural birth, interest in serving underserved or minority populations, exposure to Title VII in medical school, and rural or inner-city training experiences all significantly increased the likelihood of students choosing primary care, rural and underserved careers. Being married increased the likelihood of choosing family medicine. Attending a public medical school significantly increased the probability of choosing a primary care specialty and practicing in a rural, shortage or underserved area, compared with private medical schools. Title VII exposure in residency increased the likelihood of serving in the National Health Service Corps and physician shortage areas but not primary care or rural practice. Other student characteristics reduced the likelihood of study outcomes. Women are much less likely to choose rural practice, and men are less likely to choose primary care.

The outcomes associated with debt were complex. Students with no debt and no obligating scholarships (NHSC or Armed Forces) were the least likely to later practice in primary care, in a rural area or in a health center. Debt above $250,000 also reduced these outcomes compared to other levels of debt. Students who took scholarships and reduced debt were much more likely to have careers in all three. There is a group of students sensitive to debt or agreeable to trading debt for service that chooses NHSC and, possibly, other loan repayment programs. The NHSC is currently only available to 3-4% of physicians despite a much larger applicant pool.

Conclusions:

The outcomes we studied -- practicing in primary care, practicing in family medicine, practicing in a rural community, practicing in a health center, practicing in an underserved area, ever having served in the NHSC-- are important if we hope to secure access to primary care for all people in the United States. Within the last decade, US medical student interest in and choice of these important outcomes fell well below the thresholds necessary to maintain the physician workforce in primary care and underserved settings, threatening to enhance an existing workforce maldistribution.

The complex relationship between debt and career outcomes likely has several explanations. Medical students increasingly come from affluent families who may influence career specialty and income expectations, and limited exposure to rural or underserved populations. Alternatively, debt-averse students may not apply to medical school due to fear of debt or may choose less expensive public schools. Both suggest a selection bias against our study outcomes--schools may select students less likely to choose these careers, or students more likely to make these choices are not applying. Students willing to accept obligating debt reduction (NHSC, military), are much more likely to later practice and

remain in primary care and underserved settings and such programs could be an option for more students and residents.

This study reaffirms the positive relationship between Title VII exposure and most of our study outcomes despite severe reductions in Title VII funding. It is an important support for the presence and quality of student training experiences and is an immediately relevant policy option that promotes these outcomes as it is currently due for reauthorization.

Growing physician income disparities are a major driver of student behavior. It does so directly, but also indirectly through messages about prestige, intellectual rigor, need to increase “productivity,” and status. In many academic health centers, primary care is labeled as the revenue “loss leader” rather than as a core function or even producer of downstream revenue. This income disparity explains much of the difficulty in achieving the balance in specialty and geographic physician distribution and will continue to inhibit achieving the workforce needed for better quality, efficiency and equity.

These potent effects of market factors do not absolve medical schools and residency programs of their role in affecting student choices. We found clear evidence that the student selection process and curriculum are very important in producing primary care physicians and physicians willing to serve in rural and underserved settings. In general, public and rural schools do a better job of producing primary care, rural and health center physicians, which should be an important consideration in the ongoing expansion of medical school capacity and in the design of new schools. They should also be a focus for state and federal funding of programs that enhance their success with these outcomes.

Feminization of primary care, particularly pediatrics and family medicine, threatens the rural workforce without efforts to make rural practice a more attractive or viable choice for women. We also need to understand male resistance to primary care careers and how to improve it as an option.

Finally, there is a convergence of interest in assuring sustaining healing relationships through primary care among large employers and federal advisory bodies and agencies. Previously unthinkable conversations are happening about investing more in primary care and in specific models of care that can unfetter primary care’s capacity to achieve the effectiveness, efficiency and equity realized in other countries. There are also calls for changes in how training is financed and the settings in which training can be supported to purposefully align training with desirable population health outcomes. Both policy efforts—enhancement of primary care functions and accountable training of the next generation of physicians—will be needed to reverse the current trends for more expensive and less equitable health care. We believe that this study offers supporting evidence for these policy efforts and suggests ways that the training pipeline can be modified to help.

Recommendations:

1. **Create more opportunities for students and young physicians to trade debt for service, through effective programs such as the National Health Service Corps.**
2. **Reduce or resolve disparities in physician income.**
3. **Admit a greater proportion of students to medical school who are more likely to choose primary care, rural practice, and care of the underserved.**
4. **Study the degree to which educational debt prevents middle class and poor students from applying to medical school and potential policies to reduce such barriers.**
5. **Shift substantially more training of medical students and residents to community, rural and underserved settings.**
6. **Support primary care departments and residency programs and their roles in teaching and mentoring trainees.**
7. **Reauthorize and revitalize funding through Title VII, Section 747 of the Public Health Service Act.**
8. **Study how to make rural areas more likely practice options, especially for women physicians.**
9. **New medical schools should be public with preference for rural locations.**

Foreword

The United States struggles with an enduring shortage of physicians in rural and underserved areas, and with reliable production of primary care physicians. There is growing concern that these problems will grow worse as fewer graduates of US medical schools choose primary care, as student economic diversity declines in medical schools, and as fewer international graduates come to the US on visas that obligate them to work in underserved areas. Physician maldistribution, by specialty and geography, results in gaps in access to care, gaps that result in health disparities suffered by specific regions, races, and income groups. Sizeable growth of the physician workforce in the last two decades has not resolved the maldistribution, and current efforts to simply train more physicians are unlikely to help. Market forces alone will not prepare our nation to care for the Baby Boom generation or expand the health care safety net to a growing un- and underinsured population.

When countries at the same level of economic development are compared, those where health care is organized around the tenets of primary health care produce a higher level of health for the same investment.(1)

In 2008, the World Health Organization World Health Report called for a return to primary health care, noting that when countries at the same level of economic development are compared, those where health care is organized around the tenets of primary health care produce a higher level of heath for the same investment.(1) The report notes that, “health care is often delivered according to a model that concentrates on diseases, high technology, and specialist care, with health viewed as a product of biomedical interventions and the power of prevention largely ignored. The results are predictable: unnecessary tests and procedures, more frequent and longer hospital stays, higher overall costs, and exclusion of people who cannot pay.”(2)

Even as States demonstrate a willingness to fund expansion of physician training there is remarkably little direction or funding to purposefully tailor the output to future needs. Meanwhile, the miniscule but critical Federal funding designed to affect physician distribution is in real jeopardy: Title VII funding is reduced to a trickle after the program suffered from inadequate evaluation; Medicare Physician Scarcity Area bonus payments sunset without evaluation or attention; and, Health Professional Shortage Area incentive payments were threatened by a redesignation proposal that was not coordinated with Medicare. The federal government purposefully doubled the capacity of the healthcare safety net over the past decade,

but failed to coordinate a physician training effort to staff further expansion. Policy makers could purposefully couple these very expensive efforts--physician production and improving health care access--but need evidence to guide the use of scant resources to good effect.

Like the Macy Foundation, the Robert Graham Center is committed to finding evidence-based policy options for healthcare workforce improvement and the related goal of securing access to care for all Americans. This is our first collaboration with the Macy Foundation and we are most grateful for their support of our research.

Message from the Josiah Macy, Jr. Foundation

There is once again a serious discussion about extending health care to all Americans, and there is the real possibility that this time it is going to happen. In this context, the question about whether there will be enough primary care physicians, in the right locations, to serve the needs of the public takes on a greater urgency. With a declining number of medical graduates choosing careers in primary care or willing to practice in underserved areas, it is important to understand the factors that increase or decrease the likelihood of students and residents choosing such career paths. This understanding can then be the basis for interventions that might influence these outcomes in a socially desirable way.

The Josiah Macy, Jr. Foundation is pleased to have funded this study by the Robert Graham Center. It is one of the most comprehensive assessments of the influences on medical student and resident career choice. It incorporates nearly 20 years of survey data and looks at the final outcomes of type and location of practice rather than the proximate outcomes of residency choices.

The results indicate that the determinants of career choice are complex and multifactorial. It is clear that the large and increasing income gap between primary care and specialty care has a negative impact on the decision to enter primary care or to practice in an underserved area. This is not surprising, but the findings from this study should give further impetus to policy and payment changes that would narrow this gap.

Beyond this, one of the most important findings of this study is that the content and milieu of the medical school experience *do* matter in career choice. Medical educators sometimes have taken a fatalistic view that they cannot influence these choices because they are solely driven by market forces. But this study clearly shows that the nature of clinical experiences in medical school and residency as well as the learning environment itself can have a positive impact on the likelihood of choosing careers in primary care. It is also clear from this study, even with its limitations in the amount of socioeconomic data available, that the characteristics of the students upon admission are important determinants as well. Both of these findings are important messages to medical school leaders to encourage innovations in admissions policies and curriculum at this time of medical school expansion.

The role of student debt in the decision making process is extremely complex. In this study, as in several other studies, it has failed to emerge as a dominant factor. I suspect this is because it is powerfully

confounded by the overlap between the student characteristics that predict debt or freedom from debt and those that predict the likelihood of primary care or specialty care as a career choice. Students most likely to incur high debt are also those most predisposed to go into primary care or to practice underserved areas; and those from the highest socioeconomic strata who are most likely to be debt-free are also most likely to be interested in specialty care and in practice sites that afford them a similar lifestyle to that in which they were raised. That said, we have no reliable way to assess who never enters the profession because of prospective debt or the full extent of the negative influence of debt among the subset of students most predisposed to careers in primary care. Targeted programs to address these issues would be highly desirable, and expanded programs to allow recent graduates to reduce debt by providing public services would make good policy sense.

This document should serve as an important input to health care reform discussions in the new Obama administration, in Congress and in wider health policy circles. I applaud Robert Phillips and his team at the Graham Center for their excellent work.

George E. Thibault, MD
President
Josiah Macy, Jr. Foundation

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Chapter One

What We Know About Factors Affecting Medical Student & Resident Career Decisions

Medical schools and residency training programs in the United States produce fewer primary care physicians than subspecialist physicians, and have done so for decades.(3) The popularity of primary care among US medical students has been steadily declining for the last decade, and is now at historic lows.(4) This is especially true for Family Medicine, the broadest primary care field, and the one in which residents are least likely to eventually subspecialize and most likely to care for underserved populations.(5) The imbalance of primary care to specialist physicians in the U.S. physician workforce contributes to high health care costs(3;6;7) and leaves many parts of the country without primary care physician access, especially rural and low-income urban areas. In the coming decades, some have projected a substantial physician shortage in the United States,(8) including primary care physicians.(9) While these projections are debatable, two things are becoming more clear: 1) There is a problem with sufficient access to primary care physicians in rural and impoverished areas(3); and 2) current practice configuration or organization will have great difficulty absorbing all uninsured patients if universal access is achieved.(10) Now more than ever, it is critical for our nation's future health to understand why most U.S. medical students are not choosing to practice primary care careers or service to the nation's most needy populations, and where state, federal, and private funding sources can best be used to address these shortfalls.

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Medical students' career decision-making has been discussed and studied extensively. Studies have shown that students' choices of primary care or specialty careers are influenced by *student-related factors*, such as gender, race and ethnicity, socioeconomic status, rural or urban background, and attitudes and values (11;12) ; and *curriculum factors*, particularly exposure to required Family Medicine curriculum during the third or fourth year of medical school.(11-14) *Debt* studies are mixed but Specialty *income difference* has been a consistent factor in student specialty choice out of school. Specialty choice

is also related to *institutional factors*, such as state funding, Title VII funding, and the strength of Family Medicine departments, which all contribute to the "institutional culture."(13;13;15-19)
Studies of student and physician decisions to practice in underserved areas are less extensive, but have uncovered important predictors. Students who grow up in rural areas, plan to choose family medicine at matriculation to medical school, and are male, have historically been more likely to practice rural primary care.(20-24) Similarly, students who grow up in urban underserved areas are more likely to practice in inner cities.(20) Under-represented minority physicians(25;26) and women(26) are more likely to care for underserved populations. Personal values, spirituality, and mentoring also increase students' likelihood of choosing service careers.(25-27) Finally, longitudinal, comprehensive medical school and residency educational programs with the explicit goals of preparation of students and physicians for underserved practice have demonstrated clear success.(28-33)

Despite the importance of these issues, and the understanding gained from previous researchers, significant gaps in knowledge remain about the role of medical student debt, scholarship and loan programs, type of school, curriculum, institutional culture, and potential income on medical students' specialty choices and decisions to care for underserved populations.

Medical Student Debt

The role of medical student debt in specialty choice has received significant attention, but is most often examined through attitudinal surveys of students still in the process of training. Most medical students carry a debt burden on graduation that is out of proportion to that of other professions, and there is a substantial income gap between primary care and specialist physicians, making a primary care career a relatively poor financial investment.(34) Nearly one in four 2008 medical school graduates carried more than $200,000 in educational debt, and the rate of growth of debt is out of proportion to most inflation indices or even rate of growth of physician income.(35) Research to date has not consistently demonstrated a convincing relationship between low debt and primary care specialty choice.(36-39) (18;40-46)

Likewise, the relationship between debt and service careers is poorly understood. One might expect that higher debt would motivate physicians to maximize their income by excluding low-paying patients, such as uninsured and Medicaid patients, and by practicing in affluent areas, where the exclusion of such patients is feasible. Two older studies failed to demonstrate that debt correlated with graduating medical students' intentions to practice in an underserved area.(38;47) However, these studies only examined practice intentions, rather than actual physician behaviors; they examined broadly defined practice locations rather than actual patient panels; and they were performed at a time when student and physician debt levels were significantly lower than they are now. A more recent study, examining the career intentions of graduates in 2002, found that students with higher debt loads were slightly *more* likely

to plan to work in underserved areas than their peers.(39) Only one study has directly examined the relationship between physicians' debt level and proportion of needy patients, and this study demonstrated that Family Medicine physicians and Pediatricians with more debt were *more* likely to care for Medicaid and uninsured patients.(48) Although the findings of the latter appear counterintuitive, it is likely that willingness to care for indigent patients and level of debt are both associated with other determinants, such as the socioeconomic status of the physician's family of origin, students' interest in serving the underserved, and loan repayment options. The effect of educational debt on physicians' willingness to care for uninsured and impoverished patients, and actual practice in underserved settings, needs further study.

A recent, important study on debt was done with law students.(49) In the study, potential students were randomized to one of two financial aid packages of equivalent monetary value prior to enrollment: one offered loan repayment to graduates who pursued public interest law; the second offered full tuition scholarships contingent upon students working in public interest law. Randomization was announced prior to enrollment and tuition assistance students were twice as likely to enroll in law school as loan repayment students. Tuition assistance recipients were 36-45% more likely to work in public interest law than were students with loan repayment options. This study was exceptionally well done and suggests that the risk of incurring debt is a psychological deterrent to enrollment for some students, and to choosing non-service careers for graduates. It is difficult to say how well this generalizes to medical students, but it is an important contribution to research on the effects of debt.

Scholarship and Loan Repayment Programs

Medical students have limited opportunities to benefit from low-interest loans and loan repayment and scholarship programs, including Primary Care Loans, Loans for Disadvantaged Students, state-based loan repayment and scholarship programs, National Health Service Corps loan repayment and scholarships, Armed Forces scholarships, as well as other private loans and scholarships. Federal Primary Care Loans were created to induce medical students to choose primary care careers by offering low interest rates to students committed to primary care practice. Loans for Disadvantaged Students are low-interest loans for financially needy students from disadvantaged backgrounds, regardless of specialty or practice intentions. The US Armed Forces offer medical school scholarships and financial support during residency for students who commit to service in the Armed Forces. Since 1972, the National Health Service Corps (NHSC) has offered scholarships for students who commit to practice primary care in federally designated Health Professional Shortage Areas. In the last decade the NHSC reduced scholarships in lieu of loan repayment, moving the choice to trade debt for service after training has finished.

NHSC alumni provide vital health care in their sponsoring communities and have a high likelihood of continuing to care for underserved populations even after their commitments have ended,(25;50-52) although they are less likely to remain in underserved practice than physicians who initially care for underserved populations without NHSC financial support.(53;54;54) Pathman also demonstrated that state-sponsored scholarship and loan repayment programs support a substantial work force of physicians in underserved communities throughout the country,(55) and that physicians who benefit from state-based financial incentives are more likely than other generalist physicians to practice in needy areas and care for uninsured and Medicaid.(56) A few studies of specific state or Canadian province-based loan or scholarship programs have shown mixed success.(57)

The impact of the Primary Care Loan program, Armed Forces Scholarships, and Loans for Disadvantaged Students has not been studied with regard to career choice and underserved practice. Although the primary purposes of Armed Forces Scholarships and Loans for Disadvantaged Students are to provide medical care for military personnel and provide access to higher education for needy students, respectively, the possible secondary outcome of providing a primary care physician workforce for the nation's underserved is worthy of investigation. In addition, Pathman's study of state programs is the only study to comprehensively examine the national impact of non-NHSC loans. The specialty choices of students who benefit from state-based scholarships and loan repayment have never been compared to those without such support.

Institutional Funding

There is evidence that students' decisions to choose primary care and service careers are influenced not only by their personal finances, but by the financial structures that underpin their medical schools. As noted above, multiple studies have demonstrated that public medical schools, which are supported by the state and generally view service to the state as core to their mission, generate a larger proportion of primary care physicians than privately funded schools.(58) The proportion of state financial support per student at a given school has also been correlated with the percentage of graduates entering Family Medicine residencies.(16) Public schools also produce more students interested in rural practice(59) and more rural physicians,(60) although public medical education is not predictive of rural physician retention.(61)

Since 1976, Title VII funding from the U.S. Department of Health and Human Services has provided substantial support for Family Medicine educational programs at medical schools in many states. These curricula focus on development of primary care physicians who would care for urban and rural underserved populations.(62) Studies have found strong, sometimes dose-dependent associations between Title VII funding and increased production of primary care graduates, and physicians who eventually practice in rural areas and federally designated physician shortage areas.(13;15;63) The

manner in which it might affect these outcomes is unclear but speculated to be related to curriculum content and to training experiences developed as a result of Title VII funding.(64) Title VII funding was reduced from $92.4 million in fiscal year 2003 to $48.0 million in 2008 and the President's budget typically recommends cutting it out altogether.

Specialist / Primary Care Income Gap

Physician income disparities are consistently and strongly correlated with the initial specialty choices students make.(65;66) It is unclear how this factor relates to the other factors affecting student choices. Steinbrook recently suggested that this strong, direct correlation between income and specialty choice was related to debt since primary care income can make paying off debt a difficult burden.(35)

Studies have found strong, sometimes dose-dependent associations between Title VII funding and increased production of primary care graduates, and physicians who eventually practice in rural areas and federally designated physician shortage areas. (13,15,63)

Institutional Culture

Data about the influence of "institutional culture" on students' career choices is somewhat limited, primarily because it is difficult to differentiate recruitment from educational effects. Institutional culture is also closely related to funding and to curriculum. Regardless of the underlying contributors, medical schools' institutional culture seems to correlate with career choice. For example, medical schools located in rural areas graduate substantially more rural physicians,(60) and training away from urban centers is believed to be a core component of preparation for eventual rural practice. Schools that graduate a greater proportion of primary care physicians are more likely to: 1) have community hospital teaching sites, rather than academic medical centers(67); 2) have explicit primary care missions; 3) have been founded since 1960; and, 4) have Family Medicine departments.(68) Some studies have found an inverse relationship between the amount of institutional NIH funding and the proportion of primary care graduates, and NIH funding is hypothesized to be a measurable proxy for the research culture of medical schools.(58)

The influence of institutional culture, particularly as it can be assessed independently from other factors, deserves further study. In particular, the influence of residency program (vs. medical school) institutional culture has not been systematically evaluated. Unfortunately, the culture of academic medicine, as a whole, has a negative disposition toward primary care.(69;70)

Curriculum

Longitudinal, comprehensive medical school and residency educational programs with the explicit goals of preparing trainees for primary care rural and/or underserved practice have demonstrated clear

success.(23;28;29;71-75) It is difficult to isolate the effect of the educational experiences from the effect of selection of motivated students, but several studies have shown evidence of success beyond that of recruitment alone.(22;31;76;77) Family medicine residents who train in Community Health Centers are also more likely to later care for underserved populations.(33)

Although the achievements of these longitudinal educational experiences are commendable, they include only a small fraction of the total number of medical students educated in the United States. Unfortunately, only a few studies have examined the outcomes of brief educational interventions, such as isolated rural rotations or exposure to underserved populations, and these have not demonstrated a long-term impact on career outcomes. Both Fryer(78) and Brooks(24) have demonstrated a correlation between participation in a rural medical school rotation and rural practice, but these findings did not control for the effect of interest in rural practice prior to the rotation – which has been shown in other studies to correlate strongly with eventual rural practice. In Brooks' study, rural medical school rotation was not predictive of rural practice in multivariate analysis. Easterbrook *et al* found no association between medical school or residency exposure to rural health care and eventual rural practice.(79) Pathman demonstrated that non-NHSC physicians have the same level of retention in rural communities, regardless of whether they completed rural rotations as students or residents.(61) Brush *et al* evaluated the impact of participation in medical school service-learning activities, and did not find a relationship with specialty choice.(80) Public health and community medicine teaching are increasingly incorporated into medical school curricula, either as requirements or elective experiences. Underserved clinical electives are also widely available to most students. However, it remains unclear whether brief rotations with inner city or rural populations, or curriculum in public health or community medicine, are related to eventual specialty choice or practice with underserved populations.

Previous studies substantiate that required exposure to primary care in the curriculum influences students toward primary care specialty choices. Multiple studies have shown that implementation of a required clinical clerkship in family medicine increases the proportion of medical students who choose Family Medicine careers. Longer clerkships in Family Medicine appear to be more effective.(81) Similarly, a required outpatient rotation in Internal Medicine increases the proportion of students choosing Internal Medicine careers.(82) (A more recent study found that an outpatient Internal Medicine clerkship made a general internal medicine career appear *less* appealing to students, but final career choices of these students were not compared to students without such an experience.(45)) Several randomized studies have also demonstrated that longitudinal community primary care experiences increase students' likelihood of choosing primary care careers,(68;81) although these results have not been replicated in all studies.(83) Brief curricular interventions in the first and second year do not appear to influence specialty choice.(11)

Students report that mentors and training experiences are also important in their specialty intentions.(45) We recognize that the mentoring and training experiences are very important and are interested in whether Title VII funding makes specific types of experiences and mentoring possible. Medical students often receive negative messages from mentors about primary care and these messages may be influenced by the academic culture and income disparities.(69;70;84)

Chapter Two

Study Aims, Questions, Methods, Limitations

Purpose:

The purpose of our study is to further examine the impact of financial and educational factors on medical students' likelihood of eventually practicing as primary care physicians and caring for underserved populations. We systematically examined most of the US medical student population over several decades to assess the effects of these factors on students' practice choices over time, using a very large sample size that will be sensitive to subtle relationships.

Specific Aims:

1. To understand whether or not debt at graduation from medical school is predictive of choices related to specialty or location of practice, with working in a community health center (CHC), or with National Health Service Corps (NHSC) participation. To assess whether or not exposure to Title VII Section 747 funding modifies the effects of or interacts with debt.

Hypotheses to guide our analyses:

Hypothesis 1: Higher levels of debt at graduation will be associated with decreased likelihood of choosing a primary care specialty, rural practice location, care for underserved populations, and lower likelihood of current work in a CHC but will increase likelihood of ever having been in the NHSC despite controlling for other factors. The association will be curvilinear, increasing as debt increases. The effect of exposure to Title VII funds (predoctorate, residency, departmental) on choices related to practice location, work in a CHC, or NHSC participation will be attenuated by debt.

Hypothesis 2: Acceptance of scholarships with service commitments, including NHSC and Armed Forces scholarships will be associated with low levels of medical student debt, greater likelihood of primary care practice, service to underserved populations, rural practice, and practice in community health centers.

2. To understand the association of Title VII exposure in medical school with career choice and with perceptions of primary care training and underserved populations while in medical school.

Hypothesis 3: Exposure to Title VII funding will be associated with greater likelihood of primary care practice, service to underserved populations, rural practice, and practice in community health centers.

Hypothesis 4: Students exposed to Title VII in medical school will have measurably better assessments of their training experiences in primary care with underserved populations.

3. To understand how specialty income differences are associated with student specialty choices and to quantify the eventual Return on Investment and Rate of Return of student specialty choices.

Hypothesis 5: Differences between primary care and subspecialty income at graduation will be associated with reduced selection of primary care specialty.

Hypothesis 6: Subspecialty physicians will have a higher Return on Investment than primary care and debt at graduation will exacerbate these differences.

4. To understand how the type of medical school, the quality of primary care training experiences, experiences with underserved populations in medical school, and interest in underserved populations affect subsequent decisions about specialty and practice location.

Hypothesis 7: There will be differences in choice of primary care specialty or in practice location associated with the quality (or presence) of such experiences in medical school

Hypothesis 8: Medical school rotations in rural and inner-city underserved locations will predict primary care and service careers.

Hypothesis 9: Attending public medical school will be more predictive of primary care and underserved area career.

Hypothesis 10: Students' intentions to care for underserved populations and to enter primary care will be highly correlated with later practice patterns.

Brief Methods (see appendix A for complete methods):

The financial factors examined include medical student debt, scholarships, loan repayment programs, and Title VII funding of medical schools. Educational factors include participation in primary care clerkships, student-assessed quality of these clerkships, exposure to clerkships in rural or inner city

settings, exposure to Public Health or Community Health curriculum, and education about "health issues for underserved populations." Because previous studies have shown medical student debt to be a complex issue, itself influenced by many factors, the study also examines medical student debt as an outcome variable, evaluating geographic and institutional (public v. private) factors associated with higher debt at graduation. The study also examines the strength of the relationship between stated student intentions in the American Association of Medical Colleges' Graduate Questionnaire and eventual practice patterns. This should offer better assessment of outcome than many previous career choice studies that rely on student intentions or first year residency positions as outcomes of interest. Finally, we sought and quantify the relationship between career choice and the income difference between primary care and specialist physicians at the time of graduation from medical school. We take this one step further and objectively assess the Return on Investment for choosing a primary care career vs. subspecialty career.

Predictive variables are primarily drawn from the American Association of Medical Colleges' Medical School Graduation Questionnaire, which has been administered to most graduating medical students annually since 1972. These predictive variables include total educational debt; the presence of Armed Forces, NHSC, or need-based scholarships; the presence of Primary Care Loans, Loans for Disadvantaged Students, or state-based loans; educational experiences, including primary care clerkships, the quality assessment of these clerkships, and underserved or community medicine/public health experiences; medical school; and residency program. Medical school and residency predictive variables include the presence or absence of Title VII funding during training. We planned to test the effect of university affiliation during residency training as a marker for institutional culture during the residency years (provided by the American Medical Association), and the presence of a rural or primary care track in residency; however we were unable to get a sizeable match for these factors with physicians during training.

These predictive variables were examined for relationships to the primary outcomes of interest: primary care career choice and care for underserved populations. Career specialty and location (rural vs. urban) data were obtained from the AMA Physician Masterfile. Underserved care is defined to include work in a Community Health Center (CHC), Rural Health Center (RHC), National Health Service Corps (NHSC), federally designated rural or urban Health Professional Shortage Area (HPSA), and Medically Underserved Area/Population (MUA/P). These were obtained from Medicare claims data (CHC or RHC) for the period of 2001-2005; from historical NHSC data (1978-2004), and from geographic linkage between the AMA Masterfile and shortage area shapefiles from the US Health Resources and Services Administration. Data on Title VII grant awards were obtained from US Health Resources and Services Administration's Bureau of Health Professions and were previously linked to individual physicians in the AMA Masterfile in a prior study, the methods of which are published.(85) Nine grant types were included

and grouped into 3 categories: Pre-doctoral Education ("pre-doctoral grants"), Department Development (Academic Administrative Unit or "academic unit grants"), and Residency Training ("residency grants").

We evaluated emerging variables in stepwise multivariate analysis, including known demographic factors, in order to establish a model demonstrating their interactivity and relative importance in determining students' likelihood of choosing primary care specialties and service to underserved populations. Relative risk calculations were done independent of the logistic regression analysis to explore the relationships between this Federal support for primary care training and the presence and quality of curriculum associated with desirable physician workforce. Relative risk calculations were also used to explore the interaction effects of Title VII, debt and obligating scholarships on study outcomes.

Limitations:

This study has several real and potential limitations. First, the student response rates to the AAMC Graduate Questionnaire were variable over the last thirty years. We restricted our analysis to those years for which most complete responses were obtained (after 1980 and before 2004). The 310,000 responding students represent more than 2/3rds of graduating allopathic students (Figure 1, Appendix A). We were unable to obtain similar data from the American Association of Colleges of Osteopathic Medicine and so our analyses exclude osteopathic physicians. Since international medical graduate (IMG) physicians do not attend medical school in the US, and therefore did not complete the Graduate Questionnaire, we excluded IMGs from our analyses as well. Doctors of osteopathy and IMGs make important contributions to the primary care workforce and underserved communities. Many of these excluded physicians are reflected in the incomplete matches for Medicare claims from Federally Qualified and Rural Health Centers (FQHC, RHC), and from the National Health Service Corps files (Figure 1, Appendix A). Otherwise, we were remarkably successful (greater than 90%) in matching study subjects to these important career choices.

Since Pediatricians rarely file Medicare claims, our ability to identify their contributions to FQHCs and RHCs is necessarily limited. Largely due to disabled children with social security benefits, we were able to identify hundreds of Pediatricians in health centers, but this may belie the true commitment by these physicians to underserved care.

Finally, we did not have access to the AAMC Matriculation Survey Questionnaire data that would have enabled assessment of parental income, education and profession as additional predictive variables. These data would also have provided more complete race and ethnicity data, more about geography of upbringing, and more on undergraduate experiences. This gap in our predictive variable pool also reminds us that the associations we find may be reflective of other missing predictive factors. That said,

this study is an important step forward in terms of the collection of predictive factors and in terms of being able to connect these to ultimate practice specialty and location.

Outcomes of Current Physician Training

Primary Care

Between 2001 and 2005, slightly more than 1/3rd of practicing physicians were doing so in primary care (Table 1). A recent survey found that just 2% of students were interested in general internal medicine careers, 4.9% in family medicine, and 11.7% in general pediatrics.(45) Current US graduate interest falls short of maintaining the current proportion of primary care in the physician workforce. As a result, maintaining the primary care physician workforce is increasingly reliant on International Medical Graduates. In 2008, 37.9% of first year residency positions that could potentially produce primary care physicians were filled by International Medical Graduates.(86) Of those who do graduate from primary care residencies, an increasing number of internal medicine graduates are avoiding primary care and pursuing subspecialty training and hospitalist careers.(87) Pediatricians are also increasingly subspecializing. In fact, Salsberg estimates that between 2002 and 2006, the percentage of all residents in training who will potentially practice primary care decreased from 28.1% to 23.8%.(88) This loss in production of primary care physicians may join the problem of maldistribution and further erode access to primary care services.

Shortage areas

Nearly one in four physicians was practicing in a Primary Care Health Profession Shortage Area (HPSA), Medically Underserved Area (MUA), or Medically Underserved Population (MUP) (Table 1). This does not mean that 25% of physicians care for underserved patients in these areas. The MUA and population HPSA designations are often used to designate an area that has many underserved people with poor health outcomes among a much larger and better served population. The MUP and geographic HPSA designations are more specific for isolated, underserved communities and account for just over 3% of physicians. One estimate places the number of people with potentially reduced access to care in these areas at 56 million.(89) There are many federal and state programs that use these designations to place health care resources and incent physician location.

Federally Qualified and Rural Health Centers

Based on Medicare claims (2001-2005), one in ten practicing physicians work in a Federally Qualified Health Center (FQHC) or Rural Health Center (RHC) with the latter having the larger proportion; however we know from the Uniform Data Set, that the full time equivalent physician counts are lower (7,505 FTE physicians in FQHCs in 2006 from UDS vs. 10,642 submitting any Medicare claims).(90) The clinical

capacity of FQHCs increased by 57% between 2000 and 2006 and similar expansion is planned through 2015. The expected capacity to care for 30 million people will require nearly 16,000 more full-time primary care providers. This goal cannot be achieved with the current choices made by graduating medical students and or contributions of the NHSC.(90)

Rural Practice

Nearly 10% of physicians are in rural practice compared to about 20% of the US population. Historically, rural areas have depended more on family physicians than other specialties.(91) There has been a sharp decline in other primary care specialties choosing rural practice; for example, between 1981 and 2001, the percentage of new pediatricians choosing rural practice fell from 14.6% to less than 1%.(92) The decline in acceptance of rural-born students to medical school and general loss of new graduates to primary care will likely exacerbate the relative access shortage in rural areas.

National Health Service Corps

Between 1978 and 2005, we were able to identify 2.3% of physicians who served in the National Health Service Corps (NHSC). The majority of Corps participants were medical school scholarship recipients (1.7%) despite the fact that most NHSC physicians now come through loan repayment during or after residency training (0.7%). NHSC scholarship recipients are likely to have lower or no debt, while elevated levels of debt at graduation may be predictive of acceptance of NHSC loan repayment. For these reasons we chose to study them independently.

Table 1: Physician Specialty, Practice Location and NHSC Service

Study Outcomes (Dependent Variables)	Percent of Direct Patient Care Physicians
Ever primary care physician (2001-05)	35.3%
Family Physicians	13.2%
General Internists	13.3%
General Pediatricians	7.6%
In HPSA or MUA/P	24.6%
% practicing in Medically Underserved Population area	3.4%
% practicing in Medically Underserved Area	14.6%
% Primary Care Health Profession Shortage Area (Population)	11.1%
% Primary Care Health Profession Shortage Area (Geographic)	3.1%
Rural Practice	9.8%
Ever NHSC service	2.3%
NHSC scholarship	1.7%
NHSC loan repayment obligation	0.7%
Serving in an FQHC or RHC (2001-2005)	10.4%
% Federally Qualified Health Center	4.7%
% Rural Health Center	5.8%

See Tables, Appendix A for full tables of other findings and data sources

Debt

The role of medical school debt in specialty choice and location of practice has received considerable scrutiny, but remains unclear.

Aim

To understand whether or not debt at graduation from medical school is predictive of choices related to specialty or location of practice, with working in a community health center (CHC), or with National Health Service Corps (NHSC) participation. To assess whether or not exposure to Title VII Section 747 funding modifies the effects of or interacts with debt.

Hypothesis 1: Higher levels of debt at graduation will be associated with decreased likelihood of choosing a primary care specialty, rural practice location, or current work in a CHC but will increase likelihood of ever having been in the NHSC despite controlling for other factors. The association will be curvilinear, increasing as debt increases. The effect of exposure to Title VII funds (predoctorate, residency, departmental) on choices related to practice location, work in a CHC, or NHSC participation will be attenuated by debt.

Hypothesis 2: Acceptance of scholarships with service commitments, including NHSC and Armed Forces scholarships, will correlate with low levels of medical student debt and predict primary care and service to underserved populations.

Hypothesis 3: Exposure to Title VII funding will be associated with greater likelihood of primary care practice, service to underserved populations, rural practice, and practice in community health centers.

Hypothesis 9: Attending public medical school is more predictive of primary care and underserved area career.

Findings

Debt: The proportion of students with debt and average debt per student rose steadily over the last 30 years (Figure 1). Three out of four students in private and public schools graduate with debt, but for those

in private schools average debt is nearly 50% higher (Table 2). For students with any debt, the average in 2006 was $130,000.(93) After adjusting for inflation using the Consumer Price Index and excluding scholarship recipients, we found that the average public school debt ranged from $61,000 – $91,000, and average private school debt ranged from $85,000 - $129,000 (Table 2). As we expected, NHSC scholarship recipients had lower average debt and loan repayment physicians had higher debt than the average student.

The proportion of students with debt and average debt per student rose steadily over the last 30 years (Figure 1).

In the aggregate, debt does not appear to have a notable effect on most of our study outcomes except National Health Service Corps and rural practice. The odds of serving in the NHSC are significantly higher at all debt levels except more than $250,000, likely due to the lower debt levels of scholarship recipients, and higher debt levels of loan repayment physicians (Figure 4). The odds of practicing in a rural area rise as debt level rises but only modestly compared with other factors (Figure 6).

Separate analyses for public and private schools revealed two different pictures for the odds of choosing primary care associated with debt. For private schools, odds of choosing primary care practice increases as debt increases, with those having no debt (and no scholarships) less likely to choose primary care. For public schools, debt had more of a bell-curve shape. Students with no or low debt (less than $50,000) and those with high debt (more than $150,000) had higher odds of not choosing primary care, while those with debt between $100,000 and $150,000 had the highest odds of choosing primary care. This same pattern remained when we controlled for public school attendance, but the significance was less robust due to the effects of private school (Figure 2).

Figure 1: Mean Debt among graduating medical students who have debt in Public and Private Schools (adjusted with the Consumer Price Index)

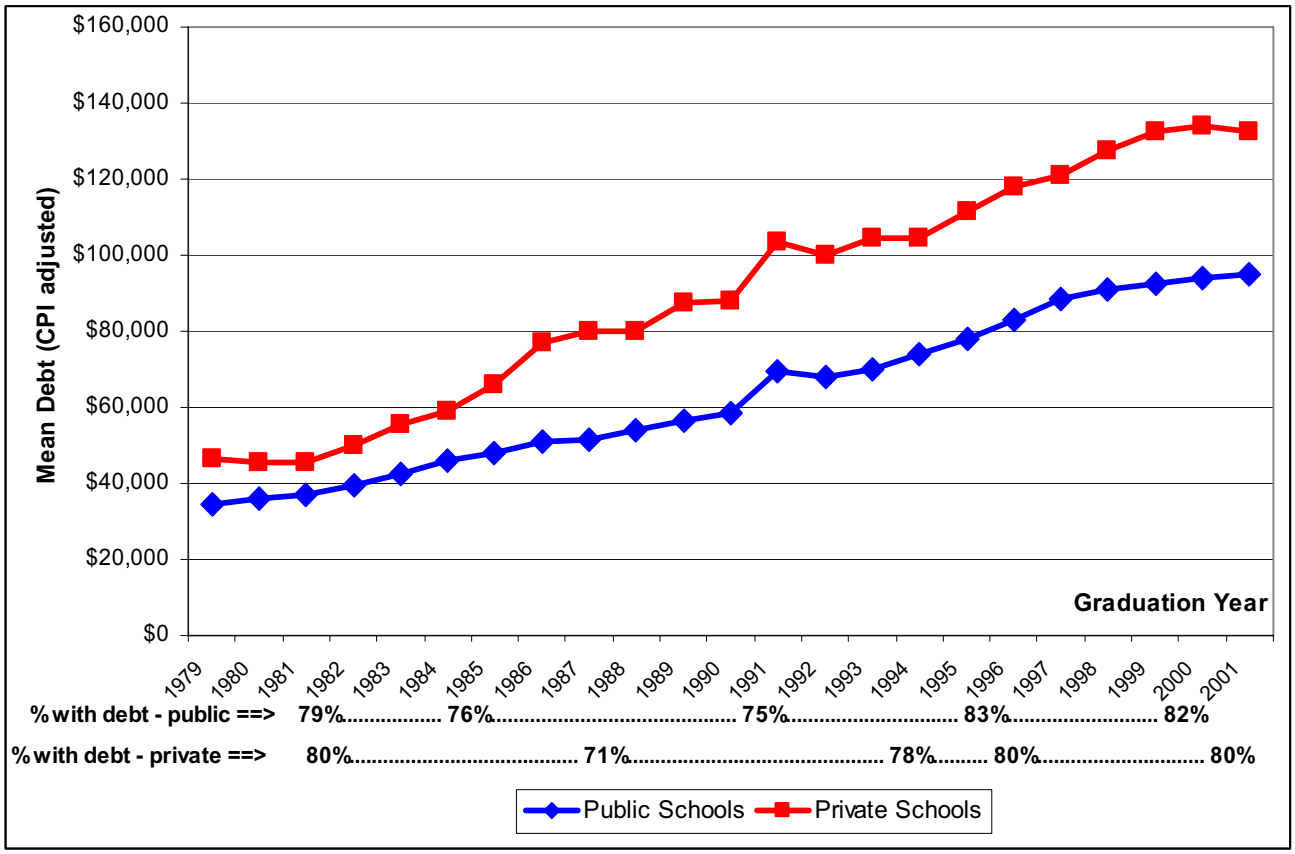


Table 2: Debt among graduating medical students who have debt and practice location (deflated with the CPI, 1979-2001)

Outcome	Attended Public Medical School			Attended Private Medical School		
	Mean debt	Median debt	Percent with debt	Mean debt	Median debt	Percent with debt
Service in FQHC or RHC	$66,958	$60,983	61%	$93,711	$84,341	56%
HPSA/MUA practice	$63,872	$57,119	81%	$90,583	$79,006	80%
Practice in other locations	$64,734	$57,791	80%	$90,305	$77,733	79%
Rural Practice	$66,975	$60,371	79%	$91,614	$81,188	77%
Primary Care	$69,916	$64,321	79%	$100,188	$91,989	78%
Family Medicine	$70,070	$64,357	80%	$99,442	$90,427	79%
Other than Primary Care	$61,257	$54,009	77%	$85,770	$73,008	76%
NHSC Scholarship	$29,507	$23,474	74%	$36,425	$28,801	74%
NHSC Loan Repayment	$89,406	$84,285	85%	$124,663	$124,018	85%

National Health Service Corps: NHSC scholars had much lower debt on average. NHSC loan repayment recipients were more likely to have debt and had much higher debt than their peers (Table 2). NHSC obligation is to an underserved area, sometimes, but not necessarily in an FQHC or RHC. Participation in the NHSC scholarship program is associated with a quadrupling of the odds of choosing primary care (Figure 2) and family medicine career (Figure 3). The association is even stronger for NHSC loan repayment but this option is chosen in or after residency when specialty is more decided. Working in an FQHC or RHC are not the only options open to NHSC physicians but participation in either the scholarship or loan repayment program increases the likelihood of working in either by 3.6 times (Figure 5). Participation in the loan repayment and scholarship programs increases the likelihood of rural practice by 2.1 and 1.9 times, respectively (Figure 6). The scholar program is associated with a small but significant increase in the odds of working in a shortage or underserved area (Figure 7).

Title VII: Matriculation in a medical school during the time that the school received Title VII funding was a proxy for potential exposure to the effects of these funds which are designed to increase primary and underserved care. The logistic regression analysis found the most impressive, independent effect to be a 24% increase in likelihood of NHSC selection for Title VII exposure in residency (Figure 4). Medical school exposure to Title VII significantly increased the likelihood of a primary care career (11%), family medicine career (12%), or rural practice (11%)(Figures 2,3,6). Strangely, exposure to Title VII in residency was associated with significantly *reduced* likelihood of a primary care career (-42%), family medicine (-6%), practice in a health center (-42%), or rural practice (-10%)(Figures 2, 3, 5, 6). Title VII exposure in residency was associated with a small but significant increase in likelihood of practice in a shortage/underserved area (10%) (Figure 7), which may explain why it had a positive association with NHSC but negative with rural (greater association with NHSC physicians in urban areas).

We conducted bivariate relative risk analysis of Title VII exposure in medical school to test for interactive effects beyond the independent effects found in the logistic regression. We found that Title VII exposure is associated with increased likelihood of students choosing primary care careers and for choosing to work in an FQHC or RHC (Figure 8). It does not appear to have a significant association with choosing to practice in underserved areas more broadly than health center staffing. The interaction of Title VII exposure, debt and obligating scholarships (NHSC or Armed Forces) produces interesting outcomes (Figures 9a-9c). Title VII exposure is associated with a step-wise increase in likelihood of choosing primary care or family medicine careers when combined with debt or debt and an obligating scholarship (Figure 9a). Practice in an FQHC or RHC is maximized by having an obligating scholarship and is reduced by any debt (Figure 9b). Exposure to Title VII is not associated with health center location when there is no scholarship but is associated with a reduced effect of debt when a student has a scholarship. Title VII exposure is associated with an increase in likelihood of practicing in a rural area, especially in conjunction with obligating scholarships (Figure 9c).

Other Factors

Physician income gap at graduation: Ebell demonstrated a tight correlation between specialty income at graduation and choice of residency specialty.(65) We found that the income gap is a significant and substantial factor in students' eventual practice location and specialty (Figures 2-7). Medical Group Management Association data on physician income show that the income gap has grown steadily since 1979 such that the difference between diagnostic radiology or orthopedic surgery and primary care was $250,000 in 2005 (Figure 10). This gap reduced the odds of students' choice of primary care or family medicine by nearly half. It reduced the odds of working in an FQHC or RHC by 30%, and of practicing in a rural area by almost 20%. Only practice in a shortage or underserved area had slightly higher odds with relative expected income at graduation which is largely due to the designations made in areas with poor people and access despite dense physician population (Figure 7). The association between this income gap and most of these outcomes is stronger than debt at graduation.

Being male: Being male was associated with a similar odds reduction of choosing primary care as the income gap, that is to say, the odds of choosing primary care was cut in half for men (Figure 2). The associated effect for choice of family medicine was not as drastic, in that male students were only 13% less likely to choose family medicine (Figure 3). Males had no reduction in odds of working in an FQHC or RHC, and were substantially more likely than women to practice in rural and underserved areas. The majority role that women now play in the Pediatrician workforce may be one of the explanations for why Pediatricians have nearly stopped going to rural and small towns.(92)

Rural birth: Birth in a rural county may not necessarily mean that someone grew up in a rural area or that they are wedded to returning to one. This potentially poor and temporally distant marker of rural background is still associated with some important outcomes. It increases the odds of practice in a rural area by 2.4 times and nearly doubles the odds of choosing Family Medicine (Figures 3 and 6). It increased students' odds of choosing primary care or serving in a health center by approximately 50% and of serving in a shortage /underserved area by nearly 30% (Figures 2, 5 and 7). For its faults, it is a potent marker if not predictor of students who will make these important choices. It is therefore not surprising that the significant declines of acceptance of rural-born students to medical school overlaps so well with the declines in student interest in choosing primary care, rural practice, and care for underserved populations.(94)

Type of Medical School: Attending a public medical school is positively associated with most of our outcomes including a 77% increase in the odds of students choosing to practice as Family Physicians and a 66% increase in practicing in a rural area (Figures 3 and 6). Not many medical schools are in rural areas, but graduating from one of them nearly triples the likelihood of practicing in a rural area. Further,

medical schools that have purposefully built community linkages realize 20% or more increase in the odds of most of our study outcomes. As states consider investments in the expansion of their existing medical schools, or in building new ones, they would do well to consider these findings if they expect a return on investment related to our study outcomes.

Summary:

Hypothesis 1:

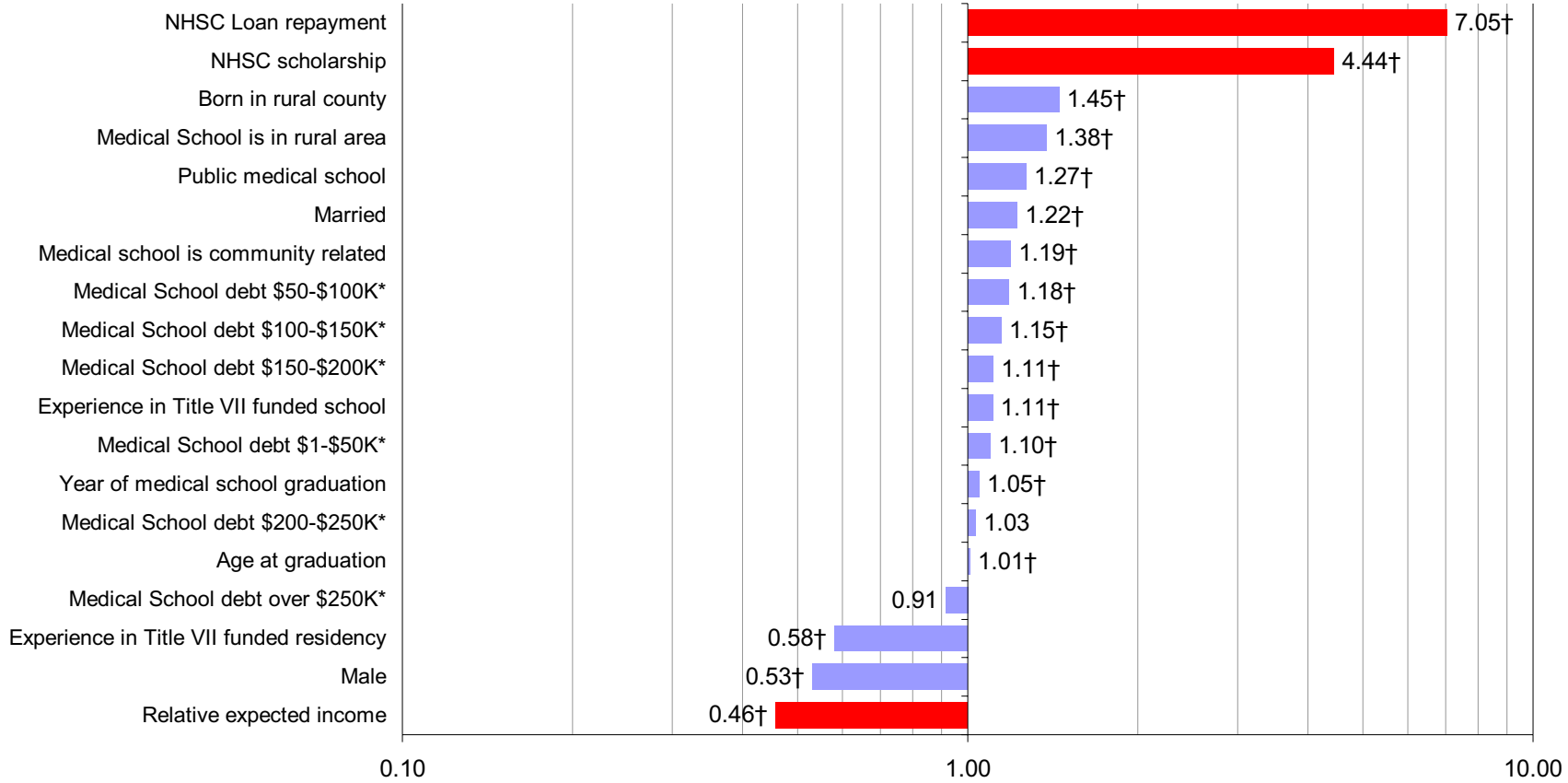
- Higher levels of debt at graduation were not associated with decreased likelihood of choosing a primary care specialty, or current work in a community health center relative to no debt
- Higher levels of debt were associated with greater likelihood of rural practice
- Students with any debt were more likely to participate in the NHSC compared to no debt—lower debt is associated more with scholarships and higher with loan repayment
- The interplay of Title VII funding and debt was complicated:
    - Title VII enhanced the likelihood of work in either an RHC or FQHC and debt attenuated this effect
    - Title VII enhanced the likelihood of primary care practice and debt enhanced this effect; the two combined with scholarships produced the greatest likelihood.

Hypothesis 2: Scholarships were strongly associated with increased likelihood of primary care practice, rural practice, service in health centers and in underserved areas.

Hypothesis 3: Title VII exposure in medical school enhanced the likelihood of primary care practice, family medicine careers, and rural practice. Title VII exposure in residency was significantly associated with increased likelihood of community health center service and practice in physician shortage or underserved areas. Title VII exposure in residency was curiously associated with a reduction in likelihood of primary care and rural careers and even had a smaller but significant negative effect for family medicine. Title VII exposure in medical school interacted with debt and scholarships to increase likelihood of practice in rural areas but not of serving in the NHSC.

Hypothesis 9: Attending public medical school strongly increased likelihood of family medicine practice and significantly increased all other outcomes (primary care practice, health centers, rural practice, and underserved area practice). Attending a medical school in a rural area substantially increased the likelihood of future rural practice.

Figure 2. Relative Likelihood of Choosing a Primary Care Career (Odds Ratios)



Interpreting the display: The odds that someone in the NHSC Loan Repayment program (top bar) will make a career of primary care medicine are 7.05 times as great as the odds of someone not in the program.

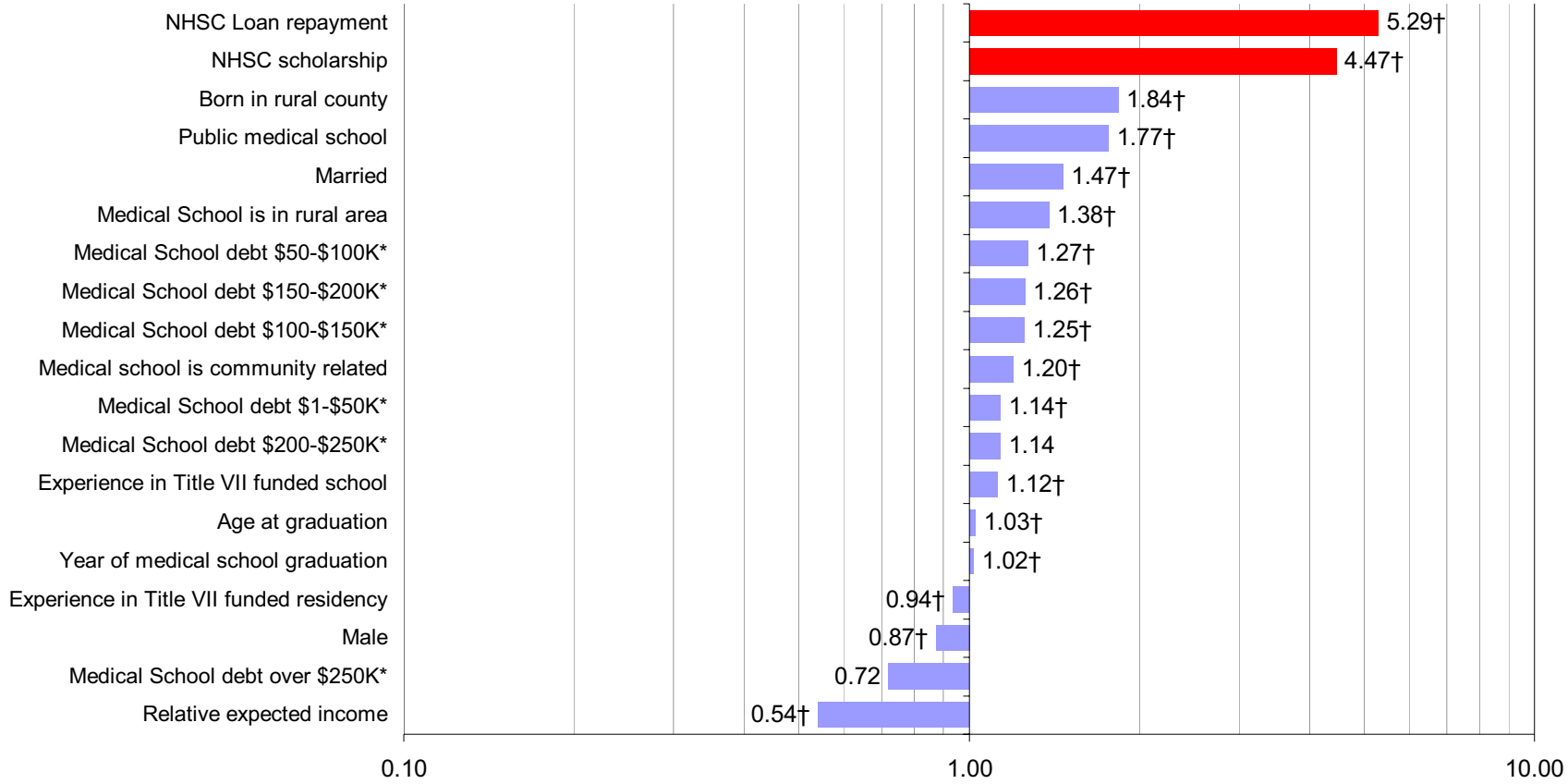
† Statistically Significant (Confidence interval do not cross 1.0)

Red bars identify odds ratios > 2.0 or < 0.5, indicating particularly strong positive or negative associations.

* Reference variable: no debt

See Appendix B, Table B1 for full logistic regression outputs and goodness-of-fit statistics.

Figure 3. Relative Likelihood of Choosing a Family Medicine Career (Odds Ratios)



Interpreting the display: The odds that someone in the NHSC Loan Repayment program (top bar) will make a career of family medicine are 5.29 times as great as the odds of someone not in the program.

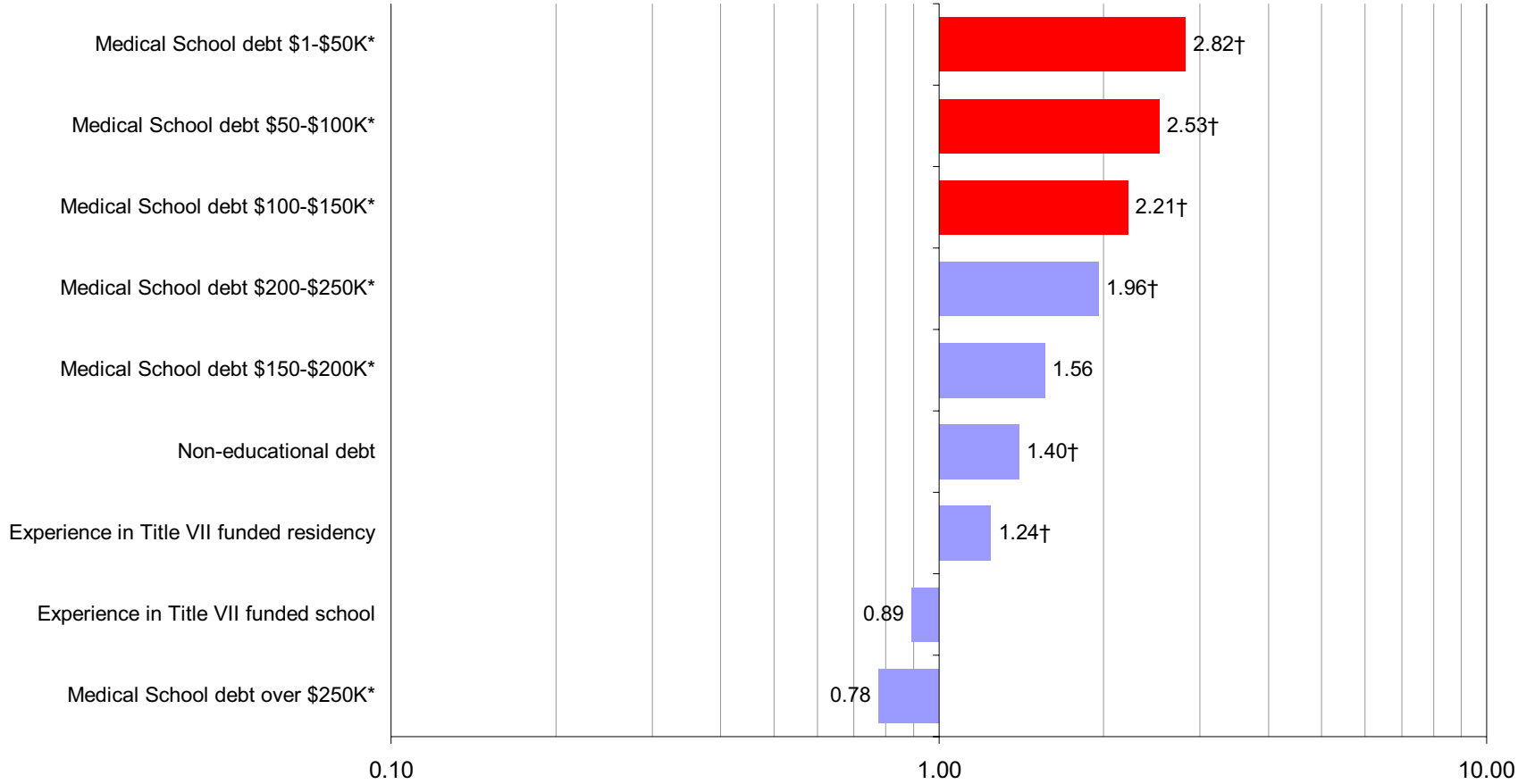
† Statistically Significant (Confidence interval did not cross 1.0)

Red bars identify odds ratios > 2.0 or < 0.5, indicating particularly strong positive or negative associations.

* Reference variable: no debt

See Appendix B, Table B2 for full logistic regression outputs and goodness-of-fit statistics.

Figure 4. Relative Likelihood Serving in the National Health Service Corps (Odds Ratios; Scholarship or Loan Repayment)



Interpreting the display: The odds that someone with medical school debt of $1,000 to $50,000 (top bar) will choose to serve in the National Health Service Corps are 2.82 times as great as the odds of someone with no debt.

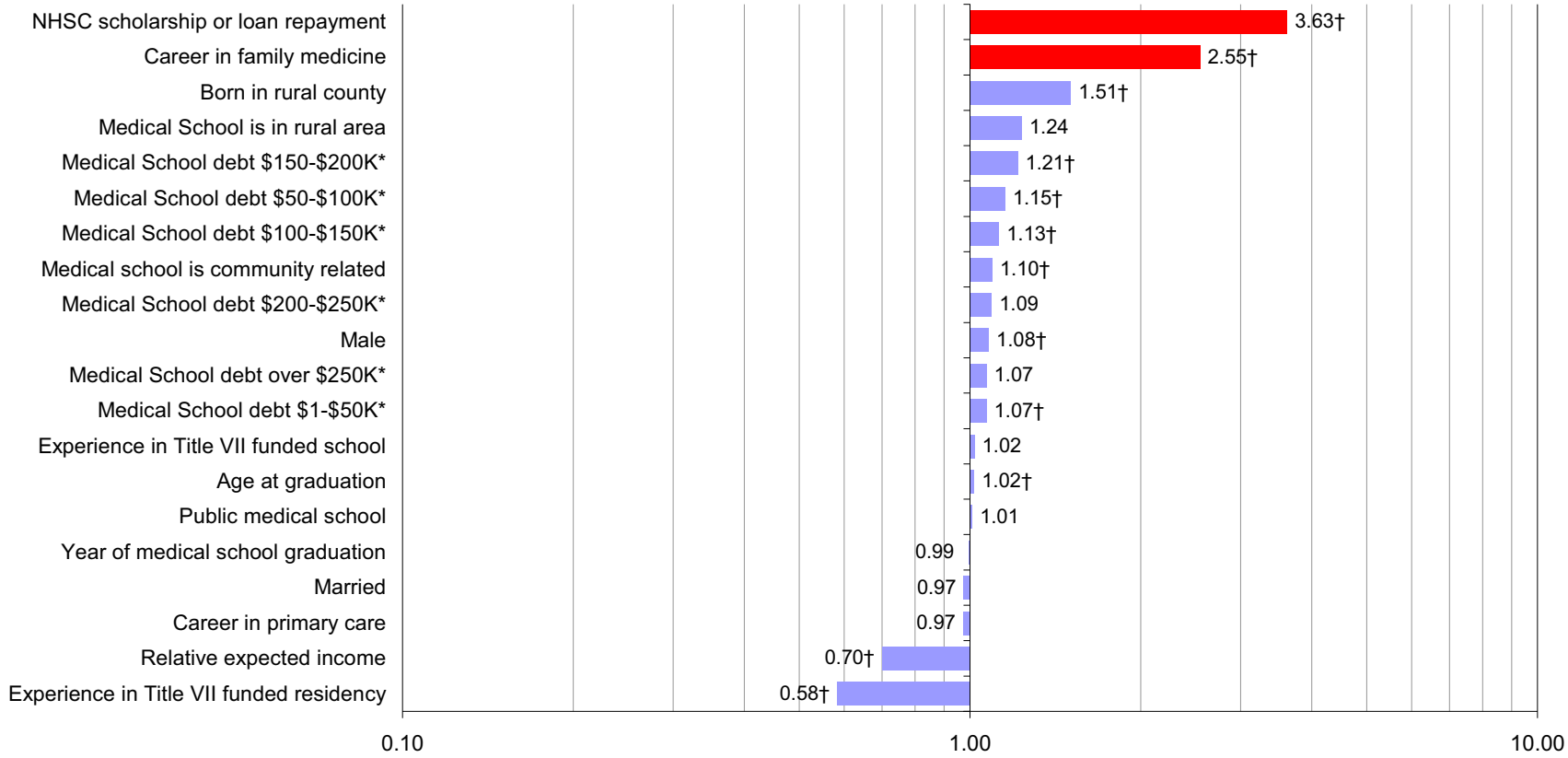
† Statistically Significant (Confidence interval do not cross 1.0)

Red bars identify odds ratios > 2.0 or < 0.5, indicating particularly strong positive or negative associations.

* Reference variable: no debt

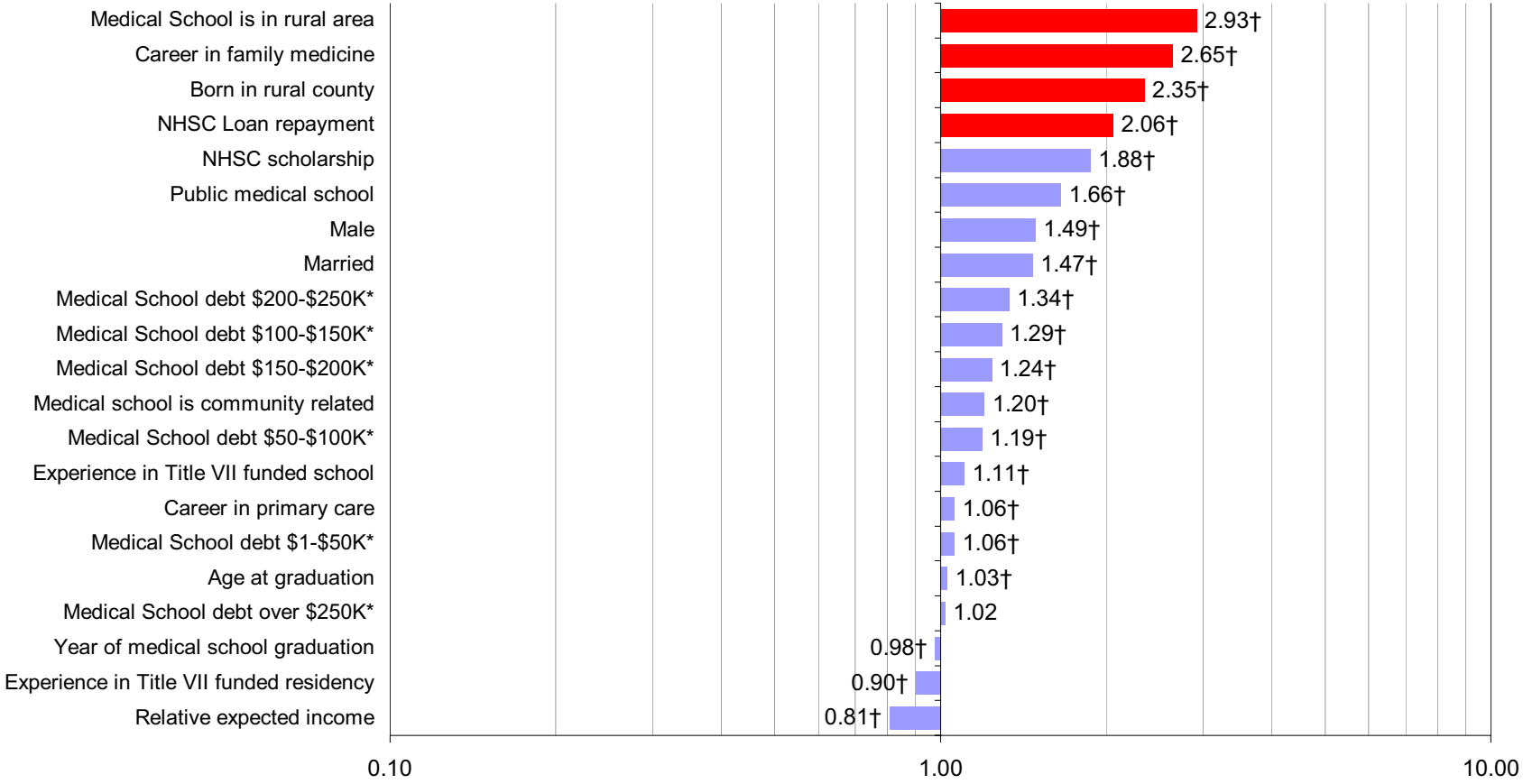
See Appendix B, Table B3 for full logistic regression outputs and goodness-of-fit statistics.

Figure 5. Relative Likelihood of Practice in a Federally Qualified or Rural Health Center (Odds Ratios)



Interpreting the display: The odds that someone participating in the NHSC scholarship or loan repayment program (top bar) will practice in a federally qualified rural health center are 3.63 times as great as the odds of someone not participating in the program.
† Statistically Significant (Confidence interval do not cross 1.0)
Red bars identify odds ratios > 2.0 or < 0.5, indicating particularly strong positive or negative associations.
* Reference variable: no debt
See Appendix B, Table B4 for full logistic regression outputs and goodness-of-fit statistics.

Figure 6. Relative Likelihood of Practice in a Rural Area (Odds Ratios)



Interpreting the display: The odds that someone who attended medical school in a rural area (top bar) will practice in a rural area are 2.93 times as great as the odds of someone who did not attend medical school in a rural area.

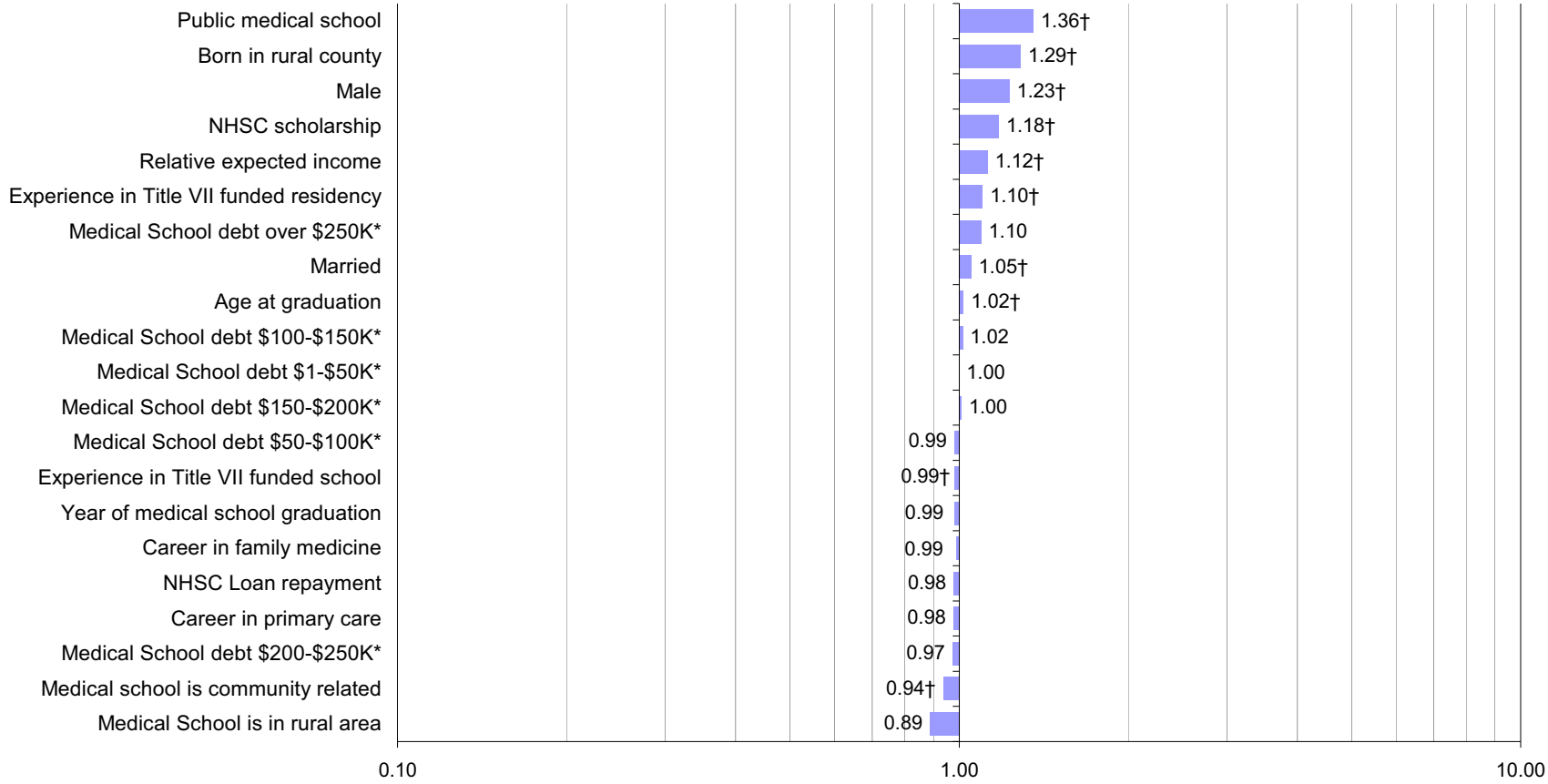
† Statistically Significant (Confidence interval do not cross 1.0)

Red bars identify odds ratios > 2.0 or < 0.5, indicating particularly strong positive or negative associations.

* Reference variable: no debt

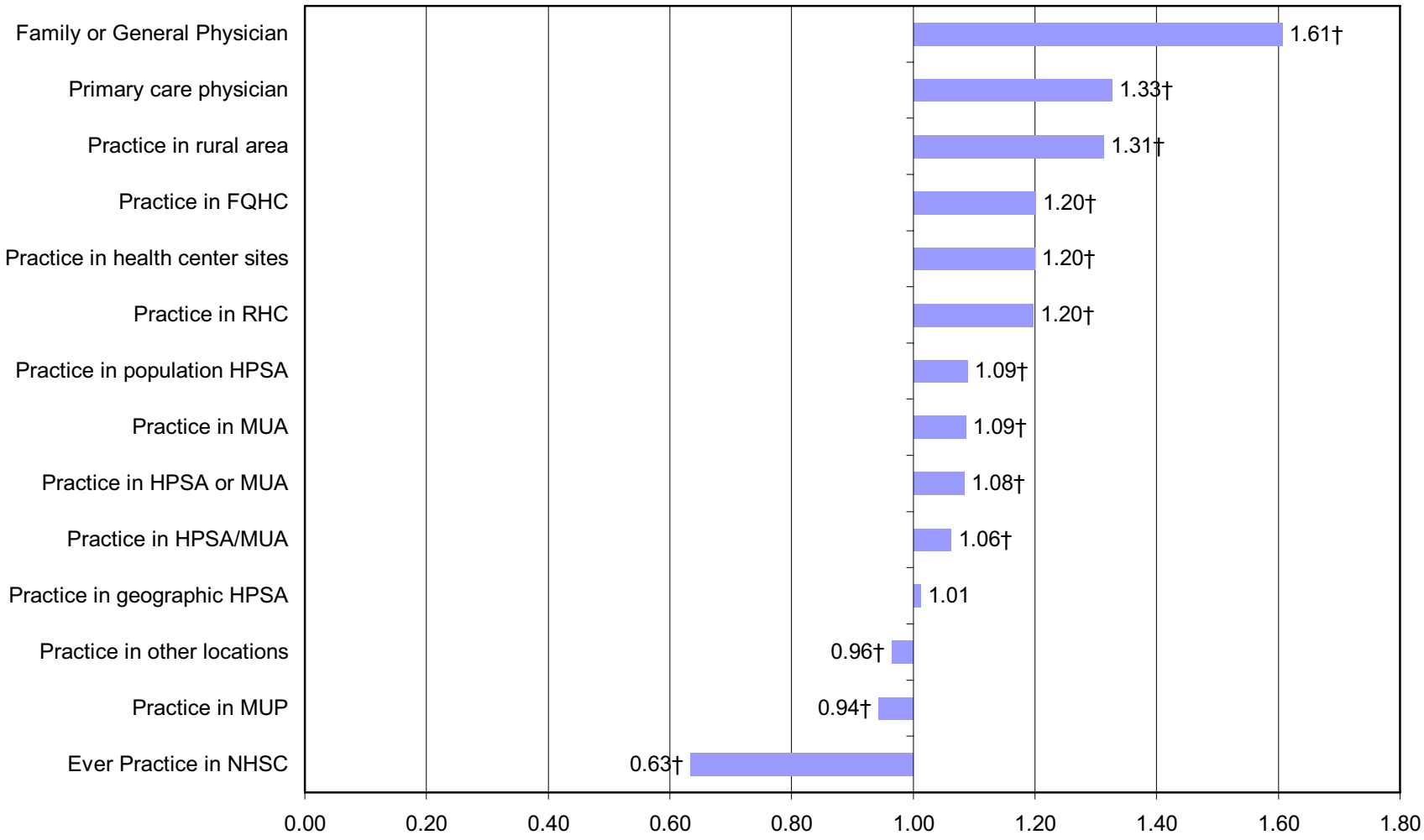
See Appendix B, Table B5 for full logistic regression outputs and goodness-of-fit statistics.

Figure 7. Relative likelihood of Practice in a Shortage Area or Underserved Area (Odds Ratios)



Interpreting the display: The odds that someone who attended a public medical school (top bar) will practice in a shortage area or underserved area are 1.36 times as great as the odds of someone who did not attend a public medical school.
† Statistically Significant (Confidence interval do not cross 1.0)
Red bars identify odds ratios > 2.0 or < 0.5, indicating particularly strong positive or negative associations.
* Reference variable: no debt
See Appendix B, Table B6 for full logistic regression outputs and goodness-of-fit statistics.

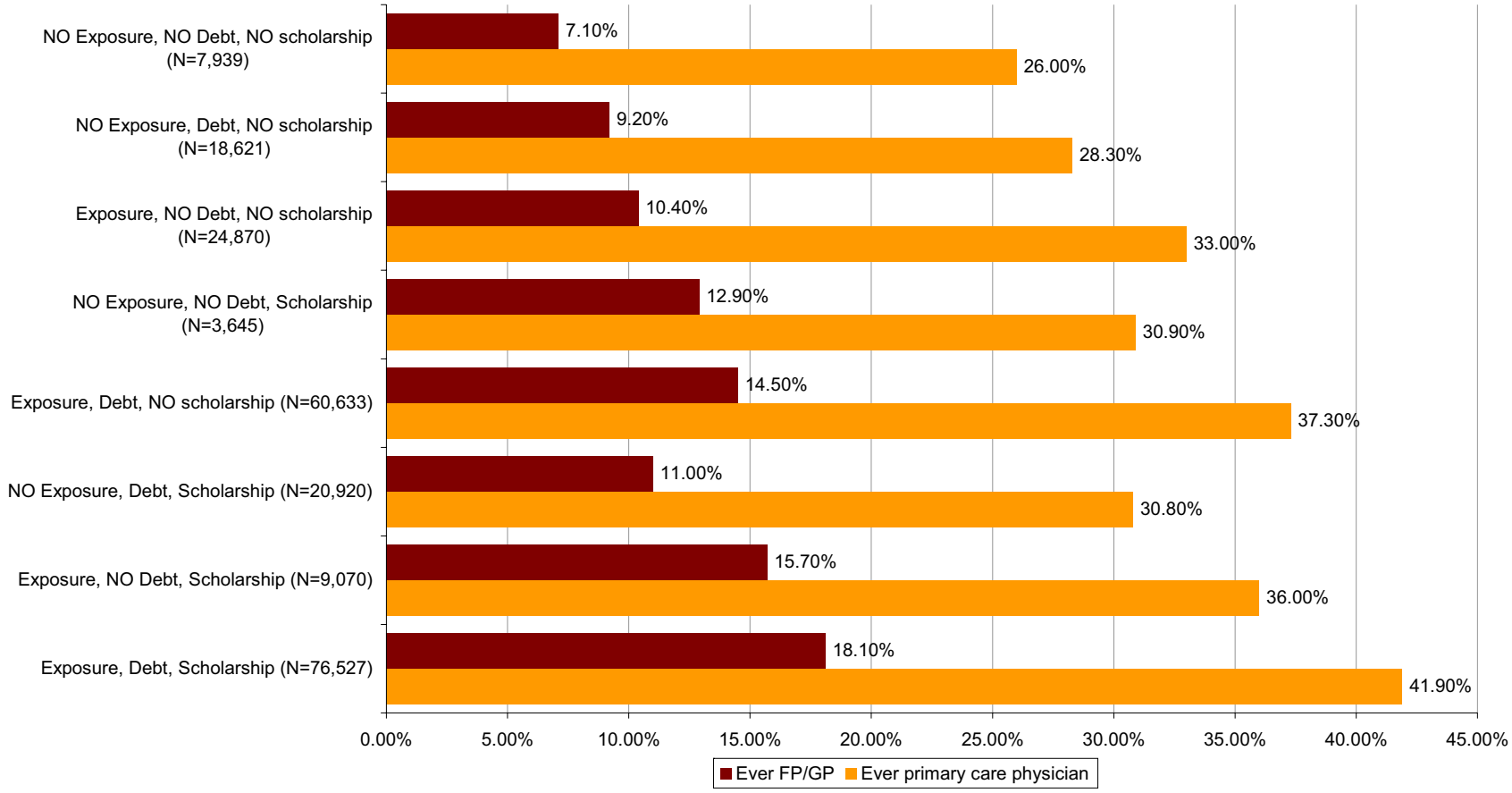
Figure 8. Relative Likelihood of Association Between Various Outcomes and Exposure to Title VII Funding (Relative Risk Estimates)



Interpreting the display: The likelihood that someone exposed in medical school to programs funded by Title VII will become a family physician or general practitioner (top bar) is about 1.6 times as great as for someone not so exposed.

† Statistically Significant (Confidence interval do not cross 1.0)

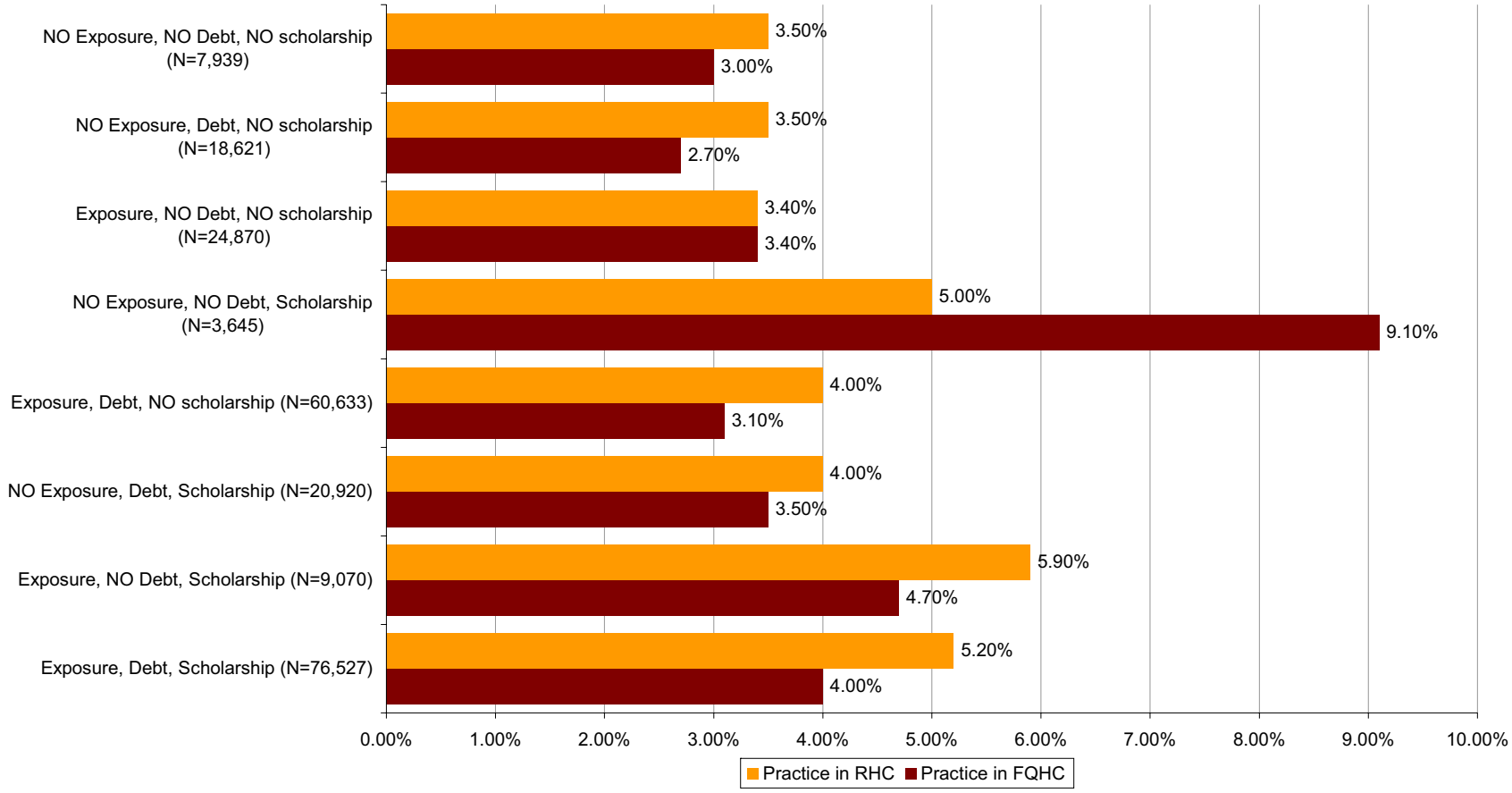
Figure 9a. Title VII Exposure, Debt and Obligating Scholarships* in Relation To Selected Outcomes:
Choice of Primary Care Specialty



Interpreting the display: Of respondents who had no exposure to Title VII programs, no debt and no NHSC or armed forces scholarship (top pair of bars), about 7% ever practiced as a family physician or general practitioner, and about 26% ever practiced as a primary care physician.

*NHSC and armed forces scholarships.

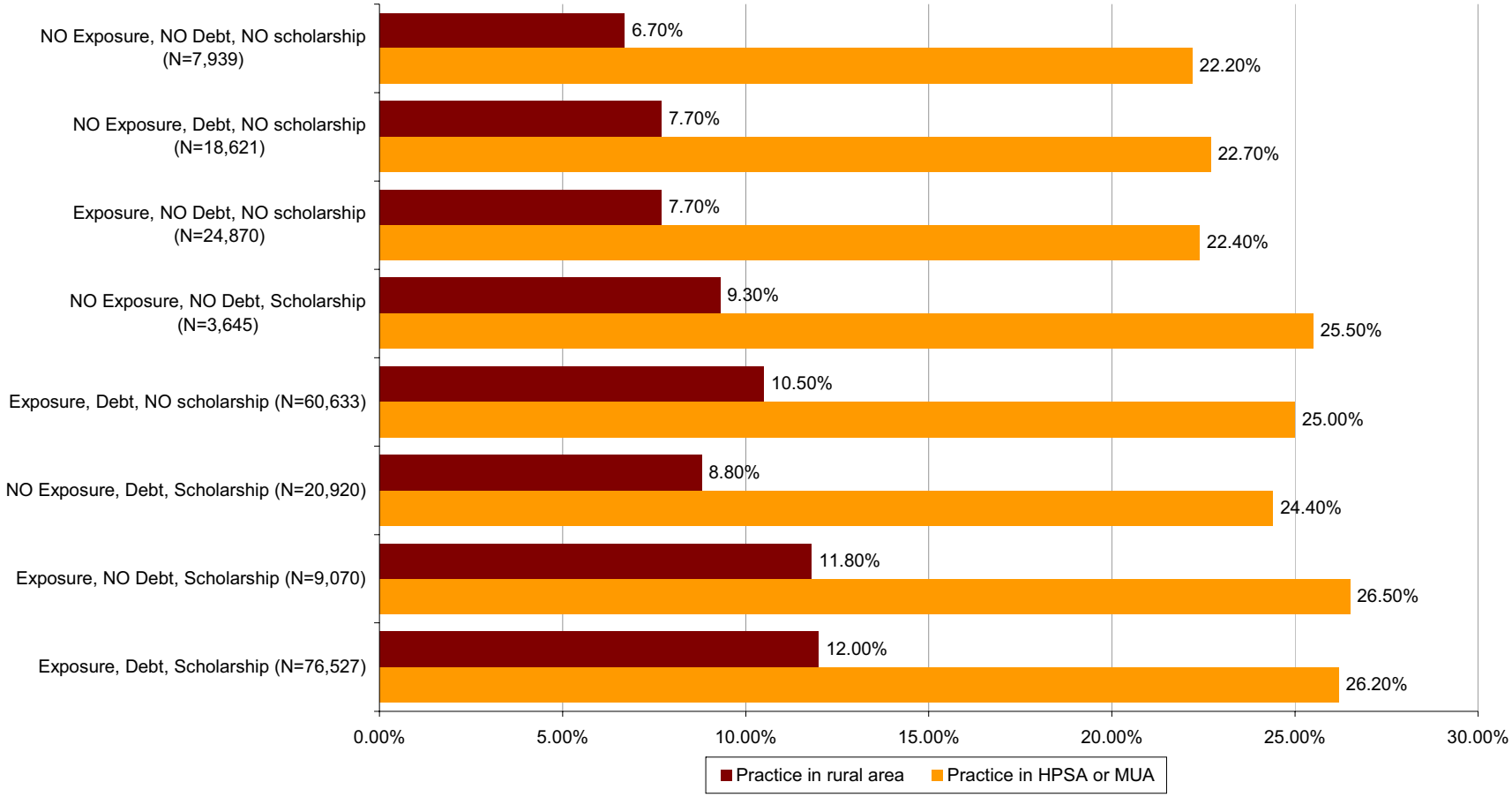
Figure 9b. Title VII Exposure, Debt and Obligating Scholarships* in Relation To Selected Outcomes: Practice Type



Interpreting the display: Of respondents who had no exposure to Title VII programs, no debt and no NHSC or armed forces scholarship (top pair of bars), about 3.5% practice in rural health clinics 3% practice in federally qualified health centers, and 73% practice in other settings.

*NHSC and armed forces scholarships.

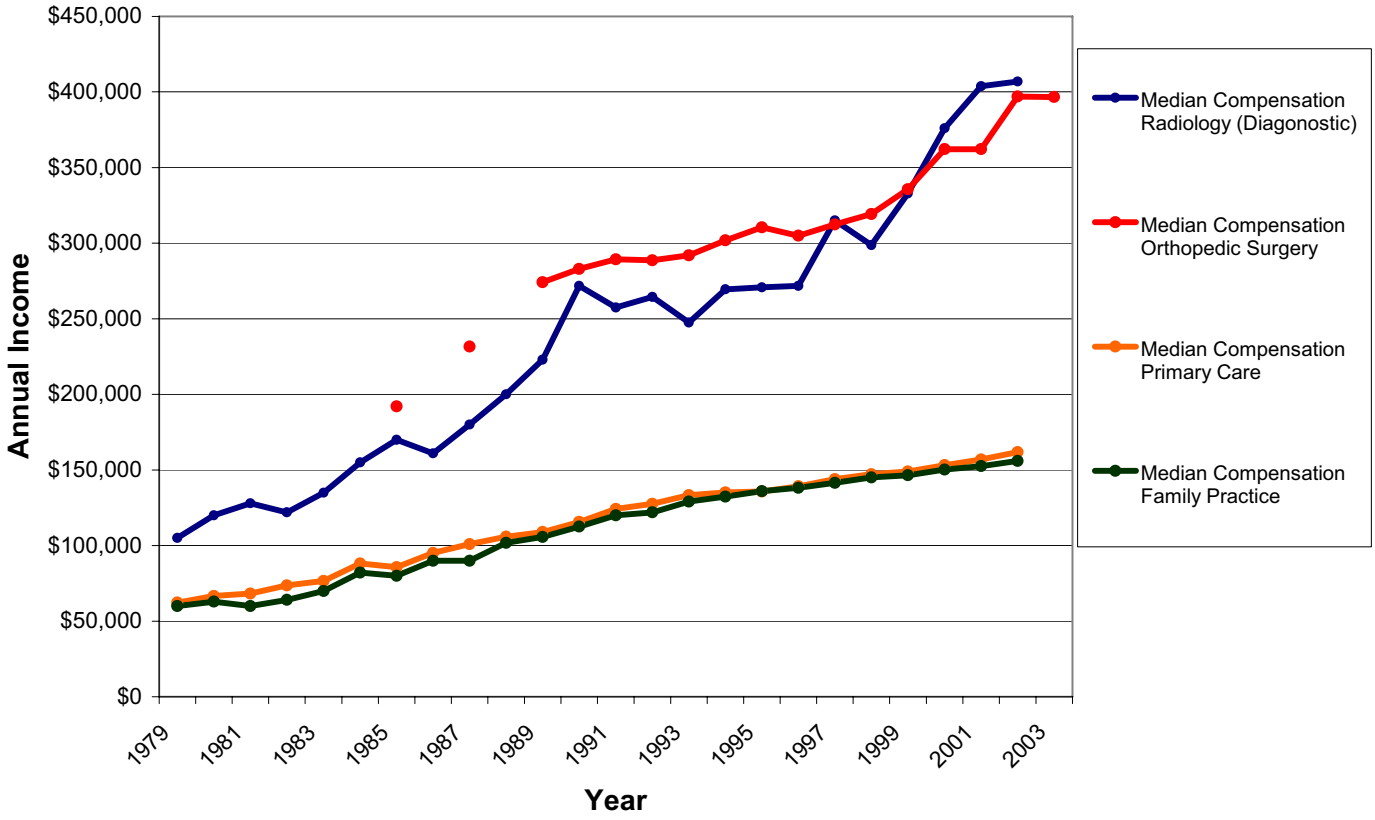
Figure 9c. Title VII Exposure, Debt and Obligating Scholarships* in Relation to Selected Outcomes: Practice Location



Interpreting the display: Of respondents who had no exposure to Title VII programs, no debt and no NHSC or armed forces scholarship (top pair of bars), about 6.7% practice in rural areas, and 22.2% practice in health professional shortage areas or medically underserved areas.

*NHSC and armed forces scholarships.

Figure 10. Progress of the Physician Payment Gap



Chapter Five

Title VII Effect, Personal Interests, and Experiences in Medical School

There is considerable evidence that Title VII is associated with increasing trainee selection of primary care, rural, and underserved practice, but the means of this effect has not been demonstrated.

Aim

To understand the association of Title VII exposure in medical school with career choice and with perceptions of primary care training and underserved populations while in medical school.

Hypothesis 4: Students exposed to Title VII in medical school will have measurably better assessments of their training experiences in primary care with underserved populations.

Aim

To understand how the quality of primary care training experiences, experiences with underserved populations in medical school, and interest in underserved populations affect subsequent decisions about specialty and practice location.

Hypothesis 7: There will be differences in choice of primary care specialty or in practice location associated with the quality (or presence) of such experiences in medical school.

Hypothesis 8: Medical school rotations in rural and inner-city underserved locations will predict primary care and service careers.

Hypothesis 10: Students' intentions to care for underserved populations and to enter primary care will be highly correlated with later practice patterns.

Findings

The presence of Title VII funding to both medical schools and departments of family medicine while students were matriculated proved to have a strong effect on student assessments of their primary care

experience regardless of where they ultimately practiced (Figure 11). This supports prior contention that it exerts some of its effect via curriculum and the quality of training experience.(64)

Primary care and family medicine physicians were moderately more likely as students to rate their primary care experience as being excellent than were subspecialists, regardless of where their practice was located (Table 3). Title VII may be an important mediator of students choosing primary care careers since it is associated with a greater likelihood of a good primary care experience.

Primary care physicians

Primary care physicians were more likely as students to express interest in serving minority populations and serving in socially deprived or underserved areas than were subspecialists (Table 3). Interest in service in underserved areas was particularly predictive of primary care careers regardless of whether the physician wound up in underserved area. Interest in certifying in a primary care specialty was not predictive of all primary care specialties but was slightly significant for family physicians. These findings suggest that altruistic student intent may have a stronger association with students who will choose primary care careers than does students' expressed interest in a primary care career. It also suggests that schools and residency programs that can foster interest in serving disadvantaged populations and create training experiences with them may enhance choice of primary care careers.

Schools and residency programs that can foster interest in serving disadvantaged populations and create training experiences with them may enhance choice of primary care careers.

Practice in a Rural Health Center

The relative risk of working in an RHC nearly quadrupled for students interested in serving in an underserved area (Table 3). It was also substantially higher if students had clerkships in family medicine, rural experiences, planned to certify in primary care or serve in a socially deprived area. Physicians completing primary care residency were nearly twice as likely to work in a rural health center.

Practice in a Federally Qualified Health Center

The likelihood of practicing in an FQHC was nearly tripled by interest in serving an underserved population and more than doubled by an interest in serving a minority population (Table 3). It was also significantly increased by school experiences delivering care to underserved people and by inner city and primary care electives (experiences selected in the fourth year of medical school).

Practice in a HPSA or MUA/P

The relative risk of working in any one of the four shortage or underserved areas were only slightly increased by interest in serving an underserved population or a community-based rural training experience (Table 3). Focusing on geographic HPSAs, the most pure of shortage areas, intent to serve underserved areas or minority populations increased the relative risk by more than two and nearly two, respectively. Training in primary care, community health electives, and highly rating one's primary care elective all significantly increased the relative risk of working in a geographic HPSA. Rural community medicine electives and experiencing a family medicine clerkship both significantly increased the relative risk of practicing in a MUP.

National Health Service Corps

The NHSC appears to be a strong calling for students with intentions to serve minority populations, to serve underserved populations, and particularly those with an interest in working in underserved areas (Table 3). Each of these was significant multipliers of the relative risk of this outcome. Experiences in community health and underserved populations were robustly associated with an increased relative risk of this outcome. These students were more likely to plan primary care careers and to do primary care residencies. Curiously, the higher the quality of their primary care experiences in medical school, the less likely they were to choose NHSC.

Rural Practice

Intention to serve underserved populations more than tripled the relative risk of this practice outcome and rural experiences in medical school doubled it. Family medicine and community medicine experiences both had significant effects. Title VII funding is also associated with significant increase in likelihood of rural practice.

Summary:

Hypothesis 2: Students exposed to Title VII in medical school were significantly more likely to have primary care and family medicine training experiences and to rate them as excellent or very good compared to students in schools that did not have Title VII funding. Rural experiences were also more likely to occur in funded schools. Students were less likely to have inner-city community medicine experiences in schools receiving Title VII funding than those not receiving funding.

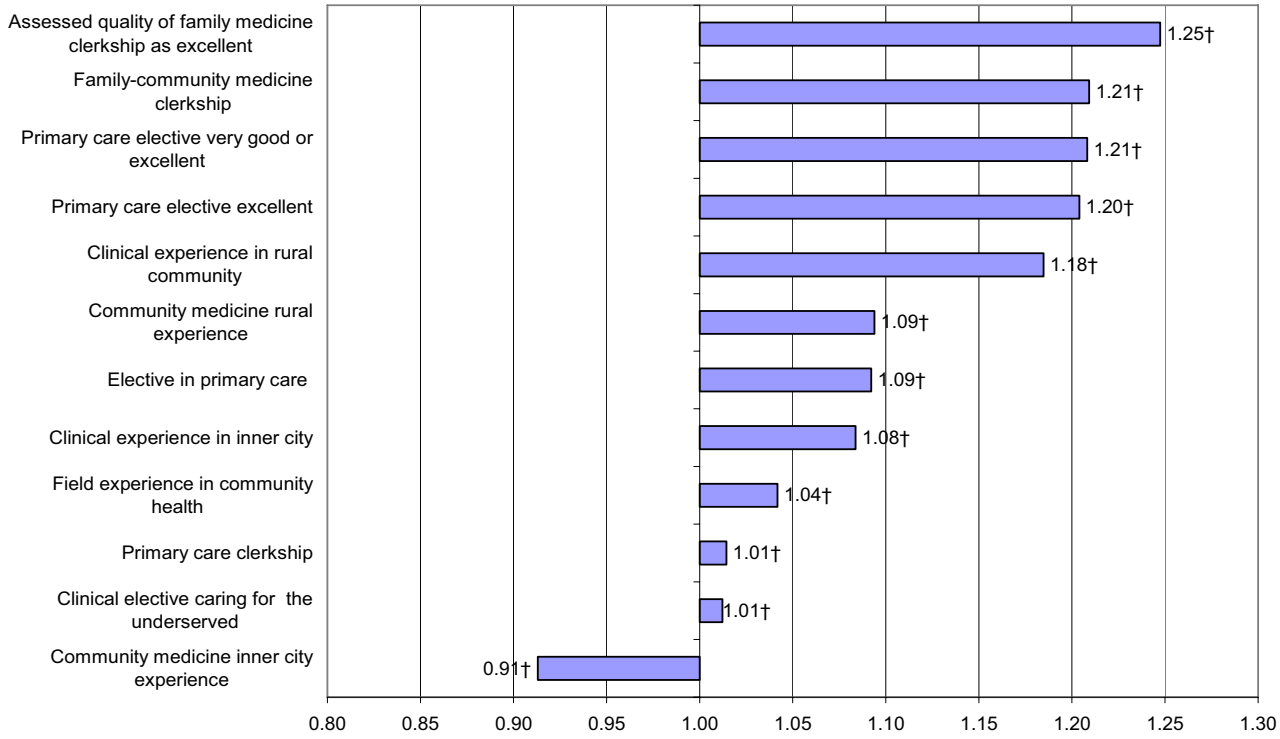
Hypothesis 7: While intentions to serve underserved or minority populations were more profoundly associated with an increased likelihood to practice in primary care or underserved areas, there was also a significantly increased likelihood of primary care specialty or

in practice location associated with the presence and quality of such experiences in medical school.

Hypothesis 8: Medical school rotations in inner-city locations increased the likelihood of serving in an FQHC. Rural rotations were associated with increased likelihood of most study outcomes, especially rural practice.

Hypothesis 10: Intentions to serve underserved or minority populations were profoundly associated with an increased likelihood to practice in primary care, health centers, rural areas, and underserved areas.

Figure 11. Relative Likelihood of Association Between Various Medical School Experiences and Exposure to Programs Funded by Title VII (Relative Risk Estimates)



Interpreting the display: The likelihood that someone exposed to Title VII funding will give a positive assessment of the quality of his or her family medicine clerkship (top bar) is about 1.2 times as great as for someone not so exposed.
† Statistically Significant (Confidence interval do not cross 1.0)

Table 3: Relative Risk of Medical School Primary Care Experience and Career Aspirations for Specialty Outcome*

Outcome	Training Experiences	Relative Risk	95% Confidence Interval
Practice in RHC	Plan to serve underserved areas	3.94	3.57 - 4.34
	Primary Care residency	1.79	1.72 - 1.86
	Plan to serve in socially deprived areas	1.71	1.60 - 1.824
	Community Medicine in rural setting	1.55	1.39 - 1.72
	Rural elective	1.53	1.45 - 1.61
	Plan certify in primary care	1.37	1.08 - 1.73
	Plan to serve minority population	1.28	1.15 - 1.42
	Family Medicine clerkship	1.26	1.08 - 1.46
Practice in FQHC	Plan to serve underserved areas	2.92	2.64 - 3.22
	Plan to serve minority population	2.34	2.11 - 2.59
	Experience with underserved	1.48	1.22 - 1.79
	Primary Care residency	1.43	1.38 - 1.49
	Plan to serve in socially deprived areas	1.35	1.29 - 1.45
	Primary care elective	1.30	1.22 - 1.38
	inner city elective	1.25	1.18 - 1.33
Practice in geographic HPSA	Plan to serve underserved areas	2.56	2.33 - 2.82
	Plan to serve minority population	1.75	1.58 - 1.94
	PC elective excellent or very good	1.31	1.24 - 1.38
	Primary care residency	1.26	1.21 - 1.32
	Plan to serve in socially deprived areas	1.22	1.14 - 1.31
	Community Health elective	1.21	1.11 - 1.32
Practice in MUP	Community Medicine in rural setting	1.38	1.22 - 1.56
	Family Medicine clerkship	1.25	1.06 - 1.47
Practice in HPSA or MUA	Community Medicine in rural setting	1.29	1.25 - 1.34
	Rural elective	1.21	1.185 - 1.23
Ever in NHSC	Plan to serve underserved areas	39.32	25.00- 61.84
	Plan to serve in socially deprived areas	8.41	7.45 - 9.50
	Plan to serve minority population	7.30	5.66 - 9.42
	Experience with underserved	3.91	2.33 - 6.57
	Primary Care residency	2.93	2.74 - 3.14
	Plan certify in primary care	2.32	1.40 - 3.84
	Community Health elective	2.27	1.90 - 2.71
	Rural Elective	1.34	1.24 - 1.44
	PC elective excellent	0.42	0.37 - 0.48
	PC elective excellent or very good	0.38	0.34 - 0.43
Primary Care Physician	PC elective excellent	1.93	1.91 - 1.95

Outcome	Training Experiences	Relative Risk	95% Confidence Interval
	PC elect excellent/Very good	1.87	1.85 - 1.89
	Plan to serve underserved areas	1.54	1.52 - 1.57
	Primary care elective	1.42	1.40 - 1.45
	Rural elective	1.38	1.36 - 1.40
	Matriculated in Title VII funded school	1.33	1.31 - 1.34
	Community Health elective	1.31	1.29 - 1.33
	Predoc Title VII training funding	1.29	1.27 - 1.30
	Department development Title VII funding	1.27	1.26 - 1.29
	Plan certify in primary care	0.44	0.43 - 0.44
Practice in rural area	Plan to serve underserved areas	3.40	3.21 - 3.60
	Rural elective	1.93	1.87 - 1.99
	Community Health elective	1.63	1.52 - 1.74
	Plan to serve in socially deprived areas	1.52	1.46 - 1.59
	Family Medicine clerkship	1.44	1.31 - 1.58
	Predoc Title VII training funding	1.39	1.36 - 1.42
	Matriculated in Title VII funded school	1.31	1.28 - 1.35
	Plan certify in primary care	1.26	1.09 - 1.44
	Primary Care residency	1.22	1.19 - 1.24

*Retained Relative Risk if >1.200 or <0.700; highlighted variables had RR > 2.0 or < 0.5, indicating particularly strong positive or negative associations

Return on Investment

Return on Investment may compound the effects of a physician specialty income gap

Aim

To understand the Return on Investment of student specialty choices, and the significance of debt at graduation from medical school on ROI (depending on specialty choice).

Hypothesis 3: There will be measurable differences in ROI for students choosing subspecialty careers over primary care and debt at graduation will exacerbate these differences.

Findings

We found that the annual income gap between primary care specialties and highly compensated specialists (radiology or orthopedic surgery) is associated with dramatic reductions in choice of primary care careers. Information on this difference is readily available to students. We were interested to understand how this annual difference relates to a career-long difference in the return on investment yielded by students' career choices. People can rarely access information on career ROI, but they see the differences in the lifestyles, offices, and personal property of their physician-teachers and role models. The income gap that stratifies much of society often stratifies the physician community as well, in terms of where they live, the types of cars they drive, and which universities their children attend. It is also reflected in where they work; the "heart hospital" side of a medical campus may have fountains and artwork, while the mental image of the primary care offices is a necessarily full waiting room of a practice where physicians see 40 or more patients a day. Many of the cognitive subspecialties that don't have well-reimbursed procedures and technology, or that depend on Medicaid and other low-margin insurance streams, like pediatric subspecialists, share primary care's lower career ROI and struggle to compete for students. Our goal is not to bemoan the career ROI of primary care physicians, most of whom will still occupy the top 10% of the US income strata. It is to show

The income gap that stratifies much of society often stratifies the physician community as well.

the cumulative, relative gap that may be even more important than annual income gap in how it drives student choices.

Most of the work on return on investment related to medical careers was done more than a decade ago when the difference between primary care physicians and subspecialists was also a concern. Weeks and colleagues used an economic measure called hours-adjusted net present value (NPV) of educational investment to compare primary care career return on investment with other potential career options.(95) They found that students could expect a poorer financial return on their educational investment by choosing a career in primary care than if they chose a procedure-based medical or surgical specialty or careers in business, law, or dentistry. The $250,000 difference between the incomes of radiologists or orthopedic surgeons and primary care physicians discussed earlier (Figure 10. Progress of the Physician Payment Gap) is an extreme. Between 2000 and 2004, the average subspecialist income ($286,777) is $125,808, or 78% more per year than the average primary care physician ($160,969)(Table 4). However, for the average physician career the difference in ROI is much more impressive. Using average income data from the Department of Labor Statistics and the Medical Group Management Association, we found that the average college graduate could expect to make a cumulative net income of nearly $3 million, primary care physician nearly $6.5 million, and the subspecialists more than $10 milllion. The hourly adjusted Net Present Value to primary care physicians was an hourly rate of $29.58 and for subspecialists $74.45 – a 165% difference. This difference is twice as high as the more simple comparison of annual income and has not change substantially in the last 25 years (Table 5). The additional time, expense and opportunity cost of choosing a subspecialty that requires additional training reaps considerable benefit. Choosing a specialty that requires relatively little more training or expense than primary care, such as Radiology or Dermatology, pays tremendous dividends.

Net Present Value (NPV) is an economic measure of cumulative income adjusted for opportunity costs. **NPV** is a traditional business calculation often used to determine whether an investment should be made. It is the difference between the sum of the discounted cash flows expected from an investment, and the initial investment. For our purposes:

NPV = (net career income) – (adjusted income lost from an average post-baccalaureate career x years in training) – (cost of schooling and maintaining licensure)

Debt plays a role in eventual ROI (as measured by hourly adjusted Net Present Value), but a relatively small role compared to the difference in cumulative earning or to opportunity costs of not taking a job straight out of college. It plays a larger role in the ROI for primary care, though, since the same relative debt level will offset a higher proportion of cumulative net earnings.

The cumulative income difference between a subspecialist and a primary care physician is nearly the same as the cumulative income difference between a primary care physician and an average college graduate. However, the relative ROI gap between primary care physician and college graduate is smaller than that between the two physician groups. The smaller gap is because the opportunity cost represented by the college graduate's first seven years of income is a much higher proportion of the primary care physician's cumulative net earnings than it will be for the subspecialist.

The consistency of the ROI gap between primary care and subspecialty physicians over the three-decades we studied suggests that the findings for the studies done in the early 1990's still hold—that ROI is higher for busines, law and dentistry than for primary care. We did not repeat this comparison but it is unlikely that these three professions will have lost much ground in ROI. This suggests that primary care is not only competing with subspecialty care for our best and brightest students, but with other professions as well. Interestingly, in 2002, when medical school applications dropped to their lowest levels in decades, applications to law schools were peaking and applications to business schools were also rising.(96) These trends have sinse reversed, but with little benefit acruing to primary care.

Table 4. Average Years of Exposure and estimated Annual Average Costs of Medical Education and Physician Earnings

	1980-1989		1990-1999		2000-2004	
	Primary Care	Not Primary Care	Primary Care	Not Primary Care	Primary Care	Not Primary Care
Average Education & Related Costs						
Length of med school (years)	4		4		4	
Annual Average Public med school costs ($)*	$18,075		$32,035		$55,018	
Annual Average Private med school costs ($)*	$27,075		$42,135		$69,218	
Typical Length of Graduate Medical Education (years)*	3	7	3	7	3	7
Annual Average costs associated with Graduate Medical Education** ($)	$7,226	$6,605	$11,234	$10,270	$18,460	$16,875
Average Opportunity & Cert. Maintenance Costs						
Number of recertifications (# of times)	5	4	5	4	5	4
Recertification costs ($)	$1,025		$2,050		$4,100	
Typical career duration after bachelors degree (yrs)	47		47		47	
Annual Opportunity costs of medical training ($)†	$30,183		$54,145		$61,394	
Average Earnings (GME training & Work Life)						
Typical Length of Graduate Medical Education (years)*	3	7	3	7	3	7
Annual stipend ($)*	$18,109	$19,431	$28,157	$30,212	$46,267	$49,644
Working life - exposure (years)	40	36	40	36	40	36
Annual earnings ($)††	$101,378	$159,032	$135,080	$225,599	$160,969	$286,777

* Source: Association of American Medical Colleges and Journal of the American Medical Association

**Room and Board, other living expenses. Source:

† Average salary with a bachelor's degree. Source: Bureau of Labor Statistics

†† Source: Medical Group Management Association

Table 5. Estimated Total Cost of Medical Education, Physician Earnings and the Returns to Investment in Medical Education.

	1980-1989		1990-1999		2000-2004	
	Primary Care	Not Primary Care	Primary Care	Not Primary Care	Primary Care	Not Primary Care
Total Education & Related Costs						
Cumulative Public medical school costs ($)	$72,299		$128,139		$220,073	
Cumulative Private medical school costs ($)	$108,299		$168,539		$276,873	
Education debt of student in public med school ($)	$46,162		$77,235		$95,080	
Education debt of student in private med school ($)	$64,552		$111,151		$133,243	
Cumulative Graduate Medical Training costs ($)	$21,677	$46,236	$33,703	$71,890	$55,380	$118,126
Total Opportunity & Cert. Maintenance Costs						
Cumulative Certification maintenance costs ($)	$5,125	$4,100	$10,250	$8,200	$20,500	$16,400
Cumulative Opportunity costs of medical training ($)	$1,418,600		$2,544,836		$2,885,500	
Total Earnings (Medical Residency & Work Life)						
Cumulative Residency/Fellowship stipend ($)	$54,328	$136,019	$84,472	$211,487	$138,801	$347,506
Cumulative Working life earnings ($)	$4,055,124	$5,725,157	$5,403,191	$8,121,555	$6,438,755	$10,323,981
Average Hours-adjusted NPV* (5% discount)	$12.54	$36.58	$23.43	$59.95	$29.58	$78.45

Net Present Value (NPV) is an economic measure of cumulative income adjusted for opportunity costs. It includes costs and subsequent profits and allows comparisons of alternative investment or career choices. Adjusted by typical hours worked per week, this represents an hourly wage adjusted for opportunity costs related to choosing a medical career.

Chapter Seven

Conclusions and Recommendations

The outcomes we studied--practicing in primary care, practicing in family medicine, practicing in a rural community, practicing in a health center, practicing in an underserved area, ever having served in the National Health Service Corps--are important for securing access to sustaining health care relationships for all people in the United States. The capacity to connect long-term career choice outcomes over 25 years to medical student survey data, AMA Masterfile data, Medicare data, NHSC data, and Title VII funding data is an important step forward in understanding the factors that affect student career choice. It permitted robust re-testing of important past research, and helped begin filling in holes in our understanding.

Lessons learned about our outcomes:

- Primary care physicians now make up slightly more than 1/3rd of the physician workforce, yet only slightly more than 1/5th of our current students are interested in a primary care career.(45) This discrepancy gives little hope of resolving a long-standing specialty maldistribution or securing patient centered medical homes for all Americans. The resulting dependence on international medical graduates to shore up our primary care workforce is unethical as it directly and indirectly deprives many developing countries.(97)
- Less than 10% of physicians practice in rural areas where more than 20% of the US population lives. In 2003, the US Government Accountability Office found that the physician workforce had grown faster than the US population but that this growth had not resolved the geographic maldistribution.(98) Fewer new physicians are choosing to practice in rural areas.
- Only 3% of allopathic physicians are currently located in the most underserved of US communities--geographic Health Professional Shortage Areas. The proportion in Medically Underserved Population areas is similarly small and fewer physicians are serving populations in these areas except through Federally Qualified Health Centers, Rural Health Centers, and the National Health Service Corps.
- At least one in ten allopathic physicians spends some time caring for patients in an FQHC or RHC. Community health centers are the cornerstone of current Federal policy for securing access to primary care services for the un- and underinsured in the US and considerable resources have been poured into rapidly expanding their capacity. Currently, incentives and policies are not sufficiently aligned for our medical schools and residencies to staff another large expansion. Staffing a rapidly

enlarged health center network will likely require incentives to shift currently practicing physicians, NPs and PAs into these settings.

- Slightly more than 2% of allopathic physicians have served in the NHSC during its first 25 years of existence. This important program was recently reauthorized and is critical to access to care for underserved people.

Lessons learned about our hypotheses:

- **Debt** has an important role in shaping the career choices for some students, but it does not appear to be a potent factor for most, at least not relative to other important factors. In private schools, increasing debt is associated with increased likelihood of choosing some of our study outcomes. In public schools, the mid-range of debt, $100,000 - $150,000, appeared to have the highest likelihood of choosing primary care practice and this likelihood decreased with no debt or higher debt. The gap in average debt between graduates of private and public schools may relate to debt tolerance and how it sorts students into the two types of schools.(49) The lower likelihood of students with no or low debt with our study outcomes may be explained by the types of students who are able to graduate from medical school without debt— they often come from households with higher socioeconomic status which may influence their career choices. Most are likely to not have rural or underserved life experiences that make such communities career options. There is some evidence that the risk of educational debt deters students from lower socioeconomic families from ever applying to professional school.

- Clearly, for **NHSC** scholars there is a willingness to accept service obligations to avoid debt, and for NHSC loan repayment physicians, to pay off high debt. There is some evidence that interest in NHSC and its trade-off of obligation for reduced debt is a growing interest among students. NHSC physicians had much higher odds of choosing careers reflective of all our study outcomes. The NHSC obligation is typically 3-5 years, but its desirable outcomes are sustaining, well beyond the initial obligation. With current interest in the NHSC and requests for NHSC providers well above offered positions, there is room to expand the program size and offset the effects of debt for many more students.

- This study confirms that **Title VII**, Section 747 of the Public Health Service Act serves an important role in facilitating the choice of primary care, practice in underserved regions, and service to needy populations. It is a shadow of its former self in terms of funding. Attending medical school receiving Title VII funds was associated with significantly increased odds of all of our study outcomes except NHSC. Attending a residency receiving Title VII funds was associated with significantly increased

odds of NHSC careers and practice in physician shortage or underserved areas. The latter was associated with reduced likelihood of some important outcomes (primary care and rural practice) which deserves further exploration. Maximizing our study outcomes looks to be best when there is Title VII exposure, debt of any kind, and an obligating scholarship (NHSC or Armed Forces).

- **Title VII** was associated with better ratings of primary care training experiences in medical school, and improved ratings were associated with greater likelihood of choosing a primary care career and working with underserved populations. While we cannot assume this is a causal link, Title VII may be an important mediator of students choosing primary care careers since it is associated with a greater likelihood of a good primary care experience.

- The **Physician income gap** is a potent damper on all of our study outcomes. It decreases odds of choosing primary care by nearly 50% and most other outcomes by 20% or more. This is consistent with Ebell's findings for specialty training choices.(65) This gap has grown and changing the payment policies that support the widening of the gap has been politically impossible. The higher paid specialties make 267% of the average primary care income. This potent disincentive for careers in primary care and rural settings is being discussed in several policy arenas but requires action to resolve the disparity if improving access, population health outcomes, and health system efficiency are important goals.

- The **Return on Investment** for choosing a subspecialty at the average salary of all subspecialties (lower than the radiology or orthopedic surgery comparison above) produces a net ROI of $3.5 million over choosing a primary care career. In the early 1990's, the ROI for primary care was lower than that for professionals in business, law or dentistry, and likely remains so. Medical students may not be able to cite the relative ROI difference, but they see its fruits in the lifestyle and respect that many subspecialists enjoy relative to their primary care colleagues. The difference in ROI makes the income disparity between primary care and subspecialties more glaring, its outcomes more understandable, and persistence unconscionable.

- **Training in rural locations** is important to students' choosing to practice in rural locations and rural health centers. Inner city experiences did not seem to have such effect for any of the outcomes. If rural–born students (2.4 x likelihood of rural practice) interested in serving the underserved (1.5 x likelihood of Rural Health Center) also have rural training experience, it may have multiples of effect. Currently, most schools do not purposefully align these enhancing factors. Schools, residency

programs, and medical education funders should consider this as they look at curriculum and funding priorities.

- Attending **public medical school** is more predictive of primary care and underserved area careers than private medical school; in fact, it increases the odds of choosing Family Medicine by 77% and primary care by 27%. To the extent that these outcomes are desirable to state policymakers and legislators, they should study their relevant schools to help inform their funding decisions. They may also want to consider public school models and outcomes if they are considering adding new medical schools.

- **Students intent on caring for underserved populations** were significantly more likely to do so. For example, interest in underserved populations nearly tripled the likelihood of practice in an FQHC and increased the likelihood of serving in the NHSC eight-fold. Interest in serving minority populations, underserved areas and underserved populations increased the likelihood of our study outcomes several fold. Schools should institute a series of interview questions about service to underserved, socioeconomically deprived, rural, minority and inner-city patients—and should give these weight in acceptance. They could also become markers for targeted mentoring and training experiences. Schools should partner with community health centers, area health education centers, and private clinicians to provide related experiences and reinforce student interest. Students could be identified early for specific mentoring and guided to residency programs that can offer clinical, community, and leadership training geared to caring for these populations.

Converting knowledge into meaningful policy: A convergence of opportunity?

The US Commission on Graduate Medical Education, an advisory body to Congress and the President on postgraduate medical training, advocated for a 15% expansion of allopathic medical school enrollment, and the Association of American Medical Colleges (AAMC) increased the recommendation to 30%. As a result, current schools are projected to expand by 20%(99) and a dozen new schools are in production.(100) Osteopathic training is also undergoing a significant expansion. Several states have committed to investing billions of dollars in supporting expansions of existing schools and building new ones. Federal, state and local policymakers will need other policy levers to correct provider maldistribution in a free market whose forces offer incentives to maximize provider revenue, not access to care. In many cases these policymakers lack evidence to guide their policy. The Association of Academic Health Centers recently recommended that this expansion, and other efforts to increase the health care workforce, should be purposefully directed to producing a workforce designed to improve the health of the public.(101)

Through this study, we have identified factors that could be purposefully imbedded in the training process to achieve purposeful physician workforce growth. Recently, employer and physician organizations have called for a medical home for all Americans, a daunting task given the inequitable distribution of primary care providers, as Massachusetts recently discovered.(102;103) In parallel to the growing burden of uninsurance, there are an increasing number of Americans who are 'medically disenfranchised' (104;105) Many of the medically disenfranchised consider federally qualified health centers across the U.S. their medical home. The 1000 health centers and their more than 5000 clinic sites are a critical component of the health care safety net. The Federal government has recently invested in an expansion of FQHCs to enhance access to care for underserved populations. It is not clear that these FQHCs will be able to recruit the primary care workforce needed to expand their service capacity.(90) As Congress considers legislation that promotes access to a Medical Home, understanding what predicts eventual service in a medical home for these disenfranchised is essential.

Several studies support the important role Title VII training grants play in preparing primary care clinicians to work in safety net settings such as FQHCs, but these studies were unable to account for important factors such as education debt, rural origins and other factors now available to us from the Association of American Medical Colleges. This study reveals the important interactions between these factors and their impact, further validating the role of Title VII funded programs as a key pipeline producing the clinician workforce for FQHCs. In terms of training support, COGME and the Medicare Payment Advisory Commission (MedPAC) both recently identified the need to increase GME funding flexibility to better support primary care training in the settings where they are needed.(106;107) Specifically, MedPAC offered:

> *Policymakers could consider ways to use some of these GME and IME subsidies toward promoting training in primary care. For example, a portion could be targeted specifically to support medical residency positions in primary care. Further, a share of GME and IME subsidies could be expressly directed toward training all medical residents on the importance of primary care and interdisciplinary teams, quality measurement, and clinical uses for information technology (IT). Encouragement of geriatric training opportunities in nonhospital settings (e.g., nursing facilities) may also be useful. Medical education subsidies could also be used to help pay student loans for clinicians committed to primary care specialties. Primary care providers generally earn lower salaries than their more procedurally based counterparts. Therefore, student loan subsidies could somewhat offset incentives for medical students to select higher paid specialties to help pay off their medical school debts more easily. (page 32)*

All of these options resonate well with our findings and could go a long way toward supporting the Commission on Medicare and Medicaid Services' goals for Medicare beneficiaries.
MedPAC also recently began considering how Medicare could help reduce primary care payment disparities, help rebuild its infrastructure, and reap the benefits of primary care:

> *To promote use of primary care and redistribute payments toward services furnished by primary care providers, the Commission recommends that Medicare's payment system for physician services—the physician fee schedule—include an adjustment for primary care. The adjustment would raise payments for selected primary care services furnished by physicians, advanced practice nurses, and physician assistants with practices focused on primary care. (June 08 report of MedPAC)*

We hope that these findings will encourage CMS/Medicare and large employers to embrace MedPAC's recommendation to secure the primary care workforce for the future.

Recommendations:

1. **Create more opportunities for students and young physicians to trade debt for service.** The NHSC experience demonstrates a willingness to make this trade and that it has profound effects for needed physician specialty and practice location choices. The most immediate rallying reason is the dire projected need for expansion of community health centers. Certainly, more Federal programs, such as expansion of the NHSC, are needed but states and municipalities could realize much higher return on investments in loan repayment than for building new medical schools as measured by retention and improved distribution.

2. **Reduce or resolve disparities in physician income.** The current income gap and return on investment disparity significantly and adversely affects primary care, rural areas, and access for underserved populations. The current disparity is the product of insidious payment policy and can be reversed by purposeful payment policy. Countries that reduced or eliminated primary care payment disparity realized greater interest and entry by their students and reaped economic and health benefits from investments in primary care.

3. **Admit a greater proportion of students to medical school who are more likely to choose primary care, rural practice, and care of the underserved.** Our findings and others' suggest that rural-born or raised students are more likely to choose primary care and practice in a rural area. Our

study also substantiated prior findings that students with demonstrated interest in working with underserved or minority populations are more likely to serve them in practice. We also feel that universities and medical schools have an obligation to expose more rural students to health care professions and increase their ability to compete for medical school.

4. **Study the degree to which educational debt prevents middle class and poor students from applying to medical school and potential policies to reduce such barriers.** Medical students are increasingly from more affluent families and, despite the high return on investment from attending medical school, the risk of high educational debt may be a barrier for students from less affluent families.(108) Reducing debt during medical training could increase applications from students more likely to choose primary care, rural and underserved careers. A rise in applicants from less affluent families could also increase the opportunity for their selection (Recommendation 3).

5. **Shift substantially more training of medical students and residents to community, rural and underserved settings.** This includes support for Title VII (Section 747 of the Public Health Service Act) funding expansion since it supports many of the experiences that promote these important choices. Rural, inner-city and underserved population clerkships and electives are associated with profound changes in students' ultimate specialty and location of practice. Learning experiences in FQHCs, RHCs and Area Health Education Centers can be means of accomplishing these goals. Arranging summer experiences for NHSC scholars after their first year of medical school could be another important opportunity.

6. **Support primary care departments and residency programs and their roles in teaching and mentoring trainees.** Strengthening the viability of primary care programs and their role in teaching and mentoring of students can provide important exposure and role-modeling. The large growth in subspecialty programs relative to primary care programs (and contraction of family medicine training positions) since the turn of this century illustrate the biases of training hospitals to bend training capacity to their bottom line. Being responsive to their mission to the health of the public will require strengthening of primary care training and ability to train in appropriate settings. The US Council on Graduate Medical Education and the Medicare Payment Advisory Committee have called for reformation of the 40-year old Graduate Medical Education payment model to better serve the public good. Changes are needed in this nearly $8 billion federal funding stream for training residents to better prepare them for practicing in communities and afford them opportunities to experience working in rural and underserved settings.

7. **Reauthorize and revitalize funding through Title VII, Section 747 of the Public Health Service Act.** Title VII Funding has languished over the last decade and is due for reauthorization. There is overwhelming evidence, confirmed in this study, of the beneficial effects associated with this small federal program. It is associated with increased primary care selection by trainees, and with rural and underserved practice. This program deserves expansion to secure these benefits and the viability of primary care departments in academic health centers.

8. **Study how to make rural areas more likely practice options, especially for women physicians.** Female physicians are twice as likely as men to choose primary care but half as likely to practice in rural areas. We need to listen to and learn from young women in medicine about what would make rural areas more of an option. Such research should also explore how to recruit female students more likely to make this choice.

9. **New medical schools should be public with preference for rural locations.** Attending a public medical school significantly increased the likelihood of primary care, family medicine, and rural practice. Attending a rural medical school was an even more potent factor for these outcomes, nearly tripling likelihood of rural practice, and also increased probability of work in a health center.

Appendix A: The data, their sources and our analytical methods

Overview:

Data was extracted from a variety of sources and various data files were match-merged to create a unique analysis file for this study. The major data files included the following:

1. American Medical Association (AMA) master file database (2001-2005)
2. An enhanced 2004 AMA master file database
3. Medicare outpatient institutional claims filed from Federally Qualified Health Centers (FQHC), Rural Health Centers (RHC), and rural primary care hospitals.
4. American Association of Medical Colleges (AAMC) graduation survey (GQ) database
5. Medical School Title VII Exposure database file
6. Primary Care Medical Residency Training History database file
7. National Health Service Corps (NHSC) participant database file
8. Supplementary data on medical student training costs

AMA master file database

The Master file database was obtained from the AMA. It is a flat-file database which contains updated information on U.S. allopathic physicians and many osteopathic physicians, including those who are not AMA members. The database is updated using information from medical schools, hospitals, state licensing agencies, medical societies, professional associations, and an ongoing survey of the physician population with each physician surveyed every 3 years. Details regarding administration of the Master file database have been published elsewhere.[1,2]

Master file variables include for each physician the "preferred mailing address" and "primary office address" for primary care physicians (family practice, general pediatrics, and general internal medicine), providing active patient care. The AMA has recently gone to great lengths to clean up the work and home

[1] Pasko, Thomas, Derek Smart, 'Physician Characteristics And Distribution In The US 2005, Amer Medical Assn (December 30, 2004)

[2] Kletke Phillip, D. Polsky, G. Wozniak, and J. Escarce "HMO Penetration and the Geographical Redistribution of Generalist and Specialist Physicians, 1987-1997," Health Services Research October, 2000.

address fields in the 2004 Master file. This is the most comprehensive data file available for physician practice location.

We used data extracted annually from the database in 2001 through 2005. We excluded from the data:

- Osteopathic physicians,
- Physicians with an indication in any of the source data files to have died.
- International medical graduate physicians not trained in an accredited US medical school.

Enhanced 2004 AMA master file database

At the Robert Graham Center the 2004 AMA Master file has specific data enhancements used for previous projects through an exclusive data agreement with the AMA. This enhanced data file includes unique identifiers, medical school experience, and up to 6 graduate medical education programs for each physician. We have geo-coded the practice location of physicians to permit both address and geographic locality matches with health center sites.

Medicare outpatient institutional claims from Health Centers

Medicare data on all physicians filing claims from Federally Qualified Health Centers (FQHC), Rural Health Centers (RHC), and Rural primary care hospitals, from 2001 through 2005, were obtained from the Centers for Medicare and Medicaid Centers (CMS). We excluded all claim lines that had clinicians with surrogate UPINs as the attending provider – billing for services by non-physician clinical providers, osteopathic physicians, dentists etc.: Anesthesia Assistant, Certified Registered Nurse Anesthetist, Certified Nurse Midwife, Clinical Nurse Specialist, Clinical Psychologist, Clinical Social Worker, Foreign Doctor (for all non-United States physicians), non-allopathic medical doctors (e.g.: DO, CH, DDM, DDS, DPM, OD), Nurse Practitioner, Occupational Therapist, Physician Assistant, Physical Therapist.

We created four extract files for each year of claims data. The first file had one record per physician per year with a Unique Physician Identification Number (UPIN) as the identifier. The second had one record per beneficiary per year and included the beneficiary's zip code. The third was a cross-walk file with one record for each combination of physician and beneficiary from the claims files. The fourth was an aggregate file with one record per health center facility or site per year. Each of the first and second extract files were geo-coded to append geographic variables corresponding to each physician and each beneficiary. Geographic variables included whether the physician was born in a rural or non-rural county.

AAMC graduation survey database

We obtained data on the Medical school loans, pre-medical school loans, non-educational loans, and data on the medical school experience from medical students graduating between 1979 and 2004 from the AAMC. We found 75 physicians who completed the GQ twice, between 1994 and 2005. In most cases with double completions (79.45%) there was one year between the completions. We summed the scholarship amounts reported on double GQ completion, deleted the first GQ completed, and kept the second (or last) GQ completed. We then substituted the summed scholarship amounts for the reported scholarship amounts on the second (or last) GQ completion.

The GQ field that indicates whether the physician received a scholarship for medical studies was missing for all the GQs completed in 1978, and about 24% of the GQs completed in 1984. For all other years the scholarship indicator is missing for only1 to 3% of the respondents. We excluded all the 1978 GQ data.

Medical School Title VII Exposure database

We obtained the Medical School Title VII Exposure database from the Health Resources and Services Administration (HRSA) of the US Department of Health and Human Services. The HRSA maintained database has the full listing of Title VII awards for the years 1978-2004. We linked individual physicians' medical school and date of graduation data from the AMA master file to the Title VII Funding database resulting in Medical School Title VII Exposure at the physician level for 1979 through 2004.

Primary Care Medical Residency Training History database

We obtained a Primary Care Medical Residency Training History database from HRSA. The database included information on not only residency programs but also hospitals, universities and other institutions affiliated with residency programs. We invested substantial staff time and effort to identify residency programs that received Title VII funding to permit matching to residency "institution codes" listed in the AMA master file and ultimate analyses of potential exposure by graduates of those programs. This effort included use of the databases maintained by professional organizations, hand searches of ACGME and AMA-FREIDA databases, and reviews of historical files on residency programs. We matched nearly all of the Title VII awards granted to residency programs between 1970 and 2004 for all relevant activity codes available from HRSA.

NHSC Participant Database

HRSA provided us with a list of all current and past participants in the NHSC. The list includes information whether a physician was a NHSC participant and the type of obligation (i.e. scholarship or loan repayment).We were able to match NHSC participants to the physicians in our AMA master file database

extracts using name and date of birth (AMA Med Ed number is not available for NHSC participants). For those without date of birth information we were able to match using a simple algorithm.

Supplementary data on medical student training costs

We also obtained supplementary data primarily to estimate the returns to medical education in the U.S. These data included for example: The Medical College Admission Test (MCAT) fees from the Association of American Medical Colleges (AAMC)[3]. The fees for participation in preparation courses for the MCAT and USMLE licensing examinations from Kaplan Medical.[4] Medical school tuition, fees and medical student expenses from AAMC[5], the Cornell University archives[6], the University of Pennsylvania archives[7], and the University of Puerto Rico.[8] Professional medical board certification examination fees from the Board of Medical Examiners and American Board of Family Medicine[9], and the American Board of Neurosurgical Surgery[10]. Supplementary data on for example the Consumer Price Index (CPI) for adjusting the debt data to account for inflation, and compensation for various physician specialties for the 1980s, the 1990s, and the 2000s, from various Medical Group Management Association (MGMA) and AMA sources.

Match-merge of data files

After match-merging the data files, we estimated relative incomes for the various physician specialties as the CPI adjusted salary for radiologist divided by the CPI adjusted salary for a primary care physician. We deflated individual debt and income data from GQ surveys using the CPI for each year. Residency history data was first merged with all the physician medical residency Title VII exposure data, prior to merging with the AMA master file data. Merge rates for each of the components of the analysis file are presented in the table below:

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[3] AAMC, 2008 "MCAT Essentials" Association of American Medical Colleges, Washington, DC, 2008, http://www.aamc.org/students/mcat/mcatessentials.pdf

[4] Kaplan Medical, 2008, http://www.kaplanmedical.com/

[5] AAMC, "Tuition and Student Fees Reports", Association of American Medical Colleges, Washington, DC, http://services.aamc.org/tsfreports/

[6] Cornell Historical Tuition, Cornell University, Weill Medical Division, "Tuition and Mandatory Fees, 1980-81 through 2007-08" http://dpb.cornell.edu/documents/1000217.pdf

7 University of Pennsylvania, University Archives and Records Center, "Tuition and mandated fees, Room and Board and other educational costs at Penn: 1970 to 2003" http://www.archives.upenn.edu/histy/features/tuition/1970.html through http://www.archives.upenn.edu/histy/features/tuition/2000.html

[8] University of Puerto Rico, School ,of Medicine, "Estimated Fees and Expenses" http://www.md.rcm.upr.edu/index.php?option=com_content&task=view&id=87&Itemid=88

[9] American Board of Family Medicine, "Examination Fee Schedule" https://www.theabfm.org/cert/exam_fees.aspx

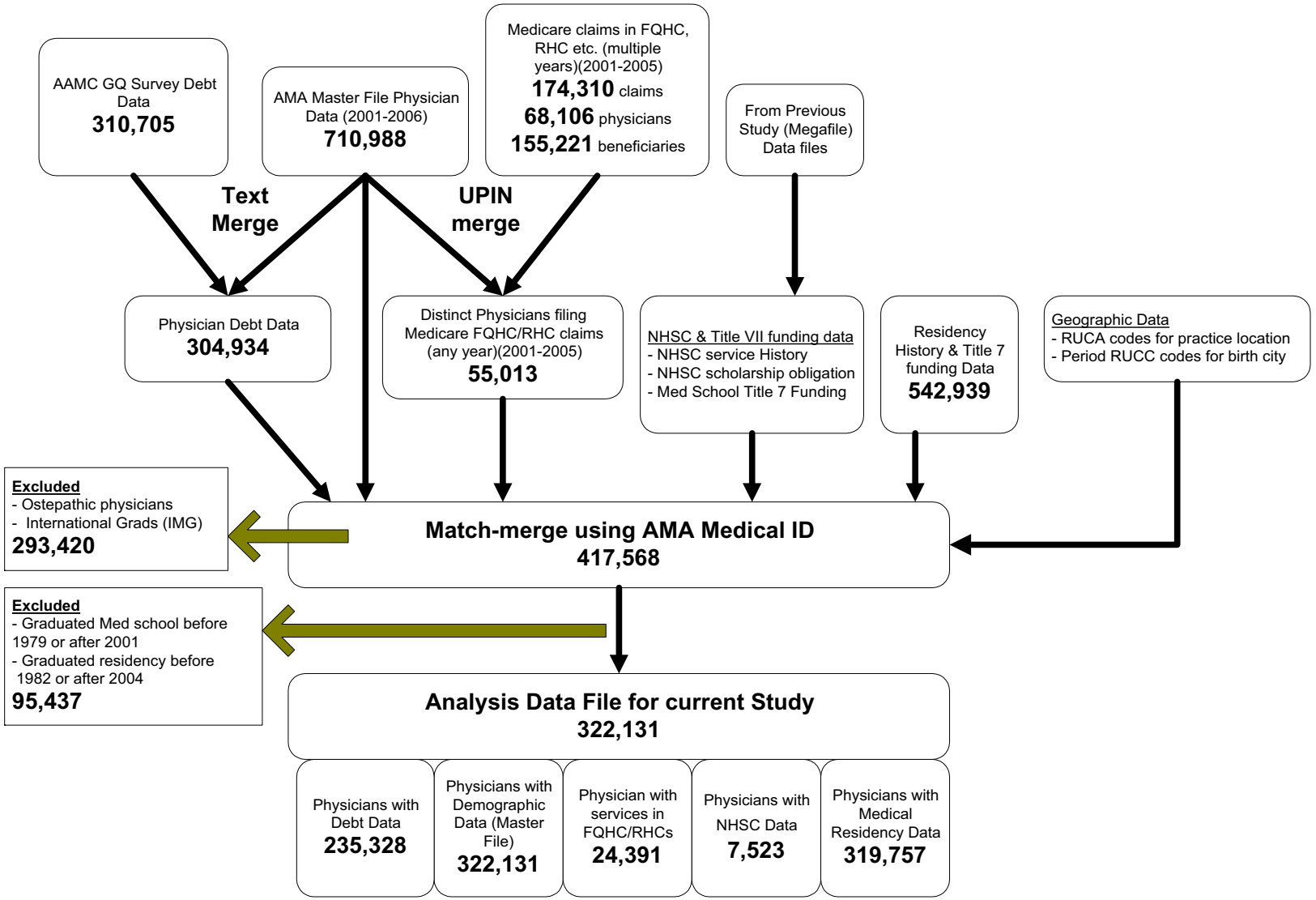
[10] American Board of Neurosurgical Surgery "Application for Oral Examination and Certification",http://www.abns.org/pdfs/Application_for_Oral_Exam_and_Certification.pdf

Table A1: Creation of analysis data file and data management

Major data files used in the study	Raw data file	Before data merge	After data merge	Merge rate (%)
(a)	*(b)*	*(c)*	*(d)*	*(d)/(c)*
1. AMA master files (2001-2005)	1,198,140	710,977	580,158	81.6%
2. AAMC GQ survey file (1979-2004)	317,769	310,705	299,245	96.3%
3. Residency history file (graduation 1978-2004)	558,699	394,483	379,443	96.2%
4. NHSC history file (up to Nov 2004)	19,934	19,934	15,939	80.0%
5. Physicians in FQHC/RHCs (2001-2005)	68,106	64,870	55,376	85.4%

The results from our match-merge results are further presented in flow-diagram format in the next page.

Figure 1: Macy Medical School Debt and Title VII Study -- Flow Diagram showing match-merge results



After merging the major data files, we created 5 mutually exclusive analysis groups for physician study comparison purposes based on site or location of physician services. A distribution of physicians in those five analysis groups are as follows:

Table A2: Distribution of physicians by specialty and analysis group (2001-2005)

Analysis Groups	All physicians	Primary care physicians	Family Physicians	Pediatricians
In RHC sites	13,107	7,291	4,983	468
In FQHC sites	10,642	5,341	2,852	637
In Rural PC hospitals	642	269	166	5
In HPSA/MUAs	70,019	24,525	9,625	5,136
In sites other than above	227,721	76,183	24,894	18,196

Notes: The above analysis groups are mutually exclusive. Together they constitute our complete analysis data file.

Table A3: Distribution of sites, providers and beneficiaries with Medicare claims (2001-2005):

	RHC sites	FQHC sites	Rural primary care hospitals	Total
Sites				
2001	3,095	1,762	64	4,921
2002	3,111	1,868	77	5,056
2003	3,222	2,076	84	5,382
2004	3,301	2,331	99	5,731
2005	3,374	2,527	234	6,135
Providers				
2001	16,023	14,063	306	30,392
2002	16,176	15,625	360	32,161
2003	16,847	18,623	515	35,985
2004	16,357	19,962	1,090	37,409
2005	15,792	19,453	3,118	38,363
Beneficiaries				
2001	1,394,382	582,821	7,601	1,984,804
2002	1,466,704	662,848	5,146	2,134,698
2003	1,544,991	741,887	9,705	2,296,583
2004	1,640,516	849,861	18,762	2,509,139
2005	1,761,764	962,466	66,947	2,791,177

Notes: Raw data files were at physician level, with one record per physician. The data excludes that of osteopathic physicians, and physicians trained in non-US medical schools. It includes data for physicians who graduated from medical schools from 1979 through 2001, or graduated from residency from 1982 through 2004.

Table A4: Distribution of GQ survey respondents -- from 1992

Graduation Year	GQ survey Respondents	Total Med School Graduates	Survey response rate (%)
1979	8,344		
1980	10,199		
1981	10,779		
1982	10,927		
1983	10,476		
1984	10,428		
1985	11,037		
1986	10,728		
1987	11,298		
1988	10,370		
1989	11,172		
1990	11,610		
1991	11,426		
1992	12,090	15,355	79%
1993	12,128	15,474	78%
1994	12,883	15,503	83%
1995	13,318	15,883	84%
1996	13,154	15,886	83%
1997	14,164	15,890	89%
1998	14,021	15,963	88%
1999	12,712	16,005	79%
2000	14,376	15,714	91%
2001	14,196	15,785	90%
2002	14,222	15,652	91%
2003	13,754	15,534	89%
2004	10,893	15,830	69%

Table A5: Mean and Median Debt among graduating medical students in Public Schools who have debt (deflated with the CPI)

School Graduation Year	N for Debt amount	Mean School debt	Lower 95% CI	Upper 95% CI	Median	N for % with debt	% with debt
1979	2,862	$34,476	$33,647	$35,306	$30,844	4,334	66%
1980	3,928	$36,175	$35,467	$36,883	$34,473	5,637	70%
1981	4,297	$36,829	$36,196	$37,461	$34,215	5,651	76%
1982	4,871	$39,454	$38,860	$40,047	$37,601	6,172	79%
1983	5,116	$42,656	$42,029	$43,283	$41,635	6,211	82%
1984	4,033	$45,778	$45,031	$46,524	$39,912	6,095	66%
1985	5,303	$47,756	$47,001	$48,512	$44,320	6,497	82%
1986	4,763	$50,977	$50,140	$51,813	$47,295	6,299	76%
1987	5,007	$51,396	$50,573	$52,218	$45,630	6,614	76%
1988	4,448	$53,903	$52,963	$54,843	$49,075	5,856	76%
1989	4,709	$56,699	$55,771	$57,626	$50,163	6,318	75%
1990	4,797	$58,307	$57,401	$59,214	$55,524	6,577	73%

1991	3,856	$69,451	$68,351	$70,551	$66,983	6,642	58%
1992	5,393	$67,952	$67,006	$68,899	$65,025	7,036	77%
1993	5,521	$70,118	$69,180	$71,056	$67,440	7,102	78%
1994	5,680	$74,023	$73,069	$74,977	$69,953	7,564	75%
1995	6,043	$77,877	$76,905	$78,849	$76,189	7,676	79%
1996	6,193	$82,928	$81,956	$83,899	$81,932	7,814	79%
1997	6,532	$88,503	$87,504	$89,501	$90,430	8,184	80%
1998	6,092	$90,893	$89,836	$91,951	$95,403	7,592	80%
1999	4,746	$92,296	$91,090	$93,501	$97,075	5,756	82%
2000	4,373	$94,103	$92,801	$95,405	$96,326	5,246	83%
2001	2,543	$95,080	$93,395	$96,766	$93,661	3,050	83%

Table A6: Mean and Median Debt among graduating medical students in Private Schools who have debt (deflated with the CPI)

School Graduation Year	N for Debt amount	Mean School debt	Lower 95% CI	Upper 95% CI	Median	N for % with debt	% with debt
1979	2,015	$46,385	$45,227	$47,543	$42,839	3,002	67%
1980	2,658	$45,299	$44,294	$46,304	$42,777	3,761	71%
1981	2,909	$45,412	$44,442	$46,382	$41,058	3,800	77%
1982	3,053	$49,974	$48,912	$51,035	$42,972	3,839	80%
1983	3,082	$55,586	$54,462	$56,711	$52,044	3,702	83%
1984	2,442	$59,158	$57,628	$60,689	$49,890	3,808	64%
1985	3,210	$65,805	$64,275	$67,334	$57,809	3,936	82%
1986	2,961	$76,935	$75,170	$78,699	$68,105	3,907	76%
1987	3,043	$79,944	$78,149	$81,739	$73,008	4,056	75%
1988	2,903	$79,814	$77,996	$81,632	$70,107	3,890	75%
1989	2,965	$87,590	$85,679	$89,501	$83,606	4,130	72%
1990	3,083	$88,183	$86,339	$90,027	$79,320	4,347	71%
1991	2,314	$103,625	$101,411	$105,839	$98,952	4,058	57%
1992	3,170	$99,884	$97,996	$101,773	$96,060	4,257	74%
1993	3,224	$104,327	$102,402	$106,253	$100,442	4,263	76%
1994	3,250	$104,564	$102,626	$106,503	$101,810	4,502	72%
1995	3,649	$111,446	$109,551	$113,341	$108,841	4,793	76%
1996	3,504	$118,062	$116,034	$120,090	$118,934	4,620	76%
1997	3,681	$121,126	$119,116	$123,137	$122,726	4,884	75%
1998	3,464	$127,569	$125,459	$129,678	$127,204	4,426	78%
1999	2,907	$132,722	$130,359	$135,084	$134,411	3,553	82%
2000	2,272	$133,865	$131,263	$136,467	$137,867	2,866	79%
2001	1,392	$132,620	$129,155	$136,084	$140,491	1,733	80%

Table A7: Distribution of graduating medical students by whether they received medical school scholarships

Graduation Year	GQ survey Respondents	Graduates with scholarships	Scholarship status not indicated
1979	8,344	3,758	-
1980	10,199	4,585	-
1981	10,779	4,839	72
1982	10,927	5,109	124
1983	10,476	4,729	142
1984	10,428	3,730	2,459
1985	11,037	4,904	99
1986	10,728	4,660	66
1987	11,298	4,934	69
1988	10,370	5,175	65
1989	11,172	5,717	128
1990	11,610	5,897	147
1991	11,426	5,800	199
1992	12,090	6,322	93
1993	12,128	6,433	162
1994	12,883	7,011	189
1995	13,318	7,023	139
1996	13,154	6,904	159
1997	14,164	7,414	141
1998	14,021	7,444	214
1999	12,712	6,789	164
2000	14,376	7,614	520
2001	14,196	7,267	73
2002	14,222	7,412	84
2003	13,754	7,096	126
2004	10,893	5,641	273

Table A8: Basic Statistics from the Analysis File

Variables	Mean or Percent	Number of observations (N)
From AMA Master file		
% practicing in MUP	3.4%	320814
% practicing in MUA	14.6%	320814
% in Population HPSA - physician	11.1%	320814
% in Geographic HPSA - physician	3.1%	320814
Mean Age at Medical School graduation	27.46	235278
Provides service in rural area	9.8%	317260
Born in rural county	0.8%	322131
Attended public medical school	61.2%	322131
Medical school in rural area	0.4%	322131

Variables	Mean or Percent	Number of observations (N)
School involved in community(proj)	5.2%	322131
In HPSA or MUA/P	24.6%	322131
Ever family physician(2001-05)	13.2%	322131
Ever internist (2001-05)	13.3%	322131
Ever pediatrician(2001-05)	7.6%	322131
Ever mixed primary care physician	1.4%	322131
Ever primary care physician	35.3%	322131
Male	65.6%	322085
From Medicare FQHC/RHC claims		
Mean Medicare beneficiaries per physician	239.9	24391
Mean age of beneficiaries	66.0	15246
% beneficiaries in rural areas	53.6	15221
% beneficiaries in geographic HPSAs	16.7	24391
% beneficiaries in MUAs	31.0	24391
% beneficiaries in HPSAs or MUAs	45.4	24391
From Med School Graduation Questionnaire (GQ)		
Fed Stafford Loan, Subsidized	45.4%	235328
Health Education Assistance Loan	15.2%	235328
Health Profession Student Loan	8.3%	235328
Disadvantaged Students Loan	2.6%	235328
Federal Perkins Loan	18.9%	235328
Primary Care Loan	2.5%	235328
University Or Medical School Loan	14.6%	235328
Fed Supp Loans	17.4%	235328
State Loans	4.2%	235328
Assessed_GE 1 Good/Excellent Primary Care experiences	19.6%	235328
Assessed_# of Good/Exce PC experiences	47.7%	235328
Assess Primary Care elective as excellent	11.0%	322131
Assess Primary Care elective as excellent or very good	14.3%	322131
Plan to serve minority population	3.5%	322131
Plan to serve under areas	3.7%	322131
Plan to serve in social deprived areas	10.5%	322131
Plan to obtain Primary Care Certification	67.7%	322131
Ever married (at graduation)	49.6%	186237
Premed loan=0	26.2%	322131
Med loan=0	57.2%	322131
No education loan	4.5%	322131
Had premed loan	35.8%	235328
Had med loan	75.5%	235328
Had debt(med school+noneducational)	73.4%	235328
Of those with loans or scholarships:		
$0-50K med loan	37.3%	177726
$50-100K med loan	36.6%	177726
$100-150K med loan	17.5%	177726

Variables	Mean or Percent	Number of observations (N)
$150-200K med loan	6.4%	177726
$200-250K med loan	1.9%	177726
$250+ med loan	0.2%	177726
From Residency History and NHSC files		
Proportion of T7program funded last residency	26.2%	319757
Mean Years of T7 funds last residency	3.96	319757
Residency Specialty=Primary Care	58.9%	319757
Mean number of residency programs per physician	1.8	319757
Mean number of Title VII residency funding yrs in instn attended	6.4	319757
Avg % physicians in TitleVII residency programs funded	29.1%	319757
NHSC service	2.3%	321664

Sources of Data: AMA – Master Files; AAMC -- graduation surveys (GQ); Residency History file; NHSC history file; CMS – Medicare claims from FQHCs, RHCs, and rural primary care hospitals.

Appendix B: Statistical Models, Outputs, Statistics

Table B1: Response variable: Chose primary care career

			95% Wald CI	
Variable	**Estimate**	**Odds ratio**	**Lower Limit**	**Upper limit**
Response: Chose primary care career				
Intercept	-92.1487			
Medical School debt $1-$50K*	0.0917	1.096	1.061	1.132
Medical School debt $50-$100K*	0.1690	1.184	1.147	1.222
Medical School debt $100-$150K*	0.1373	1.147	1.100	1.197
Medical School debt $150-$200K*	0.1038	1.109	1.039	1.185
Medical School debt $200-$250K*	0.0332	1.034	0.909	1.176
Medical School debt over $250K*	-0.0913	0.913	0.631	1.320
Male	-0.6326	0.531	0.519	0.544
Married	0.2009	1.223	1.194	1.252
Born in rural county	0.3730	1.452	1.294	1.629
Age at graduation	0.00862	1.009	1.005	1.012
Year of medical school graduation	0.0469	1.048	1.045	1.051
NHSC Loan repayment	1.9526	7.047	6.070	8.180
NHSC scholarship	1.4908	4.441	4.054	4.864
Relative expected income	-0.7834	0.457	0.421	0.496
Medical School is in rural area	0.3220	1.380	1.145	1.662
Public medical school	0.2377	1.268	1.235	1.303
Medical school is community related	0.1744	1.191	1.134	1.249
Experience in Title VII funded school	0.1008	1.106	1.074	1.139
Experience in Title VII funded residency	-0.5428	0.581	0.568	0.595
Hosmer and Lemeshow Goodness-of-Fit		Chi-Square	DF	Pr > ChiSq
		134.1014	8	<.0001

Notes: *-Reference variable is “Non-educational debt.”
d.f. represents “degrees of freedom.”

Table B2: Response variable: Chose family medicine (FP/GP) career

			95% Wald CI	
Variable	**Estimate**	**Odds ratio**	**Lower Limit**	**Upper limit**
Response: Chose family medicine career				
Response: Chose family medicine career				
Intercept	-38.9106			
Medical School debt $1-$50K*	0.1293	1.138	1.090	1.188
Medical School debt $50-$100K*	0.2387	1.270	1.217	1.324
Medical School debt $100-$150K*	0.2260	1.254	1.185	1.327
Medical School debt $150-$200K*	0.2290	1.257	1.148	1.377
Medical School debt $200-$250K*	0.1287	1.137	0.945	1.368
Medical School debt over $250K*	-0.3273	0.721	0.392	1.324
Male	-0.1352	0.874	0.846	0.902
Married	0.3847	1.469	1.424	1.516
Born in rural county	0.6092	1.839	1.622	2.085
Age at graduation	0.0272	1.028	1.023	1.032
Year of medical school graduation	0.0186	1.019	1.015	1.022
NHSC Loan repayment	1.6665	5.294	4.700	5.963
NHSC scholarship	1.4964	4.466	4.067	4.903
Relative expected income	-0.6156	0.540	0.485	0.602
Medical School is in rural area	0.3251	1.384	1.074	1.785
Public medical school	0.5691	1.767	1.701	1.835
Medical school is community related	0.1816	1.199	1.131	1.271
Experience in Title VII funded school	0.1158	1.123	1.079	1.169
Experience in Title VII funded residency	-0.0661	0.936	0.908	0.965
Hosmer and Lemeshow Goodness-of-Fit		Chi-Square	DF	Pr > ChiSq
		6.1524	8	0.6302

Notes: *-Reference variable is “Non-educational debt.”
d.f. represents “degrees of freedom.”

Table B3: Response variable: Ever provided NHSC service

			95% Wald CI	
Variable	**Estimate**	**Odds ratio**	**Lower Limit**	**Upper limit**
Response: NHSC service				
Intercept	-4.9961			
Medical School debt $1-$50K*	1.0380	2.824	1.895	4.207
Medical School debt $50-$100K*	0.9273	2.528	1.740	3.672
Medical School debt $100-$150K*	0.7935	2.211	1.515	3.226
Medical School debt $150-$200K*	0.4454	1.561	0.988	2.466
Medical School debt $200-$250K*	0.6721	1.958	1.122	3.417
Medical School debt over $250K*	-0.2541	0.776	0.105	5.709
Non-educational debt	0.3365	1.400	1.162	1.687
Experience in Title VII funded school	-0.1157	0.891	0.654	1.213
Experience in Title VII funded residency	0.2177	1.243	1.030	1.501
Hosmer and Lemeshow Goodness-of-Fit		Chi-Square	DF	Pr > ChiSq
		12.7581	8	0.1204

Notes: *-Reference variable is “Non-educational debt.”
d.f. represents “degrees of freedom.”

Table B4: Response Variable: Ever Provided Service in FQHC or RHC

			95% Wald CI	
Variable	**Estimate**	**Odds ratio**	**Lower Limit**	**Upper limit**
Response: Service in FQHC or RHC				
Intercept	11.5146			
Medical School debt $1-$50K*	0.0673	1.070	1.018	1.124
Medical School debt $50-$100K*	0.1434	1.154	1.099	1.212
Medical School debt $100-$150K*	0.1189	1.126	1.055	1.202
Medical School debt $150-$200K*	0.1943	1.214	1.101	1.340
Medical School debt $200-$250K*	0.0886	1.093	0.898	1.329
Medical School debt over $250K*	0.0675	1.070	0.608	1.882
Career in primary care	-0.0279	0.972	0.926	1.021
Career in family medicine	0.9341	2.545	2.410	2.687
Male	0.0782	1.081	1.041	1.123
Married	-0.0266	0.974	0.939	1.010
Born in rural county	0.4097	1.506	1.296	1.751
Age at graduation	0.0191	1.019	1.014	1.025
Year of medical school graduation	-0.00680	0.993	0.989	0.997
NHSC scholarship or loan repayment	1.2888	3.629	3.355	3.925
Relative expected income	-0.3560	0.700	0.617	0.795
Medical School is in rural area	0.2119	1.236	0.942	1.622
Public medical school	0.00960	1.010	0.969	1.052
Medical school is community related	0.0904	1.095	1.020	1.175
Experience in Title VII funded school	0.0201	1.020	0.976	1.066
Experience in Title VII funded residency	-0.5389	0.583	0.562	0.605
Hosmer and Lemeshow Goodness-of-Fit		Chi-Square	DF	Pr > ChiSq
		70.9537	8	<.0001

Notes: *-Reference variable is “Non-educational debt.”
d.f. represents “degrees of freedom.”

Table B5: Response Variable: Ever Practice in Rural Area

			95% Wald CI	
Variable	**Estimate**	**Odds ratio**	**Lower Limit**	**Upper limit**
Response: Practice in rural area				
Intercept	40.6643			
Medical School debt $1-$50K*	0.0595	1.061	1.011	1.114
Medical School debt $50-$100K*	0.1751	1.191	1.135	1.250
Medical School debt $100-$150K*	0.2565	1.292	1.211	1.379
Medical School debt $150-$200K*	0.2141	1.239	1.113	1.378
Medical School debt $200-$250K*	0.2906	1.337	1.087	1.645
Medical School debt over $250K*	0.0194	1.020	0.527	1.973
Career in primary care	0.0593	1.061	1.010	1.114
Career in family medicine	0.9740	2.648	2.511	2.794
Male	0.3991	1.491	1.433	1.550
Married	0.3865	1.472	1.420	1.526
Born in rural county	0.8548	2.351	2.071	2.669
Age at graduation	0.0297	1.030	1.025	1.035
Year of medical school graduation	-0.0223	0.978	0.974	0.982
NHSC Loan repayment	0.7247	2.064	1.799	2.369
NHSC scholarship	0.6296	1.877	1.682	2.095
Relative expected income	-0.2127	0.808	0.715	0.914
Medical School is in rural area	1.0740	2.927	2.322	3.689
Public medical school	0.5048	1.657	1.586	1.730
Medical school is community related	0.1842	1.202	1.126	1.284
Experience in Title VII funded school	0.1016	1.107	1.058	1.158
Experience in Title VII funded residency	-0.1005	0.904	0.873	0.937
Hosmer and Lemeshow Goodness-of-Fit		Chi-Square	DF	Pr > ChiSq
		19.5844	8	0.0120

Notes: *-Reference variable is “Non-educational debt.”
d.f. represents “degrees of freedom.”

Table B6: Response Variable: Ever practiced in a shortage area or underserved area

			95% Wald CI	
Variable	**Estimate**	**Odds ratio**	**Lower Limit**	**Upper limit**
Response: Practice in shortage or underserved area				
Intercept	17.3611			
Medical School debt $1-$50K*	0.00116	1.001	0.967	1.037
Medical School debt $50-$100K*	-0.00784	0.992	0.958	1.028
Medical School debt $100-$150K*	0.0163	1.016	0.968	1.067
Medical School debt $150-$200K*	-0.00267	0.997	0.922	1.078
Medical School debt $200-$250K*	-0.0285	0.972	0.832	1.135
Medical School debt over $250K*	0.0918	1.096	0.717	1.675
Career in primary care	-0.0256	0.975	0.941	1.009
Career in family medicine	-0.0122	0.988	0.944	1.034
Male	0.2072	1.230	1.195	1.266
Married	0.0501	1.051	1.024	1.080
Born in rural county	0.2531	1.288	1.140	1.456
Age at graduation	0.0184	1.019	1.015	1.023
Year of medical school graduation	-0.00997	0.990	0.987	0.993
NHSC Loan repayment	-0.0217	0.978	0.847	1.131
NHSC scholarship	0.1630	1.177	1.063	1.303
Relative expected income	0.1168	1.124	1.028	1.229
Medical School is in rural area	-0.1202	0.887	0.698	1.127
Public medical school	0.3055	1.357	1.316	1.399
Medical school is community related	-0.0658	0.936	0.886	0.990
Experience in Title VII funded school	-0.00977	0.990	0.959	1.023
Experience in Title VII funded residency	0.0968	1.102	1.073	1.131
Hosmer and Lemeshow Goodness-of-Fit		Chi-Square	DF	Pr > ChiSq
		10.2540	8	0.2476

Notes: *-Reference variable is “Non-educational debt.”
d.f. represents “degrees of freedom.”

Appendix C: List of Analysis Variables

Table C1: List of Analysis Variables

Variable	Type	Label	Research topic
Hypothesis 4			
AYEARS2	Num	Med Sch T7 dept devt funds?	Exposure to T7 in med sch (Dep.)
UGYEARS2	Num	matriculated in T7 funded med sch	Exposure to T7 in med sch (Dep.)
PC_exce	Num	Assess PC elect as excellent	Med sch training assessment
PC_excegd	Num	Assess PC elect as Excel/VG	Med sch training assessment
Numb_Pcexp	Num	Asse_# of Good/Exce PC exps	Med sch training assessment
Pcexp_asse	Num	Asse_GE 1 Good/Exce PC exp	Med sch training assessment
Hypotheses 1, 2, 3			
FP	Num	FP/GP	Career choice/practice location (Dep.)
PC	Num	Primary care	Career choice/practice location (Dep.)
anasamp	Num	Status in analysis samples	Career choice/practice location (Dep.)
type	Num	Type of facility-FQHC/RHC	Career choice/practice location (Dep.)
NHSC	Num	NHSC service	Career choice/practice location (Dep.)
dphy_hpmua	Num	Address in HPSA or MUA/P	Career choice/practice location (Dep.)
nyrs	Num	# of yrs of service in FQHC/RHC	Career choice/practice location (Dep.)
pben_hpmua	Num	% benes in HPSAs or MUA/Ps	Career choice/practice location (Dep.)
pben_hpsa_geo	Num	% benes in geog HPSAs	Career choice/practice location (Dep.)
pben_lrgtown	Num	% benes in large town areas	Career choice/practice location (Dep.)
pben_mua	Num	% benes in MUAs	Career choice/practice location (Dep.)
pben_smtnrural	Num	% benes in small town isolated rural	Career choice/practice location (Dep.)
pben_suburb	Num	% benes in suburban areas	Career choice/practice location (Dep.)
pben_urbcore	Num	% benes in urban core areas	Career choice/practice location (Dep.)
ajmed_debt	Num	Med Sch Debt Amt	Debt – amount
ajnoned_a	Num	Non-Edu Debt Amt	Debt – amount
ajpremed_d	Num	Premed Debt Amt	Debt – amount
ajtotal_de	Num	Total Debt Amt	Debt – amount
NONED_DE	Char	Debt_Non-educ Debt Indicator	Debt – indicator
MED_LOAN	Char	Debt_Medical School Loans Indicator	Debt – indicator
PREMED_L	Char	Debt_Premedical Loans Indicator	Debt – indicator
nmbloans	Num	Number of Med Sch loans	Debt – indicator (to use only in regression analysis)
lns_gl	Num	Fed Stafford Loan, Subsd	Debt – indicator – detail
lns_he	Num	Hlth Educ Assist Loan	Debt – indicator – detail
lns_hp	Num	Hlth Profe Student Loan	Debt – indicator – detail
lns_ld	Num	Disadvant Students Loan	Debt – indicator – detail
lns_me	Num	Medloans Alt Loan	Debt – indicator – detail
lns_ot	Num	Other loans	Debt – indicator – detail

lns_pe	Num	Federal Perkins Loan	Debt – indicator – detail
lns_pr	Num	Primary Care Loan	Debt – indicator – detail
lns_sc	Num	Univ Or Med Sch Loan	Debt – indicator – detail
lns_sl	Num	Fed Supp Loans	Debt – indicator – detail
lns_st	Num	State Loans	Debt – indicator – detail
ajschola_a	Num	Scholarship/Grant Amt	Scholarship/Grant Amt
SCHOLAR	Char	Scholarship Indicator	Scholarship/Grant Indicator
armynhsc	Num	Loan obligation to Armed forces or NHSC	Scholarship/Grant Indicator
HSCOBLIG	Num	Oblig to HSC loan repayt/scholarshp	Loan repaymt and grants
pcresid	Num	Specialty=PC in resid	Exposure to T7 in residency
t7resyrs	Num	Total T7 resid funding yrs	Exposure to T7 in residency
avt7resfd	Num	Avg propn T7 res prgs funded	Exposure to T7 in residency
tyrfunds1	Num	Yrs of T7 funds last resi	Exposure to T7 in residency
propfund1	Num	Propn T7prgs funded last resi	Exposure to T7 in residency
resfund	Num	Residency Instn funded as	Exposure to T7 in residency
resprgs	Num	No. of resid progs	Exposure to T7 in residency
spe1	Char	Specialty of last resi	Exposure to T7 in residency
spect1	Char	Specialty Training 1	Training characteristics
spect2	Char	Specialty Training 2	Training characteristics
Hypotheses 1, 5			
FP	Num	FP/GP	Career choice/practice location (Dep.)
PC	Num	Primary care	Career choice/practice location (Dep.)
anasamp	Num	Status in analysis samples	Career choice/practice location (Dep.)
pcsal	Num	Prim care median salary 8-17yrs exp	Expected income
radiolsal	Num	Radiologist median salary 8-17yrs exp	Expected income
ajmed_debt	Num	Med Sch Debt Amt	Debt – amount
ajnoned_a	Num	Non-Edu Debt Amt	Debt – amount
ajpremed_d	Num	Premed Debt Amt	Debt – amount
ajtotal_de	Num	Total Debt Amt	Debt – amount
NONED_DE	Char	Debt_Non-educ Debt Indicator	Debt – indicator
MED_LOAN	Char	Debt_Medical School Loans Indicator	Debt – indicator
PREMED_L	Char	Debt_Premedical Loans Indicator	Debt – indicator
nmbloans	Num	Number of Med Sch loans	Debt – indicator ()
lns_gl	Num	Fed Stafford Loan, Subsd	Debt – indicator – detail
lns_he	Num	Hlth Educ Assist Loan	Debt – indicator – detail
lns_hp	Num	Hlth Profe Student Loan	Debt – indicator – detail
lns_ld	Num	Disadvant Students Loan	Debt – indicator – detail
lns_me	Num	Medloans Alt Loan	Debt – indicator – detail
lns_ot	Num	Other loans	Debt – indicator – detail
lns_pe	Num	Federal Perkins Loan	Debt – indicator – detail
lns_pr	Num	Primary Care Loan	Debt – indicator – detail
lns_sc	Num	Univ Or Med Sch Loan	Debt – indicator – detail
lns_sl	Num	Fed Supp Loans	Debt – indicator – detail

lns_st	Num	State Loans	Debt – indicator – detail
Hypotheses 7, 8, 10			
FP	Num	FP/GP	Career choice/practice location (Dep.)
PC	Num	Primary care	Career choice/practice location (Dep.)
anasamp	Num	Status in analysis samples	Career choice/practice location (Dep.)
PD	Num	General Pediatrics	Career choice/practice location (Dep.)
HPSA_GEO	Num	Geog HPSA – physician	Career choice/practice location (Dep.)
HPSA_POP	Num	Population HPSA – physician	Career choice/practice location (Dep.)
MUA	Num	MUA	Career choice/practice location (Dep.)
MUP	Num	MUP	Career choice/practice location (Dep.)
MINOR_GR	Char	The primary minority popln of practice	(Not sure)
CLERK_FA	Char	Asse_Qual of FM Clerkship	Med sch training assessment
CLERK_IN	Char	Asse_Qual of IM Clerkship	Med sch training assessment
CLERK_PE	Char	Asse_Qual of PED Clerkship	Med sch training assessment
PC_exce	Num	Assess PC elect as excellent	Med sch training assessment
PC_excegd	Num	Assess PC elect as excel/VG	Med sch training assessment
Numb_Pcexp	Num	Asse_# of Good/Exce PC exps	Med sch training assessment
Pcexp_asse	Num	Asse_GE 1 Good/Exce PC exp	Med sch training assessment
Other research tests:			
CAREER_R	Char	Plan_Expect research in med career	Planned career and practice location
MINOR_PL	Char	Plan_to serve prim. Minority popln	Planned career and practice location
SOCIO_DE	Char	Plan_Plan practice in soc deprived area	Planned career and practice location
SPEC_PLA	Char	Plan_to certify in sub-specialty	Planned career and practice location
SPEC_PRE	Char	Plan_to get general special cert	Planned career and practice location
SUB_SPEC	Char	Plan_Sub-specialty plans	Planned career and practice location
UNDER_PL	Char	Plan_to locate pract in unde area	Planned career and practice location
plan_cert	Num	Plan to obtain PC cert	Planned career and practice location
plan_minor	Num	Plan to serve minority poplns	Planned career and practice location
plan_socde	Num	Plan to serve in social deprived areas	Planned career and practice location
plan_under	Num	Plan to serve under areas	Planned career and practice location
Control variables – physicians			
AGE_AT_G	Num	Age at Med Sch gradtn	Control variables – individual level
MARITAL	Char	Marital status – at Med Sch graduation	Control variables – individual level
gender	Char	Gender	Control variables – individual level
msgryear	Num	Med Sch year of graduation	Control variables – individual level
gradyr	Char	Year grad from residency	Control variables – individual level
urcode	Num	Urban/rural codes(6) of birth city	Control variables – individual level
rurban	Num	Birth city is 1=Rural 0=Urban	Control variables – individual level
direct	Num	Direct patient care	Control variables – individual level
division	Num	Division	Control variables – individual level
avfacphys_yr	Num	Avg phys per facility per yr	Control variables – individual level
avphybene_yr	Num	Avg benes per phys per yr	Control variables – individual level
avphypayt_yr	Num	Avg payt per phys per yr	Control variables – individual level
pben_avgage	Num	Avg age of benes	Control variables – individual level

region	Num	Region	Control variables – individual level
pben_npatients	Num	No. benes with claims	Control variables – individual level
Control variables – med schools (Hypothesis 10)			
msruca	Num	RUCA code for medical schools	Control variables – med sch level
pubpvt	Num	Med Sch type: Pub=1, Pvt=0	Control variables – med sch level
comsch	Num	Med School involved in community	Control variables – med sch level
Other variables			
AMB_FAM	Char	MS expo_Fam Med Clerkship	
AMB_INNE	Char	MS expo_Comm Med Clerkship in Inner-City	
AMB_INT	Char	MS expo_Ambu Blk Assignment in IM Clerkship	
AMB_PEDI	Char	MS expo_Ambu Blk Assignment in PED Clerkship	
AMB_PRI	Char	MS expo_Prim Care Clerkship (Multidiscip)	
AMB_RURA	Char	MS expo_Comm Med Clerkship in rural setting	
AMT_PUB	Char	MS expo_Course in Pub Hlth And Comm Med	
AMT_SOC	Char	MS expo_Course in Role Of Comm Hlth/Soc Serv	
AMT_UNDE	Char	MS expo_Course in Hlth Issues for Und Popns	
ELEC_COM	Char	MS expo_Field Expe In Comm Health	
ELEC_INN	Char	MS expo_Clin Elective in Inner City	
ELEC_PRI	Char	MS expo_Elect Prim Care Clerkship	
ELEC_RUR	Char	MS expo_Clin Expe in Rural Community	
PYEARS2	Num	predoc training funding?	Not used (pre-med sch)
GQ_YEAR	Num	GQ Year	Not used – Used gradyr instead
gmetdate	Char	GME Ending Date	
PRAC_LOC	Char	State of Practice	Detailed codes
maistate	Char	Physician State (address)	Detailed codes
medsch	Char	Med Sch code	Detailed codes
ICODE1	Char	Code for last resi	Detailed codes
diffyrs	Num	Compl GQ 2X: diff in yrs	Detailed codes
numb_flags	Num	No. benes w/ poor geog info	Detailed codes
pmprofac	Char	Primary Major Professional Activity	Detailed codes
ppemploy	Char	Primary Practice Employment	Detailed codes
ppractyp	Char	Primary Practice Type	Detailed codes
INFL_DEB	Char	Think Educ Debt influences Spec Choice	
Sample inclusive and ID variables			
inama	Num	In master file	ID and sample variables
inbcity	Num		ID and sample variables
inclaims	Num	In Medicare claims file	ID and sample variables
indebt	Num	In AAMC GQ file	ID and sample variables
inmega	Num		ID and sample variables
inresi	Num	In resid history file	ID and sample variables
insid	Num	GME Institution I.D.	ID and sample variables
inupin	Num	In UPIN file	ID and sample variables
menum	Char	Medical Education Number	ID and sample variables

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