The Physician Workforce: Projections and Research into Current Issues Affecting Supply and Demand

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Key Acronyms

AAMC	American Association of Medical Colleges
AMA	American Medical Association
AOA	American Osteopathic Association
BHPr	Bureau of Health Professions
COGME	Council on Graduate Medical Education
DO	Doctor of Osteopathy
ECFMG	Educational Commission for Foreign Medical Graduates
GME	Graduate medical education
GMENAC	The Graduate Medical Education National Advisory Committee
HMO	Health Maintenance Organization
HPSA	Health Profession Shortage Area
HRSA	Health Resources and Services Administration
IMG	International Medical Graduate
MD	Medical Doctor
PGY	Post Graduate Year
PRM	BHPr's Physician Requirements Model
PSM	BHPr's Physician Supply Model
USMG	U.S. Medical Graduate

Executive Summary

An adequate supply of physicians is needed to help ensure access to affordable, quality health care. For the past 2 decades the number of graduates from the Nation's medical schools has been relatively constant, following rapid growth in physician supply during the 1970s. The physician workforce is aging, average hours worked are falling compared to historical levels, and a large number of physicians are nearing retirement. After nearly 3 decades of growth, the physician-to-population ratio is leveling off and is expected to decline. At the same time, the growth and aging of the United States population, as well as advances in technology with an accompanying growth in public expectations, contribute to a growing demand for physician services.

To help meet its mission to provide health workforce information, HRSA has supported research on physician workforce issues and maintains the Physician Supply Model and Physician Requirements Model. This report describes the various components of these models and presents projections of the supply of and demand for physicians under alternative scenarios reflecting different assumptions about the future health care system, the evolving role of physicians, and trends in other supply and demand determinants.

The baseline projections assume that over the next 1 to 2 decades factors affecting physician supply, health care utilization patterns, and health care delivery patterns will continue largely unchanged. These baseline projections suggest:

- Physician supply will increase from current levels of approximately 817,000 active physicians under age 75 in 2005 to approximately 952,000 active physicians by 2020.

- The increasing proportion of physicians who are women and are older, and who typically work fewer hours per year compared to their younger male colleagues, suggests that total hours of physician services provided is increasing less rapidly than the number of licensed physicians (13 percent versus 16 percent between 2005 and 2020).

- The growth and aging of the population will contribute to a 22 percent increase in demand for physician services between 2005 and 2020. Growth in demand will be highest among specialties that predominantly serve the elderly (e.g., cardiology, internal medicine, and most surgical specialties).

- Growing public expectations and the ability to pay for higher levels of care through economic growth could increase demand substantially above the baseline projections. Factors that may offset the growth in demand for physicians include improvements in physician productivity such that each physician can care for a larger population, scientific advances that can contribute to improved health, and increased use of non-physician clinicians.

The Federal Government, as a major player in the health care system via its role as health care insurer, a subsidizer of physician training, and through its mission to improve access to care to underserved populations, has often helped to improve access to affordable, quality health care.

The modest but growing projected shortfall of physicians could contribute to greater geographic disparities in physician supply. For several decades the United States has been a net importer of medical school graduates. A growing demand for physicians that exceeds production from U.S. medical schools could make the Nation even more reliant on international medical schools, at a time when other nations face greater health workforce inadequacies than our own.

The health care system continues to evolve as does the role of physicians. Because of the long length of time needed to train physicians and to change our education infrastructure, policymakers, educators, physicians, and other stakeholders need to know at least a decade in advance how changes in the health care system and other trends will affect the adequacy of physician supply. Updating physician supply and demand projections every few years would allow the Federal Government to better reflect the latest trends and to provide advance warning of changes in the adequacy of physician supply.

Finally, it should be noted that the physician workforce is only one part of an increasingly complex health care system in which the final goal is a healthier society. The link between number and type of physicians, as well as the content of their education, and the health status of the populations they serve has yet to be completely understood. Further investigation regarding the impact of the physician workforce on health will better inform workforce planning.

I. BACKGROUND

A. Purpose

The mission of the Health Resources and Services Administration (HRSA) includes facilitating and supporting national, State, and local workforce planning efforts. To help meet this mission, HRSA has supported research on physician workforce issues and maintains the Physician Supply Model (PSM) and Physician Requirements Model (PRM). [1,2]

This report describes the various components of the PSM and PRM and presents findings from the literature and original research to provide the context for the data, assumptions and methods used to project the future supply of and demand for physicians. Projections from the PSM and PRM are presented, and the adequacy of future physician supply is discussed. This information is important to policy makers, health researchers, educators, professional associations, physicians, and the public to better understand current physician workforce issues and trends and their implications for the adequacy of the future supply of physicians.

B. Review of Physician Workforce Projection Studies and Approaches

Over the past 70 years, numerous commissions and studies on physician workforce issues have contributed to our understanding of the physician workforce and helped shape policies and programs that affect the supply of physician services. These studies have documented important aspects of physician supply, the determinants of demand for physician services, and concerns about the maldistribution of physicians by geographic location and by specialty.

> ***Whereas projections of the supply of physicians often achieve agreement, estimates of the requirements for physician services rarely do.***
>
> Tarlov (1995, p. 1558)

A relatively small number of these studies make original projections of the supply of and requirements for physicians to assess the adequacy of future supply. It has been stated that whereas projections of the supply of physicians often achieve agreement, estimates of the requirements for physician services rarely do (Tarlov, 1995). The lack of consensus regarding current and projected physician requirements is in part due to conceptual disagreements—such as whether physician requirements should be based on a clinical definition of need, based on what society is willing to pay for, or based on some other benchmark. Disagreements also exist regarding the size and impact of trends affecting future supply and demand. It has often been said that projecting future requirements is an art, not a science. Despite the uncertainties regarding projections of impending physician shortages or surpluses, the policy responses to these projections have real consequences in terms of the size

[1] The Lewin Group and Altarum updated the PSM and PRM under contract HRSA-230-BHPr-27(2).

[2] The PRM has evolved over time from a model to forecast requirements for primary care physicians to a model to forecast requirements for numerous medical specialties. The PRM was formerly known as the Integrated Requirements Model (IRM).

and specialty composition of physicians being trained; the cost, quality, and accessibility of health care services; and the careers and income of individual physicians.

In the words of Snyderman, Sheldon and Bischoff (2002) regarding projections of the adequacy of physician supply, "because past predictions were so far off the mark, we need to understand why, before we can confidently predict the [adequacy of the] future supply of physicians (p. 167)." In this spirit, we synthesize and critique the extant literature on the physician workforce and compare the findings in the literature with the data and assumptions used in the PSM and PRM.

The following brief history of physician workforce modeling summarizes key studies that make original projections of physician supply, requirements, or both. For each study, we give a brief summary of the approach, the key assumptions made, and major critiques of the approach used. The approach and assumptions used to model specific components of physician supply and requirements are described in more detail throughout this report.

- **The Committee on the Costs of Medical Care (CCMC, 1933)** was perhaps the first major study of physician requirements in the United States. CCMC defined physician requirements based on a clinical assessment of population needs. Using information on the prevalence of disease, the committee determined the number of physician encounters that would occur for the U.S. population in 1929 under the premise that all health care needs would be met. Combined with estimates of minutes of physician time per patient encounter and average time physicians spent in patient care per year, CCMC determined that the Nation needed 140.5 physicians per 100,000 population. A major criticism of the approach used by CCMC is that the requirements estimate did not reflect economic realities. Even if the physician supply were increased to equal CCMC's estimates of requirements, economic constraints and patterns of health care utilization would result in some people not seeking needed services (based on CCMC's definition). Another critique is that the needs-based approach is open to the biases of the expert panel formed to determine parameters for the model.

> ***...[CCMC's] greatest deficit was not methodological, but conceptual. It was their adoption of a social planning perspective that centered on what ought to occur, rather than an analytic approach that sought to define what most likely would occur.***
>
> Cooper et al. (2002, p. 142)

- **The Surgeon General's Consultant Group on Medical Education (the Bane report, 1959)** was the next major study to assess the current and future adequacy of physician supply. Using a needs-based approach similar to CCMC, this report predicted a growing shortage of physicians, with a projected shortage of 40,000 physicians by 1975. This report was instrumental in influencing the Federal Government to subsidize and expand medical schools, and to allow more foreign-trained physicians to immigrate to the United States.

- **The Graduate Medical Education National Advisory Committee (GMENAC, 1981)** undertook a study of the adequacy of physician supply in response to concerns that efforts to increase the number of trained physicians in the United States during the 1960s and 1970s would create a national oversupply of physicians. GMENAC used an "adjusted-needs model" that, like the CCMC approach, starts with the premise that physician requirements can be calculated based on the prevalence of disease, an estimate of physician time required per patient to provide needed services, and an estimate of the number of physicians needed to meet the aggregate time requirement for patient care activities. GMENAC went a step further than CCMC and adjusted downward their needs-based estimates to reflect some economic expectations of the health care system. The committee concluded that the increased number of graduates from U.S. medical schools (USMGs), combined with the increased number of international medical graduates (IMGs) practicing in the United States, would eliminate the shortage of physicians in most specialties and would greatly alleviate (although not eliminate) the maldistribution of physicians by geographic area. GMENAC predicted a surplus of 70,000 physicians (13 percent) by 1990, and a surplus of 145,000 (22 percent) by 2000. In response to this report, the Federal Government reduced general funding for medical schools, but inadvertently increased the financial incentives for teaching hospitals to admit more international medical school graduates to train in the United States (Blumenthal, 2004). The medical need model used by GMENAC was updated in 1990 by interdisciplinary panels of health professionals (Abt Associates, 1991). Critiques of needs-based modeling also apply to the adjusted needs-based approach.

> ***This modeling approach is not a demand forecast; it yields requirements that are consistent with providing ideal levels and types of medical care, to meet the expected morbidity and well-care needs of the population without regard to the typical barriers posed by ability to pay, access, availability, or ignorance.***
>
> Abt Associates (1991, p. ii)

- **The Council on Graduate Medical Education (COGME),** formed in the mid-1980s, was created with the mandate to provide advice and recommendations to Congress on the supply and distribution of physicians in the United States. COGME has issued a series of reports looking at different aspects of the physician workforce. COGME (2003) used preliminary projections from the PSM and PRM, adjusted for trends in economic growth and other assumptions, to project physician supply and requirements under alternative scenarios. This study concludes that without a modest increase in U.S. medical school capacity there will be a shortfall of approximately 85,000 physicians, mostly specialists, by 2020. This projected shortfall contrasts with COGME's 1994 report which projected an overall surplus of 80,000 specialists by 2000, and a surplus of 120,000 specialists by 2020. The dramatic change in findings is attributed to three factors:

  1. The 1994 requirements projections are highly sensitive to trends in managed care, following the work by Weiner (1994), but projected trends in the continued growth of the strictest forms of health maintenance organizations (HMOs) failed to appear.
  2. In response to reports that there was a growing over supply of specialists, during the mid-to-late 1990s a growing proportion of new medical graduates chose primary care specialties over non-primary care specialties. Changes in Federal graduate medical education (GME) financing also favored training generalists over specialists.

3. The 2004 projections are sensitive to COGME's assumptions of the impact of economic growth on future physician requirements, following the work of Cooper et al. (2002) that suggests continued economic growth will increase demand for all physician services, particularly those of specialists.

- **Workforce studies responding to the growth of managed care (e.g., Weiner, 1994; Hart et al., 1997; Gamliel et al., 1995; Wennberg et al., 1993; and others)** found smaller physician-to-population ratios for populations enrolled in HMOs. Using physician-to-population estimates from a small number of closed-panel HMOS as indicators of an efficient number and mix of physicians, Weiner (1994) projected a surplus of 163,000 physicians in 2000, with the entire surplus consisting of specialists. Hart et al. criticized Weiner's study for not including specialist care provided by out-of-network physicians and, after adjusting for out-of-network care, found physician-to-enrollee rates much closer to national physician-to-population rates than those found by Weiner. One major criticism of using closed-panel HMO staffing patterns to estimate future physician requirements is that the projections are quite sensitive to assumptions regarding the proportion of the future population enrolled in closed-panel HMOs. Enrollment in closed-panel HMOs grew slower than predicted by many analysts during the early and mid 1990s, partly because of a backlash from consumers desiring greater access to care than provided by closed-panel HMOs. Another critique of using closed-panel HMOs as a benchmark is that selection bias in who enrolls in HMO plans complicates extrapolating HMO physician staffing patterns to the rest of the U.S. population. Weiner (2004) is an update of the 1994 study and finds that physician-to-population ratios at the three pre-paid group practices studied are about 25 percent lower for primary care physicians and 32 percent lower for specialists compared to national ratios. Weiner concludes that the United States could continue to provide adequate care with substantially fewer physicians if the entire system were to function more like HMOs.
- **Workforce studies sponsored by individual physician specialties** were motivated in part by the controversies surrounding the predictions of Weiner and others in the 1990s of impending surpluses as well as the desire to better inform educators and individual specialties about the likelihood of future demand. A sample of the physician specialties studied to assess the adequacy of the current and future supply include: emergency medicine (Holliman et al., 1997; Moorhead et al., 1998), endocrinology (Hogan et al., 2001), gastroenterology (Meyer et al., 1996), general surgery (Jonasson, Kwakwa, and Sheldon, 1995), nephrology (Neilson et al., 1997), optometry and ophthalmology (Lee, Jackson and Relles, 1995), orthopedic surgery (Lee, Jackson and Relles, 1998), physiatry (Hogan et al., 1996), pulmonary and critical care medicine (Schmitz, Lantin, and White, 1998), and urology (Weiner, McDaniel and Lowe, 1997). These studies investigated a range of workforce issues, including issues related to scope of practice and training requirements. These studies used different approaches and assumptions, but generally relied on either a utilization-based approach or an HMO benchmarking approach.
- **Cooper (2000) and colleagues (2002)** use an approach that is a radical departure from the major modeling approaches used in the past. Cooper's "Trend Model" approach starts with the premise that the health care system is too complex and diverse to build an estimate of physician requirements "from their component tasks and to standardize them by applying the metric of time (2002, p. 2)." Cooper identifies changes in the level of economic output as the dominant force affecting per capita demand for physician services based on an analysis

of national trends from the period 1929 to 2000. The premise that underlies the economic growth argument is that technological advances provide an almost unlimited demand for physician services—specialist services in particular—that are capped only by our ability and willingness to pay. Changes in technology, physician productivity, demographics, and the changing role of non-physician clinicians also are important determinants of demand. The overall conclusion of Cooper's work is that the United States has a looming shortage of specialists, possibly as many as 200,000 physicians by 2020. Cooper's approach has been criticized as placing too much emphasis on observed correlations without a clear causal relationship and for the assumption that historical patterns of physician supply are good proxies of physician demand (e.g., see critiques by Barer, 2002; Grumbach, 2002; Reinhardt, 2002; and Weiner, 2002). Cooper's requirements are sensitive to the estimated relationships between economic growth and demand for physician services, and there is no consensus on the size of this relationship; they also are predicated on the idea that there is a relatively high ceiling on what patients are willing to pay for medical care. Still, Cooper's work illustrates the possible importance of including economic growth as a determinant of physician requirements.

> ***Physician workforce studies have been dominated by a linear, mathematical mode of thinking based on dissecting and reconstituting the health care system and standardizing its components according to the metric of time.***
>
> Cooper (2000, p. 14)

- **The Health Resources and Services Administration** maintains a physician supply model and two physician requirements models: The Physician Requirements Model (PRM) and the Physician Aggregate Requirements Model (PARM). The assumptions, methods, data and findings from the PSM and PRM are described in more detail in Chapters II and III, respectively. Both the PRM and the PARM are utilization-based models, but use different approaches and rely on different sets of assumptions. The critiques that apply to demand-based requirements models in general also apply to these two models. Namely, that they assume the market is roughly in equilibrium in the base year such that inefficiencies in current utilization and delivery patterns are extrapolated into the future. The PARM produces national estimates of physician requirements for 19 medical specialties. The PARM divides the population into 108 categories based on age, gender, race/ethnicity, and insurance status. Using estimates of per capita utilization of physician services by delivery setting (i.e., inpatient care, outpatient care, doctor's offices, other) and Census Bureau population projections, the PARM projects the number of physician-patient encounters by setting and medical specialty. BHPr (2003) presents physician requirements projections under alternative scenarios. Under the baseline scenario that assumes no changes in health care utilization and physician staffing patterns over time, the PARM projects that between 2000 and 2020 physician requirements will increase by 33 percent. Under an alternative scenario that assumes modest growth in managed care and modest shifts in patient care from inpatient to outpatient settings, projected requirements increase by 26 percent between 2000 and 2020.

Although HRSA's models can be used to analyze the consequences of specific health care programs and policies, the main purpose of this report is to present long-term trends and assess the workforce implications of these trends. The next two chapters of this report discuss how current and projected trends could affect physician supply and requirements. Chapter II uses

the components of the PSM as a framework for discussing trends in important determinants of physician supply. The discussion also provides a context for each component of the PSM and a synthesis of the relevant literature. Chapter III uses the PRM to help frame the discussion of physician requirements. A synthesis of the literature and a summary of original research provide context to understand and critique inputs to the PRM. Chapter IV compares the supply and demand projections and discusses the adequacy of physician supply. Chapter V discusses trends in physician compensation and the implications of the PSM and PRM projections on physician compensation. Chapters VI and VII, respectively, discuss issues of physician gender and race/ethnicity as they apply to projecting the adequacy of physician supply. Chapter VIII contains a summary of the key findings and concludes with a discussion of areas for future research.

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II. PHYSICIAN SUPPLY

The size, demographics, specialty mix, practice location, and practice patterns of the current physician workforce are the outcome of current and past decisions made by nearly 800,000 individual physicians. Decisions regarding what, where, when and how to practice are influenced by numerous factors, including: personal preferences, market forces, State and Federal policies and programs, and institutions that constitute the health care system and medical education infrastructure.

This chapter synthesizes the literature, presents the findings of original empirical analysis, and describes how the various supply determinants are incorporated into HRSA's Physician Supply Model. Section A provides an overview of the PSM, while Section B describes the major determinants of future physician supply. Section C concludes with projections from the PSM. The chapter discusses physician supply issues related to geographic distribution in Chapter IV, and supply issues related to gender and race/ethnicity in Chapters VI and VII, respectively.

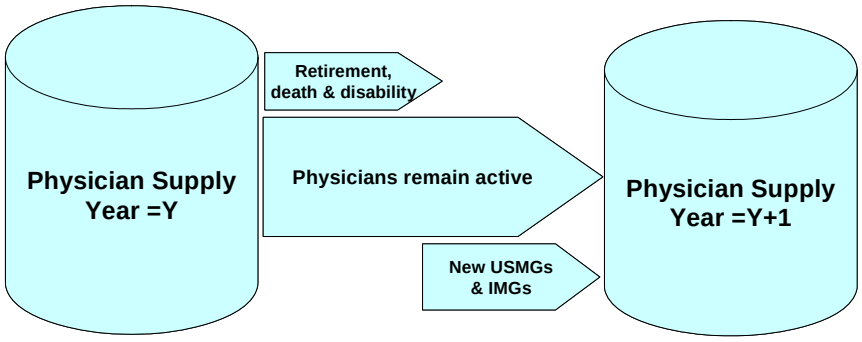
A. Physician Supply Model Overview

The PSM produces national projections of physician supply for 35 medical specialties through 2020. The PSM is an inventory model that tracks the supply of physicians by age, sex, country of medical education (whether USMG or IMG), type of degree (Medical Doctor [MD] or Doctor of Osteopathy [DO]),[3] and medical specialty. It uses historical data to determine the probability that physicians will remain active from year to year and the number of hours worked per year in patient care activities.

The PSM (Exhibit 1) projects the future supply of physicians based on:

- Number of physicians in the preceding year (starting with the base year 2000),
- New additions to the physician workforce,
- Attrition from the physician workforce, and
- Trends in physician productivity.

Exhibit 1. Overview of the Physician Supply Model



The PSM produces two measures of physician supply: (1) *active supply* and (2) *full-time equivalent (FTE) supply*. The FTE supply measure takes into account projected changes in the average

[3] The education, training, credentialing, and licensing of allopathic medical doctors (MDs) and doctors of osteopathic medicine (DOs) is similar. The main difference between the two degrees is the DO emphasis on the musculoskeletal system and how an injury or illness in one area can affect another.

hours worked in patient care activities. Tracking changes in average hours worked is particularly important because women and older physicians constitute a growing proportion of the physician workforce and provide fewer patient care hours, on average, compared to male and younger physicians.

B. Determinants of Physician Supply

1. Current Physician Workforce

The current physician workforce is the starting point for projecting the future supply of physicians. The physician workforce is often defined by its size, specialty mix, demographic composition, and geographic location.[4] The primary data sources for this information are the American Medical Association (AMA) and the American Osteopathic Association (AOA).

In 2000, the base year for the PSM, there were an estimated 756,000 active physicians under age 75.[5] Of these, approximately 714,000 (94 percent) physicians report that they are primarily engaged in patient care activities, while the remaining 42,000 (6 percent) report being engaged primarily in non-patient care activities such as teaching, research, and administration. The AMA classifies physicians into over 180 self-reported specialties which, for modeling purposes, are collapsed into 35 categories.[6] In Chapter IV we further aggregate supply to 18 specialty categories for comparison to the 18 categories in the PRM.

PSM projections suggest that the current number of active physicians under age 75 (as of 2005) is approximately 817,500 (Exhibit 2). Slightly over one third are generalists (family practice, general pediatrics or general internal medicine); the remaining two thirds are specialists.

Exhibit 2. Estimates of Primary Specialty of Active Physicians, 2005

Specialty	MDs	DOs	Total
Primary Care	271,400	34,700	306,100
Non-Primary Care	491,800	19,600	511,400
Total	**763,200**	**54,300**	**817,500**

Source: Projections from the BHPr Physician Supply Model.

The age, sex, and race/ethnicity composition of the physician workforce has implications for specialty choice, practice patterns, and practice location. The PSM does not track physicians by

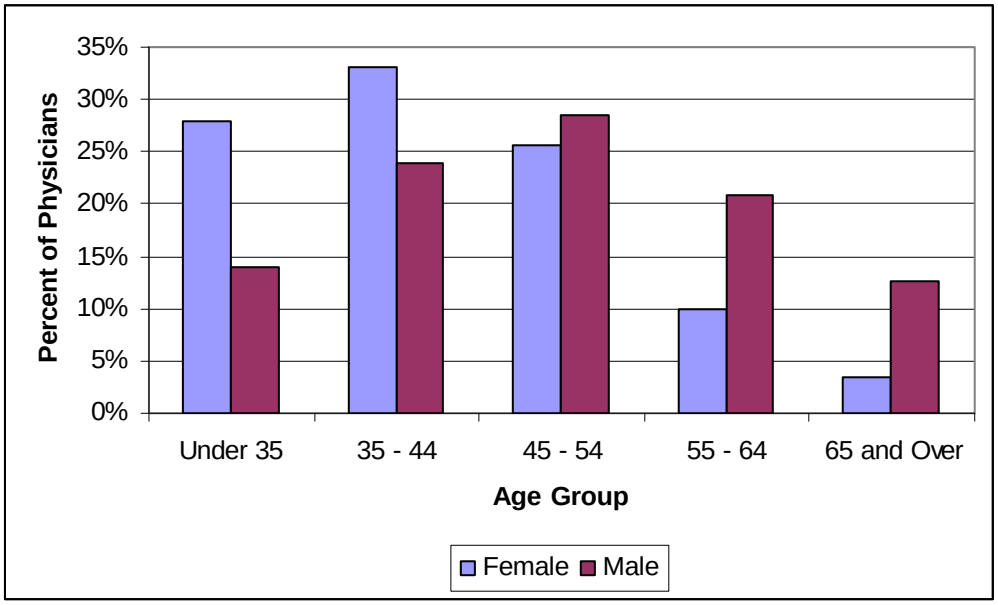
[4] The PSM was designed primarily as a national model and thus does not track physicians by geographic location within the United States. The physician workforce is, however, unevenly distributed throughout the Nation, with pockets of severe shortages (primarily in poor, rural and inner-city areas).

[5] The AMA defines "active" as working 20 or more hours per week in professional activities. The estimates provided in this paper include only physicians under age 75.

[6] Physicians whose medical specialty and patient care/non-patient care classification is listed as unknown were distributed across specialties and patient care classification based on each specialty's/classification's share of total active physicians.

race or ethnicity, but does track physicians by age and sex. Currently, approximately 1 in 4 physicians is female. Approximately half of all graduating physicians are female, so over time women will constitute a growing proportion of the physician workforce. Also, because the large number of women entering the profession is a recent phenomenon, the age distribution of female physicians is much younger than the age distribution of male physicians (Exhibit 3). In 2003, for example, AMA (2005) reports that an estimated 61 percent of active female physicians were under the age of 45, while only 38 percent of active male physicians were under age 45. Furthermore, more than one-in-five active male physicians was age 65 or older in 2000, compared to only 6 percent of active female physicians.

Exhibit 3. Age Distribution of Physicians Active in Patient Care: 2004



Source: Physician Characteristics and Distribution in the US: 2006 Edition (AMA, 2006).

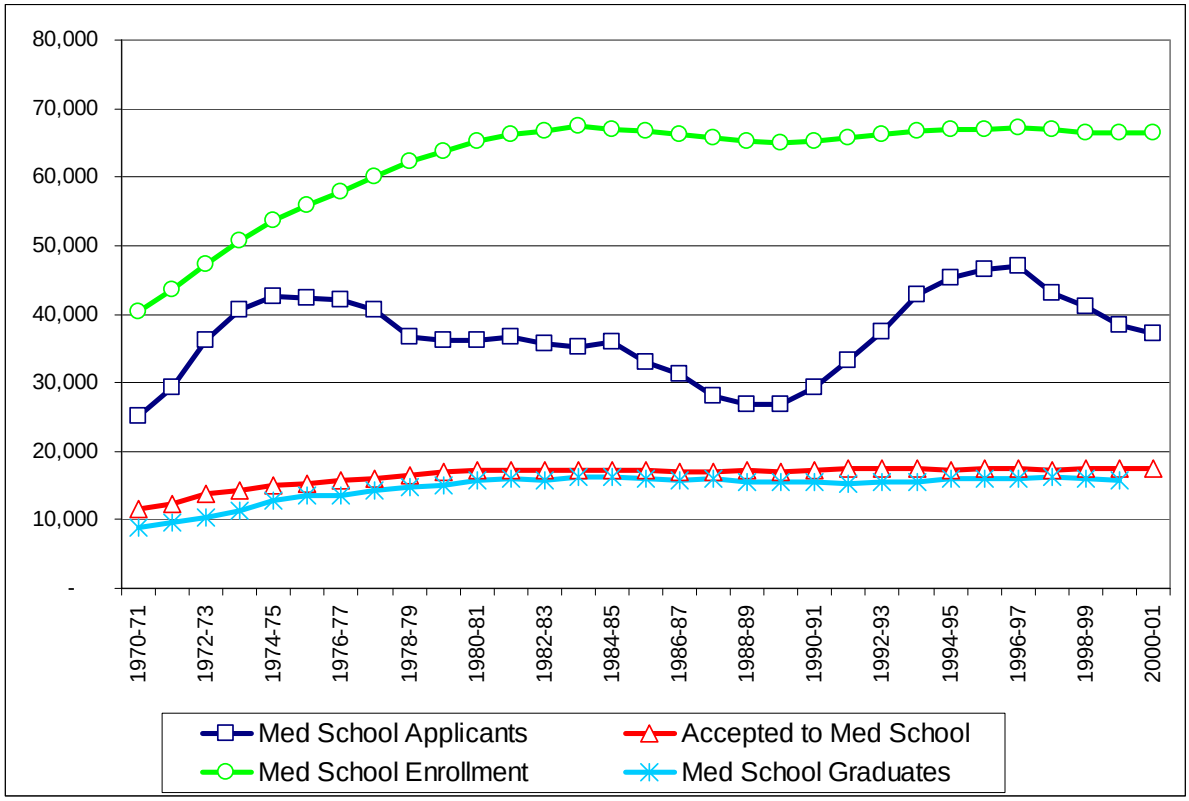
2. Medical School Graduates

Almost 24,000 physicians complete their training through GME programs each year. Before completing residencies and fellowships, new physicians generally complete a 4-year college degree and 4 years of medical education. Physicians enter practice in the United States through one of three routes: graduation from a U.S. school of allopathic or osteopathic medicine, or graduation from an international medical school. Each route is discussed in turn, as well as data on new medical graduates used in the PSM projections.

Approximately two-thirds of physicians entering U.S. residency programs are trained at an allopathic medical school in the United States or Canada. The number of graduates from U.S. allopathic medical schools has been relatively stable in recent years at approximately 15,000 to 16,000 graduates per year (Exhibit 4). The PSM baseline projections assume that allopathic medical schools will continue to produce approximately 16,000 MDs annually. This steady flow of graduates reflects the relatively constant number of individuals accepted to medical school.

In recent years, applicants to U.S. medical schools have fluctuated between approximately 25,000 and 45,000, while only 17,000 to 18,000 individuals are accepted in a typical year. In any given year, approximately 65,000 to 67,000 students are enrolled in U.S. medical schools. The relatively constant number of individuals accepted, despite wide fluctuations in the number of applicants, reflects that the number of physicians trained is determined largely by the current capacity of the educational system.

Exhibit 4. Applicants, Enrollment, and Graduates from U.S. Medical Schools



Source: American Association of Medical Colleges (AAMC) Data Book (2001).

The second route, taken by approximately 10 percent of new physicians, is to complete four years of training in an osteopathic medical school. Doctors of Osteopathy (DOs) and doctors trained in allopathic medicine (MDs), are alike in many ways. The main differences are that the training of DOs places greater emphasis on preventive medicine and the use of a holistic approach to improving the overall health of patients.

Over 5,000 IMGs are accepted into U.S. GME programs each year. IMGs consist of U.S. citizens trained abroad, as well as foreigners who enter the United States through the temporary work (H) or training (J) visa programs.[7] In 2003, the Educational Commission for Foreign Medical Graduates (ECFMG) issued certificates to 9,164 individuals, of which 1,571 (17.1 percent) were

[7] IMGs are defined as graduates from accredited medical schools outside the United States, Canada, and Puerto Rico. Canadians, Puerto Ricans, and citizens of U.S. territories are not subject to the visa policies that affect the ability of foreign IMGs to practice in the U.S.

U.S. citizens at their time of entry into medical school. In the 2004 Match, a total of 4,087 IMGs matched into post graduate year (PGY) one positions. Of these, 1,117 (27 percent) were identified as being United States citizens.[8]

To practice in the United States, IMGs must pass the U.S. Medical License Exam (USMLE) Steps 1 through 3, pass a clinical examination administered by ECFMG, and complete a U.S. GME program. Most foreign IMGs enter the U.S. on a J visa that requires the physician to return to his or her country of nationality for at least 2 years after GME completion. Foreign IMGs can receive a waiver to this visa requirement by agreeing to provide primary care services for at least 3 years in a Federally-designated Health Professional Shortage Area (HPSA) or in another Federally or State-designated shortage area (such as those established through the Conrad program). One reason why the PSM separately tracks IMGs and USMGs is that because IMGs are subject to certain Federal and State government restrictions regarding their opportunities to practice in the United States (and affected by decisions of educators and employers), there are systematic differences in the decisions made by USMGs and IMGs regarding choice of specialty and practice location.

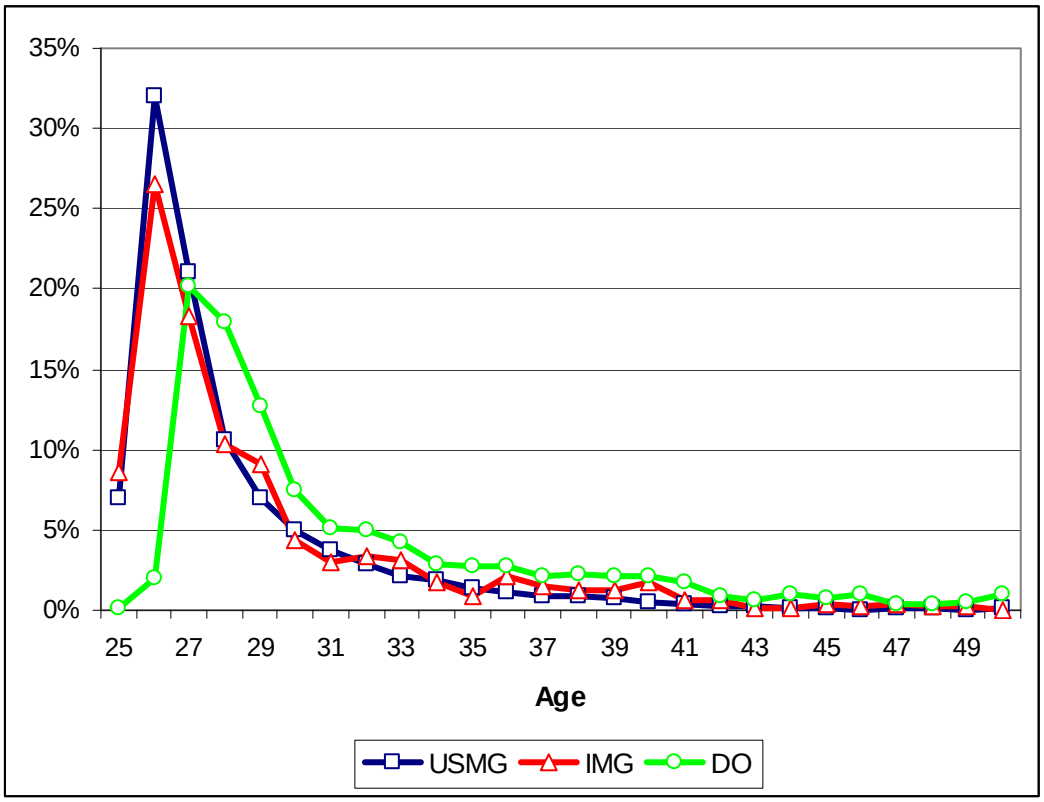
The PSM's baseline scenario assumes that the number of residents and fellows completing GME annually in the United States will increase gradually over time, from approximately 23,500 in 2000 to approximately 25,000 in 2020. These estimates assume that the number of MDs graduating from U.S. medical schools will remain relatively constant at approximately 16,000 per year; the number of new IMGs will remain relatively constant at approximately 5,000 per year; and the number of new DOs will continue to increase from approximately 2,500 per year to 4,000 per year by 2020.

The PSM baseline projections assume that the percentage of graduates from U.S. medical schools who are female will increase from the current 45 percent to 50 percent. The proportion of IMGs who are female is assumed to remain at approximately 24 percent.

The PSM baseline projections are based on the assumption that the age distribution of new medical school graduates will change little over time. Currently, most U.S. MDs are approximately 26 to 28 years old when they complete medical school (see Exhibit 5). IMGs tend to be slightly older.

[8] Statistics obtained through personal correspondence with James Hallock, Educational Commission for Foreign Medical Graduates.

Exhibit 5. Age Distribution at Graduation from Medical School



Source: Analysis of AMA and AOA Masterfiles.

3. Residency and Choice of Medical Specialty

After completing medical school, physicians choose a specialty and enter a residency program. Choice of specialty is the product of numerous factors, including physicians' interest, ability, desired lifestyle, prestige and expected remuneration; residency slots available; and policy and market factors, including perceived job availability and expected income.[9] An understanding of the relationship between choice of specialty and its determinants, and the impact of specialty choice on competing physicians are of great policy interest.

The PSM tracks physicians through residency based on historical patterns of residency choice, with physicians entering one of the 35 medical specialty categories modeled. The distribution across specialties is based on an analysis of AMA Masterfile data and physicians' self-reported

[9] The prevalent belief over the past decade that the United States has an oversupply of physicians (especially specialists) that would grow more severe over time led to over numerous calls for policies that restrict the number of new physicians and the generalist/specialist mix of new physicians. Recommendations included: (1) a moratorium on the creation of new medical schools, (2) limiting total enrollment in U.S. medical schools, (3) limiting the number of residency slots to 110 percent of the number of graduates from U.S. medical schools, (4) trying to achieve a 50/50 balance of generalists and specialists, and (5) changing funding for GME to encourage more training in primary care specialties.

specialty in each post-graduate year. The distribution is based on the assumption that by PGY10 physicians have chosen a specialty. The rationale for choosing PGY10 to estimate the percentage of physicians eventually entering each specialty is that physicians will sometimes change specialties while completing their graduate training, and many physicians complete fellowships after residency to specialize in their chosen field. One of the limitations of using historical PGY10 specialty distribution to estimate the number of current graduates entering each specialty is that recent trends in specialty choice might be overlooked. Consequently, determining the specialty distribution required some judgment calls and slight adjustments to take into account new and growing specialties (e.g., critical care), as well as policy and market factors that affect specialty choice (e.g., the trend away from the most restrictive forms of managed care).

4. Direct Patient Care Hours

Physician productivity is often defined for workforce analysis purposes in terms of total patient care hours worked or number of patients seen during a given period of time.[10] An increase (decrease) in productivity would increase (decrease) the total supply of physician services. (Alternatively, one might view an increase in physician productivity as reducing the number of physicians needed to provide a given level of services, and we discuss this issue in Chapter III).

Average physician-patient encounters per year is primarily determined by the amount of time physicians spend in patient care activities and the average amount of time physicians spend with patients per encounter. BHPr (2003) found evidence that, in some medical specialties, physicians spend slightly more time per visit with older patients than with younger patients (possibly because older patients have more comorbidities and multiple chronic illnesses), but that the difference in length of visit is relatively small. While the PSM does not track trends in the average length per visit, the PSM does track three major trends that affect average number of hours worked in patient care activities: the aging of the physician population, the increasing proportion of physicians who are women, and changes in specialty mix.

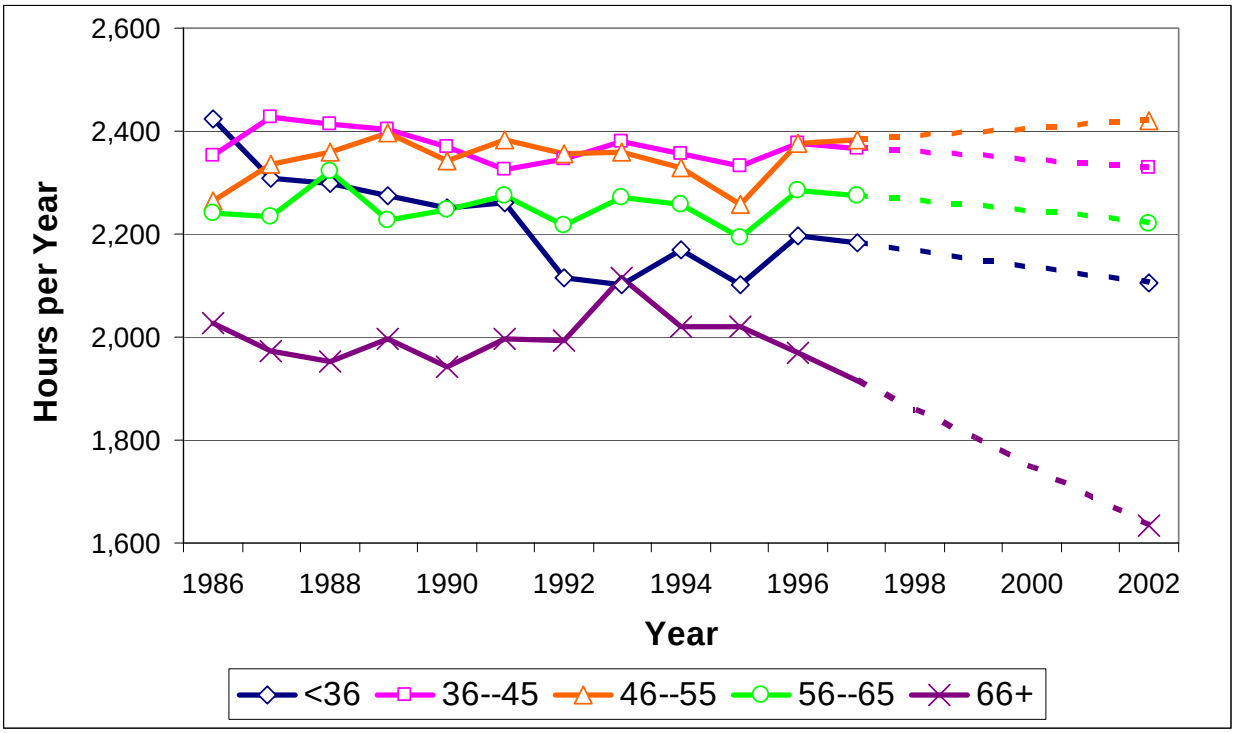
AMA reports average direct patient care hours worked, by physician age. AMA stopped publishing hours worked by physician age in 1997, but we analyzed data from a HRSA-commissioned survey on hours worked to obtain estimates for 2002 to 2003. On average, middle-aged physicians work more hours per week and more weeks per year compared to older physicians and younger physicians (Exhibits 6 and 7). Furthermore, average hours worked for some age groups changes over time. Physicians under age 36 worked 10 percent fewer hours in 2002, on average, compared to 1985. There is a slight downward trend in average hours worked for physicians age 36 to 45, and a drop in average hours worked by physicians over age 65. For this oldest group of physicians, though, the sample used to compute the AMA statistics is relatively small, which reduces the reliability of the observed statistics. Physicians age 46-55 appear to be working more hours than in earlier years, while for physicians age 56 to 65 average hours worked appears to be relatively constant. It is unclear to what extent the downward trend in hours worked by younger physicians is attributed to

[10] Many employers of physicians measure the productivity of individual physicians in terms of the revenue they generate (e.g., using resource-based relative value scale units, or RVUs).

women entering the physician workforce in higher numbers and to what extent it represents a shift in desired lifestyle for both male and female physicians.

AMA statistics show that average hours per week and average weeks per year providing direct patient care vary substantially by specialty. During the period 1985 to 2001, obstetrician/gynecologists averaged more hours than other specialty categories reported by AMA, with pediatricians averaging the fewest hours of those specialties reported by AMA (Exhibit 8). There is a downward trend in average hours worked in pediatrics, obstetrics and gynecology, and general and family practice (Exhibit 9). Interestingly, these are specialties chosen by large numbers of women. Average hours appear to be relatively constant for surgical and internal medical specialties between 1985 and 2001. It is important to note that data regarding working hours is self-reported; time spent on call may be interpreted differently between specialties.

Exhibit 6. Average Hours per Year in Direct Patient Care, by Physician Age



Source: AMA Physician Socioeconomic Statistics (various years) for 1985-1996 statistics, analysis of unpublished AMA/HRSA data for 2002 statistics; statistics for 1997 to 2001 extrapolated.

Exhibit 7. Linear Trend in Average Hours per Year in Direct Patient Care, by Physician Age

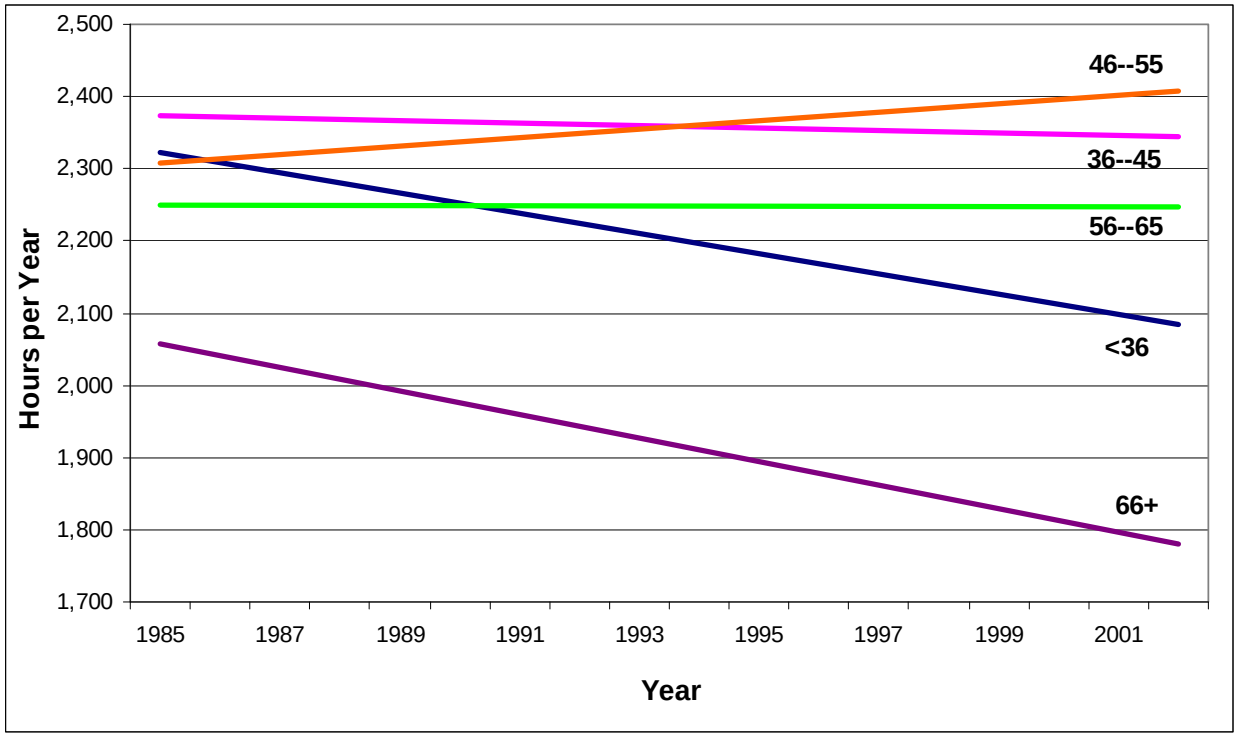
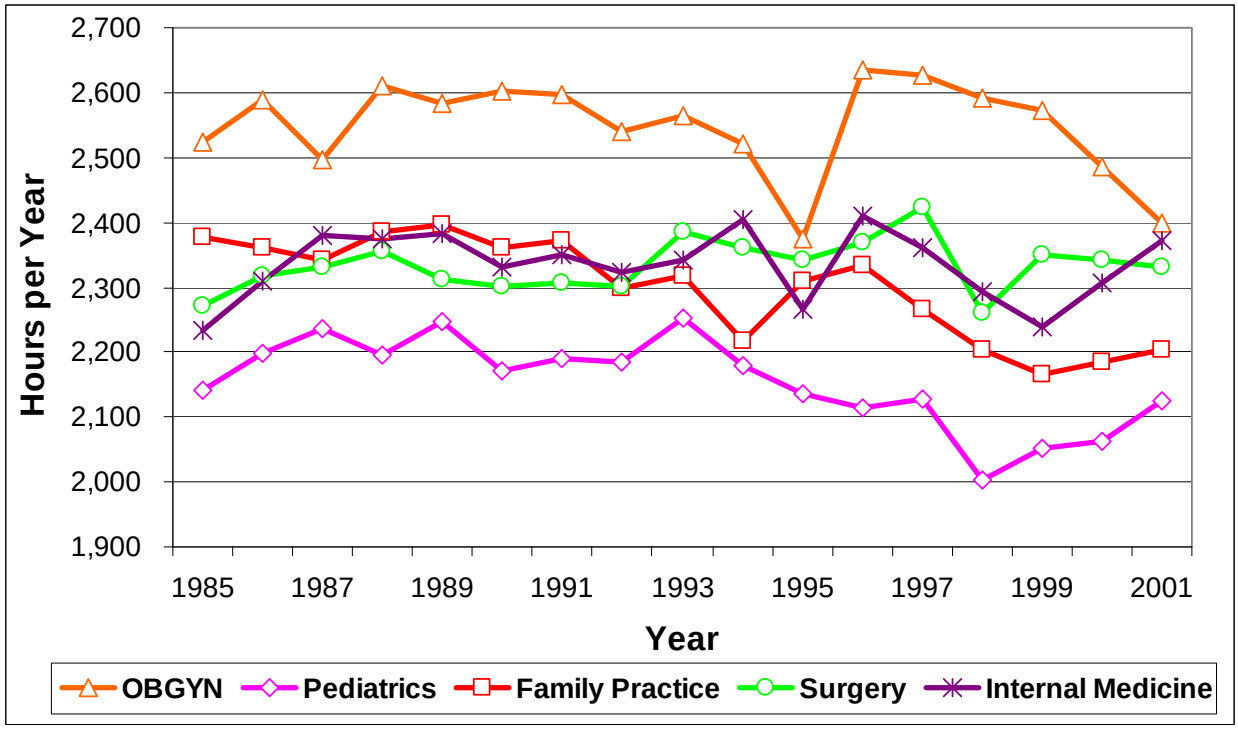
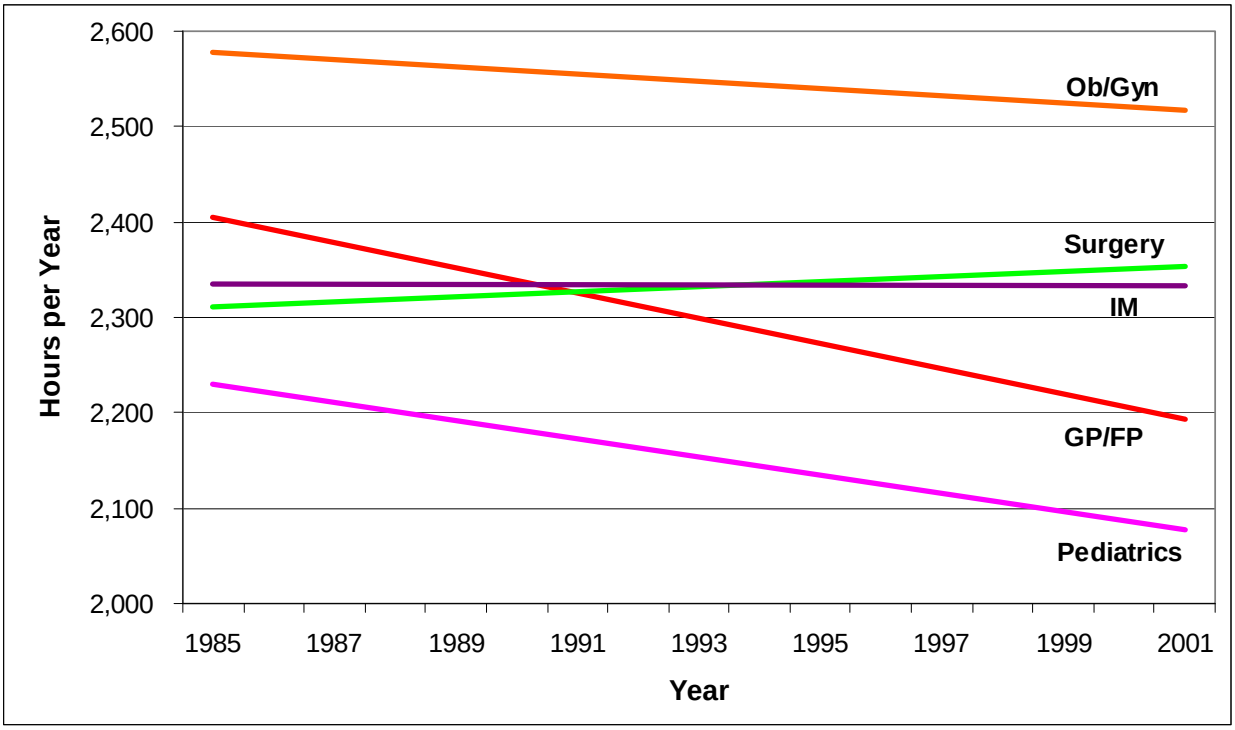


Exhibit 8. Average Hours per Year in Direct Patient Care, by Specialty



Source: AMA Physician Socioeconomic Statistics (various years).

Exhibit 9. Linear Trend in Average Hours per Year in Direct Patient Care, by Specialty



Based on an analysis of the 1998 AMA Socioeconomic Monitoring System (SMS), the average number of hours worked by physician age, sex, and specialty were estimated.[11] The baseline supply projections assume that average hours worked remain constant over time within each age by sex by specialty category. The PSM tracks the number of active physicians as well as total patient care hours supplied. The hours supplied data are converted into full-time-equivalent (FTE) physicians as a measure of effective supply. FTE physicians are estimated relative to year 1998 average hours worked. For example, in 1998 Allergists provided 53 hours of patient care per week, on average. If the demographic composition of the Allergist workforce changes over time, such that by 2020 Allergists are providing 45 hours per week, on average, then each Allergist in 2020 would be counted as 0.85 of a FTE Allergist in 1998 (45/53=0.85).

[11] At the time this analysis was conducted, the 1999 survey was the most recent SMS data publicly available. Based on conversations with AMA, however, it was decided to use the 1998 survey because the response rate was higher and the sample size was larger.

Exhibit 10. Average Hours per Week in Patient Care Activities in 1998, by Specialty

Primary Specialty	Hours	Primary Specialty	Hours
Allergy	53	Occupational Medicine	53
Anesthesiology	57	Ophthalmology	52
Cardiovascular Disease	55	Orthopedic Surgery	53
Child Psychiatry	47	Other Specialties	47
Dermatology	52	Otorhinolaryngology	52
Diagnostic Radiology	57	Psychiatry	47
Emergency Medicine	45	General Pediatrics	50
Gastroenterology	55	Pediatrics Sub Spec	53
Gen. & Family Practice	51	Pediatric Cardiology	54
Gen. Prevent Medicine	53	Critical Care Medicine	16
General Surgery	55	Physical Med. & Rehab.	48
General Surg Sub Spec	53	Plastic Surgery	52
General Internal Med.	55	Pathology	47
Internal Med. Sub Spec	54	Pulmonary Diseases	55
Neurology	54	Radiology	56
Nuclear Medicine	56	Radiation Oncology	48
Neurological Surgery	52	Thoracic Surgery	52
Obstetrics & Gynecology	58	Urology	52

Source: Analysis of the 1998 AMA Socioeconomic Monitoring System.

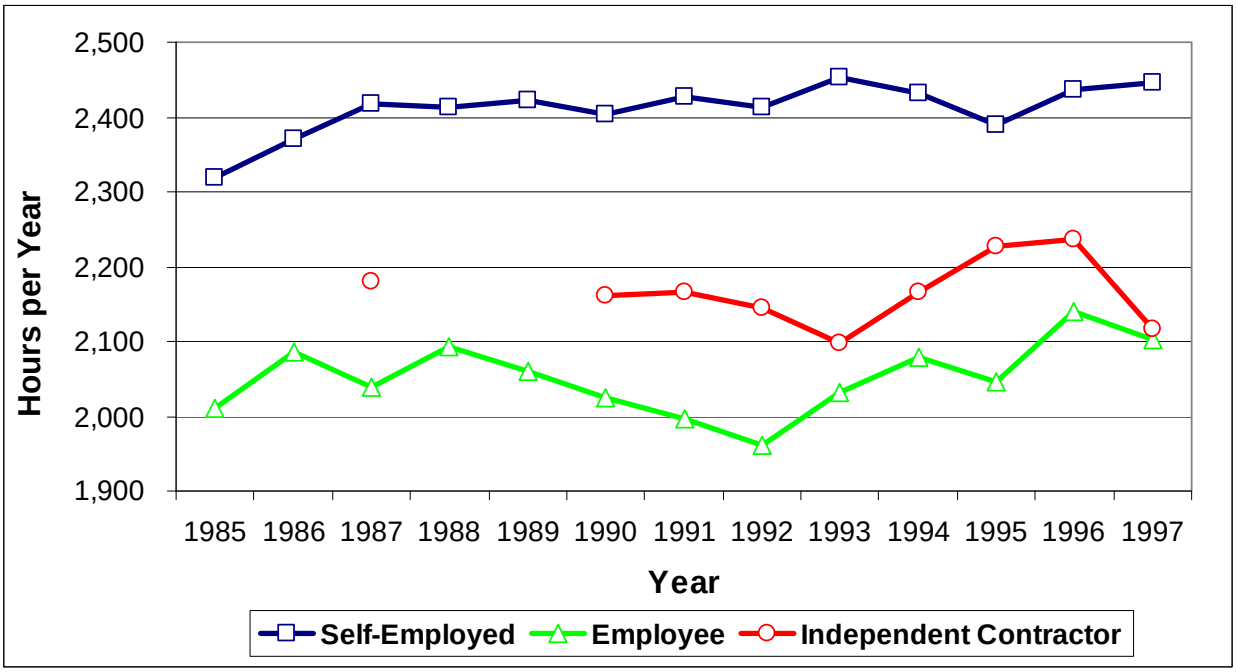
Women constitute a growing proportion of the physician workforce, and AMA (2001) reports the median number of practice hours worked per week for female physicians was 49 hours as compared to 57 hours for male physicians. An analysis of a HRSA commissioned survey of hours worked found that in 2002 female physicians spent approximately 7 fewer hours per week in patient care activities, compared to male physicians, after controlling for age and specialty.

In addition to physician age, sex, and specialty, there are two additional trends that could affect average hours worked but that are not modeled in the PSM: employment type and practice location.

During the 1990s, the growth in managed care resulted in increased movement towards salaries and capitation to pay for physician services. These trends change the incentives that existed historically when physicians were largely self-employed and a fee-for-service system rewarded physicians for higher volume of services and thus greater hours worked. AMA statistics show that self-employed physicians tend to work more hours per year in patient care compared to physicians who are independent contractors (Exhibit 11). Independent contractors, in turn, tend to spend more time in patient care activities compared to employee physicians. Compared to employee physicians, independent contractors provide 6 percent more hours and self-employed physicians provide 18 percent more hours per year in patient care activities. Although employment type is not specifically modeled in the PSM, part of the difference in hours worked by employment type might be explained by differences in demographics of the self-employed and employee physician workforces. To the extent that physicians who tend to work fewer

hours (e.g., younger physicians, older physicians, and women) are more likely to be employees rather than self-employed, the model will partially capture the trends in employment type and their impact on average hours worked.

Exhibit 11. Average Hours per Year in Direct Patient Care, by Employment Type



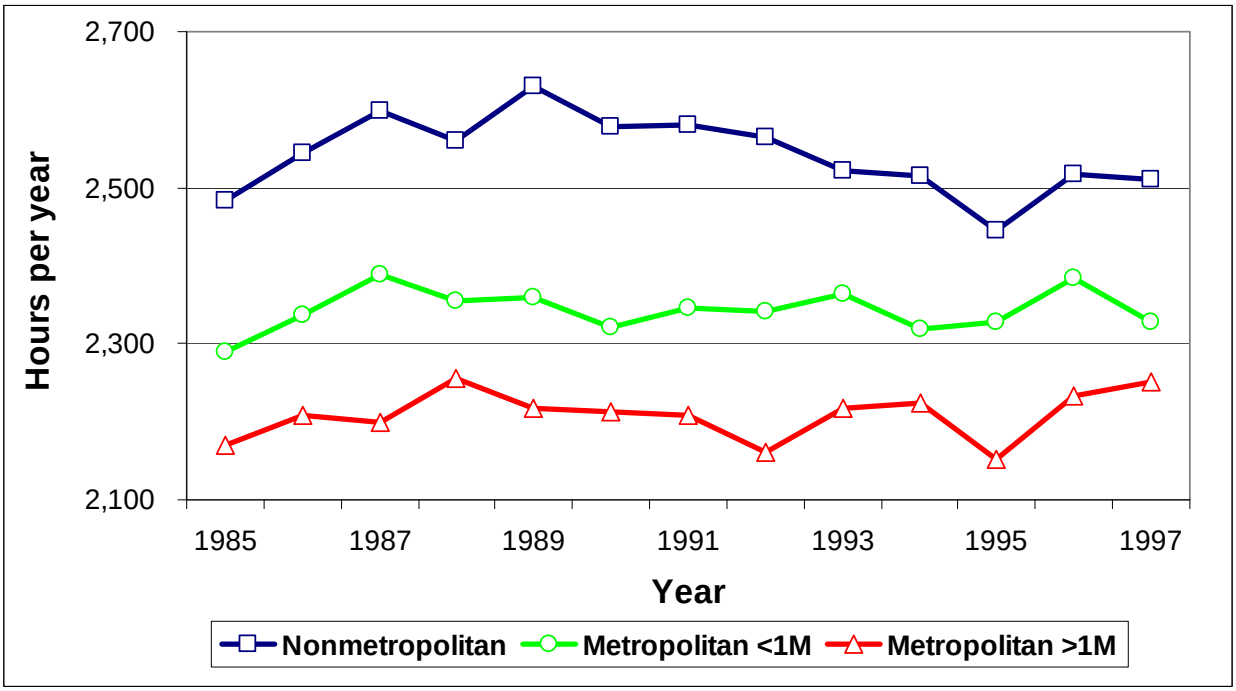
Source: AMA Physician Socioeconomic Statistics (various years).

Another phenomenon is that physicians in less populated areas tend to spend more time providing patient care than do physicians in more populated areas. AMA publications for various years indicate that during the period 1985 to 1997, physicians practicing in non-metropolitan areas averaged 53.5 hours per week in direct patient care; physicians practicing in metropolitan areas with fewer than 1 million people averaged 49.7 hours per week in direct patient care; and physicians practicing in metropolitan areas with more than 1 million people averaged 46.8 hours per week in direct patient care. During this period, physicians practicing in non-metropolitan areas provided patient care for slightly more weeks per year compared to physicians practicing in metropolitan areas. Compared to physicians in metropolitan areas with more than 1 million people, physicians in smaller metropolitan areas work 6 percent more hours and physicians in non-metropolitan areas work 15 percent more hours per year providing direct patient care. This difference in hours worked has been relatively constant over time (Exhibit 12).

Physicians practicing in non-metropolitan areas might be providing more hours of direct patient care compared to physicians in metropolitan areas, on average, because practice location is correlated with other physician characteristics and circumstances that are correlated with direct patient care hours worked. For example, physicians in non-metropolitan areas are less likely to be engaged in teaching and research, more likely to be a solo practitioner, and are

disproportionately male. The PSM does not track physicians by metropolitan location, but over time a slightly larger proportion of physicians will likely be working in metropolitan areas as the U.S. population grows.

Exhibit 12. Average Hours per Year in Direct Patient Care, by Metropolitan Location



Source: AMA Physician Socioeconomic Statistics (various years).

5. Physician Retirement Patterns

The physician workforce is aging, with a relatively large proportion of physicians approaching retirement just as the demand for their services is projected to surge due to an aging U.S. population. Accurately estimating retirement rates and identifying trends in such rates is vital to obtaining reliable projections of physician supply.

Physicians leave the workforce through retirement, mortality, disability, and career change. The PSM combines estimates of physician retirement rates with mortality rates for highly educated men and women in the United States obtained from the Centers for Disease Control and Prevention (CDC) to estimate the probability that a physician of a given age, sex, and USMG/IMG status will remain in the workforce from year to year.

Historically, estimates of physician retirement rates have come from analysis of the AMA Masterfile data, but concerns that the AMA Masterfile overstates the likelihood that older physicians are still active prompted us to consider alternative sources of retirement rates. To test the sensitivity of the supply projections to retirement rates, in a later section we present projections of physician supply with retirement rates calculated using three sources: AMA Masterfile, Physician Worklife Survey (PWS), and Current Population Survey (CPS).

- The **AMA Masterfile** contains information on whether a physician is active—defined as working 20 or more hours per week in professional activities—or inactive. The AMA data can be used to estimate the probability that a physician with certain characteristics (e.g., age, sex, specialty, and IMG status) is active.[12] The retirement rates currently used in the PSM are rates calculated using AMA data from the early-to-mid 1990s. Our analysis of AMA data from the late 1990s through 2001 raised concerns that a growing number of older physicians are inaccurately categorized as active.[13]
- The **Physician Worklife Survey** was conducted by The Sheps Center at the University of North Carolina on behalf of HRSA's Bureau of Health Professions' National Center for Health Workforce Analysis.[14] The first round of this survey was conducted in 1997, with physicians asked about their intentions to retire. A follow-up survey was conducted in 2003 to obtain data on actual retirement behavior. The PWS sample size is sufficient to provide stable estimates of retirement rates for physicians age 55 to 74, but the sample size is insufficient to provide accurate retirement rates for physicians younger than 55 or older than 75.
- The **Current Population Survey** is a monthly survey, with the March survey asking detailed questions regarding employment and current (or former) occupation. The CPS combines physicians, lawyers, accountants, architects, and other licensed professionals into an occupation entitled *licensed professionals*. From the CPS, retirement patterns for males and females in this occupation category were estimated as a proxy for physician retirement patterns. To increase sample size we combine CPS data from 6 years—1998 through 2003.

A comparison of workforce activity rates from these three sources suggests that physicians tend to retire at a more advanced age than individuals in other occupations (Exhibit 13). Activity rates based on the 2001 AMA Masterfile are much higher than rates based on AMA Masterfile data from the early to middle 1990s. The PWS-based rates are lower than the AMA-based rates, and although the PWS results are based on a modest-size sample, the results are consistent with our suspicion that the AMA-based rates overestimate the number of older, active physicians. (The likelihood that using the AMA-based retirement rates results in overestimates of the number of active physicians under age 75 is counterbalanced by our assumption that all physicians have retired by age 75.) The CPS-based rates, though for a broader group than just physicians, are relatively consistent with the other two sources. Other analyses not shown here

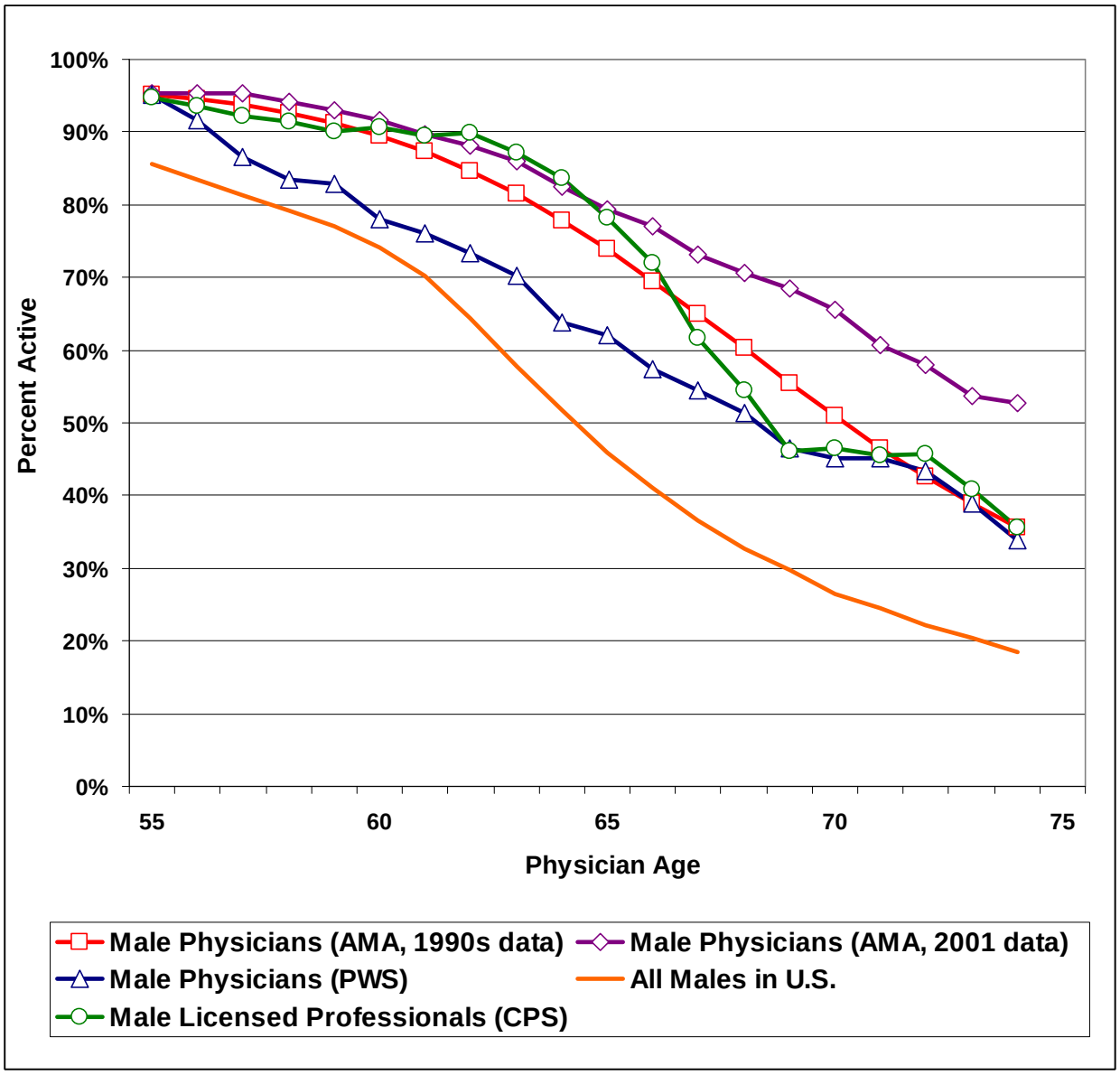
[12] Separation rates calculated for use in the PSM differ by physician age, sex, and USMG or IMG. The PSM does not have different separation rates by medical specialty, although the Career Change Module in the PSM is used to "retire" physicians at earlier ages for high-intensity specialties such as emergency medicine.

[13] Although the AMA remains the most accurate source of information on the physician workforce, the process whereby AMA currently surveys one third of its members every 4 years means that up to a 4-year lag could exist between when a physician's activity status changes and when that change is recorded in the AMA Masterfile. Furthermore, activity status is self reported, and some retired physicians might fail to respond to the AMA survey. Recognizing this problem, the AMA automatically recodes as retired all physicians age 75 and older who fail to respond to its survey and all physicians who receive AMA retirement benefits.

[14] Estimates of physician retirement rates were obtained via personal correspondence with Bob Konrad, principal investigator for the PWS.

find that female physicians retire earlier than their male counterparts, reinforcing the need to use sex-specific retirement rates for modeling purposes.

Exhibit 13. Percent of Male Physicians Active in the Workforce, by Physician Age

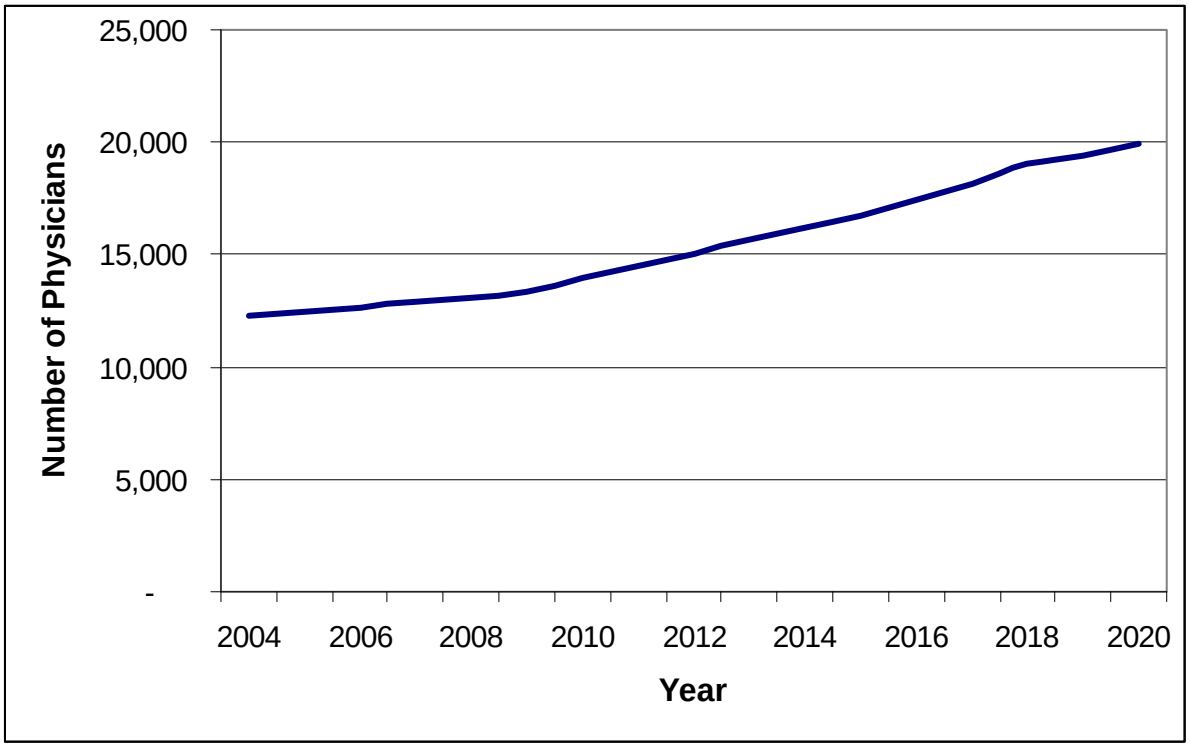


Economic theory, empirical research, and anecdotal evidence suggest that physician demographics, economic considerations, physicians' overall satisfaction with the health care operating environment, and societal factors influence physician retirement behavior. Several key trends influencing retirements are discussed.

a) Growing Number of Elderly Physicians

The PSM baseline projections suggest that by 2020 the annual number of retiring physicians will reach 20,000, up 60 percent from the current number of approximately 12,000 (Exhibit 14).

Exhibit 14. Projected Number of Retiring Physicians



Although physician age is the most common and reliable single predictor of when physicians leave the workforce, age is simply a proxy for many of the actual factors that increase the propensity of physicians to retire. Factors that are positively correlated with age and are hypothesized to affect the propensity to retire include: higher physician net worth, increased risk of burnout, health problems, and eligibility for government programs for the elderly. Other considerations in the retirement decision include societal expectations, preferences of the physician and his or her spouse, and financial incentives. Changes in market conditions, the health care operating environment, or government policies that affect any of these factors could change physician retirement patterns relative to the status quo. Current trends in these determinants of physician retirement decisions suggests contradicting forces on the propensity of physicians to retire, with no clear indication of whether physician retirement rates will change in the near future.

b) Growing Number of Female Physicians

Female physicians tend to retire slightly earlier than male physicians, so the growing number of women in the profession will likely decrease average years of practice. The surge in women

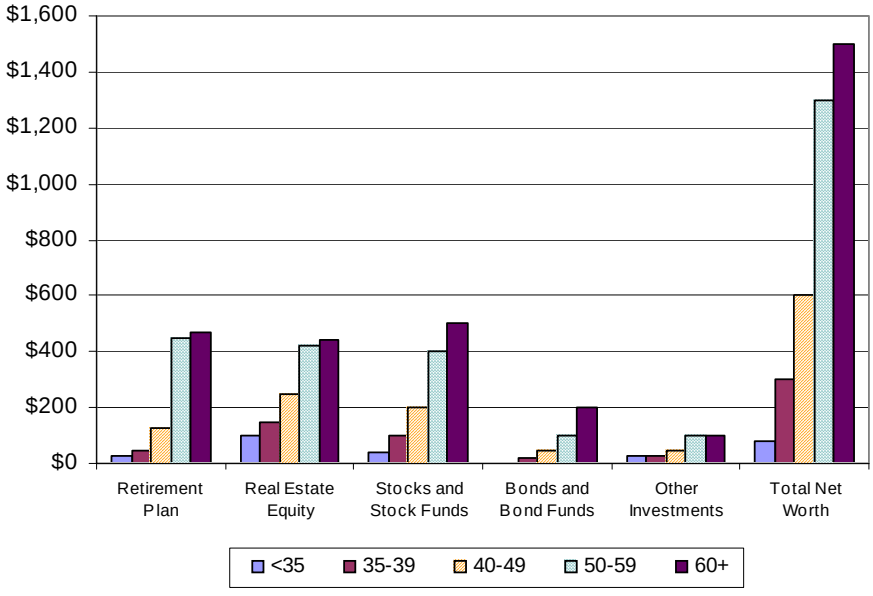
entering the profession is a relatively recent phenomenon, so the retirement implications will not be felt for another 2 to 3 decades.

c) Changes in Physician Wealth and Earnings

A physician's net worth affects his or her ability to maintain a desired lifestyle after retirement. Higher net worth, therefore, increases the propensity to retire. Average physician net worth is highly correlated with age, which reinforces the reliability of using age as a predictor of retirement. Farber and Murray (2001) report on the findings of a financial survey of physicians conducted in 2000 (Exhibit 15). They report that physicians age 60 and above had the highest median net worth (approximately $1.5 million) of all age groups, followed closely by physicians age 50-59 (approximately $1.3 million). Median net worth drops dramatically for subsequent age groups, to approximately $600,000 for physicians age 40-49, to $300,000 for physicians age 35-39, and to $80,000 for physicians younger than age 35.

Many physicians have experienced volatility (and a significant decline) in their financial assets in recent years reflecting the effect of market conditions on stocks and other financial investments. Farber and Murray describe anecdotal evidence that suggests some physicians have changed their retirement expectations as the value of their stocks and expected market returns have fallen. Some physicians approaching normal retirement age and some physicians planning on early retirement are opting to delay retirement to build back the loss in net worth. This drop in net worth likely will cause only a temporary drop in retirement rates.

Exhibit 15. Median Asset Holdings of Physicians, by Asset Type and by Physician Age



Source: Medical Economics Survey of Physician Net Worth (Farber and Murray, 2001).

An important component of physician net worth is the value of their practice. Three trends are depressing the sale value of physician practices, and this decline in sale value could delay some physician retirement decisions.

1. **Market trends away from physician practice consolidation**. In the mid 1990s hospitals and physician associations spent large sums of money purchasing and consolidating physician practices. This trend was an industry effort to increase market share and negotiating power and improve the efficiency of health care delivery. This surge in buyouts meant that physicians nearing retirement often could sell their practice or receive a cash buyout for between 100 to 150 percent of annual practice gross revenue (Terry, 1999). In recent years, the expected financial benefits of practice purchase and consolidation have failed to materialize. The dampened enthusiasm to purchase and consolidate practices has reduced practice valuations back towards their historical range of 30 to 70 percent of annual gross revenue. Furthermore, physicians who invested substantial resources in the purchase of other practices have seen the value of their investment decline (along with the declining market value of their own practices).

2. **The growth in managed care**. Historically, retiring physicians could sell their practice to competing physicians interested in building their patient base. Retiring physicians often cannot transfer their managed care contracts, which depresses the sale price of their practice. In addition, competitors in the same managed care network as the retiring physician often have little financial incentive to purchase the practice of the retiring physician. Patients of the retiring physician will simply be redistributed among the remaining physicians in that network.

3. **Increased uncertainty of future cash flow**. Declining reimbursement rates, increasing competition, and uncertainty regarding key characteristics of the health care system all increase the uncertainty of a practice's future cash flow. As with most investments, higher uncertainty regarding the expected future returns is depressing physician practice valuation.

In a simplified model of physician work behavior, physicians value both leisure time and earnings. In deciding how much time to spend at work, physicians will balance the benefits of working (i.e., increasing their earnings) with the benefits of not working (i.e., more leisure time). This simple model is also instructive regarding physician retirement decisions. Physicians will continue working as long as the expected benefits exceed expected costs. A drop in net earnings due to market or other exogenous forces will reduce physician earnings potential, which reduces the financial incentive to continue working. In other words, a drop in earnings potential reduces the opportunity cost of retirement thus making it more likely that the physician will retire.

A shortage of physicians could drive up average physician net earnings, which could in turn increase the propensity to delay retirement. A physician surplus could have the opposite effect and increase retirement rates.

d) Changes in Other Factors

- **Managed Care**. Growth in the more restrictive forms of managed care during the 1990s raised the issue of whether growing physician dissatisfaction with managed care might increase the propensity of physicians to retire early. The consumer backlash against the most restrictive forms of managed care reduced the impact of managed care on physician retirement behavior.

- **Medical Malpractice Premiums**. A current topic of concern is that large hikes in insurance premiums might drive some physicians into retirement. Anecdotal evidence suggests that some physicians—particularly in high-risk surgical specialties and in certain geographic areas—have stopped performing surgery or have stopped practicing altogether. In the long term, rising malpractice premiums will likely have a larger impact on specialty choice rather than retirement behavior.

- **Physician Burnout**. Factors contributing to growing discontent among physicians include the increasing complexities of medical practice, a perceived loss of independence and clinical control in an increasingly cost-conscious environment, and continuous work overload (Spickard, Gabbe, and Christensen, 2002). McMurray et al. (2000) report that the odds of burnout among female physicians increases by 12 percent to 15 percent for each additional 5 hours worked per week in excess of 40 hours.

- **Health, Societal Expectations, and Government Policies.** The continued increase in average life span and the increasing eligibility age for government programs could result in modest increases in average years of practice. Countering this trend, a growing number of elderly physicians are leaving the workforce to care for their aging parents.

For modeling purposes, we focus on long-term trends that affect the number of retirements (e.g., the aging of the physician workforce and the growing number of female physicians) rather than factors that might cause short-term fluctuations in retirement patterns.

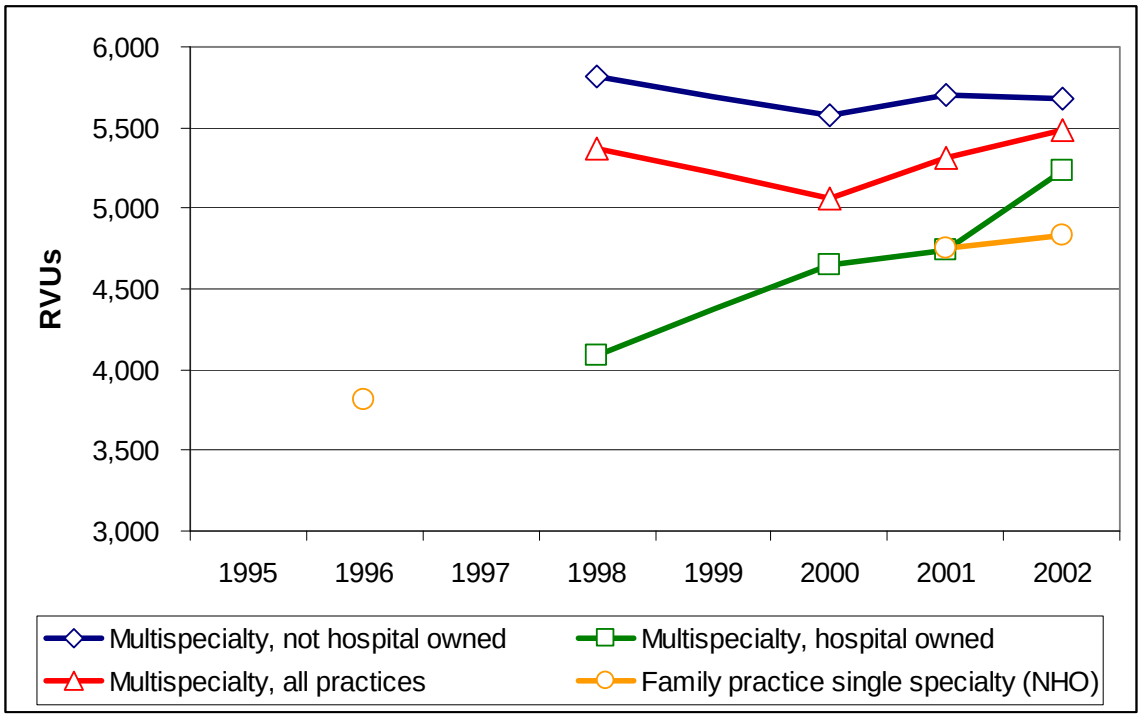
6. Trends in Physician Productivity

Trends in physician productivity are important to consider when projecting the supply of physician services. In addition to number of hours worked in direct patient care (discussed previously), physician productivity continues to increase through improved science and technology, improved education, and increased efficiency in delivering services.

One productivity measure that captures both physician time and skill necessary to provide services is Relative Value Units (RVUs). More complex and time consuming services have higher RVUs. Data from the Medical Group Management Association (MGMA) cost survey suggests a small increase over time in RVUs per FTE physician (Exhibit 16). For example, between 1998 and 2002, median work RVUs per physician in multi-specialty practices increased from 5,368 to 5,489 (about 0.6 percent per year). For multi-specialty, hospital-owned practices, the annual growth rate over this 4-year period was approximately 7 percent, while for practices not owned by hospitals, the annual growth rate was approximately -0.5 percent. The number of support staff per FTE physician has also increased (Exhibit 17). Between 1996 and 2002, the number of support staff per FTE physician in multi-specialty practices increased, on averge, 1.4

percent annually. The average annual growth rate for family practice groups over this 6-year period was 1.2 percent. To capture these trends in greater physician productivity for a sensitivity analysis, the supply of physician services was projected under the assumption that productivity will increase by a modest 1 percent annually. [15]

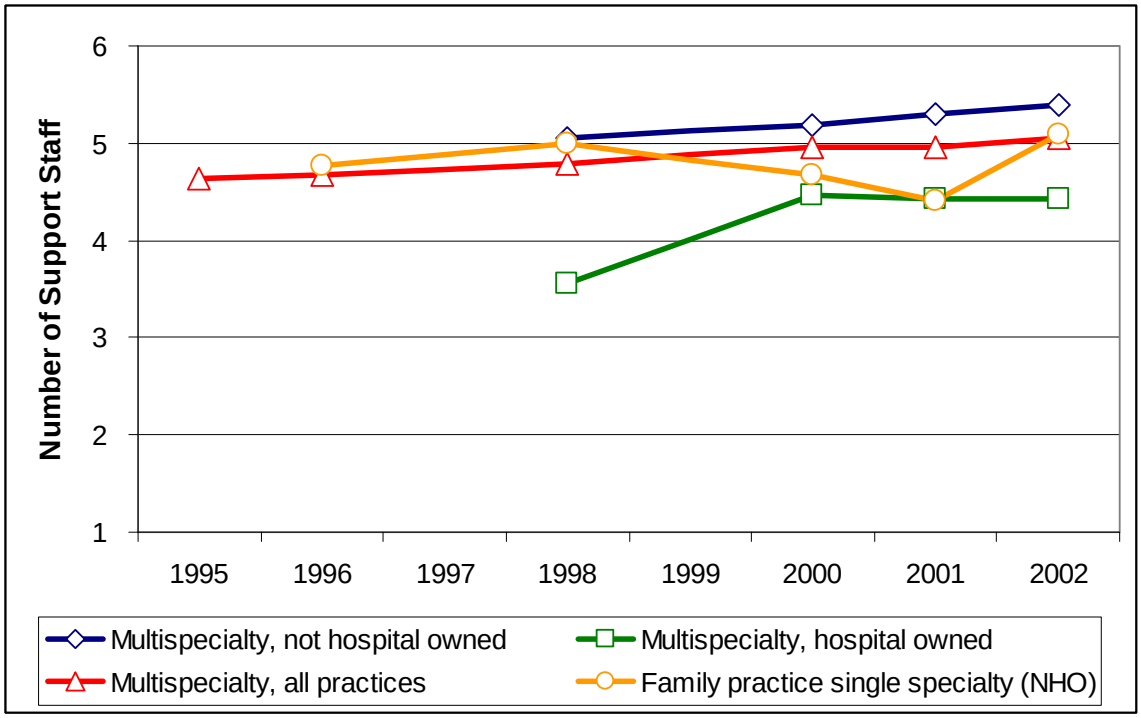
Exhibit 16. Physician Work RVUs per FTE Physician



Source: MGMA Cost Survey, various years.

[15] The Congressional Budget Office (CBO) projects a 3 percent annual growth rate in real Gross Domestic Product (GDP) between 2003 to 2013, which is approximately equal to about 2 percent average annual growth in real per capita GDP. Real economic growth, controlling for changing demographics, occurs through an increase in productivity. CBO projections, therefore, assume that worker productivity will increase by approximately 2 percent annually, on average, throughout the economy. For modeling purposes, an annual 1percent growth in physician productivity is assumed, which will likely increase less rapidly than overall productivity due to the labor intensiveness of physician services.

Exhibit 17. Total Support Staff per FTE Physician



Source: MGMA Cost Survey, various years.

C. Physician Supply Projections

Baseline Projections

The baseline projections of physician supply assume that current patterns of new graduates, specialty choice, and practice behavior will continue through 2020. The number of active physicians under the age of 75 grew from approximately 756,000 in 2000 to an estimated 817,500 in 2005, and this number will grow to approximately 951,700 by 2020 if current trends continue (Exhibit 18). When physicians engaged primarily in non-patient care activities and residents are excluded to estimate the supply of physicians in clinical practice, total supply is projected to grow from approximately 641,400 in 2005 to 745,000 in 2020, a 16 percent increase (Exhibit 19).

FTE supply projections provide a more accurate picture of the adequacy of supply (than do projections of active physicians) because the FTE projections consider the decrease in average hours worked as the physician workforce ages and women constitute a growing proportion of physicians. FTE supply of physicians engaged in clinical practice grew from approximately 597,400 in 2000 to 635,800 in 2005, and this number is projected to reach approximately 720,000 by 2020 (Exhibit 20).

FTE physicians providing patient care (which includes physicians in clinical practice and residents), numbered approximately 713,800 in 2000, increasing to approximately 764,500 by 2005, and are projected to reach over 866,000 by 2020 (Exhibit 21). Although total physicians

engaged primarily in patient care grew by approximately 56,000 between 2000 and 2005, the projected decrease in average hours worked suggests that during this period the net increase in total patient care hours was equivalent to only 50,000 physicians.

The projected growth in supply varies substantially by medical specialty, reflecting differences in the components of supply (e.g., number of new entrants, age distribution) for each specialty. If current supply trends continue, the number of FTE primary care physicians engaged primarily in patient care is projected to grow approximately 18 percent between 2005 and 2020, compared to a growth rate of 10 percent for non-primary care physicians. FTE supply in some surgical specialties is projected to decline. Reflecting the dynamic nature of physician supply, an increasing percentage of first-year residency positions in general surgery have been filled in recent years with over 95 percent of these positions filled in 2005 (AAMC, 2005). Thus, these supply projections likely overestimate the size of projected shortages and surpluses within individual specialties because the Nation can adjust more quickly to inadequacies in the supply of individual specialties than to inadequacies in the overall supply of physicians.

Exhibit 18. Supply of Total Active Physicians: 2000, Projected to 2020

Specialty	Base Year	Projected				Percent Change from 2005–2020
	2000	2005	2010	2015	2020	
Total	**756,050**	**817,440**	**872,900**	**919,060**	**951,700**	**16%**
Primary Care	**277,720**	**306,130**	**331,560**	**354,000**	**371,410**	**21%**
Gen. & Family Practice	110,990	118,360	127,110	135,940	143,350	21%
General Internal Med.	112,220	128,020	139,400	148,680	155,330	21%
General Pediatrics	54,520	59,750	65,050	69,390	72,730	22%
Other Med. Specialties	**107,540**	**116,260**	**124,420**	**130,310**	**133,720**	**15%**
Allergy	4,020	3,870	3,750	3,660	3,540	-9%
Cardiovascular Disease	21,990	23,180	24,470	25,340	25,620	11%
Dermatology	9,990	11,100	11,780	12,390	12,880	16%
Gastroenterology	11,200	11,890	12,480	12,850	12,970	9%
Internal Med. Sub Spec	36,750	40,720	43,970	46,290	47,740	17%
Pediatric Cardiology	1,630	1,890	2,110	2,300	2,460	30%
Pediatrics Sub Spec	12,600	13,910	15,870	17,430	18,590	34%
Pulmonary Diseases	9,350	9,700	10,000	10,050	9,940	2%
Surgical Specialties	**163,780**	**170,350**	**174,850**	**177,990**	**179,300**	**5%**
General Surg Sub Spec	6,370	7,090	7,690	8,120	8,340	18%
General Surgery	33,980	32,700	32,460	32,210	31,880	-3%
Neurological Surgery	5,290	5,450	5,570	5,650	5,670	4%
Obstetrics & Gynecology	42,780	47,150	50,630	53,470	55,580	18%
Ophthalmology	18,830	19,680	19,950	20,100	20,020	2%
Orthopedic Surgery	24,560	25,750	26,320	26,640	26,630	3%
Otorhinolaryngology	9,970	10,410	10,580	10,700	10,730	3%
Plastic Surgery	6,440	6,660	6,620	6,520	6,370	-4%
Thoracic Surgery	4,930	4,690	4,520	4,320	4,100	-13%
Urology	10,630	10,770	10,510	10,250	9,990	-7%
Other Specialties	**207,010**	**224,710**	**242,070**	**256,760**	**267,260**	**19%**
Anesthesiology	39,090	43,630	47,880	51,340	53,660	23%
Child Psychiatry	6,650	7,730	8,830	9,930	10,920	41%
Diagnostic Radiology	23,100	26,210	28,270	29,700	30,560	17%
Emergency Medicine	27,460	30,840	34,640	37,620	39,890	29%
Gen. Prevent Medicine	3,670	3,090	2,880	2,780	2,750	-11%
Neurology	13,870	15,740	17,310	18,540	19,360	23%
Nuclear Medicine	1,530	1,610	1,670	1,710	1,740	8%
Occupational Medicine	3,130	3,430	3,780	4,100	4,350	27%
Other Specialties	6,310	6,270	6,630	7,020	7,230	15%
Pathology	20,200	20,970	21,580	22,040	22,280	6%
Physical Med. & Rehab.	7,200	8,410	9,630	10,700	11,580	38%
Psychiatry	41,550	43,360	45,210	47,050	48,310	11%
Radiation Oncology	4,150	4,790	5,280	5,670	5,950	24%
Radiology	9,110	8,640	8,510	8,550	8,710	1%

Note: Totals might not equal sum of subtotals due to rounding.

Exhibit 19. Supply of Physicians in Clinical Practice: 2000, Projected to 2020

Specialty	Base Year	Projected				Percent Change from 2005–2020
	2000	2005	2010	2015	2020	
Total	**597,440**	**641,380**	**681,130**	**718,620**	**744,990**	**16%**
Primary Care	**214,820**	**230,560**	**248,910**	**267,470**	**281,570**	**22%**
Gen. & Family Practice	89,720	94,990	101,520	108,460	114,120	20%
General Internal Med.	82,250	89,330	97,120	105,070	110,720	24%
General Pediatrics	42,850	46,240	50,260	53,930	56,730	23%
Other Med. Specialties	**84,460**	**91,090**	**95,010**	**99,210**	**102,010**	**12%**
Allergy	3,320	3,180	3,030	2,960	2,840	-11%
Cardiovascular Disease	18,680	19,710	20,310	20,920	21,080	7%
Dermatology	8,630	9,560	10,160	10,720	11,210	17%
Gastroenterology	9,660	10,320	10,620	10,890	10,950	6%
Internal Med. Sub Spec	27,450	29,680	30,880	32,490	33,700	14%
Pediatric Cardiology	1,210	1,410	1,540	1,670	1,780	26%
Pediatrics Sub Spec	8,060	9,470	10,680	11,870	12,890	36%
Pulmonary Diseases	7,460	7,770	7,790	7,700	7,570	-3%
Surgical Specialties	**134,470**	**140,040**	**143,780**	**146,240**	**147,010**	**5%**
General Surg Sub Spec	5,780	6,460	7,000	7,340	7,520	16%
General Surgery	23,620	22,610	22,090	21,690	21,250	-6%
Neurological Surgery	4,230	4,400	4,520	4,570	4,560	4%
Obstetrics & Gynecology	35,990	39,230	42,230	44,750	46,590	19%
Ophthalmology	16,810	17,600	17,830	17,940	17,830	1%
Orthopedic Surgery	20,160	21,360	21,980	22,250	22,190	4%
Otorhinolaryngology	8,440	8,890	9,070	9,180	9,200	4%
Plastic Surgery	5,760	5,940	5,900	5,810	5,650	-5%
Thoracic Surgery	4,480	4,290	4,110	3,910	3,690	-14%
Urology	9,200	9,280	9,050	8,800	8,530	-8%
Other Specialties	**163,690**	**179,690**	**193,430**	**205,700**	**214,410**	**19%**
Anesthesiology	33,560	37,930	41,570	44,510	46,430	22%
Child Psychiatry	5,550	6,520	7,420	8,370	9,220	41%
Diagnostic Radiology	18,130	20,820	22,590	23,850	24,590	18%
Emergency Medicine	21,890	25,750	29,210	31,920	33,950	32%
Gen. Prevent Medicine	2,160	1,860	1,700	1,650	1,600	-14%
Neurology	10,810	12,170	13,150	14,070	14,680	21%
Nuclear Medicine	1,230	1,300	1,320	1,350	1,360	5%
Occupational Medicine	2,320	2,520	2,730	2,960	3,160	25%
Other Specialties	3,280	3,230	3,370	3,540	3,640	13%
Pathology	14,240	14,850	15,130	15,360	15,450	4%
Physical Med. & Rehab.	5,790	6,900	7,910	8,840	9,580	39%
Psychiatry	33,120	33,960	35,170	36,730	37,830	11%
Radiation Oncology	3,560	4,140	4,590	4,940	5,200	26%
Radiology	8,090	7,730	7,580	7,600	7,740	0%

Note: Totals might not equal sum of subtotals due to rounding.

Exhibit 20. FTE Supply of Physicians in Clinical Practice: 2000, Projected to 2020

Specialty	Base Year	Projected				Percent Change from 2005–2020
	2000	2005	2010	2015	2020	
Total	**597,430**	**635,780**	**669,010**	**699,450**	**719,940**	**13%**
Primary Care	**214,810**	**228,660**	**244,370**	**259,910**	**271,440**	**19%**
Gen. & Family Practice	89,710	94,380	99,850	105,460	109,980	17%
General Internal Med.	82,250	88,620	95,410	102,230	106,910	21%
General Pediatrics	42,850	45,670	49,110	52,230	54,560	19%
Other Med. Specialties	**84,460**	**90,130**	**93,040**	**96,370**	**98,540**	**9%**
Allergy	3,320	3,140	2,970	2,860	2,730	-13%
Cardiovascular Disease	18,690	19,540	19,940	20,370	20,420	5%
Dermatology	8,630	9,420	9,880	10,310	10,680	13%
Gastroenterology	9,660	10,220	10,430	10,630	10,650	4%
Internal Med. Sub Spec	27,450	29,350	30,240	31,620	32,650	11%
Pediatric Cardiology	1,210	1,410	1,530	1,650	1,750	24%
Pediatrics Sub Spec	8,060	9,360	10,440	11,490	12,390	32%
Pulmonary Diseases	7,460	7,690	7,610	7,450	7,270	-5%
Surgical Specialties	**134,470**	**138,990**	**141,750**	**143,140**	**143,090**	**3%**
General Surg Sub Spec	5,780	6,410	6,900	7,180	7,310	14%
General Surgery	23,610	22,570	21,970	21,510	21,040	-7%
Neurological Surgery	4,220	4,380	4,490	4,520	4,490	3%
Obstetrics & Gynecology	35,990	38,790	41,280	43,240	44,630	15%
Ophthalmology	16,820	17,440	17,560	17,550	17,350	-1%
Orthopedic Surgery	20,170	21,210	21,740	21,870	21,710	2%
Otorhinolaryngology	8,440	8,820	8,980	9,050	9,030	2%
Plastic Surgery	5,760	5,890	5,820	5,690	5,510	-6%
Thoracic Surgery	4,480	4,270	4,070	3,850	3,620	-15%
Urology	9,200	9,200	8,950	8,680	8,400	-9%
Other Specialties	**163,690**	**178,010**	**189,860**	**200,020**	**206,860**	**16%**
Anesthesiology	33,560	37,680	41,080	43,690	45,250	20%
Child Psychiatry	5,550	6,440	7,240	8,070	8,800	37%
Diagnostic Radiology	18,130	20,570	22,100	23,120	23,640	15%
Emergency Medicine	21,890	25,450	28,490	30,770	32,490	28%
Gen. Prevent Medicine	2,160	1,850	1,680	1,620	1,560	-16%
Neurology	10,810	12,040	12,870	13,660	14,160	18%
Nuclear Medicine	1,230	1,280	1,300	1,320	1,330	4%
Occupational Medicine	2,320	2,520	2,690	2,880	3,020	20%
Other Specialties	3,280	3,200	3,290	3,400	3,450	8%
Pathology	14,240	14,730	14,880	14,970	14,940	1%
Physical Med. & Rehab.	5,790	6,830	7,770	8,610	9,250	35%
Psychiatry	33,120	33,630	34,410	35,510	36,230	8%
Radiation Oncology	3,560	4,100	4,500	4,810	5,020	23%
Radiology	8,090	7,690	7,560	7,600	7,730	0%

Note: Totals might not equal sum of subtotals due to rounding.

Exhibit 21. FTE Supply of Physicians in Patient Care (Clinical Practice plus Residents): 2000, Projected to 2020

Specialty	Base Year	Projected				Percent Change from 2005–2020
	2000	2005	2010	2015	2020	
Total	**713,810**	**764,450**	**808,080**	**842,650**	**866,440**	**13%**
Primary Care	**267,040**	**292,070**	**313,220**	**331,110**	**344,710**	**18%**
Gen. & Family Practice	107,650	114,000	121,400	128,620	134,680	18%
General Internal Med.	107,470	121,900	131,440	138,820	143,900	18%
General Pediatrics	51,920	56,160	60,380	63,670	66,120	18%
Other Med. Specialties	**97,530**	**103,400**	**109,020**	**112,890**	**115,300**	**12%**
Allergy	3,530	3,330	3,190	3,090	2,960	-11%
Cardiovascular Disease	20,570	21,350	22,230	22,760	22,850	7%
Dermatology	9,720	10,640	11,170	11,610	12,000	13%
Gastroenterology	10,520	10,980	11,360	11,610	11,670	6%
Internal Med. Sub Spec	31,400	34,100	36,300	37,900	39,030	14%
Pediatric Cardiology	1,390	1,590	1,750	1,890	1,990	25%
Pediatrics Sub Spec	11,910	12,820	14,370	15,510	16,440	28%
Pulmonary Diseases	8,500	8,590	8,650	8,520	8,360	-3%
Surgical Specialties	**159,430**	**164,610**	**167,840**	**169,590**	**169,840**	**3%**
General Surg Sub Spec	6,080	6,700	7,200	7,490	7,620	14%
General Surgery	32,990	31,750	31,420	31,120	30,770	-3%
Neurological Surgery	5,140	5,280	5,380	5,430	5,410	2%
Obstetrics & Gynecology	41,510	45,270	48,040	50,120	51,610	14%
Ophthalmology	18,430	19,070	19,230	19,230	19,050	0%
Orthopedic Surgery	24,080	25,040	25,470	25,630	25,490	2%
Otorhinolaryngology	9,780	10,130	10,270	10,360	10,340	2%
Plastic Surgery	6,330	6,480	6,410	6,270	6,100	-6%
Thoracic Surgery	4,740	4,490	4,290	4,080	3,850	-14%
Urology	10,370	10,410	10,130	9,860	9,590	-8%
Other Specialties	**189,800**	**204,350**	**217,990**	**229,070**	**236,600**	**16%**
Anesthesiology	37,820	41,760	45,430	48,270	49,990	20%
Child Psychiatry	6,160	7,070	7,960	8,830	9,580	36%
Diagnostic Radiology	22,340	25,000	26,700	27,790	28,370	13%
Emergency Medicine	26,330	29,070	32,150	34,500	36,290	25%
Gen. Prevent Medicine	2,500	2,180	2,030	1,970	1,920	-12%
Neurology	12,600	14,060	15,240	16,120	16,690	19%
Nuclear Medicine	1,350	1,410	1,450	1,480	1,500	6%
Occupational Medicine	2,320	2,530	2,710	2,900	3,040	20%
Other Specialties	3,400	3,340	3,440	3,560	3,620	8%
Pathology	17,230	17,660	17,960	18,130	18,200	3%
Physical Med. & Rehab.	6,900	7,940	8,980	9,870	10,540	33%
Psychiatry	38,280	39,660	40,970	42,300	43,150	9%
Radiation Oncology	4,030	4,600	5,010	5,330	5,540	20%
Radiology	8,570	8,070	7,980	8,040	8,180	1%

Note: Totals might not equal sum of subtotals due to rounding.

The United States Census Bureau projects population growth between 2005 and 2020 to be approximately 14 percent, which is about the same percent as the supply of physicians in patient care. Thus, the ratio of physicians per 100,000 population will remain relatively stable at about 259, although if current trends continue then non-primary care physicians per capita will decline slightly (Exhibits 22 and 23).

Exhibit 22. FTE Patient Care Physicians per 100,000 Population: 2000 to 2020

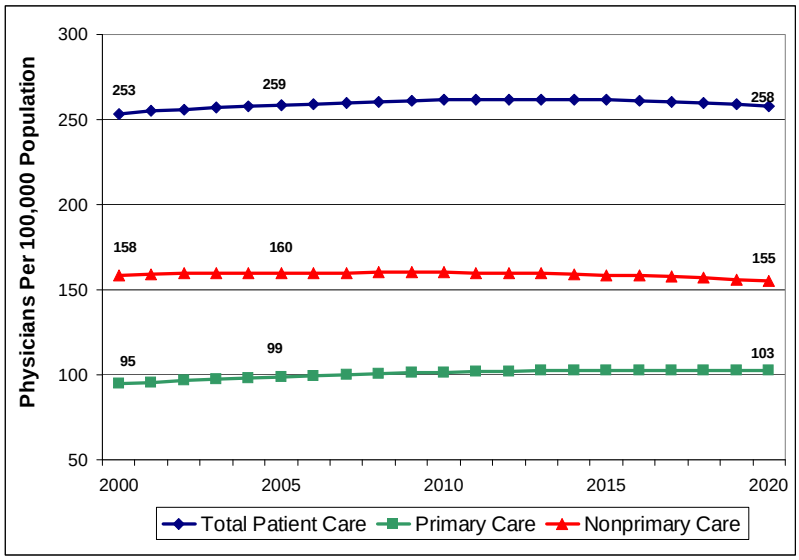
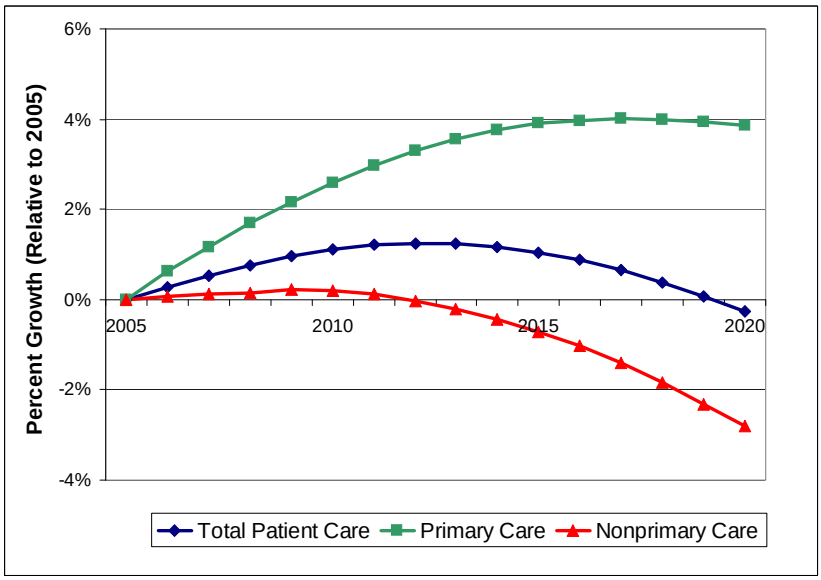
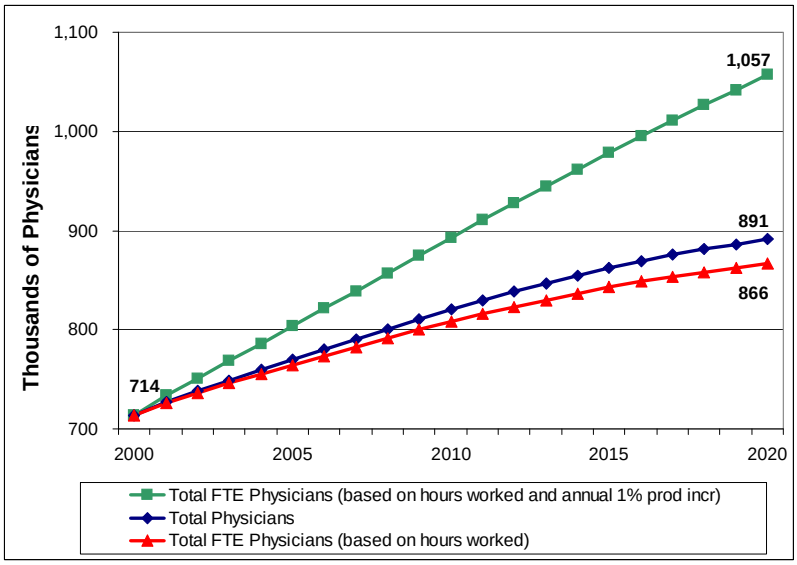


Exhibit 23. Percentage Change in FTE Patient Care Physicians per 100,000 Population: 2005-2020



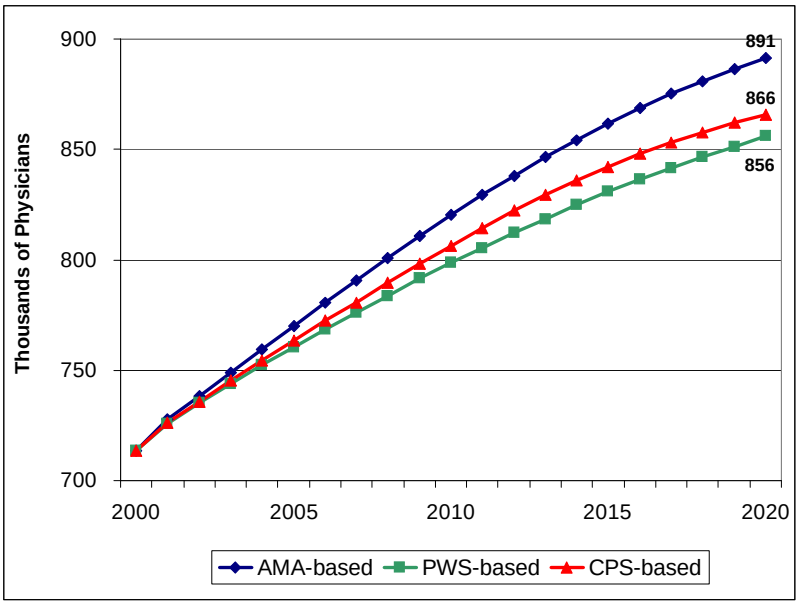
Sensitivity and Policy Analysis

Exhibit 24. Alternative Patient Care Supply Projections



The baseline supply projections assume that patterns of providing physician services will remain relatively similar between 2000 and 2020. While average, annual, patient-care hours worked per physician is projected to decline slightly over time, average physician productivity will likely continue to increase due to improved training, technological advances, increased use of other health professionals, and other factors. Under the assumption that physician productivity increases annually by 1 percent (which is approximately half the average annual per capita productivity increase), increased physician productivity would more than offset the decline in average hours worked, resulting in a net increase of nearly 40 percent in supply of physician services between 2000 and 2020 (Exhibit 24).

Exhibit 25. Patient Care Supply Using Alternative Retirement Rates

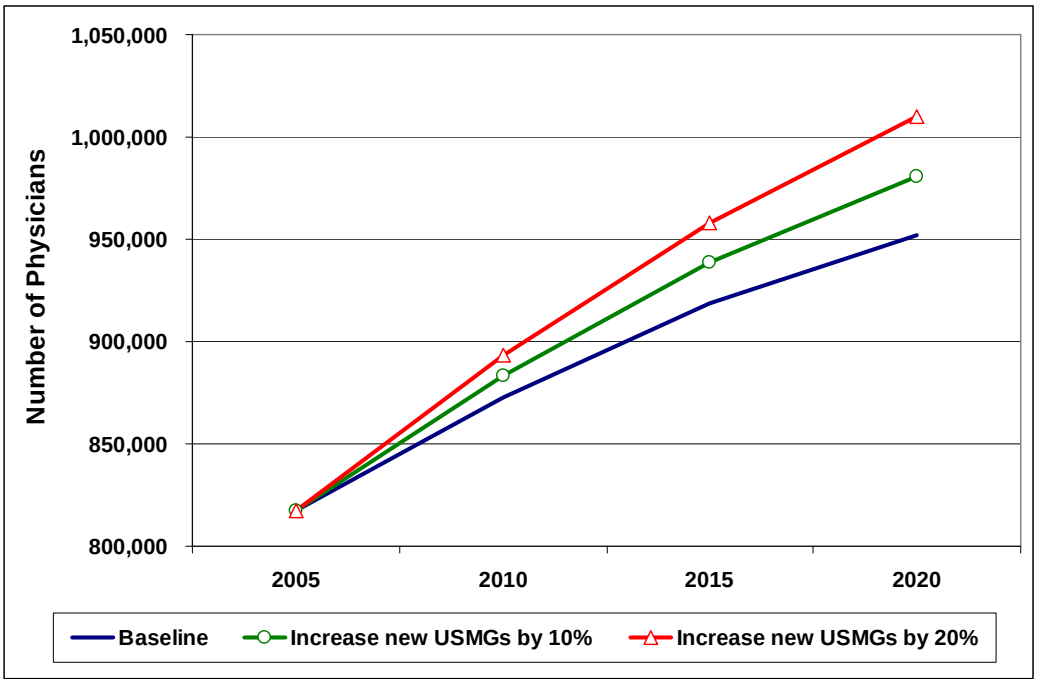


The supply projections vary by choice of retirement rates. Retirement rates based on an analysis of the AMA Masterfile produce supply projections that are higher than projections when using retirement rates based on an analysis of the CPS or the PWS (Exhibit 25).

The PSM can also be used to project supply under alternative education and policy scenarios. For example, we show supply projections if U.S. medical schools increase the number of graduates by 10 percent and 20 percent, respectively, without any change in number of IMGs (Exhibit 26).

The PSM attempts to capture the major trends affecting physician supply but is a relatively simple representation of the millions of supply-related decisions physicians and the institutions make that affect physician training and practice. Like all projection models, the accuracy of the projections diminishes with the time horizon such that short-term projections are likely more accurate than longer-term projections. Similarly, projections for broader categories of medical specialties are likely more accurate than projections for narrowly defined medical specialties. Furthermore, many physician specialties have overlapping scopes of practice that blur the distinction between individual related specialties.

Exhibit 26. Supply Implications of Increased U.S. Medical School Graduates



III. PHYSICIAN REQUIREMENTS

Physician "requirements" refers to an assessment of the total number of physicians needed to provide a specified level of services to a given population. Estimating physician requirements and projecting future requirements is often the most difficult and controversial component of assessing the adequacy of the physician supply. There exists no consensus on

> ***The term "requirements" is generally used as an umbrella term to encompass all attempts to measure the need or the demand for physician services.***
>
> Institute of Medicine (1996, p. 32)

- what constitutes an adequate level of services (given the needs of a population and its ability to pay for services),
- the relationship between requirements and certain key determinants, and
- how the characteristics of the health care system and other key determinants of physician requirements will change over time.

In the remainder of this Chapter we discuss approaches to modeling physician requirements, provide an overview of the PRM, describe the major determinants of physician requirements, and present projections from the PRM.

A. Approaches to Model Physician Requirements

Approaches to estimate physician requirements range from estimating some socially optimal number (a needs-based analysis), to estimating the number that society will likely employ (a demand-based analysis), to some variation of these approaches. In addition to simply extrapolating current physician-to-population ratios, four major approaches have been used to estimate physician requirements:

(1) **Needs-based approach**. The Committee on the Costs of Medical Care (CCMC) might be considered the first attempt to apply scientific principles to determine the adequacy of physician supply in the United States. In 1933, the CCMC published its finding that the Nation needed 140.5 physicians per 100,000 population (an estimate that exceeded existing supply by 10 percent), and that 82 percent of the physician workforce should be generalists. CCMC reached its conclusion by estimating (1) the incidence of disease and other health problems, (2) the expected number of patient-physician encounters per incidence of disease, (3) the average amount of physician time per encounter with a patient, and (4) the average amount of physician time per year spent in patient care activities. A major criticism of this approach is that it ignores the economic realities of the health care system. [16] Schroeder (1994) and others have criticized this approach as being open to bias because it relies heavily

[16] A survey of 835 physicians by Hojat et al. (2000) found that 59 percent agreed with the statement that "cost should be considered an important factor by physicians in their decisions concerning the care of their patients."

on the subjective assessments of expert panels. A further complication of using this needs-base approach is that it fails to account for the technological changes in the practice of medicine which increase the ability to treat complex clinical conditions; these technological advances are also heavily concentrated in specialty care, thereby having a larger impact on the need or demand for specialists than for primary care. GMENAC (1981) estimated physician requirements using an "adjusted" needs-based approach, similar to the CCMC study, but adjusted downward their initial requirements estimates to reflect "realistic" physician and patient behavior.

(2) **Demand/utilization-based approach**. The demand-based approach extrapolates current patterns of utilization of physician services taking into account changing demographics and trends in key determinants of the demand for physician services. This approach relies primarily on empirical analysis to estimate the relationship between utilization of health care services and its determinants, and relies less on subjective assessments from a panel of experts. This approach forms the basis for HRSA's requirements models, as well as for numerous studies on individual clinical specialties. A major criticism of the demand-based approach is that because it extrapolates current health care utilization and service delivery patterns, inequities in the current system are carried into future requirements projections.

(3) **Benchmarking approach**. Benchmarking involves the identification of a certain standard of care, and then extrapolating that standard to a different population. Examples of benchmarks include: (1) physician staffing patterns in HMOs (e.g., Weiner, 1994; Weiner 2004), and (2) physician-to-population ratios in other countries. Some utilization-based projections of physician requirements could be considered benchmarking, where the physician staffing patterns in future years are compared to physician staffing patterns in the reference year. The implicit assumption of benchmarking is that the benchmark (e.g., HMO, country, time period, etc.) reflects an efficient (or at least adequate) mix and number of physicians for the population served. A challenge with using this approach is that health care delivery systems might be very different between the benchmark entity and the population of interest such that a comparison of physician-to-population ratios requires substantial adjustments. For example, the role of primary care physicians in the United States might be quite different than the role of primary care physicians in other countries, which complicates the comparison of simple statistics such as physician-to-population ratios. Weiner (2004) studied three prepaid group plans and found that compared to the U.S. population as a whole, physician-to-population ratios at the three prepaid group plans were about 25 percent lower for primary care physicians and 32 percent lower for specialists.

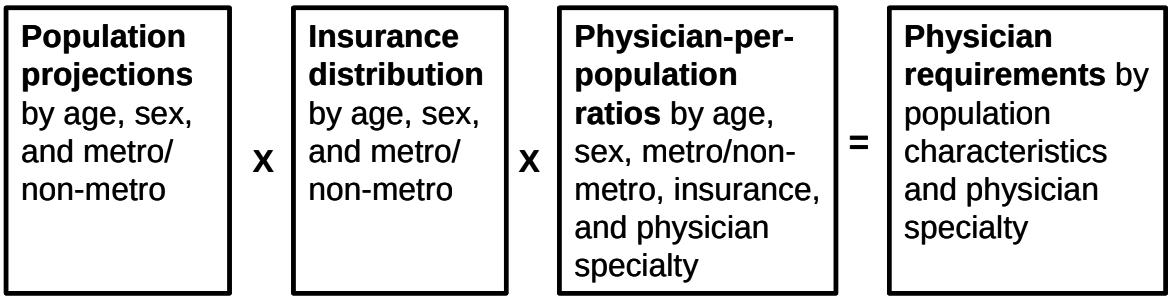
(4) **Trend analysis approach**. Cooper (2000) and colleagues (2002) use a "Trend Model" that estimates the correlation between a proxy for the demand for physician services (they use physician-to-population ratios under the assumption that historically, supply has equaled demand) and factors hypothesized to be major determinants of demand. Cooper uses aggregate-level, time-series data to estimate the relationship between physicians-per-population and its hypothesized determinants: per capita GDP and demographics to control for population growth and aging. Cooper concludes that there is a trend to desiring a higher level of care (specialist care, in particular) that is limited primarily by our ability and willingness to pay.

B. Physician Requirements Model Overview

The PRM uses a utilization-based approach to project future physician requirements. The PRM projects requirements for 18 medical specialties through 2020. Projections are based on current use patterns of physician services and expected trends in U.S. demographics, insurance coverage, and patterns of care delivery. These use patterns are expressed as physician-to-population ratios for each specialty and population segment defined by age, sex, metropolitan/non-metropolitan location, and insurance type. The baseline ratios are established using 2000 data. Thus, the major components of the model are:

(1) Population projections by age,[17] sex, and metropolitan/non-metropolitan location;
(2) Projected insurance distribution by insurance type, age, sex, metropolitan/non-metropolitan location; and
(3) Detailed physician-to-population ratios (Exhibit 27).

Exhibit 27. Overview of the Physician Requirements Model



The model's base year is 2000, which means that the model's baseline scenario projects growth in demand for physician services based on the level of care provided to the U.S. population in 2000. Population growth and aging, as projected by the U.S. Census Bureau, are the main drivers of growth in demand for physician services in the baseline projections. Alternative scenarios are projected using different assumptions regarding changes in insurance coverage and type, economic growth, and the increased use of NPCs. We explore trends in major determinants of physician requirements and their implications for future physician requirements.

C. Determinants of Physician Demand

Physician requirements derive from the demand for physician-related services. The demand for such services is the outcome of countless decisions made by consumers, physicians providing services, and other entities involved in the health care system such as insurers. The PRM is a simplified model of a complex health care system and tries to capture the major trends that

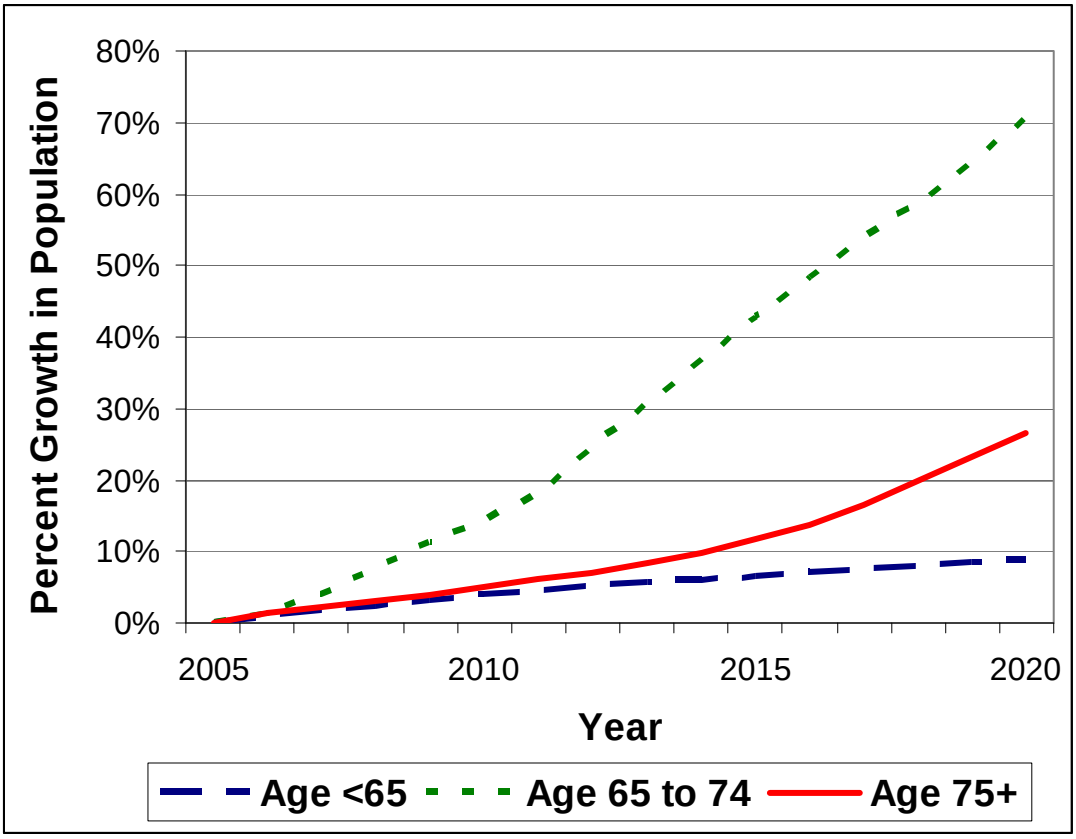
[17] The eight categories are ages 0–4, 5–17, 18–24, 25–44, 45–64, 65–74, 75–84, and 85 and older.

affect the demand for physician services, and thus the number of physicians needed to provide that level of service. The major determinants of physician requirements are population growth and aging, changes in medical insurance coverage and type, economic growth, the growing role of NPCs, advances in science and technology, changing public expectations, the price of physician services, and government policy. We discuss each of these determinants in turn.

1. Population Growth and Aging

The United States Census Bureau projects a rapid increase in the elderly population beginning in 2010 when the leading edge of the baby boom generation approaches age 65 (Exhibit 28). Between 2005 and 2020, the population younger than age 65 is expected to grow by about 9 percent, while the population age 65 to 74 is projected to grow by about 71 percent and the age 74 and older population is projected to grow by about 26%.

Exhibit 28. Projected Percent Growth in Population, by Age: 2005 to 2020



Source: United States Census Bureau population projections (April 2005 release).

The elderly, especially those over age 85, use much greater levels of physician services relative to the non-elderly, so the rapid growth of the elderly population portends a significant increase in demand for physician services. To estimate differences in use of physician services by different demographic groups, for each physician specialty we estimated per capita encounters for segments of the United States population categorized by age, sex, and insurance status. We

analyzed health care use data from the National Ambulatory Medical Care Survey (NAMCS), National Hospital Ambulatory Medical Care Survey (NHAMCS), National Inpatient Sample (NIS), National Nursing Home Survey (NNHS), and National Home and Health Survey (NHHS) (BHPr, 2003). After determining what portion of physicians' time is spent with each segment of the population, we calculated physician-per-population ratios that reflect current use patterns and current patterns of care.

For presentation purposes, these ratios are summarized in estimates of physician requirements per 100,000 population for four categories of physicians and six age groups (Exhibit 29). In 2000, for the United States population as a whole, approximately 253 active physicians (MDs and DOs) were engaged primarily in patient care per 100,000 population.[18] The aggregate estimates ranged from a low of 149 for the population ages 0 to 17, to a high of 781 for the population ages 75 and older. The ratios vary substantially by medical specialty. These data suggest that the aging of the population will contribute to faster growth, in percentage terms, for specialist services relative to the growth in demand for primary care services.

Exhibit 29. Estimated Requirements for Patient Care Physicians per 100,000 Population, by Patient Age and Physician Specialty, 2000

Age Group	Specialty				
	Primary [1] Care	Medical [2] Specialties	Surgery [3]	Other [4] Care	Total
0–17 years	95	10	16	29	**149**
18–24 years	43	15	54	48	**159**
25–44 years	59	23	52	62	**196**
45–64 years	89	41	59	81	**270**
65–74 years	175	97	125	145	**543**
75+ years	270	130	161	220	**781**
Total	**95**	**33**	**55**	**70**	**253**

Source: PRM. [1]Includes general and family practice, general internal medicine, and pediatrics. [2]Includes cardiology and other internal medicine subspecialties. [3]Includes general surgery, obstetrics/ gynecology, ophthalmology, orthopedic surgery, otolaryngology, urology and other surgical specialties. [4]Includes anesthesiology, emergency medicine, pathology, psychiatry, radiology, and other specialties.

The PRM segments the U.S. population into 176 mutually exclusive categories based on age, gender, metropolitan/non-metropolitan location, medical insurance status, and insurer type. The PRM considers differences in per capita health care utilization in each of these 176 categories and uses this information to estimate physician-to-population ratios in the base year for each population category. Combining these physician-to-population ratios with population projections creates the baseline demand projections in the PRM.

[18] As with the physician supply estimate, this count uses AMA and AOA Masterfile data on physicians' activity status for physicians younger than age 75.

2. *Medical Insurance Coverage and Type*

Whether a person has medical insurance and type of insurance plan are important determinants of the amount and type of physician services utilized. Insured persons have greater access to physician services, relative to the uninsured, because insurers typically negotiate discounts with providers and cover much of the cost of services. Modeling insurance coverage and type is especially important for projecting how demand for physician services will likely change under alternative insurance scenarios (e.g., implementing Federal policies or programs that expand medical coverage), and in response to trends in the health care system (e.g., such as changes in managed care enrollment rates).

Managed care plans attempt to control health care costs through the use of gatekeepers, preferred providers, utilization review and other managed care practices. The lower physician-to-population ratios among managed care plans form the basis for Weiner's (2004) analysis that suggests that the Nation could get by with substantially fewer physicians—especially specialists.

The PRM models 10 insurance categories. These include four payer categories: private insurance; Medicare (defined for modeling purposes as all government-sponsored insurance for the age 65 and older[19]); government-sponsored insurance for the age < 65 (which is primarily Medicaid); and uninsured. The three insured categories are each divided into three subcategories: traditional fee-for-service; exclusive network HMO (i.e., group-, staff-, network- or mixed-model HMO); and all other managed care plans (to include preferred provider organizations [PPOs], point-of-service [POS] plans organized as open-ended HMO, non-HMO POS, and other HMO/managed care plans).

The PRM starts with the insurance distribution in 2000 (Exhibit 30), with the probability of being in a particular insurance category differing by age and sex. The baseline projections in the PRM assume that, controlling for age and sex, the probability of being in a particular insurance category remains constant over time.

The PRM uses an index to scale the physician-to-population ratios used for each demographic group in different insurance categories (Exhibit 31).[20] In this index, the fee-for-service (FFS) setting is used as the comparison group and has an index value of 1. Consider the index values for anesthesiology. The value of 0.86 for the exclusive network HMO indicates that a person enrolled in an HMO will tend to utilize only 86 percent of anesthesiologist time, on average, compared to a similar person insured under a fee-for-service plan. Enrollees in other types of managed care plans will use approximately 98 percent and the uninsured will use only 29 percent of anesthesiologist time, on average, relative to a comparable population insured under a fee-for-service plan.

[19] The entire population age 65 and older is assumed insured under Medicare.

[20] These index values are based on an analysis of health care utilization patterns using 1999 to 2001 data from the NAMCS, NHAMCS, NIS, NNHS and NHHS (see BHPr, 2003).

Exhibit 30. Estimated U.S. Population, by Insurance Status: 2000

Insurance Category	Population (in millions)	% of U.S. Population
Government Sponsored Programs (Population ≥ 65)		
Fee-for-service	29.2	10
Exclusive network HMO	4.6	2
All other managed care	1.2	0
Government Sponsored Programs (Population < 65)		
Fee-for-service	9.8	3
Exclusive network HMO	11.8	4
All other managed care	0.7	<1
Private		
Fee-for-service	32.1	11
Exclusive network HMO	71.1	25
All other managed care	71.8	25
Uninsured	49.2	17
Total Insured		
Fee-for-service	71.1	25
HMO	87.5	31
All other managed care	73.6	26

Source: Analysis of the 1999, 2000 and 2001 NHIS.

Exhibit 31. Per Capita Index for Use of Physician Services (relative to a fee-for-service)

Specialty	Fee-for-service	Exclusive Network HMO	All Other Managed Care	Uninsured
Anesthesiology	**1.00**	**0.86**	**0.98**	**0.29**
Cardiovascular Diseases	**1.00**	**0.92**	**1.00**[1]	**0.18**
Emergency Medicine	**1.00**	**0.41**	**0.47**	**0.78**
General/Family Practice	**1.00**	**0.87**	**0.99**	**0.60**
General Surgery	**1.00**	**0.86**	**0.98**	**0.33**
General Surgery Subspecialties	**1.00**	**0.86**	**0.98**	**0.33**
Internal Medicine	**1.00**	**1.03**	**1.18**	**0.25**
Internal Medicine Subspecialties	**1.00**	**0.90**	**1.00**[1]	**0.24**
Obstetrics/Gynecology	**1.00**	**0.83**	**0.95**	**0.30**
Ophthalmology	**1.00**	**1.00**[1]	**1.00**[1]	**0.67**
Orthopedic Surgery	**1.00**	**0.78**	**0.90**	**0.22**
Other Specialties	**1.00**	**0.59**	**0.68**	**0.32**
Otolaryngology	**1.00**	**0.66**	**0.76**	**0.45**
General Pediatrics	**1.00**	**1.00**[1]	**1.00**[1]	**0.62**
Pathology	**1.00**	**0.86**	**0.98**	**0.27**
Psychiatry	**1.00**	**0.65**	**0.75**	**1.00**[1]
Radiology	**1.00**	**0.86**	**0.98**	**0.22**
Urology	**1.00**	**0.94**	**1.00**[1]	**0.21**

Source: BHPr (2003). [1]Estimates capped.

3. Economic Growth

Economic theory and empirical research suggest a positive correlation between ability to pay for physician services and demand for such services.[21] At the micro level, the ability of an individual or a household to afford medical insurance and out-of-pocket expenses influences whether a person seeks needed medical services. At the macro level, the Nation's ability to pay determines the number of persons who receive medical insurance and the generosity of such insurance in terms of services covered and out-of-pocket costs to beneficiaries. [22] For example, during an economic expansion, employers might provide more generous medical benefits to attract and retain employees (Christianson and Trude, 2003). Economic growth also affects tax revenues, which in turn affect the ability of the Federal and State governments to fund programs such as Medicaid, Medicare, and the State Children's Health Insurance Program (SCHIP).

Income elasticity, the economic term for a measure that quantifies the relationship between ability to pay and demand, is defined as the percent increase in demand for physician services for each 1 percent increase in ability to pay. While the direction of the relationship between ability to pay and overall demand for physician services is clear, there exists no consensus regarding the size of this relationship. Obtaining precise estimates of this relationship is complicated by several factors:

1. The relationship likely varies by medical specialty (e.g., elective and cosmetic procedures being among the most sensitive to ability to pay). Cooper et al. (2002) find a positive correlation across States between the number of active physicians per capita (which they use as a proxy for demand) and personal income per capita, with the relationship being stronger for specialists compared to generalists.

2. The relationship reflects decisions made at the household level (e.g., whether or not to visit the doctor), at the employer level (e.g., whether to offer medical insurance), and at the societal level (e.g., whether or not to expand a government-sponsored medical insurance program).

3. The relationship is distorted by the nature of a three-party health care system—patients, physicians and insurers. Once insured, most patients are relatively shielded from the costs of physician services and physicians are less constrained by patients' ability to pay. This tends to be true regardless of whether the insurance is public or private.

[21] Macro-level measures of ability to pay include gross domestic product (GDP) per capita and personal income per capita. An example of a micro-level measure of ability to pay is average household income.

[22] Holahan and Pohl (2002) find, however, that changes in per capita GDP in the United States during the period 1994 to 2000 results in little change in the overall number of insured persons. While downturns in economic activity result in a decline in number of persons insured under private plans, economic downturns result in an increased number of households eligible for Medicaid. The analysis does not, however, indicate whether the quality of the insurance products changes with changes in per capita GDP.

4. The relationship is confounded by variables that are correlated with both ability to pay and utilization of physician services (e.g., health status, adequacy of physician supply, and implementation of new technology).

The following is a brief summary of key and recent studies of the relationship between ability to pay and demand for health care or physician services, as well as our own empirical analysis.

Cooper et al. (2002, p. 143) state that "the major trend affecting the [per capita] demand for physician services is the economy." Assuming that historical, national rates of physicians per capita reflect demand for physician services, the authors estimate the relationship between physicians per capita and per capita GDP using annual data from 1929 to 2000. The authors conclude that each 10 percent increase in per capita GDP results in a 7.5 percent increase in demand for physician services (i.e., income elasticity [ε]=0.75). They view changes in economic growth over time as both an indicator of increased ability to pay and a proxy for technological advances, and argue that because of increased ability to pay for health care services consumers will demand a higher level of services in the future than is provided under the current health care system. Cooper et al. project the future supply of and demand for physicians and conclude that we face a looming shortage of specialists.

> ***The major trend affecting the [per capita] demand for physician services is the economy***
>
> Cooper et al. (2002, p. 143)

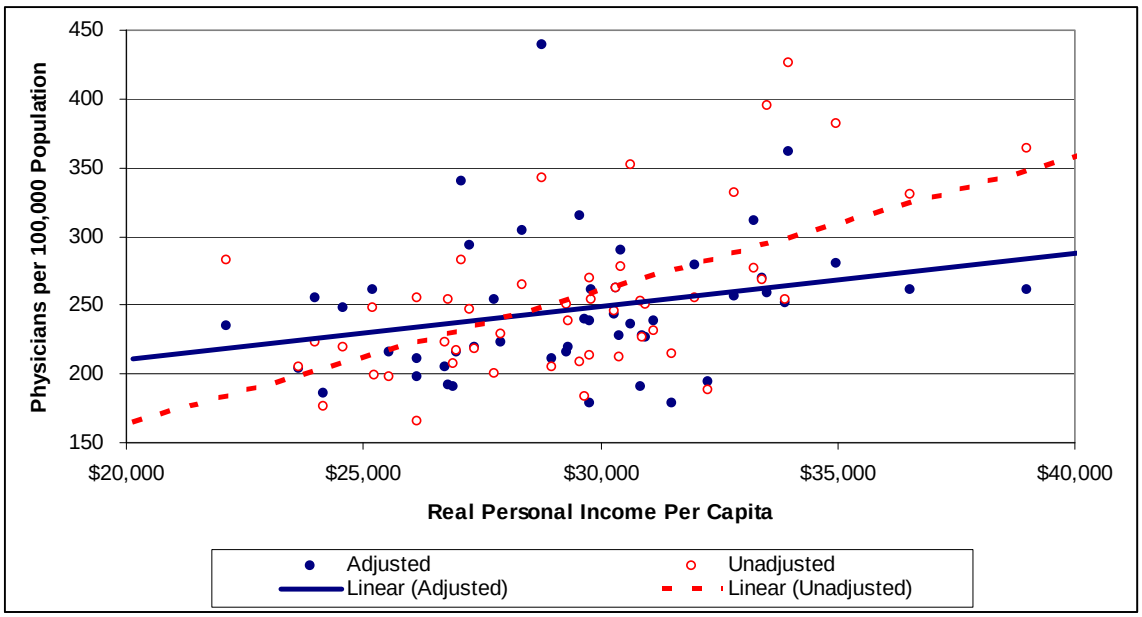
Other researchers have expressed concerns with Cooper et al.'s assumptions and conclusions (e.g., Barer, 2002; Grumbach, 2002; Reinhardt, 2002; Weiner, 2002). One critique is that the authors do not establish a causal relationship between economic well-being and demand for physicians despite the finding of a statistical correlation. Another critique is the assumption that physician supply and demand were in equilibrium during the 70 year period included in the analysis, which assumption is necessary when using physicians per capita (a supply measure) as a proxy for demand. Cooper et al. assume that in the past market (and other) forces helped keep a balance of supply and demand, but in the future supply and demand will diverge.

Exhibit 32 illustrates one of the problems with using a simple correlation between physicians per capita and measures of economic well-being to estimate the relationship between demand and ability to pay. This exhibit shows a positive correlation across States between personal income per capita (controlling for cross-State differences in cost of living) and physicians per 100,000 population. Two series are plotted: (1) a series that adjusts for out-of-State consumption of health care services, and (2) a series that does not adjust for out-of-State consumption of health care services. The adjusted series is computed based on work by MEDPAC (2002), which estimates Medicare payments per beneficiary with and without adjusting for out-of-State service use and health status. The unadjusted series suggests that each $1,000 increase in personal income per capita increases the number of physicians per 100,000 population by approximately 9.7. Evaluated at the mean personal income per capita, this translates to an elasticity of 1.12, meaning a 10 percent increase in personal income per capita is correlated with an 11.2 percent increase in physicians per capita. The series that adjusts for out-of-State consumption of health care services suggests that each $1,000 increase in personal income per capita results in an increase of 3.8 physicians per 100,000 population. Evaluated at the mean

personal income per capita, a 10 percent increase in personal income per capita is correlated with a 4.7 percent increase in the supply of physicians. The 95 percent confidence interval for this estimate is quite large, though, ranging from 0.06 to 0.87.

This comparison of the adjusted and unadjusted series suggests that States with higher per capita income are net exporters of physician services. Controlling for where patients receive services explains away approximately 60 percent of the observed cross-State relationship between physicians per capita and personal income per capita. While the adjusted series still shows a positive correlation between personal income per capita and physicians per capita, the estimated relationship is substantially smaller than Cooper et al.'s estimate, which in turn is substantially smaller than the estimate from the unadjusted series.

Exhibit 32. Relationship across States between Real Per Capita Personal Income and Physicians per 100,000 Population: 2001



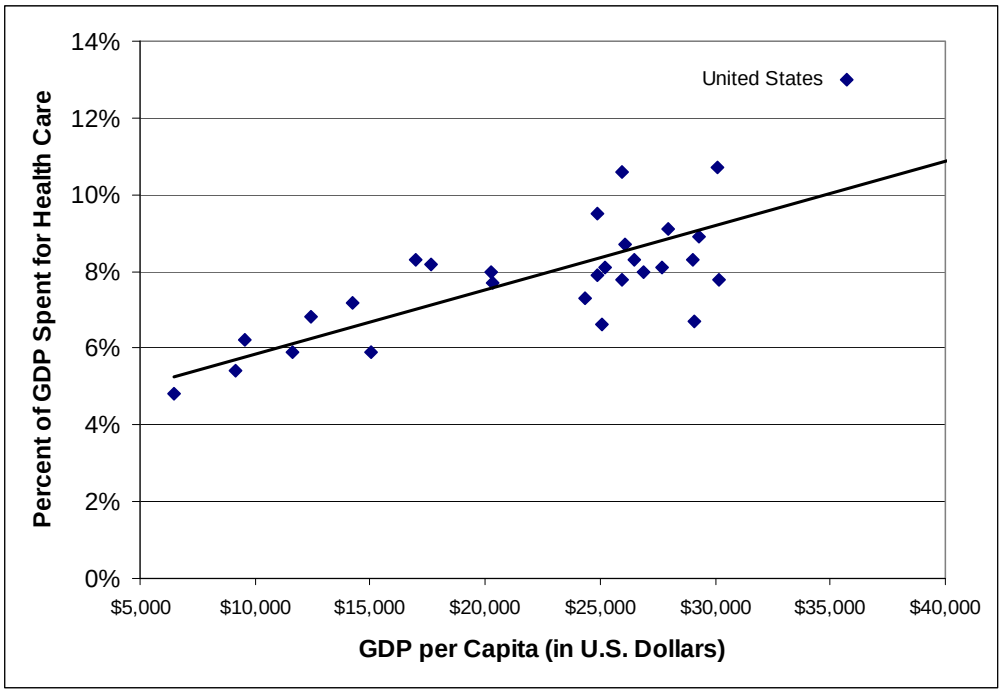
Sources: Income estimates from the U.S. Bureau of Economic Analysis. Population estimates from the U.S. Census Bureau. State-level estimates of physician supply from AMA's Physician Characteristics and Distribution in the U.S. (AMA, 2003). Note: The District of Columbia, which is omitted from this graph, has a physician-to-100,000 population ratio of 698.

Anderson et al. (2003) report statistics that show a positive correlation between a country's per capita GDP and the percentage of GDP spent on health care for the Organization for Economic Cooperation and Development (OECD) countries (Exhibit 33).[23] Although the United States

[23] Note that this graph excludes Luxembourg, a small OECD country with the highest per capita GDP ($46,960 in U.S. dollars) and one of the lowest percentages of GDP spent on health care (6 percent). The simple correlation of per capita GDP and the percent of GDP spent on health care produces a correlation coefficient of 0.75 when Luxembourg is omitted, and a coefficient of 0.52 when Luxembourg is included.

spends a disproportionate amount of GDP on health care relative to other countries, Anderson et al. attribute this phenomenon largely to higher prices for health care goods and services in the United States rather than higher utilization of such goods and services.

Exhibit 33 Relationship Between GDP Per Capita and Total Health Spending as a Percent of GDP in 2000: OECD Countries



Source: Anderson et al (2003).

A visual inspection of Exhibit 33 suggests that the relationship between per capita GDP and percent of GDP spent on health care is strongest among countries with per capita GDP less than $25,000. Close to 60 percent of the OECD countries have per capita GDP in the $25,000 to $35,000 range, and among this subset of countries there is little relationship between per capita GDP and the percent of GDP spent on health care.

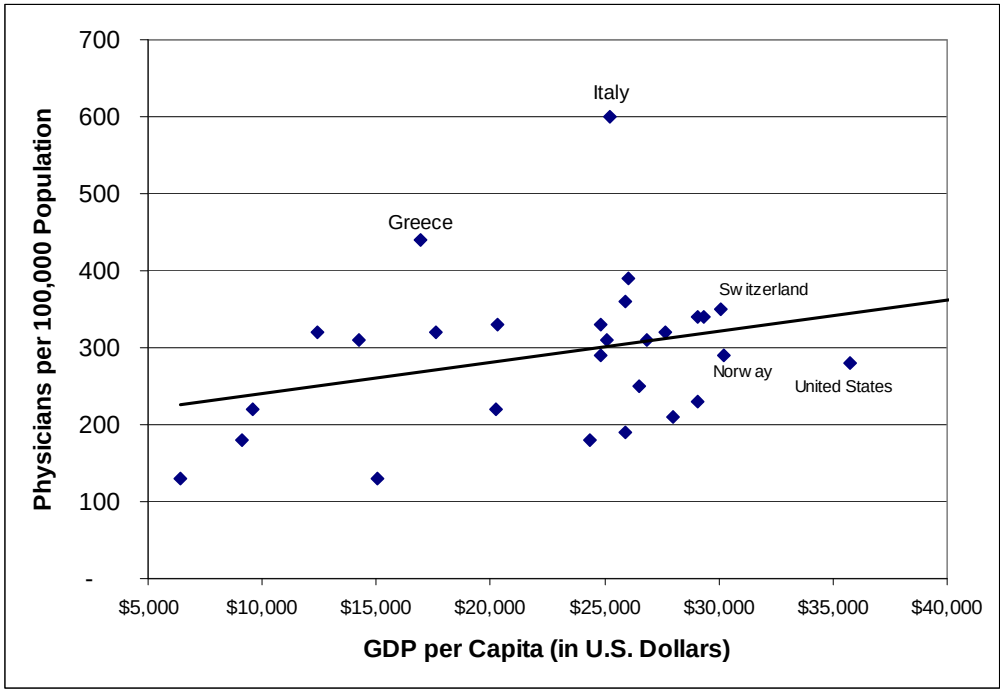
Using data on physicians per capita from Anderson et al., we estimated the relationship between physicians per capita and per capita GDP by estimating a log-log model using a bivariate regression analysis. The estimated income elasticity is 0.4, which suggests that each 10 percent increase in per capita GDP is associated with a 4 percent increase in physicians per capita. The estimated 0.4 elasticity is roughly half the 0.75 estimate found by Cooper et al., but the 95 percent confidence interval is large, ranging from 0.10 to 0.70.

Exhibit 34 plots the relationship between per capita GDP and supply of physicians per 100,000 population for OECD countries.[24] The number of physicians per capita in the United States falls

[24] Again, Luxembourg is omitted as an extreme outlier. Slovakia is omitted because data on physicians per capita is unavailable.

below the trend line, suggesting that demand for physicians exceeds supply if economic well-being is the major determinant of demand for physicians. A caution against drawing causal conclusions from observed statistical correlations, such as presented here, is the failure to control for differences across countries in the health care system, demographics, and indicators of health care needs. For example, the United States has a much greater supply of other trained health workers (e.g., NPCs, nurses, technicians, etc.) compared to other countries, which distorts the observed simple relationship between physicians per capita and measures of economic well-being. Demographics, lifestyle, the public health infrastructure, and other important determinants of physician demand vary substantially by country.

Exhibit 34 Relationship Between GDP Per Capita and Physicians Per 100,000 Population in 2000: OECD Countries



Source: Anderson et al (2003).

Koenig et al. (2003) estimate the relationship between income and expenditures for physician services both using aggregate-level data and using beneficiary-level data. The authors simultaneously control for nine categories of factors hypothesized to affect expenditures for physician services: demographics, health status, insurance product and benefit design, provider supply and organization, provider payment, practice operating costs, health care regulation, medical technology, and economic activity. One analysis uses State-level data from 1990 to 1998 to estimate the relationship between per capita expenditures for physician services and various explanatory variables. This analysis produces an income elasticity estimate of 0.76 with a 95 percent confidence interval of 0.57 to 0.95. The second analysis uses data on beneficiaries enrolled in a national preferred provider organization from May 1998 to May 2000. This second analysis produced an income elasticity estimate of 0.31 with a 95 percent confidence interval of 0.10 to 0.53. This lower estimate, however, is based on a subset of the population that is insured and thus excludes the income impact on ability to purchase medical insurance.

Cookson and Reilly (1994) model health care consumption using a trend analysis, where national health care expenditures is modeled as a function of numerous factors including measures of real personal income. These authors find a significant lagged "wealth effect," with change in real income being a statistically significant predictor of change in health care expenditures 3, 4 and 5 years into the future. The estimated income elasticities for 3, 4 and 5 years are, respectively, 0.17, 0.39 and 0.33. The cumulative effect is approximately 0.88, which implies that a 10 percent increase in real per capita personal income eventually translates into an 8.8 percent increase in health care expenditures.

The findings and methods used in these studies are summarized below (Exhibit 35). The estimated elasticities range from 0.31 to 0.88, with relatively large standard errors on these estimates.

Exhibit 35. Income Elasticity Estimates

Source	Elasticity (95% CI)	Economic Variable	Physician/Healthcare Services Demand Variable	Description of Regression Analysis
Cookson and Reilly (1994)	0.88	Lagged per capita GDP	National health care expenditures	Time series analysis (1961-1993) relating national health care expenditures to lagged per capita GDP.
Koenig et al. (2003)	0.76 ($0.57 \leq \varepsilon \leq 0.95$)	Disposable income per capita	Expenditures for physician services	Time-series, cross-sectional analysis using State-level data from multiple years. This analysis controls for demographics, health status, medical insurance products, physician practice characteristics, health care regulations, medical technology, and physician supply.
Cooper et al. (2002)	0.75	Per capita GDP	Physicians per capita	Time series analysis (1929-2000) relating physicians per capita to per capita GDP.
Authors' analysis of State-level data	0.47 ($0.06 \leq \varepsilon \leq 0.87$)	Income per capita	Physicians per capita	Cross-sectional analysis of State-level physicians per capita and personal income per capita, adjusted for out-of-State health care utilization, in 2000.
Authors' analysis of data from Anderson et al. (2003)	0.40 ($0.10 \leq \varepsilon \leq 0.70$)	Per capita GDP	Physicians per capita	Cross-sectional analysis using OECD country data on physicians per capita and per capita GDP in 2000.
Koenig et al. (2003)	0.31 ($0.10 \leq \varepsilon \leq 0.53$)	Income per capita	Expenditures for physician services	Analysis using data on 3+ million beneficiaries enrolled in a large national group health insurer. This analysis controls for demographics, health status, medical insurance products, physician practice characteristics, health care regulations, medical technology, and physician supply.

The extant research sheds little light on how to incorporate national economic growth into the PRM projections. Empirical questions raised include:

- **How does the relationship between national economic growth and demand for physician services differ by medical specialty?** Theory would suggest that elective services (e.g., some plastic surgery services) are more responsive to ability to pay than are less elective services (e.g., cardiologist services). Indeed, when Cooper et al. look at the relationship between States' physician per population ratio and income per capita they find a stronger relationship for specialists compared to generalists. Therefore, separate estimates of income elasticity are needed for each specialty.
- **To what extent is the relationship between national economic growth and demand for physician services already built into the PRM via the insurance distribution assumptions?** If the main effect of national economic growth is to move people into more generous insurance status (e.g., from uninsured to insured, from managed care into fee-for-service), then the research needed to incorporate economic growth into the PRM is very different from the research needed to estimate health care utilization changes within insurance status.
- **Does the size of the relationship between ability to pay and demand for physician services diminish at higher income levels?** As discussed earlier, when using country-level data the relationship between per capita GDP and health care measures such as percent of GDP spent on health care and physicians per capita seems to diminish as a country's per capita wealth increases.

The argument that economic growth should be considered in the PRM projections raises a philosophical question regarding how the PRM projections should be used. Incorporating economic growth into the model will result in higher demand projections because the hypothesized impact is that consumers will demand higher-quality care as the Nation's wealth increases. Historically, projections of an impending physician shortage have had large policy implications and have been instrumental in securing additional Federal funding for training new doctors. Should the government role be to help ensure sufficient supply to meet demand (even if society wants the "sport-utility vehicle [SUV] version of health care" as discussed by Grumbach [2002])?

For this study we project the future demand for physicians under alternative scenarios. The baseline scenario omits economic growth, and in essence projects future demand for physicians assuming the same level of care that is currently supplied is provided in the future. An alternative scenario incorporates economic growth. Projections under this alternative scenario are presented in a later section, but these alternative projections assume the following:

- **Economic growth of 2 percent annually between 2000 and 2020**. The CBO projects a 3 percent annual growth rate in real GDP between 2003 to 2013, which is approximately equal to about a 2 percent average annual growth in real per capita GDP.
- **Income elasticity of 0.25, 0.5, and 0.75 varies by specialty**. There is no consensus on what the income elasticity of demand is for physician services. Physician requirements are projected under the assumption that demand for some specialties is relatively

insensitive (elasticity=0.25)[25], modestly sensitive (elasticity=0.50)[26], or more sensitive (elasticity=0.75)[27] to economic growth.

Real, per capita economic growth occurs through increased productivity. The CBO's economic growth projections, therefore, imply that productivity will increase by approximately 2 percent annually, on average, throughout the economy. Productivity growth will differ by industry and occupation, and because physician services are labor intensive it is reasonable to assume that growth in physician productivity (however measured) will lag behind overall productivity growth in the economy. An increase in physician productivity of 1 percent annually would offset the increased demand for physician services under the scenario and accompanying assumptions described above. Trends in physician productivity are discussed in more detail in a later section, but the limited available data suggest physician productivity appears to be growing at about 1 percent annually.

4. Role of Nonphysician Clinicians

Three trends during the past decade have increased the proportion of health care services being provided by NPCs (Cooper, Laud and Dietrich, 1998; Druss et al., 2003). First, the number of NCPs has grown substantially. Second, State legislatures have expanded the legal scope of practice for NCPs (Cooper, Henderson and Dietrich, 1998). Third, pressure to contain rising health care costs has fueled demand for NPCs.

The size of the NPC workforce has grown significantly in recent years and is projected to continue growing rapidly. Assessments of the adequacy of the future physician supply should take into consideration changes in the growth and use of NPCs. The BLS projects that between 2000 and 2010 employment of PAs will increase 53 percent, employment of chiropractors will increase 24 percent, employment of optometrists will increase 19 percent, and employment of podiatrists will increase 11 percent. Cooper et al. (2002) report that by 2015 there could be as many as 525,000 NPCs—including 275,000 nurse practitioners, physician assistants and nurse – midwives; 150,000 acupuncturists and chiropractors; and 100,000 other NPCs engaged in various medical specialties. These authors calculate that by 2015 these NPCs could be providing services that are the equivalent of 40 physicians per 100,000 population (with most of the services displacing services that historically have been provided by primary care physicians).

Physicians view NPCs in their role as both a complement and a competitor in the provision of care (Grumbach, 1998).

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[25] Specialties hypothesized to be in this low-sensitivity category include general and family practice, general internal medicine, pediatrics, obstetrics/gynecology, and emergency medicine.

[26] Specialties hypothesized to be in this medium-sensitivity category include cardiology, internal medicine subspecialties, general surgery, otolaryngology, urology, anesthesiology, radiology, pathology, and "other" specialties.

[27] Specialties hypothesized to be in this high-sensitivity category include orthopedic surgery, ophthalmology, "other" surgery, and psychiatry.

1. **NPCs as complements to physicians**. The view of NPCs as complements to physicians is one in which NPCs allow physicians to leverage their expertise. In this model of care, there is a division of labor such that NPCs provide those services within the scope of their training, with physicians handling the more complex cases. Druss et al. (2003) find evidence of increased collaboration between NPCs and physicians over the period 1987 to 1997, and Trude (2003) reports that between 1997 and 2001 the proportion of physicians in non-institutional practice settings who worked with NPCs increased from 40 percent to 48 percent. The increase in working with NPCs was most noticeable for group practices of three or more physicians where the percentage of physicians working with NPCs increased from 53 percent to 66 percent between 1997 and 2001. Part of the increased collaboration between physicians and NPCs might be considered voluntary on the part of physicians (e.g., physicians hiring NPCs), while part of the increased collaboration might be considered imposed (e.g., in the case of a managed care company that hires both physicians and NPCs). A recent survey by Farber and Murray (2001) found that 19 percent of responding physicians indicated that to counter lagging income they are considering hiring nurse practitioners or physician assistants.

2. **NPCs as competitors to physicians**. As noted by the American Academy of Physician Assistants (AAPA, 1999) and others, the increasing financial uncertainties in the health care system has increased concerns by physicians about encroachment into their practice territory by physicians in other specialties and by NPCs. Cooper, Henderson and Dietrich (1998) document legislation passed by States giving NPCs greater business and clinical autonomy. Because NPCs can provide some services currently offered by physicians but at a lower cost, there exists an economic incentive to use NPCs to provide services within their legal scope of practice.

Whether viewed as competitors or complements in delivering care, the increasing size of the NPC workforce will likely reduce demand for physicians. The growing role of NPCs raises several questions pertinent to modeling future demand for physicians in specific specialties:

1. How large is the overlap in services provided by NPCs and physicians. That is, what proportion of physician workload can legally and safely be transferred to NPCs?

2. Although the supply of NPCs is growing rapidly, is there a saturation point at which there will be a NPC surplus? Will all NPCs trained displace physicians, or will the United States reach a point at which there is no longer the ability to partially substitute NPCs for physicians?

3. To what extent are NPCs practicing in markets that are left unfilled by physicians? Physician assistants and nurse practitioners are disproportionately employed in rural areas that have difficulty attracting physicians.

Cooper, Laud, and Dietrich (1998) analyzed State distributions of physicians and NPCs per 100,000 population and found that for most NPC specialties, there were higher NPC-to-population ratios in States that also had high physician-to-population ratios. This finding suggests that economic growth is associated with higher demand for health care services, with little economic-related preference for physicians over NPCs. This analysis, though, does not

control for cross-State variation in factors that would be correlated with demand for both NPC and physician services (e.g., health care needs of the population).

The baseline projections in the PRM assume that current patterns of health care delivery will continue over the projection horizon. Physicians and NPCs will continue to have overlapping scopes of practice, and each will maintain their share of total services provided. An alternative scenario assumes that the increased supply of NPCs will retard growth in demand for physicians by capturing a growing percentage of total patient volume. Projections for this scenario are produced for physicians in the aggregate, not by specialty. Specific assumptions are that (1) the number of active NPCs will double between 2000 and 2020, (2) all NPCs that are trained will become employed[28] and will provide services that otherwise would have been provided by physicians, and (3) on average each NPC will provide 40 percent of the work currently provided by a physician. The projections under this scenario are presented later.

5. Science and Technology

> ***...the perceived triumphs of technology contribute to a culture that is willing to devote more resources to health care.***
>
> Cooper et al. (2002, p. 145

Advances in science and technology have great potential to affect the demand for physician services and thus physician requirements. Most health workforce projection models, however, do not include trends in science and technology in the set of determinants because there is too much uncertainty regarding how new innovations will impact the supply of or demand for certain health care services. Furthermore, technological advances will likely have differing impacts on individual physician specialties. Advances in science and technology have the capability to affect the demand for physicians by:

1. Creating additional demand for physician services so that consumers seek treatments that previously did not exist (e.g., fertility treatment) or that can now be provided at lower cost (e.g., minimally invasive surgery);

2. Increasing physicians' productivity (which increases the amount of services that physicians can provide and thus reduces the number of physicians needed to adequately serve a given population); and

3. Eliminating certain illnesses or otherwise reducing the amount of time needed to treat certain health problems, thus reducing demand for physician services.

4. Increasing longevity that may eventually increase the demand for physician services as patients age and seek care for other health problems.

[28] The assumption that all NPCs that are trained will become employed thus reducing demand for physicians is a strong assumption. The National Health Service Corps (NHSC), which helps to place primary care physicians and NPCs in underserved areas, has reduced the number of new NPCs participating in the program because of recent difficulties in placing NPCs at NHSC-qualified sites despite strong demand for additional physicians at these sites.

The following are areas of scientific and technological advancement with the potential to affect physician supply and demand.

- **Information technology**: Physician reliance on electronic medical records is increasing rapidly and will only continue to do so in the next decade. The goals of these systems are to "enhance patient safety and reduce the amount of paperwork for clinicians, giving them more time to devote to patient care" (Morrissey, 2004). Efforts to expand electronic data collection and allow for interoperability (exchange of data within a facility) and portability (exchange of data across facilities) are underway. Significant hurdles, such as privacy concerns and system compatibility, remain. *Improvements in physician productivity likely would reduce the demand for physicians because fewer physicians would be needed to provide the same level of services.*

- **Emerging forms of communication:** The Internet, telemedicine, video conferencing, and telesurgery are emerging innovations with the potential to transform the way some physician services are delivered. Currently, most physician services are provided through face-to-face encounters with patients. *The potential for technology to reduce the importance of geography in providing physician services has mixed implications for the amount of physician services utilized. There is the potential to increase utilization by improving access to care by rural and other underserved populations. There is also the potential for outsourcing some services (e.g., interpreting scans and test results) to physicians in foreign countries.* Telemedicine could potentially affect all medical specialties, but the greatest current applications are found in providing diagnostic-related services in radiology, pathology, and cardiology. Advances are also being made in systems that use robotics, minimally invasive surgical gear, and video equipment to provide surgical services remotely.

  Miller and Derse (2002, p. 168) opine that "the emergence of the Internet portends a dramatic shift for health care and the relationships of patients and physicians," potentially improving the quality, timeliness, and efficacy with which physician services are provided. Miller and Derse document that physician services currently provided over the Internet include: (1) proscribing medications, (2) responding to consumers' medical questions, (3) providing psychotherapy, (4) reviewing biopsies and medical records, and (5) providing second opinions to a patient's physician. The overall impact of patient Internet access to physicians is uncertain. Such access will likely increase the level of correspondence between patients and physicians, but this increased demand for physician services might be offset by increased efficiency in the delivery of services.

  > ***The emergence of the Internet portends a dramatic shift for health care and the relationships of patients and physicians.***
  >
  > Miller and Derse (2002, p. 168)

  While face-to-face encounters between physician and patient will continue in importance, these other forms of communication have great potential to alleviate the geographic misdistribution of physicians. For example, email may facilitate more productive interactions between patients and physicians without necessitating an office visit. Email, while not having the urgency of a phone call, allows both the patient and the physician to communicate efficiently. Physicians might find email useful for sending additional medical or condition-related information, thereby potentially reducing the need for an office visit.

Although the technology exists to provide a larger proportion of physician services remotely, third-party payers for medical services have been slow to change their reimbursement structure to compensate physicians for services provided remotely. Currently, only capitation allows physicians to fully realize the benefits of communicating with patients via nontraditional means such as email. Thus, reimbursement system and regulatory changes are needed before these new forms of communication with patients can be fully implemented (Terry, 2000).

- **Minimally invasive surgery**: Most surgical specialties increasingly use minimally invasive surgery (MIS) in place of open surgery. The benefits of MIS over open surgery include reducing patient recovery time, risk of infection, pain, and scaring. MIS requires greater surgical skill, and sometimes longer operating times are required compared to open surgery. Because MIS greatly reduces the direct medical costs, patient indirect costs (e.g., lost time from work), and patient suffering, advances in MIS have increased demand for such procedures. For example, between 1990 and 1994 the number of patients that elected to have a cholecystectomy increased 84 percent (AHA TrendWatch, 2002). A*dvances in MIS, therefore, will likely increase demand for surgeons because of increased time to perform surgeries and increased demand for such surgeries. These advances might decrease demand for hospitalists and primary care physicians because MIS reduces patient recovery time and risk of complications.*

- **Diagnostic equipment**: Advances in diagnostic equipment such as X-rays, ultrasound, CT and MRI scans allow physicians to identify health problems earlier and with greater accuracy. *Technological advances that increase the ability to diagnosis health problems and reduce the cost of such equipment will likely lead to increased demand for physicians (e.g., radiologists, neurologists) and technicians who provide these diagnostic services. The ability to more quickly identify health problems has a mixed effect on demand for physician services.* There will likely be increased demand for services to correct health problems, while the ability to identify health problems at an earlier stage could reduce the need for more extensive physician services that would occur if a health problem becomes more advanced.

- **Pharmaceutical and vaccination advancement**: Rational Drug Design, the development of new chemical and molecular entities by looking at the physical structure and chemical composition, continues to shorten the drug discovery process. The discovery of new and more potent pharmaceuticals with fewer side effects will enable physicians to treat patients quickly and effectively, reducing the need for time consuming treatments and surgeries. In addition, pharmaceutical advancement will bring with it an increase in prophylactic drugs and vaccines. These in turn will reduce the overall burden of illness and help alleviate certain chronic conditions. Prophylactic and therapeutic pharmaceuticals and vaccines will reduce the demand for physicians by both reducing the number of face-to-face visits and surgical procedures required to treat a patients. (RWJF, Health and Health Care 2010). *Pharmaceutical and vaccination advancement, therefore, is likely to reduce overall demand for physician services.*

- **Genetic mapping, genetic testing, gene therapy, and transplantation**: Genetic mapping, genetic testing, gene therapy, and transplantation are technologies which will come to play an increasingly important role in medicine in the future. New innovations can increase demand for specific tests and therapies, but the ability to cure diseases and other ailments

creates the potential to reduce overall, long-term demand for physician services. *Therefore, the likely long-term impact on demand for physician services is unknown and will likely differ substantially by medical specialty.*

6. Public Expectations

Public expectations of medicine are different today than they were 100 years ago, or even 20 years ago. New medicines have improved the ability to care for chronic conditions and have improved the quality of life for many individuals. The Institute of Medicine (2000) has highlighted the prevalence of medical errors which has led to increased scrutiny of quality of care by the public and by policymakers. The elderly baby boom population will not have experienced the same hardships as their grandparents which may also affect their expectations of the health care system. Rising public expectations will increase physician requirements.

7. Price of Physician Services

In most economic models, the price of goods and services is a major determinant of the quantity of such goods and services demanded. Likewise, theory would suggest that as the price of physician services rises (falls), utilization of such services would fall (rise). The scenarios modeled in the PRM assume no changes in the relative price of physician services over the projection horizon.

The responsiveness of physician requirements projections to changes in the cost of services is an area for future research. There are many challenges to quantifying the price of physician services, projecting how these prices will change over time, and determining the likely impact of price changes on utilization of physician services. The following are a few such challenges:

1. The quality of services changes over time due to technological advances and increased skill and sophistication of the services provided, thus increasing the difficulty of obtaining historical price data on a give set of physician services.

2. It is difficult to predict how the price of physician services will change over time relative to the price of other goods and services. Because physician services are labor intensive and thus less likely to benefit from technological advances that increase productivity, it is reasonable to assume that physician services will become relatively more expensive over time. That is, the cost per unit of physician services is likely to become more expensive relative to the cost per unit of food, transportation, etc.

3. Additional research is needed to determine the *price elasticity* of various goods and services—that is, how responsive health care utilization is to changes in price. Price elasticities are particularly difficult to estimate for health care services because our third-party payment system reduces the cost-consciousness of patients and physicians making health care utilization decisions. Unlike the purchase of most goods and services, the majority of patients are shielded from the true cost of health care services. Employers and insurers, however, are relatively sensitive to the cost of health care services and have a strong financial incentive to keep physician payments to a minimum. Employers demonstrate their sensitivity to health care costs through the selection of insurers. Many insurers demonstrate their sensitivity to the cost of physician services through the use of

selective contracting with physicians and the implementation of other managed care techniques.

4. Additional research is needed to quantify trends in the total price of medical services—including physician charges for services and indirect costs (e.g., wait times) associated with seeking services.

A final note regarding the price of physician services is that market pressures (e.g., competition among physicians, bargaining clout of employers and insurers) will help to correct imbalances in physician supply. A shortage (surplus) of physicians will tend to drive prices up (down), thus reducing (increasing) per capita utilization of services.

8. Government Policy

The changing role of government, which is closely linked to public expectations, may also have a significant impact on the demand for physician services. This includes the impact of regulation as well as payment policies. Policies that might increase demand for physician services include more generous Medicare and Medicaid benefits, while policies that might reduce physician requirements include giving NPCs greater clinical and business autonomy, and efforts to ration or otherwise limit access to certain services.

Government Medicare projections take into account expected changes in physician behavior resulting from changes in program policies and practices. For example, Nguyen (1994) finds that legislation that reduced physician fees for providing Medicare services in 1989 and 1990 had the unintended consequences of increasing the volume of services provided. Nguyen found that that each planned dollar decrease in physician payments due to fee reductions was offset by a $0.40 increase in payments attributed to higher volume. Nguyen attributes this volume offset to physician behavior motivated by a desire to maintain earnings. The size of the volume offset differs by medical specialty, with surgical specialties showing a larger volume offset, on average, compared to non-surgical specialties. Nguyen cites other studies with similar findings, as well as studies that find no evidence of a volume offset.

Although the PRM can be used to model the demand implications of policy changes, this report contains no projections modeling changes in government programs or policies.

D. Physician Requirements Projections

The baseline projections take into account the growth and aging of the population, but are calculated on the assumption that the United States will provide the same level of care in the future that is currently provided. Essentially, the baseline projections assume that the future will use today's health care system. Alternative projections are based on different assumptions of how the health care system will evolve over time.

The baseline projections suggest that between 2005 and 2020 overall requirements for physicians engaged primarily in patient care increase 22 percent, from approximately 757,300 to 921,500 (Exhibits 36, 38, and 39). In percentage terms, growth is lower for primary care (20 percent) than for non-primary care (23 percent). If it is assumed that requirements for physicians engaged primarily in non-patient care activities (e.g., administration, teaching, and

research) remain relatively constant at approximately 6 percent of total physicians, then total requirements for physicians will increase from about 802,100 to 976,000 during this period.[29]

On a per capita basis, demand for physicians is increasing as a result of an aging population (Exhibits 37, 40, and 41). For example, under the baseline scenario, requirements for physicians engaged in patient care increases from approximately 256 to 274 (7 percent) per 100,000 population between 2005 and 2020. In percentage terms, the increase is greater for non-primary care (8 percent) than for primary care (5 percent).

Projected growth in requirements between 2005 and 2020 varies substantially by specialty (Exhibit 42). Between 2005 and 2020, specialties with the highest percentage growth are cardiology (33 percent) and urology (30 percent). Specialties with the lowest percentage growth are pediatrics (9 percent) and obstetrics/gynecology (10 percent).

Exhibit 36. Baseline Projections of Physician Requirements

	Patient Care			Non-patient Care	Total
Year	Primary Care	Non-primary Care	Total Patient Care		
2000*	267,100	446,800	713,800	42,200	756,100
2005	281,800	475,500	757,300	44,800	802,100
2010	297,500	507,900	805,400	47,700	853,100
2015	316,300	544,300	860,600	50,900	911,500
2020	337,400	584,100	921,500	54,500	976,000
Change: 2005–2020	20%	23%	22%	22%	22%

* Base year assumes that physician supply and demand are balanced.

Exhibit 37. Baseline Physician Requirements per 100,000 Population

	Patient Care			Non-patient Care	Total
Year	Primary Care	Non-primary Care	Total Patient Care		
2000*	95	158	253	15	268
2005	95	161	256	15	271
2010	96	164	261	15	276
2015	98	169	267	16	283
2020	100	174	274	16	291
Change 2005–2020	5%	8%	7%	7%	7%

* Base year assumes that physician supply and demand are balanced.

[29] Over the past 20 years, the percentage of total Federal and nonFederal physicians engaged primarily in non-patient care activities has steadily declined from around 9 percent to its current level of about percent.

Exhibit 38. Physician Requirements

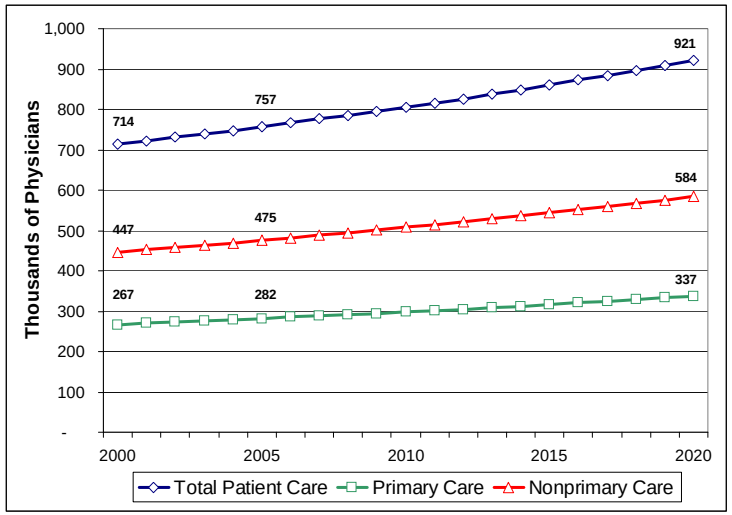


Exhibit 39. % Growth in Physician Requirements

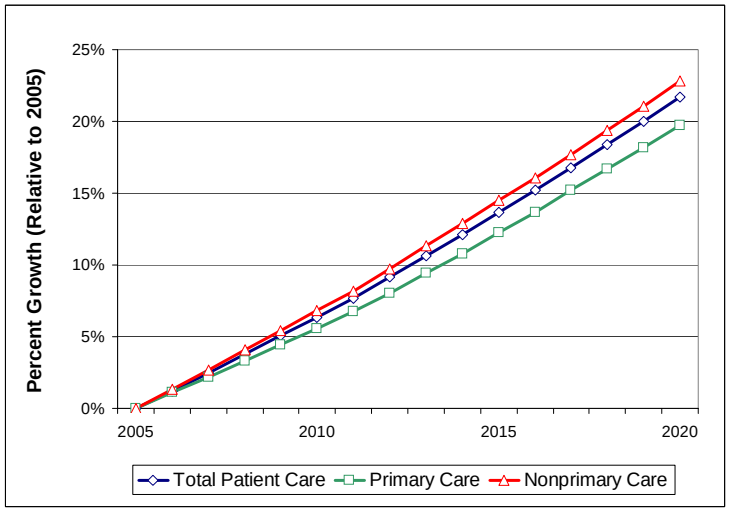


Exhibit 40. Requirements per 100,000 Population

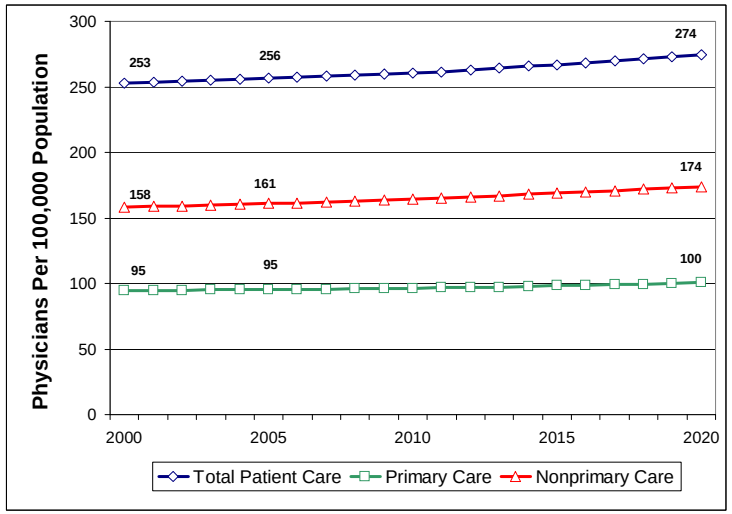


Exhibit 41. % Growth in Requirements per Capita

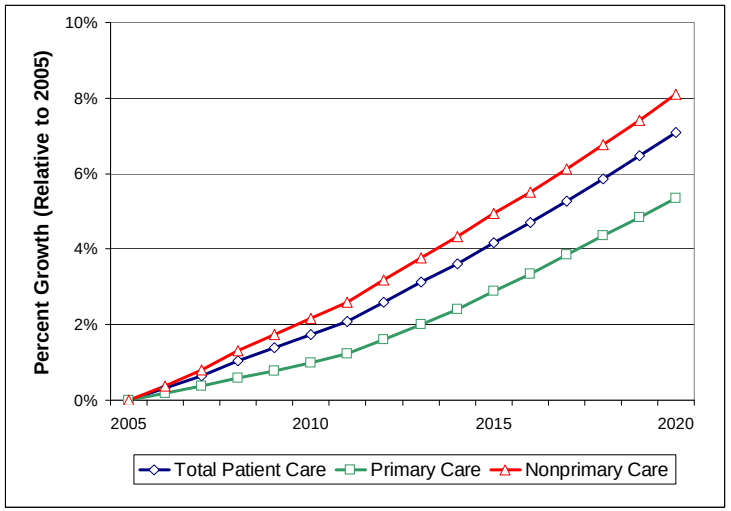


Exhibit 42. Baseline Physician Requirements Projections

Specialty	Base Year 2000	Projected 2005	2010	2015	2020	% Change 2005 to 2020
Total	**756,100**	**802,100**	**853,100**	**911,500**	**976,000**	**22%**
Total Non-Patient Care	**42,200**	**44,800**	**47,700**	**50,900**	**54,500**	**22%**
Total Patient Care	**713,800**	**757,300**	**805,400**	**860,600**	**921,500**	**22%**
Primary Care	**267,100**	**281,800**	**297,500**	**316,300**	**337,400**	**20%**
General Family Practice	107,700	113,900	120,600	127,900	135,900	19%
General Internal Medicine	107,500	115,000	123,400	132,900	143,500	25%
Pediatrics	51,900	52,900	53,500	55,500	57,900	9%
Nonprimary Care	**446,800**	**475,500**	**507,900**	**544,300**	**584,100**	**23%**
Medical Specialties	**86,400**	**93,000**	**100,700**	**109,800**	**119,800**	**29%**
Cardiology	20,600	22,200	24,200	26,700	29,600	33%
Other Internal Medicine	65,900	70,800	76,500	83,100	90,200	27%
Surgical Specialties	**159,400**	**169,000**	**179,900**	**192,000**	**205,100**	**21%**
General Surgery	39,100	41,700	44,800	48,400	52,200	25%
OB/GYN	41,500	43,100	44,800	46,000	47,200	10%
Ophthalmology	18,400	19,700	21,200	23,100	25,200	28%
Orthopedic Surgery	24,100	25,600	27,300	29,300	31,600	23%
Other Surgery	16,200	17,400	18,800	20,300	22,000	26%
Otolaryngology	9,800	10,300	11,000	11,600	12,400	20%
Urology	10,400	11,100	12,000	13,200	14,400	30%
Other Specialties	**200,900**	**213,500**	**227,300**	**242,500**	**259,200**	**21%**
Anesthesiology	37,800	40,200	43,000	46,500	50,400	25%
Emergency Medicine	26,300	27,600	28,900	30,300	31,800	15%
Pathology	17,200	18,400	19,800	21,200	22,600	23%
Psychiatry	38,300	40,700	43,000	45,200	47,400	16%
Radiology	30,900	32,900	35,200	37,900	41,100	25%
Other Specialties	50,400	53,700	57,400	61,400	65,800	23%

Note: Totals might not equal sum of subtotals due to rounding.

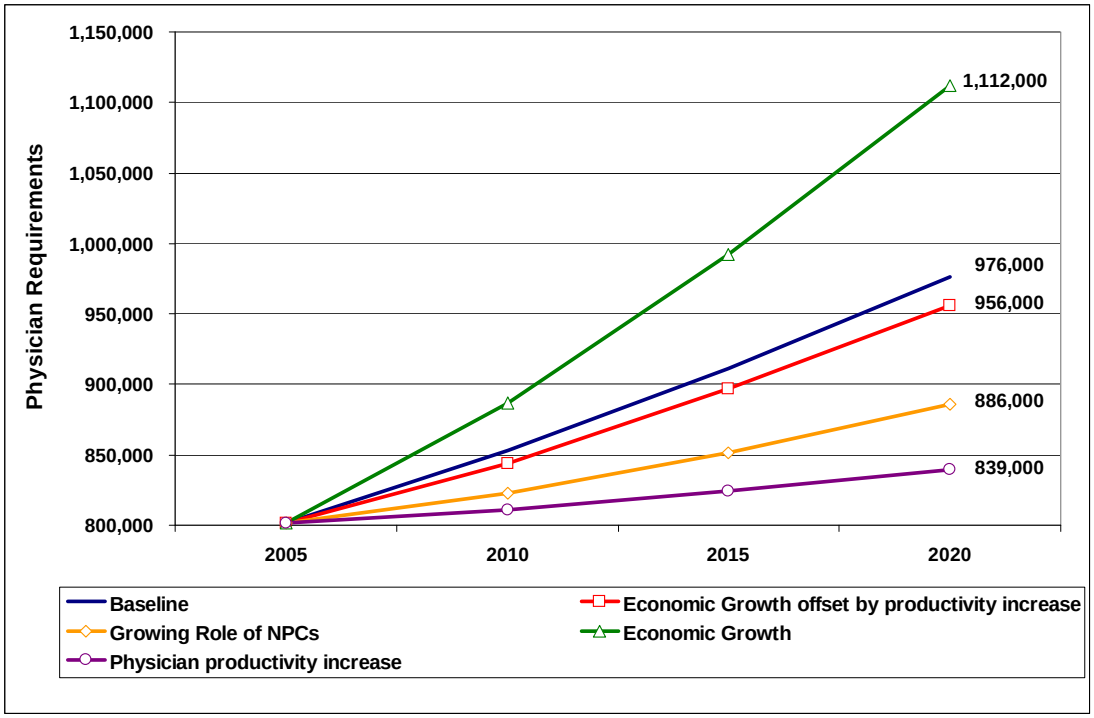
The baseline projections assume that patterns of health care use and delivery of care remain unchanged over the projection horizon and that changing demographics are the primary driver of changes in physician requirements. To better understand the implications of possible changes in utilization and delivery patterns, physician requirements are projected from 2005 to 2020 under alternative scenarios (Exhibits 43 and 44).

- **Growing role of NPCs**. This scenario assumes that (1) the number of active NPCs will increase 60 percent between 2005 and 2020, (2) all NPCs that are trained will become employed and will provide services that otherwise would have been provided by physicians, and (3) on average each NPC will provide 40 percent of the work currently provided by a physician. Under this scenario, by 2020 physician requirements would be approximately 90,000 physicians less than the baseline projections. NPCs will have a disproportionate impact by specialty, with NPCs having a greater impact on reducing demand for generalists.
- **Economic growth.** This scenario assumes that economic growth will allow the Nation to afford a higher-quality health care system. This new health care system will require more physician and, in particular, more specialists. Physician requirements are projected under

the assumption that per capita income will grow by 2 percent annually, and that demand for some specialties is relatively insensitive (elasticity=0.25), modestly sensitive (elasticity=0.50), or more sensitive (elasticity=0.75) to economic growth (Exhibit 34). This scenario produces the highest projections, with requirements growing to 1.1 million physicians in 2020 (136,000 higher than the baseline projection).

- **Physician productivity increase.** Requirements are projected under the assumption that physician productivity increases 1 percent annually (i.e., each physician can see one percent more patients per year through improved use of staff and technology). Projected physician requirements remain relatively constant through 2020 under this scenario, with the 2020 projection suggesting 137,000 fewer physicians than projected under the baseline scenario.
- **Economic growth offset by physician productivity increase.** Combining the previous two scenarios, the growth in demand for physician services due to economic growth is offset by the increased productivity of physicians resulting in projected requirements of 956,000 in 2020 (20,000 fewer than under the baseline scenario).

Exhibit 43. Alternative Requirements Projections



The scenarios described here produce a large range in projected future demand for physicians. The sensitivity of the projections to key assumptions regarding the impact of economic growth and increases in physician productivity illustrate why researchers arrive at such different conclusions regarding the future requirements for physicians. These national projections use current patterns in the utilization and delivery of physician services as a starting point. Throughout the Nation there remain pockets of under service, especially in poor, rural and urban areas. These geographic disparities are discussed in Chapter IV.

Exhibit 44. Physician Requirements by Medical Specialty: High Economic Growth Series

Specialty	2005	2010	2015	2020	Percent Change 2005 to 2020	Elasticity Assumption
Total	**802,000**	**887,000**	**992,000**	**1,112,000**	**38%**	**NA**
Total Non-Patient Care	**45,000**	**48,000**	**51,000**	**55,000**	**22%**	**NA**
Total Patient Care	**757,000**	**839,000**	**941,000**	**1,057,000**	**39%**	**NA**
Primary Care	**282,000**	**306,000**	**334,000**	**367,000**	**30%**	**NA**
General Family Practice	114,000	124,000	135,000	148,000	30%	0.25
General Internal Medicine	115,000	127,000	140,000	156,000	36%	0.25
Pediatrics	53,000	55,000	59,000	63,000	19%	0.25
Nonprimary Care	**476,000**	**533,000**	**607,000**	**690,000**	**45%**	**NA**
Medical Specialties	**93,000**	**105,000**	**122,000**	**141,000**	**52%**	**NA**
Cardiology	22,000	25,000	30,000	35,000	59%	0.50
Other Internal Medicine	71,000	80,000	92,000	106,000	49%	0.50
Surgical Specialties	**169,000**	**189,000**	**215,000**	**243,000**	**44%**	**NA**
General Surgery	42,000	47,000	54,000	61,000	45%	0.50
OB/GYN	43,000	46,000	49,000	51,000	19%	0.25
Ophthalmology	20,000	23,000	27,000	32,000	60%	0.75
Orthopedic Surgery	26,000	29,000	34,000	40,000	54%	0.75
Other Surgery	17,000	20,000	24,000	28,000	65%	0.75
Otolaryngology	10,000	12,000	13,000	15,000	50%	0.50
Urology	11,000	12,000	14,000	16,000	45%	0.25
Other Specialties	**214,000**	**239,000**	**270,000**	**306,000**	**43%**	**NA**
Anesthesiology	40,000	45,000	52,000	59,000	48%	0.50
Emergency Medicine	28,000	30,000	32,000	35,000	25%	0.25
Pathology	18,000	21,000	23,000	27,000	50%	0.50
Psychiatry	41,000	46,000	53,000	60,000	46%	0.75
Radiology	33,000	37,000	42,000	48,000	45%	0.50
Other Specialties	54,000	60,000	68,000	77,000	43%	0.50

Note: Totals might not equal sum of subtotals due to rounding.

IV. ADEQUACY OF PHYSICIAN SUPPLY

A. What is an "Adequate" Supply of Physicians?

An adequate physician supply could be defined as having the right number of physicians, with the right skills, in the right place, at the right time. The adequacy of supply, therefore, has specialty, geographic, and time dimensions. Numerous studies and commissions have investigated the issues of what constitutes an appropriate number and mix of physicians, how the United States can help ensure an adequate supply of physicians at the national level, and how the Nation can improve the geographic distribution of physicians—especially in underserved rural and urban areas. Findings from these and other studies have contributed to the development of government policies and programs that have helped shape the current physician workforce and that have implications for the three major health policy concerns: access to care, cost of care, and quality of care.

Determining what constitutes an adequate supply of physicians can be approached from both a clinical and an economic framework. The clinical approach addresses the question: "Is supply sufficient to meet the needs of the population?" The economic approach addresses the question: "What level of physician services are we willing and able to pay for?" While there is substantial overlap in need and demand for physician services, many services provided may not meet a clinical definition of need and many needed services are never obtained—especially in medically underserved communities.

> ***"Labor shortages are sometimes characterized by a tendency to define a shortage in terms that are independent of demand. According to our definition a shortage exists if, at the prevailing wage rate for a given occupation, demand exceeds supply. Frequently, however, actual demand is ignored and a shortage is defined with reference to what someone thinks society 'needs.'"***
>
> Ehrenberg and Smith (1991, p. 55)

Ideally, an approach to determine the adequacy of physician supply would rely on an optimization framework where services are provided to the point where the marginal benefits of services equal the marginal costs. The marginal benefits and the marginal costs, however, differ for the various participants in the health care system (e.g., patients, physicians, and insurers). Therefore, beliefs on what constitutes an adequate physician supply will differ by the various participants in the health care system. What society thinks is adequate, for example, could be quite different from what the marketplace, insurers, physicians, NPCs, or patients think is adequate.

- **From society's perspective**, an adequate supply is one that is large enough to ensure patient access to quality care but that does not create significant inefficiencies in the health care system. From a societal perspective, some "inefficiencies" are acceptable—such as having sufficient excess physician capacity to handle unexpected surges in demand. From the perspective of society, care would be provided in the most cost-effective manner, whether that care is provided by physicians or other health workers.

- **From a marketplace perspective**, an adequate supply is one that operates efficiently. Market forces would determine an adequate supply. Physician staffing patterns of closed-panel HMOs are an example of market-defined adequate staffing levels, and Weiner (1994, 2004) concludes that the United States could continue to provide quality care with substantially fewer physicians.[30] From the HMO perspective, physician requirements are defined by the demand for needed services (as defined by the HMO). This definition differs from the marketplace perspective where physician requirements are defined by the demand for all physician services (including elective services).
- **From an insurer's perspective**, an adequate supply is one that produces a socially acceptable level of care for a minimum cost. Too few physicians will limit competition, and for managed care organizations, competition among physicians strengthens the insurer's hand in negotiating payment discounts. For some insurers, and in particular those that pay for physician services on a fee-for-service basis, having too many physicians can drive up health care costs by creating incentives to provide marginally beneficial services.
- **From a physician perspective**, an adequate supply is one that is large enough to ensure patient access to quality care, but that is not so large that it introduces excessive competition for the existing patient base. Too many physicians competing for a limited number of insurance contracts or a limited number of employment opportunities will drive down physician earnings. On the other hand, a shortage of physicians is undesirable because it places pressures on physicians to handle larger patient loads. Many physicians are employers of other physicians, and a shortage of physicians drives up recruiting and labor costs. A shortage of physicians could reduce the sale value of existing physician practices because physicians desiring to expand their practices can more easily increase their patient base without purchasing other practices.
- **From the nonphysician clinician perspective**, an adequate physician supply is defined not only by the ability of the health care system to ensure adequate access to care, but also by whether there are sufficient employments opportunities for NPCs. An oversupply of physicians could crowd out the market for some NPC services.
- **From the patient perspective**, an adequate supply is one where the patient can receive prompt and high-quality care. For most patients who are shielded from the total direct cost of care, at least in the short term, economic considerations such as inefficiencies created by an inadequate supply are of lesser importance in determining what constitutes an adequate physician supply.

Exhibit 45 illustrates the range of physician requirements assumptions to provide services to a particular market—whether that market is defined by geographic location or specialty. At one end of the spectrum, physicians and NPCs have a financial incentive to limit competition so they might view a smaller number of physicians as desirable. At the other end of the spectrum,

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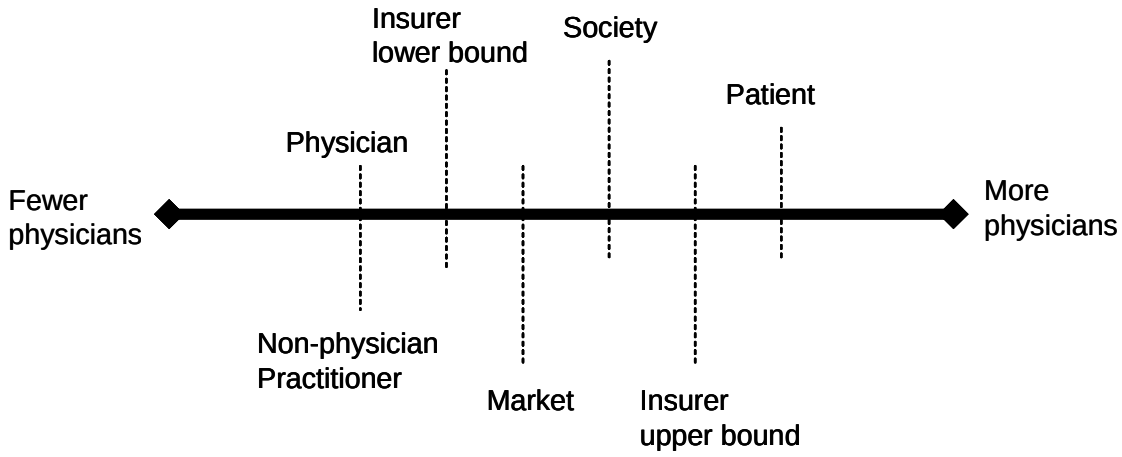
[30] In the HMO example, market forces provide a strong incentive for the HMO to have a sufficient number of physicians and an appropriate specialty mix to ensure patient access to quality care. Access to care and quality of services are vital to recruiting and retaining HMO enrollees. Market forces (i.e., the profit motive) provide a strong incentive to contain costs by eliminating unnecessary services and by supplying physician services using the most cost-effective mix of health workers (e.g., using a mix of specialist physicians, primary care physicians, NPCs and other health workers).

individual patients are relatively shielded from the costs of training physicians and the cost of physician services. Consequently, patients will tend to desire a larger number of physicians with its associated increase in access to care.

Exhibit 45. Number of Physicians that Constitutes an Adequate Supply in a Given Market, by Perspective



Because of differences in perspective and incomplete information to estimate physician requirements, and because of their policy implications, estimates of current or projected shortages and surpluses are often controversial.

During the 1990s, the growth in managed care led many to predict a growing surplus of physicians—and in particular specialists. These predictions, in turn, led to changes in government support for graduate medical education financing and policy recommendations from groups such as COGME that, at the time, tended to favor producing more generalists and fewer specialists.

> ***Given the widespread consensus that the future health care system will be dominated by managed care (i.e., capitated financing with strong utilization controls), COGME believes that ranges of patient care generalists between 60-80 per 100,000 population and specialists between 85-105 per 100,000 population are reasonable estimates of physician utilization in the early 21st century."***
>
> COGME Eighth Report, 1996

In recent years, the consumer backlash against the more restrictive forms of managed care and the growing elderly population has prompted a reconsideration of physician workforce policy. Now, the growing concern is that the United States is producing too few physicians—and in particular specialists (COGME 2003; Cooper 2000, 2002)—although there is no consensus. ***Perhaps one lesson from the past decade is that forecasters should exercise caution when relying heavily on one trend or demand determinant to project future physician requirements.***

B. Market Indicators of an Adequate Supply of Physicians

Historically, utilization-based forecasting models such as the PRM are based on the assumption that current patterns in the utilization and delivery of physician services are adequate. That is, the assumption is made that the current physician supply and demand are relatively in balance at the national level. A review of the market indicators that generally accompany an imbalance in physician supply and demand is useful to assess this assumption.

If a serious imbalance in physician supply and requirements occurs, one would expect to see tell-tale signs. (For small imbalances in physician supply such tell-tale signs might not be readily apparent.) In this section we discuss different approaches and indicators that have been, or could be, used to identify imbalances in physician supply to assess the underlying assumption in the PRM that physician supply and demand were relatively in balance at the national level in the base year. These approaches and indicators are summarized in Exhibit 46 and discussed in more detail in the remainder of this section.

Exhibit 46. Market Indicators of an Imbalance in Physician Supply and Demand

Market Category	Indicators of a Physician Surplus (Shortage)
Economic	• **Average earnings are lower than (exceed) expected earnings based on expected returns to training and other factors** • **New physicians have greater (fewer) problems obtaining employment** • **Downward (upward) pressure on the price of health care services** • **Insurers are more (less) selective in including physicians in their plan.**
Access to care	• **Patients have shorter (longer) wait times in scheduling appointments—especially new patients** • **Patients have shorter (longer) wait times at physicians' offices**
Physician productivity and practice behavior	• **Individual physicians see fewer (more) patients compared to historical norms** • **Individual physicians work fewer (more) hours in patient care** • **Physicians retire earlier (later)** • **Physicians provide more (fewer) services with marginal medical value given patients' needs** • **The average length of time between patient follow-up visits decreases (increases)** • **Physicians are more (less) likely to relocate** • **Physicians are more (less) likely to change specialty** • **Less (greater) use of NPCs**

Economic Indicators

Economic theory suggests that in the unfettered marketplace long-term imbalances in the adequacy of physician supply cannot exist because market forces provide a self-correcting mechanism to eliminate persistent surpluses or shortages of physicians. According to economic theory, a shortage is accompanied by rising physician incomes and improved choice of employment opportunities thus signaling the need for more physicians or a reallocation of

physicians across specialties. Rising income provides the financial incentive to enter the medical profession, to enter a particular residency, and to delay retirement.

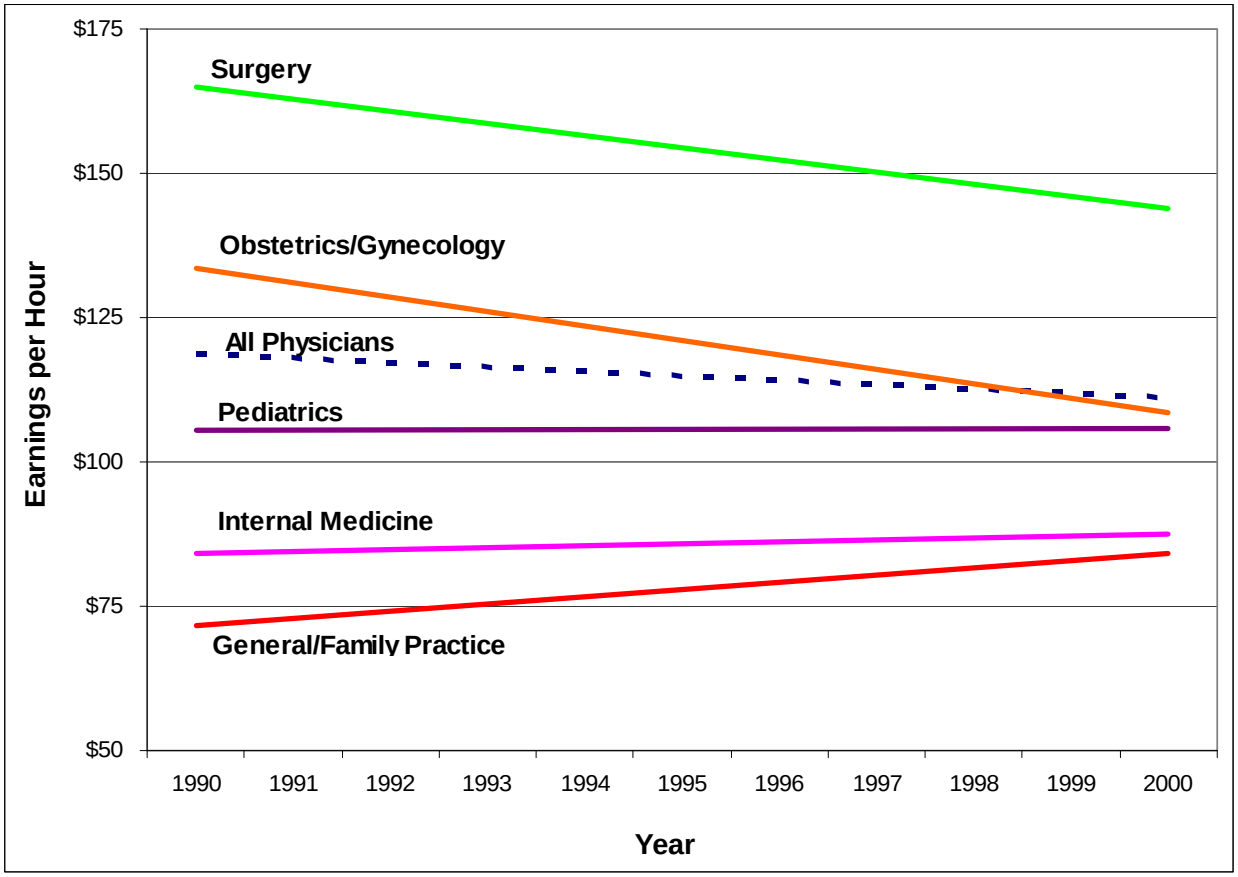
Conversely, economic theory suggests that an oversupply of physicians depresses physician earnings and reduces choice of employment opportunities. Critics would argue that market failures and government interventions in the health care system interrupt and distort market signals that could help to self-regulate the adequacy of physician supply, thus reducing the effectiveness of economic indicators to signal imbalances in physician supply and demand. Information on selected economic indicators of the adequacy of physician supply is provided below.

Physician Earnings

Between 1990 and 2000, mean hourly earnings of physicians declined by 5 percent (Exhibit 47). The decline was largest for surgical specialties (-14.1 percent) and obstetrics and gynecology (-13.7 percent). Mean hourly earnings remained relatively unchanged for internal medicine and pediatrics, and grew by 14.5 percent for general and family practice. These earnings trends cover a period when numerous commissions, panels and studies projected a growing surplus of specialists and the need for more generalists as managed care attempted to direct work away from specialists towards their less expensive generalist colleagues. Unfortunately, more recent data are not available from AMA publications, and physician salary surveys by other organizations are not necessarily comparable to the AMA sampling frame.

On the surface, these income trends in the 1990s suggest that the United States had a more than adequate supply of physicians in surgical specialties and obstetrics/gynecology, an adequate supply in internal medicine and pediatrics, and a less than adequate supply in general/family practice. This simple analysis of mean hourly earnings, however, does not control for other trends that could affect mean hourly earnings and that may or may not be indicative of an inadequate supply of physicians—such as changing physician demographics, changes in the health care operating system, and changes in reimbursement rates from third-party payers.

Exhibit 47. Trends in Mean Hourly Earnings Per Hour of Direct Patient Care: by Specialty (in 2004 dollars)



Source: Analysis of AMA Physician Marketplace Statistics, various years.

Physician Employment Opportunities

A physician surplus creates a buyer's market that allows physician practices and other employers of physicians to be more selective in hiring decisions. New physician graduates faced with relatively fewer employment opportunities could take longer to find employment and be less satisfied with offers in terms of starting salary and location.

A 1996 survey of graduating residents and fellows in internal medicine collected information on job-seeking experiences in that year (Miller et al., 1998). Fifty-three percent of graduating residents/fellows in infectious diseases indicated significant difficulty in finding a practice position and 29 percent indicated they received only one job offer (Exhibit 48). Comparatively, in general internal medicine only 23 percent indicated significant difficulty finding a practice location and only 12 percent indicated receiving only one job offer. Unfortunately, information on employment opportunities is not readily available to track trends over time and to ascertain current imbalances in supply and demand. Over the last decade, the job potential for many specialties, such as anesthesiology, has changed dramatically.

Exhibit 48. Percent of Residents Reporting the Following Job Market Conditions: 1996

Specialty	Significant difficulty in finding a practice position	Received only 1 job offer	Position was not their first choice	Location was not their first choice	Salary lower than expected
General Internal Medicine	22.7	12.4	11.4	21.7	**20.9**
Cardiology	29.9	7.6	10.0	29.2	**21.8**
Critical Care	45.5	8.3	8.3	33.3	**25.0**
Endocrine	45.5	8.3	8.3	33.3	**25.0**
Gastroenterology	43.9	16.7	16.3	37.5	**33.0**
Geriatrics	25.0	0.0	44.4	14.3	**44.0**
Hematology	25.0	25.0	12.5	37.5	**25.0**
Infectious Diseases	52.9	28.6	17.8	45.7	**35.3**
Nephrology	30.2	6.7	28.6	33.3	**26.7**
Oncology	40.7	19.0	22.2	42.1	**19.0**
Pulmonary	40.7	14.8	21.2	9.6	**33.3**
Rheumatology	34.8	17.4	17.4	26.1	**34.8**
Totals for all specialties (including those outside of internal medicine)	**22.4**	**12.5**	**12.0**	**24.2**	**22.2**

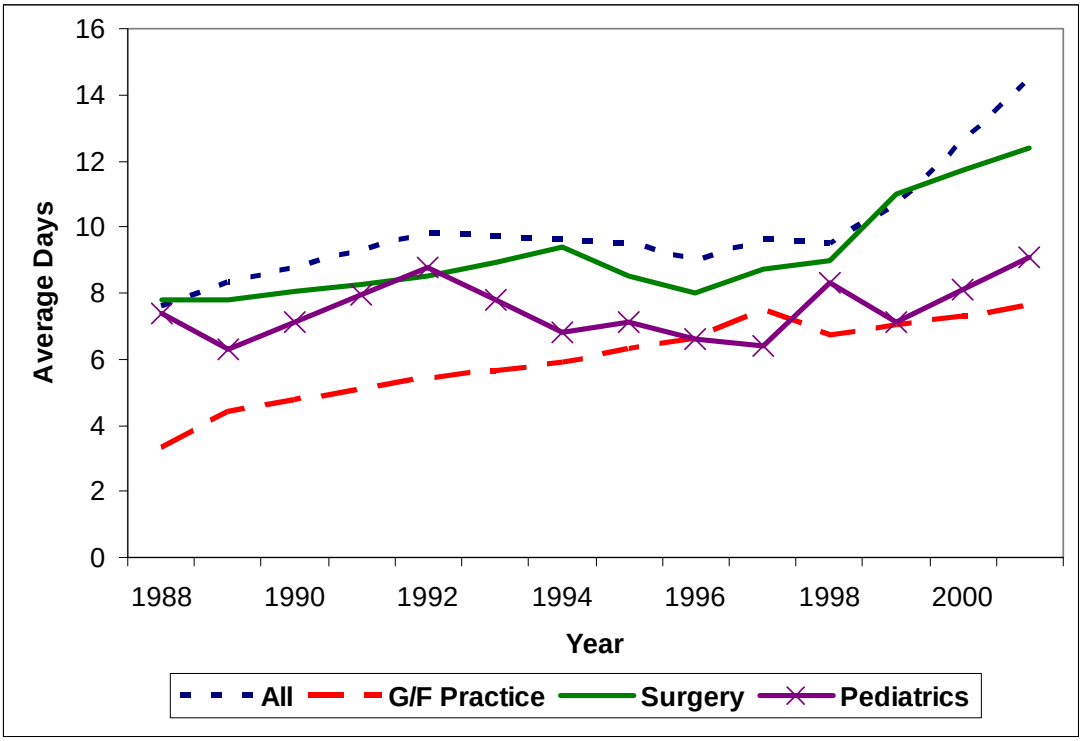
Source: ACP-ASIP Online, http://www.acponline.org/counseling/wrkforce.htm.

Access to Care Indicators

Access to care can be measured in many ways, and for policy purposes is often measured in terms of lack of medical insurance or low physician-to-population ratios. Two indicators of the adequacy of physician supply are the length of wait for new patients to schedule an appointment and the wait time upon arriving at a scheduled appointment. Longer wait times are indicative of growing demand for services relative to supply.

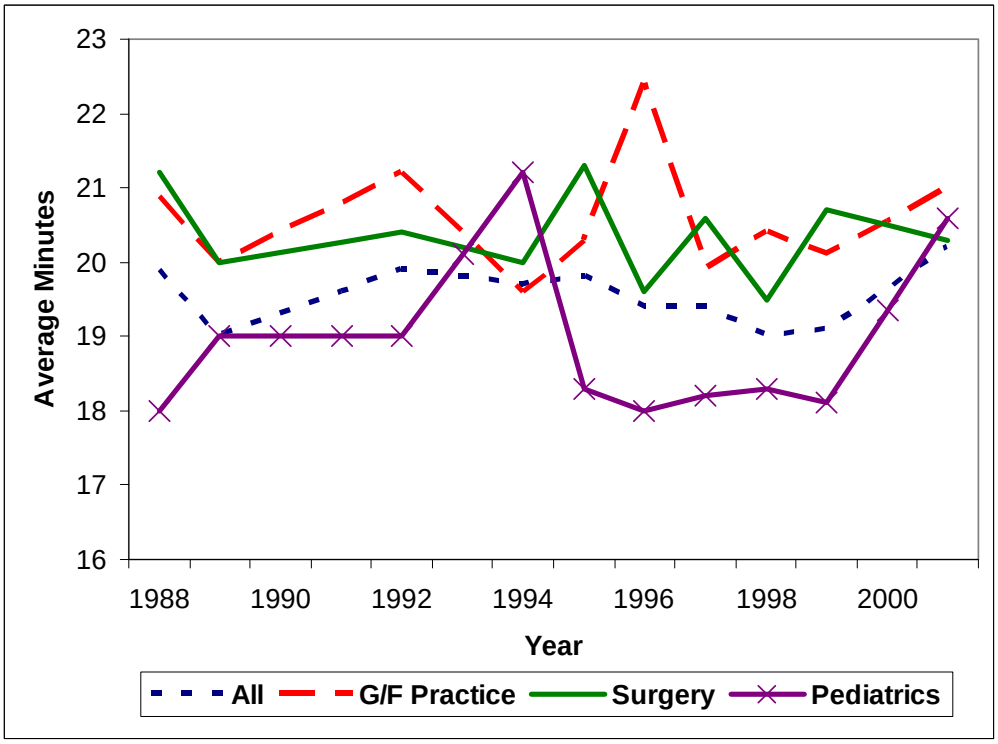
The AMA collects data on wait times through its annual practice survey (Exhibits 49 and 50). During the 1990s and early 2000s the average wait time for new patients to schedule an appointment increased steadily for general and family practice consistent with growing demand for services relative to supply. For surgical specialties, and for all physician specialties combined, the average wait time for new patients to schedule an appointment was relatively constant during the early-to-mid 1990s, but increased in the late 1990s and early 2000s. Average minutes of waiting upon arrival for a scheduled appointment was relatively unchanged in 2000 compared to 1990, although there were fluctuations from year to year.

Exhibit 49. Average Days of Wait for an Appointment by New Patients



Source: AMA Physician Socioeconomic Statistics (various years)

Exhibit 50. Ave. Minutes Waiting upon Arriving for a Scheduled Appointment



Source: AMA Physician Socioeconomic Statistics (various years)

Physician Productivity and Practice Behavior

Physician productivity and practice behavior are sometimes indicative of whether demand for services is growing faster or slower than supply. An increase in demand for services, relative to an increase in supply might allow physicians to be more productive in terms of seeing more patients per hour, induce physicians to work more hours, result in delays in retirement, and result in greater employment opportunities for NPCs.

As discussed in Section II.B, average hours spent in direct patient care declined throughout the 1990s, and although this decline is consistent with growing supply (relative to demand), there are many other factors such as changes by physicians in desired lifestyle that could explain this trend towards reduced hours worked. Also discussed in Chapter II.B, MGMA statistics showing a trend towards greater physician productivity and greater use of other staff (e.g., NPCs) are consistent with growing demand (relative to supply), but can also be explained by other factors such as improved training and technology.

While changes over time (or differences across geographic locations and medical specialties) in many of the factors summarized above could indicate variation in the adequacy of physician supply, there are often no good sources of data to track these indicators and each indicator is influenced by multiple factors which complicates isolating the impact caused by small imbalances between supply and demand. Consequently, researchers are sometimes left with only anecdotal evidence to suggest whether there is an adequate supply of physicians.

C. Comparing National Projections of Physician Supply and Requirements

The baseline projections from BHPr's physician supply and requirements models suggest that overall requirements are growing faster than the FTE supply of physicians (Exhibits 51 and 52). Between 2005 and 2020, requirements are projected to grow to approximately 976,000 (22 percent), while FTE supply is projected to grow to approximately 926,600 (14 percent). These projections suggest a modest, but growing, shortfall of approximately 49,000 physicians by 2020 if today's level of health care services is extrapolated to the future population.

These projections suggest supply imbalances in many medical specialties, although rebalancing residency programs to areas of greatest need will help mitigate severe imbalances. The supply of primary care physicians is growing slightly faster than demand, and this trend could help to relieve the current undersupply of primary care physicians in some Federally designated shortage areas. Approximately 7,000 additional primary care physicians are currently needed to de-designate primary care HPSAs.

The projections suggest a growing shortage of specialists, with demand growing by approximately 62,000 more physicians than will be supplied. Surgical specialties account for more than half of this shortfall, although non-surgical specialties such as cardiology and pathology show demand growing significantly faster than supply.

As discussed previously, the dynamic nature of the physician workforce means that projected shortages and surpluses in individual specialties tend to be overestimated with a static model. As inadequacies between supply and demand grow larger, market and other forces help to direct new graduates into specialties of greater need. Comparing the FTE supply projections to

demand projections under the high-growth scenario (Exhibit 44), produces an estimated shortfall of 185,000 physicians (or approximately a 20 percent shortfall in overall supply).

Exhibit 51. Baseline FTE Supply Projections of Active Physicians

Specialty	Base Year	Projected				Percent Change from 2005–2020
	2000	2005	2010	2015	2020	
Total	**756,100**	**811,800**	**860,800**	**899,900**	**926,600**	**14%**
Total Non-patient Care	**42,200**	**47,400**	**52,700**	**57,200**	**60,200**	**27%**
Total Patient Care	**713,800**	**764,400**	**808,100**	**842,700**	**866,400**	**13%**
Primary Care	**267,100**	**292,100**	**313,200**	**331,100**	**344,700**	**18%**
General Family Practice	107,700	114,000	121,400	128,600	134,700	18%
General Internal Medicine	107,500	121,900	131,400	138,800	143,900	18%
Pediatrics	51,900	56,200	60,400	63,700	66,100	18%
Non-primary Care	**446,800**	**472,400**	**494,900**	**511,500**	**521,700**	**10%**
Medical Specialties	**86,400**	**91,200**	**96,100**	**99,400**	**101,300**	**11%**
Cardiology	20,600	21,300	22,200	22,800	22,900	8%
Other Internal Medicine	65,900	69,800	73,900	76,600	78,500	12%
Surgical Specialties	**159,400**	**164,600**	**167,800**	**169,600**	**169,800**	**3%**
General Surgery	39,100	31,700	31,400	31,100	30,800	-3%
Obstetrics/Gynecology	41,500	45,300	48,000	50,100	51,600	14%
Ophthalmology	18,400	19,100	19,200	19,200	19,100	0%
Orthopedic Surgery	24,100	25,000	25,500	25,600	25,500	2%
Other Surgery	16,200	22,900	23,300	23,300	23,000	0%
Otolaryngology	9,800	10,100	10,300	10,400	10,300	2%
Urology	10,400	10,400	10,100	9,900	9,600	-8%
Other Specialties	**200,900**	**216,600**	**230,900**	**242,600**	**250,600**	**16%**
Anesthesiology	37,800	41,800	45,400	48,300	50,000	20%
Emergency Medicine	26,300	29,100	32,200	34,500	36,300	25%
Pathology	17,200	17,700	18,000	18,100	18,200	3%
Psychiatry	38,300	39,700	41,000	42,300	43,100	9%
Radiology	30,900	33,100	34,700	35,800	36,500	10%
Other Specialties	50,400	55,400	59,700	63,600	66,400	20%

Note: Totals might not equal sum of subtotals due to rounding.

Exhibit 52. Baseline Physician Requirements Projections

	Base Year	Projected				
Specialty	**2000**	**2005**	**2010**	**2015**	**2020**	**% Change 2005 to 2020**
Total	**756,100**	**802,100**	**853,100**	**911,500**	**976,000**	**22%**
Total Non-Patient Care	**42,200**	**44,800**	**47,700**	**50,900**	**54,500**	**22%**
Total Patient Care	**713,800**	**757,300**	**805,400**	**860,600**	**921,500**	**22%**
Primary Care	**267,100**	**281,800**	**297,500**	**316,300**	**337,400**	**20%**
General Family Practice	107,700	113,900	120,600	127,900	135,900	19%
General Internal Medicine	107,500	115,000	123,400	132,900	143,500	25%
Pediatrics	51,900	52,900	53,500	55,500	57,900	9%
Nonprimary Care	**446,800**	**475,500**	**507,900**	**544,300**	**584,100**	**23%**
Medical Specialties	**86,400**	**93,000**	**100,700**	**109,800**	**119,800**	**29%**
Cardiology	20,600	22,200	24,200	26,700	29,600	33%
Other Internal Medicine	65,900	70,800	76,500	83,100	90,200	27%
Surgical Specialties	**159,400**	**169,000**	**179,900**	**192,000**	**205,100**	**21%**
General Surgery	39,100	41,700	44,800	48,400	52,200	25%
OB/GYN	41,500	43,100	44,800	46,000	47,200	10%
Ophthalmology	18,400	19,700	21,200	23,100	25,200	28%
Orthopedic Surgery	24,100	25,600	27,300	29,300	31,600	23%
Other Surgery	16,200	17,400	18,800	20,300	22,000	26%
Otolaryngology	9,800	10,300	11,000	11,600	12,400	20%
Urology	10,400	11,100	12,000	13,200	14,400	30%
Other Specialties	**200,900**	**213,500**	**227,300**	**242,500**	**259,200**	**21%**
Anesthesiology	37,800	40,200	43,000	46,500	50,400	25%
Emergency Medicine	26,300	27,600	28,900	30,300	31,800	15%
Pathology	17,200	18,400	19,800	21,200	22,600	23%
Psychiatry	38,300	40,700	43,000	45,200	47,400	16%
Radiology	30,900	32,900	35,200	37,900	41,100	25%
Other Specialties	50,400	53,700	57,400	61,400	65,800	23%

Note: Sum of subtotals might not add to totals because of rounding.

D. Extrapolating National Patterns of Physician Requirements to Assess the Adequacy of Physician Supply by State

Exhibit 53 shows a State-by-State comparison of physician supply to simple estimates of physician demand. Demand estimates in this exhibit were calculated as the product of the size of the population in eight age categories and national, age-specific physician-to-population ratios from the PARM (BHPr, 2003). Each dot represents a State. The vertical error bars span the supply estimate ± 10%, while the horizontal error bars span the demand estimate ± 10%.

The reference line indicates an equilibrium between supply and demand (as calculated). Note that the age-specific physician-to-population ratios are based on health care utilization patterns in 2000, and assume that at the national level there is an equilibrium between the supply of and demand for doctors. While most of the States lie close to the reference line where estimated supply equals estimated demand, several of the larger States above the reference line (suggesting a possible oversupply) include New York, Pennsylvania, Massachusetts, and

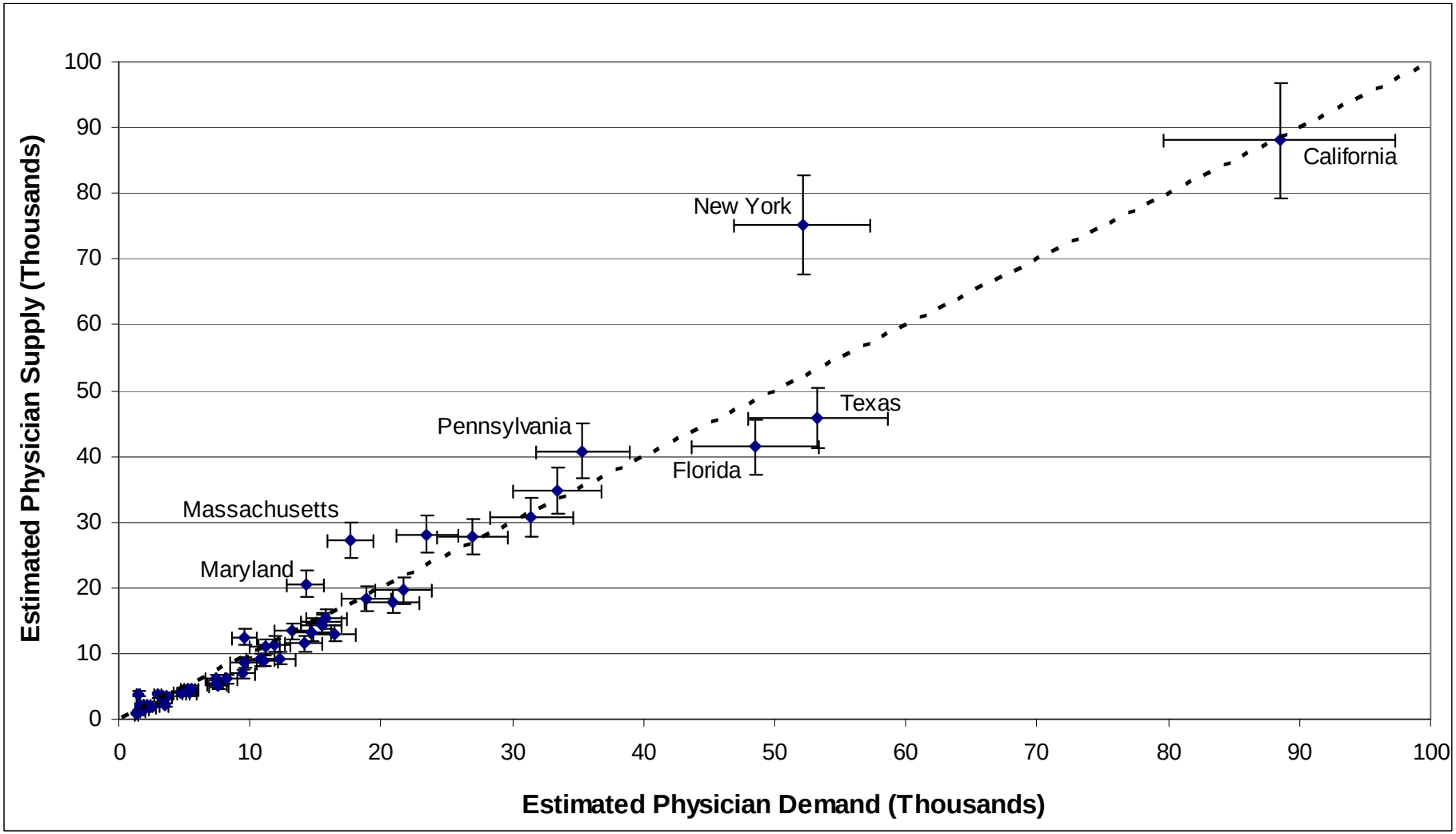
Maryland. Many States substantially above this reference line are home to top medical facilities that treat out-of-State patients. Large States below the reference line (suggesting a possible undersupply) include Texas and Florida. California is exactly on the reference line, but it should be noted that California's large population greatly influences the national physician-to-population ratios.

E. Summary

While there exist geographic pockets of physician undersupply, at the national level there exists no strong evidence that in the base year (2000) there were any serious imbalances in physician supply. During the 1990s there were clear indicators that demand for primary care physicians was growing faster than demand for specialist services (reflecting managed care trends), as well as short-term imbalances in specific specialties as indicated by anecdotal evidence of fluctuating starting salaries and level of difficulty for new graduates to find work.

Physician demand, driven primarily by population growth and a growing number of elderly, is projected to grow slightly faster than supply under the assumption that the health care system continues to provide the current level of care using current patterns of care delivery. If, as some suggest, increased public expectations and ability to pay spur additional demand for physician services, then a significant shortfall of physicians could develop over the next 15 or more years in the absence of increased output from U.S. medical schools, increased recruitment of foreign-trained physicians, or both.

Exhibit 53. Comparison of Physician Supply and Demand by State, 2001



V. PHYSICIAN COMPENSATION

Physician compensation plays an important role in the functioning of the physician labor market. Not only do earnings reward physicians for their training and services, but earnings provide both a signal and an economic incentive that affects the decision to enter medicine as a profession, choice of medical specialty, choice of practice location, and level of work effort.

This chapter focuses on four compensation issues: (1) What are the historical trends in physician compensation? (2) What are the key determinants of compensation? (3) What are the expected future trends in physician compensation? (4) How will trends in compensation affect the physician supply? In Chapters VI and VII, respectively, compensation issues are discussed as related to physician gender and race/ethnicity.

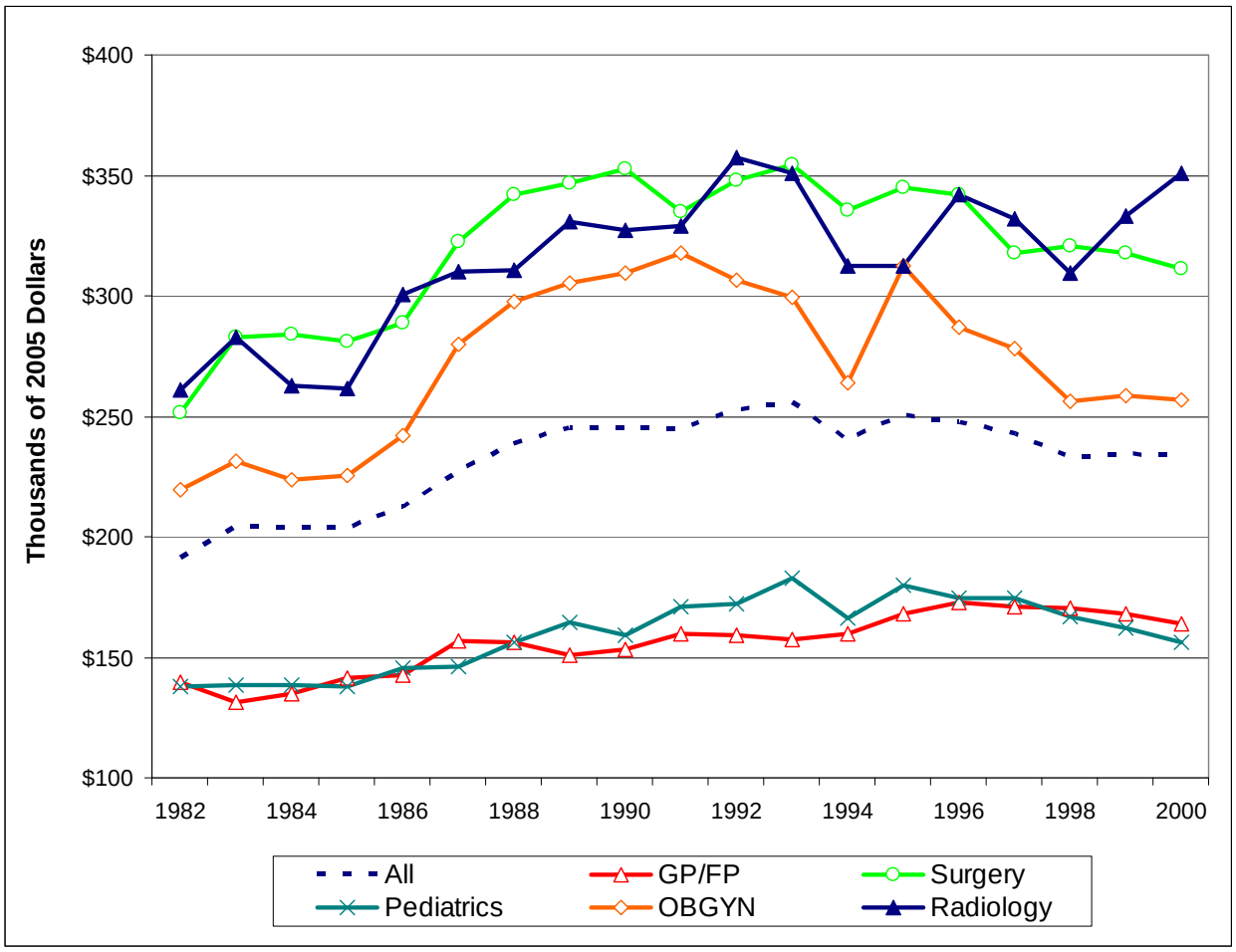
A. Historical Trends in Physician Compensation

AMA statistics show a steady growth in real, mean income between 1982 and 1993 for physician in most specialties, but that during the mid-to-late-1990s mean earnings tended to decline (Exhibit 54). Unfortunately, AMA no longer publishes information on mean earnings, and earnings data from other sources are not necessarily a representative sample of physicians. During the 1980s and 1990s the higher-income specialties (e.g., surgery, obstetrics/gynecology, and radiology) tended to see the largest volatility in mean earnings, while the lower-income specialties (e.g., psychiatry, pediatrics and general/family practice tended to have relatively constant mean earnings.

Mean income tended to be highest for physicians practicing in metropolitan areas with less than 1 million in population, followed by physicians practicing in metropolitan areas with greater than 1 million in population (Exhibit 55). Physicians practicing in non-metropolitan areas tended to have consistently lower mean income. These differences in mean income do not control for differences in specialty composition, cost of living, and other determinants of income (e.g., patient care hours worked).

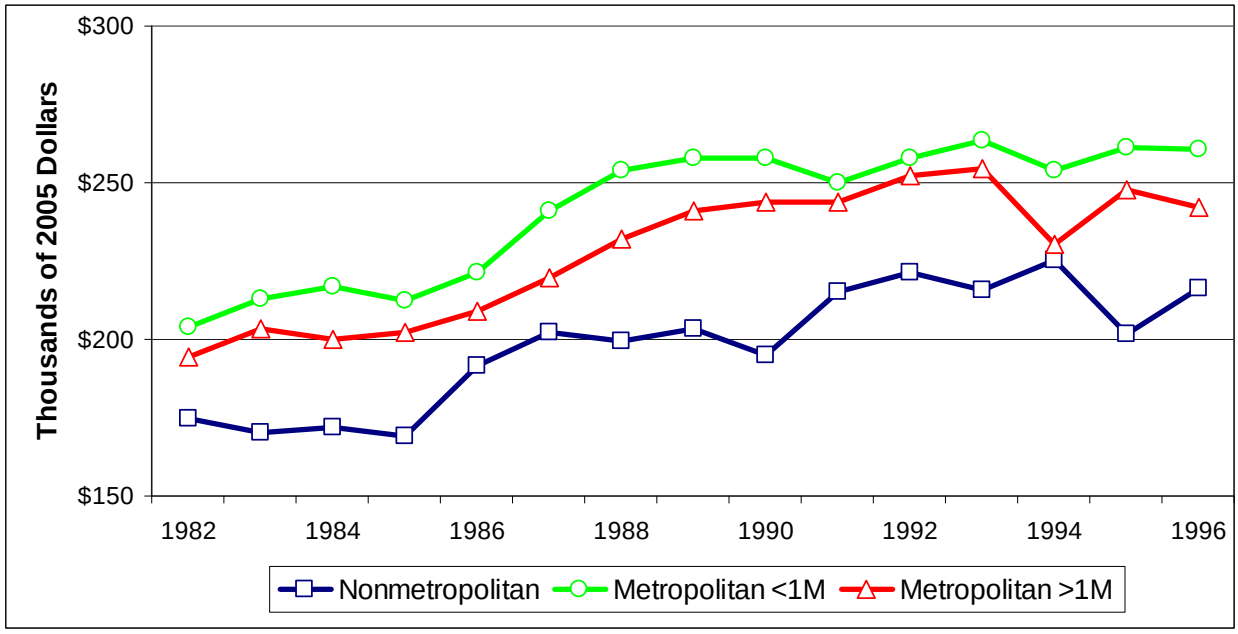
Mean income tended to be systematically correlated with physician age (Exhibit 56). Mean income increases with physician age up through age 55, at which time mean income for the age group falls. Much of this decline for older physicians is attributed to reduced work hours.

Exhibit 54. Mean Net Income After Expenses and Before Taxes: by Specialty



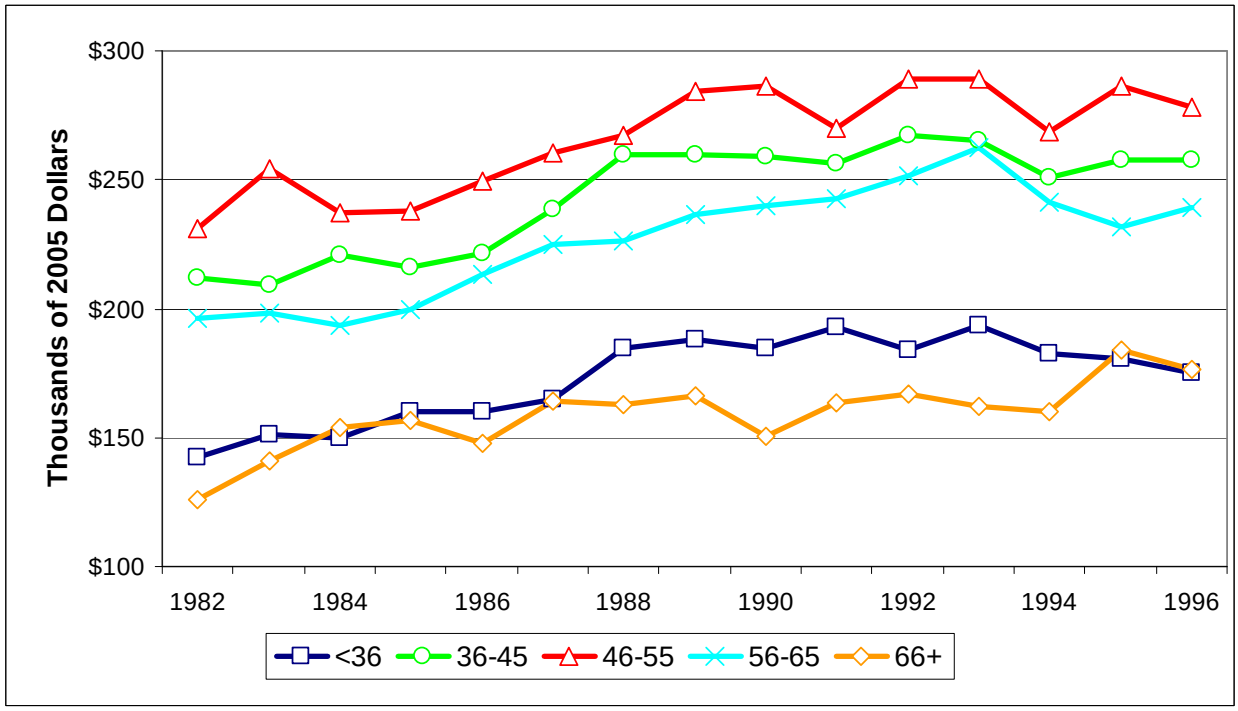
Source: AMA Physician Socioeconomic Statistics (various years).

Exhibit 55. Mean Net Income After Expenses and Before Taxes: by Metropolitan Location



Source: AMA Physician Socioeconomic Statistics (various years).

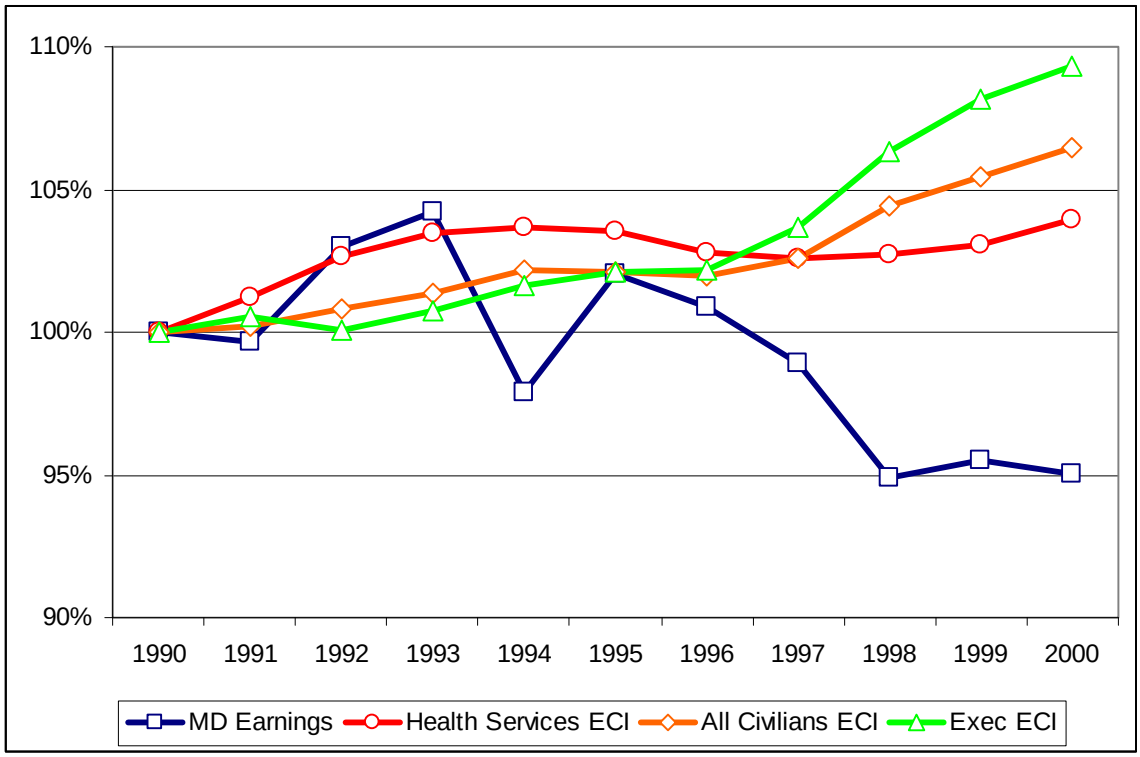
Exhibit 56. Mean Income After Expenses and Before Taxes: by Physician Age



Source: AMA Physician Socioeconomic Statistics (various years).

A comparison of mean physician earnings to Bureau of Labor Statistics (BLS) employment cost indices for the health services sector, the civilian sector, and executive positions finds that during the 1990s physician earnings fell by 10 to 15 percent relative to earnings in other occupations (Exhibit 57). During the 1990s, mean physicians' earnings fell by 5 percent in inflation-adjusted terms. During this time mean earnings in the health services sector tended to rise slightly, while mean earnings of executives (an occupation group that is perhaps comparable with physicians in terms of attracting bright and talented people) increased by approximately 10 percent in real terms.

Exhibit 57. Change in Mean Income Compared to Employment Cost Indices: 1990 to 2000



Sources: AMA Physician Socioeconomic Statistics. Employment Cost Index data obtained from the Bureau of Labor Statistics.

While market factors such as increased managed care in the 1990s can explain part of the decline in mean earnings for physicians, changes in the demographic and specialty composition of the physician workforce also help explain this trend. Trends in physician earnings can be better understood by analyzing the determinants of physician compensation.

B. Determinants of Physician Compensation

Payment rates for physician services reflect the pecuniary value that society places on physician services. Rates reflect the value of physician time and expertise, so physicians in specialties that

require more years of training and for which there are few substitutes (e.g., surgical specialties) tend to earn more than physicians in primary care specialties. An analysis of AMA's 1998 SMS data finds substantial variation in physician pay (Exhibit 58). Annual earnings is positively (and statistically significantly) associated with working more hours, being male, being a U.S. medical graduate, being in the middle of one's career, working in a multi-physician practice versus solo practice, and being board certified. There is also substantial regional variation in earnings.

Exhibit 58. Regression Analysis of Physician Earnings

	OLS Regression Results			Sample Means		
Variable	**Parameter**	**Std. Error**	**Prob**	**All**	**Male**	**Female**
Intercept	$82,133	$86,549	0.3427			
Annual hours worked	$24	$4	<.0001	2,673	2,725	2,412
Female	$(37,760)	$7,552	<.0001	0.17	0.00	1.00
Caucasian	$(946)	$7,740	0.9028	0.79	0.80	0.71
IMG	$(5,965)	$7,927	0.4519	0.20	0.19	0.21
Began practicing medicine (reference is before 1960)						
1960 -1969	$(32,944)	$17,122	0.0545	0.03	0.03	0.01
1970 -1979	$12,826	$9,929	0.1966	0.11	0.12	0.05
1980 - 1989	$39,453	$7,635	<.0001	0.26	0.29	0.14
1990 or after	$34,188	$7,125	<.0001	0.35	0.33	0.43
Solo practitioner	$(15,926)	$6,496	0.0143	0.26	0.27	0.20
Specialty (reference is general/family practice)				0.13	0.13	0.12
General internal medicine	$34,304	$10,342	0.0009	0.14	0.14	0.15
IM subspecialties	$74,362	$13,499	<.0001	0.05	0.06	0.02
General surgery	$77,080	$13,945	<.0001	0.05	0.06	0.01
Surgical subspecialties	$126,097	$10,179	<.0001	0.15	0.17	0.05
Pediatrics	$10,029	$11,573	0.3863	0.09	0.07	0.20
Obstetrics/gynecology	$85,544	$12,522	<.0001	0.07	0.06	0.10
Radiology	$128,447	$13,608	<.0001	0.05	0.05	0.06
Psychiatry	$12,556	$12,637	0.3206	0.07	0.06	0.11
Anesthesiology	$87,777	$13,038	<.0001	0.06	0.07	0.04
Pathology	$56,387	$16,663	0.0007	0.03	0.03	0.04
Emergency med	$69,056	$14,729	<.0001	0.04	0.05	0.03
Other specs	$55,156	$13,150	<.0001	0.06	0.06	0.07
Board Certified	$28,295	$7,091	<.0001	0.81	0.81	0.77
Region (reference is New England)				0.06	0.06	0.10
Middle Atlantic	$7,407	$12,508	0.5538	0.15	0.15	0.17
E North Central	$14,264	$12,577	0.2569	0.15	0.15	0.13
W North Central	$29,364	$14,585	0.0442	0.07	0.07	0.06
South Atlantic	$14,264	$12,111	0.239	0.20	0.20	0.18
E South Central	$37,052	$14,995	0.0136	0.06	0.06	0.05
W South Central	$30,755	$13,334	0.0212	0.11	0.11	0.09
Mountain	$27,927	$15,113	0.0648	0.06	0.06	0.06
Pacific	$2,409	$12,582	0.8482	0.15	0.14	0.17

Source: Analysis of the 1998 AMA Socioeconomic Monitoring System File.

C. Expected Future Trends in Physician Compensation

Three trends will likely affect physician compensation over the next couple of decades: (1) the aging of the population and the greater reliance on Medicare as a source of revenue, (2) increasing competition from NPCs, and (3) efforts by insurers to make patients and physicians more cost conscious.

Population Aging and Medicare

The aging of the population means that a larger proportion of physician revenue will come from Medicare, so physician earnings and practice patterns will become increasingly tied to Medicare policies and reimbursement formulas. AMA's (1999) Physician Socioeconomic Statistics reports that in 1998 an estimated 29 percent of revenue received by non-Federal physicians came from Medicare, 12 percent came from Medicaid, 43 percent came from private insurance, 12 percent came from patient out-of-pocket payments, and 4 percent came from other sources. BHPr (2003) estimates that between 2000 and 2020, the proportion of physician services that are provided to patients age 65 and older will grow from approximately 32 percent to 39 percent.

In an era of increasing Federal debt and large, projected increases in the number of Medicare and Social Security beneficiaries, there will likely be strong pressure to hold down medical costs—potentially affecting physicians through downward pressures on reimbursement rates and utilization of some services.

Exhibit 59. Average Percent of Non-Federal Physician Revenue by Payment Source 1998

Specialty	Medicare	Medicaid	Private Insurance	Patient out of pocket	Other
All Physicians	29	12	43	12	4
General & Family Practice	23	12	44	17	4
General Internal Medicine	44	8	36	9	3
Surgery	35	8	43	12	2
Pediatrics	1	26	56	13	5
Obstetrics/Gynecology	11	20	54	13	2
Radiology	34	10	42	11	3
Psychiatry	16	17	37	22	9
Anesthesiology	28	13	48	9	3
Pathology	28	11	41	10	10
Other specialties	28	10	43	12	8

Source: Physician Socioeconomic Statistics, 1999-2000 Edition (AMA, 1999).

Exhibit 60. Estimated Percentage of Physician Time Spent Providing Care to Patients Age 65 and Older

Specialty	2000	2020	Percentage Point Change
All Physicians	32	39	7
General & Family Practice	30	38	8
General Internal Medicine	43	50	7
Surgery	39	46	7
Pediatrics	0	0	0
Obstetrics/Gynecology	5	7	2
Radiology	15	20	5
Psychiatry	34	41	7
Anesthesiology	19	25	6
Pathology	43	49	6

Source: BHPr (2003).

Competition from Non-Physician Providers

As discussed in Section III.C the increased supply of NPCs could reduce the demand for physicians to provide some services (especially primary care services). Because NPCs can provide some services currently offered by physicians but at a lower cost, there exists an economic incentive for health care groups to use NPCs to provide services within their legal scope of practice.

Increased Cost Consciousness

Health practitioners, patients, policymakers, researchers and others have long understood that insurance markets can create inefficiencies in the health care system because patients and physicians are partially shielded from the true cost of their health care decisions. The increased use of managed care principles in the 1990s (e. g, the use of gatekeepers, exclusive networks, utilization review and capitation) were driven largely by the belief that the health care system could be more efficient if physicians bore a greater burden of the costs of their decisions, either through financial incentives or constraints on prescription of services.

The backlash against the most restrictive forms of managed care has forced payers to find other ways to control costs, and in recent years the trend has been to make patients more cost-conscious by shifting a greater portion of the cost of care onto patients. This is occurring through increasing deductibles and co-payments, as well as efforts to inform patients of the true cost of their health care utilization. Greater cost-consciousness on the part of patients could result in decreased utilization of physician services which could have a negative impact on physician earnings.

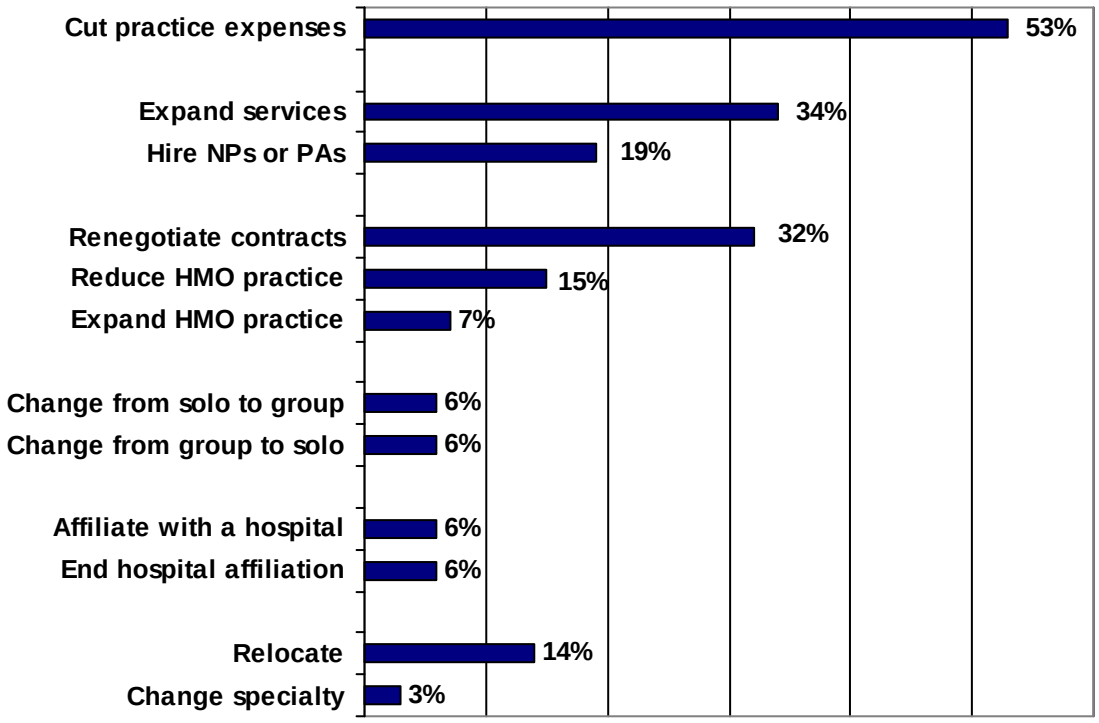
D. Supply Implications of Trends in Physician Compensation

As discussed in Chapter II, research shows that physicians respond to financial incentives regarding (1) the decision to enter medicine as a profession, (2) choice of medical specialty, (3) practice location, (4) number of hours working to provide patient care, and (5) decision when to retire. Research suggests that physicians also react to market forces that affect earnings by changing the way they practice medicine.

Practice Patterns

Farber and Murray (2001) report findings from a 2000 survey of the economic situation of physicians. Over half the survey respondents indicated that they have taken or plan to take one or more of the following actions to counter lagging income (Exhibit 61). Cutting practice expenses was the most popular choice (53 percent), followed by expanding services (34 percent), renegotiating contracts (32 percent) and hiring NPs or PAs (19 percent). While 15 percent of respondents indicated they planed to cut back on their HMO practice, 7 percent indicated they plan to increase their HMO practice. The number of respondents indicating they plan to change from solo to group practice (6 percent) equaled the number indicating they plan to change from group to solo practice (6 percent). Likewise, the number indicating they would seek to affiliate with a hospital (6 percent) equaled the number indicating they would like to end an existing hospital affiliation (6 percent). Relocation was an option being considered by 14 percent of survey respondents, with 3 percent of physicians considering a change in specialty.

Exhibit 61. Percentage of Physicians Indicating They Have or Plan to Take the Following Actions



Source: Medical Economics 2000 Financial Survey, Farber and Murray (2001).

Hours Worked and Income Tax Rates

Discussions of ways to reduce the growing national debt often include the topic of income taxes. Most physicians are in the highest marginal income tax brackets so changes in income tax rates can have a significant impact on after-tax earnings. Economic theory suggests that a rise in income tax rates could have conflicting implications for physician supply. The *substitution effect* suggests that raising tax rates will reduce the benefits of working additional hours, so raising income tax rates could have a negative impact on physician supply by reducing the incentive to work long hours. Countering this is the *income effect*--some physicians might choose to work longer hours to make up for income lost to higher taxes.

Showalter and Thurston (1997) find that higher marginal tax rates reduce the number of hours physicians work, on average. The reduction in hours occurs mainly among self-employed physicians, which suggests that changes in physician hours worked could become less sensitive to income tax policy over time if a greater proportion of physicians become employees versus self-employed. Using data from the 1983-1985 Physicians' Practice Costs and Income Survey and State variation in income tax rates, these authors estimate a 17 hour reduction in annual hours worked for each 1 percentage point increase in a State's top marginal tax rate. Thus, a 10 percentage point increase in the top tax bracket would reduce average annual hours worked by approximately 170 hours per year (or approximately 7.5 percent of average hours spent in direct patient care). Presumably, physicians' labor supply response to changes in income tax rates would be similar for both changes in State and Federal tax rates (although changes in State tax rates could result in some cross-State migration).

Specialty Choice

Systematic differences across specialties in mean earnings and work behavior reflect differences in training costs (e.g., length of residency), nature of the work (e.g., time commitments, job stress), market conditions (e.g., demand for services), and perhaps differences in physician ability. An important question for physician workforce modeling is "How responsive is specialty choice to expected future earnings?"

> ***The rapidly evolving career preferences of physicians in training indicate that medical students are taking their advice from the columns of the Wall Street Journal as well as from traditional sources such as clinical mentors and deans of student affairs.***
>
> Jacoby and Meyer (1998, p. 824)

To determine the extent to which market forces and economic factors affect specialty choice, we investigated whether there are "specialty premiums." We define specialty premiums as systematic differences across specialties in physician income after controlling for expected returns to training and differences in the characteristics or practice decisions of physicians (e.g., number of hours worked). An earnings premium in a particular specialty provides a financial incentive for new medical graduates to enter that specialty. Theory suggests that while there might be short-run premiums for a particular specialty, in a market economy with good information on physician earnings the long-run premiums should be similar across specialties.

Earlier studies of the returns to medical training (e.g., Sloan and Feldman, 1978; Burnstein and Cromwell, 1985) estimate the returns to training for physicians compared to other occupations. We modify their approach to estimate returns to training in a particular medical specialty versus the returns to becoming a physician in general. Training costs and future earnings are compared starting with the first year of residency and ending at age 65 (the assumed age of retirement). We use general and family practitioners as the reference category for determining the opportunity cost associated with training in another specialty and estimate the return on training for nine specialty groups.

The expected returns to training are determined by the amount and timing of expected future earnings and training costs. To compute the returns to specialty training costs and future expected earnings are discounted to estimate the present value (PV) of net earnings for a particular specialty.

$$\text{PV(net earnings)}_{\text{specialty}} = \sum_{\text{age}=27}^{\text{age}=65} \frac{\text{net earnings}_{\text{age, specialty}} - \text{net earnings}_{\text{age,GFP}}}{\text{rate}^{(\text{age}-27)}}$$

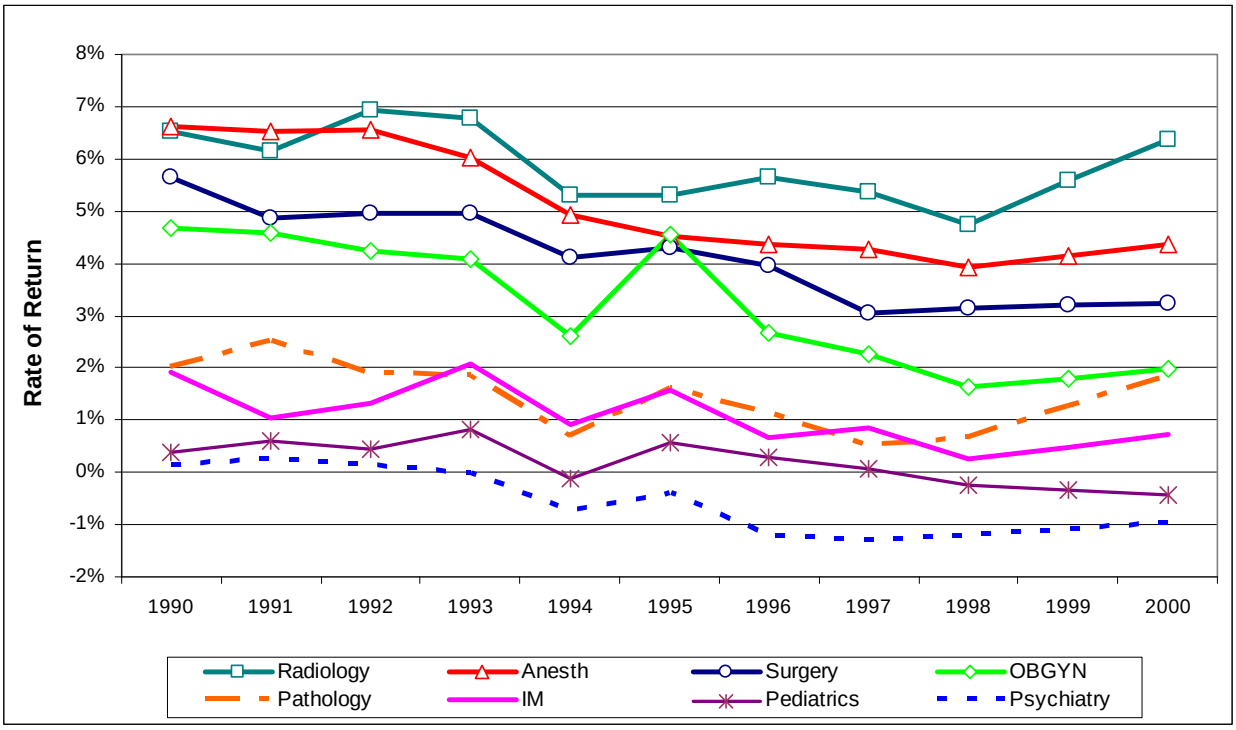
Any differences across specialties in returns to training are determined by differences in the internal rate of return, and the internal rate of return is that rate which makes the present value in the above equation equal to zero. To estimate present value of expected future earnings, current actual mean earnings are used for physicians in different age groups. The returns to specialty training both with and without adjusting for differences are estimated across specialties in average hours worked per year, but only the adjusted numbers are reported (Exhibit 62).

Although physicians in surgical specialties earn substantially more than general and family practitioners, surgical specialties require additional years of training and thus a delay in significant earnings. Consequently, taking into account the additional costs of training (such as foregone earnings during residency) and differences in hours worked the returns to training in surgery are approximately 3 to 5 percent. The returns to training for radiologists and anesthesiologists are the highest—ranging from 4 to 7 percent. The returns to OBGYN training declined during the 1990s from 5 percent down to 2 percent. The returns to pathology and internal medicine were in the 1 to 2 percent range, and specialization in psychiatry is associated with a negative rate of return compared to entering general and family practice.

These estimated premiums are not adjusted for physician geographic location, and the fact that some specialists predominantly locate in higher-cost, metropolitan areas results in an overestimate of the earnings premium for those specialties. Also, the estimates do not account for differences across professions in attributes that could require compensating differentials (e.g., job stress, requirements to be on-call).

AMA's (1985) estimates of returns to training (adjusted here to reflect differences relative to becoming a general/family practitioner) are much higher—e.g., 7 percent for general internal medicine, 14 percent for surgery, 0 percent for pediatrics, 17 percent for obstetrics/gynecology, 18 percent for radiology, 5 percent for psychiatry, 22 percent for anesthesiology, and 14 percent for pathology.

Exhibit 62 Return to Training by Specialty (Relative to GP/FP)



Understanding how monetary incentives motivate physicians to work more or fewer hours in patient care, choice of specialty and practice location, practice patterns, and retirement behavior helps build more reliable projections of future physician supply. The paucity of information in the literature on the relationship between compensation and physician behavior is due, in part, to the lack of good data on physician earnings.

In summary, during the next couple of decades there will likely be competing factors placing upward and downward pressures on physician earnings. The projected growing shortfall of physicians—and in particular specialists—will have an elevating effect on earnings. The increasing reliance on Medicare as a source of income, combined with pressures by the Federal Government to control rising Medicare and Social Security expenditures, will have a depressing effect on physician earnings. Physicians in some specialties will encounter increasing competition from NPCs, as well as from other physicians in other specialties expanding their scope of practice, and increased competition could negatively impact compensation. Insurance practices that increase patients' cost awareness could also affect demand for services and thus negatively impact physician earnings.

VI. FEMALE PHYSICIANS

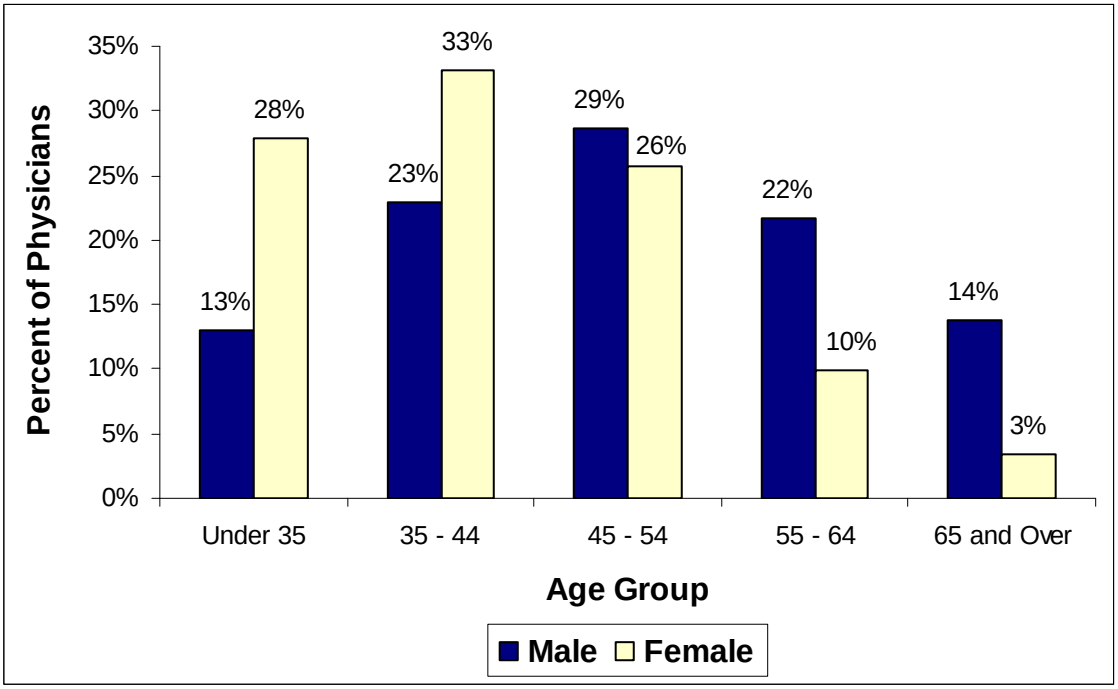
The growing proportion of physicians who are female is having a profound impact on the physician workforce and delivery of care. In this chapter we discuss supply trends and differences in productivity and compensation between male and female physicians.

A. Supply Trends

During the past 3 decades the proportion of physicians who are female has risen from 8 percent to nearly one in four physicians. Recent trends suggest that within the next 2 decades women will constitute nearly half the physician workforce.

The increase in number of new physicians who are female means that male physicians tend to be older, on average, than female physicians. AMA (2006) reports that in 2004 approximately 36 percent of active male physicians were under the age of 45 as compared to approximately 61 percent of active female physicians. Exhibit 63 illustrates the different age distribution of male and female physicians.

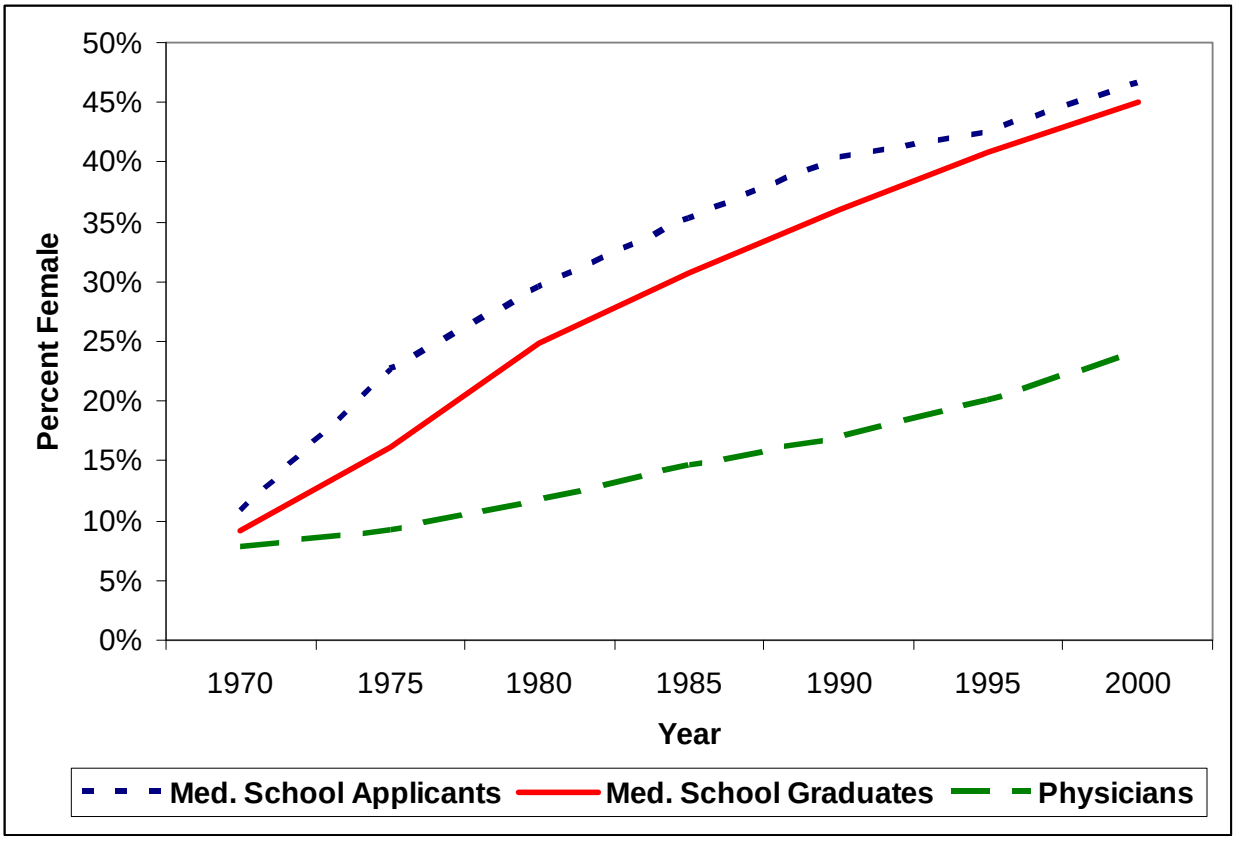
Exhibit 63. Male and Female Physician Age Distribution, 2004



Source: Physician Characteristics and Distribution in the US: 2006 Edition (AMA, 2006).

Since 1970 the number of female medical school applicants and medical school graduates have risen sharply (Exhibit 64). Today (2005), nearly half of all U.S. medical students are female.

Exhibit 64. Percentage of U.S. Medical School Applicants and Graduates who are Female



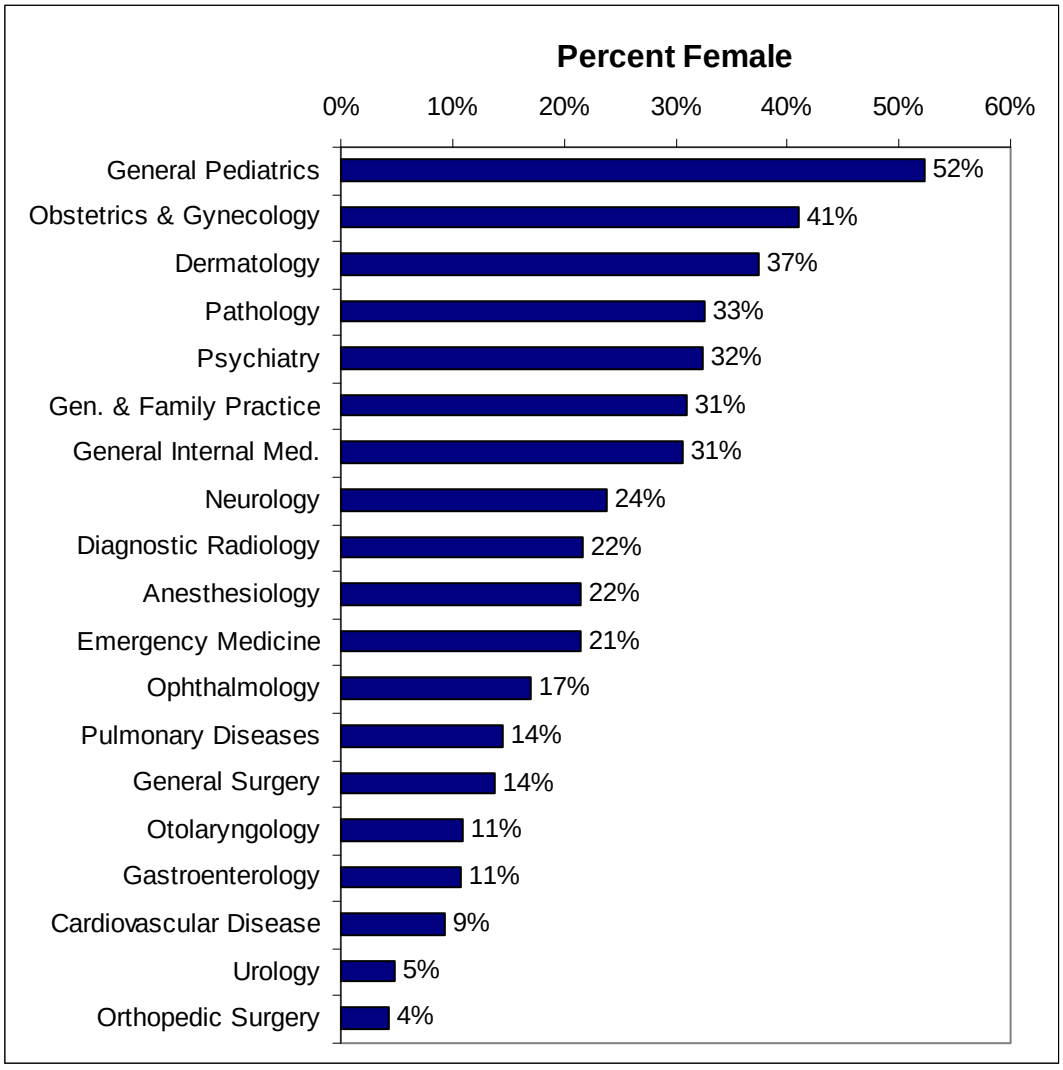
Source: AAMC (2001) and AMA Physician Characteristics and Distribution in the U.S. (various years).

Specialty Choice

The proportion of physicians who are women varies substantially by medical specialty, with women more likely to choose primary care specialties over surgical or other subspecialties. Among those specialties with more than 10,000 physicians, the two specialties with the highest proportion of female physicians are general pediatrics (52 percent) and obstetrics and gynecology (41 percent). The two specialties with the smallest proportion of female physicians are orthopedic surgery (4 percent) and urology (5 percent) (Exhibit 65).

Novielli et al. (2001) report that differences between male and female physicians in choice of medical career path stem not from experience, but rather from personal preference. The authors find that women starting medical school are more likely than men to express a desire to practice in a non-surgical specialty. Furthermore, during medical school women are more likely than men to be dissuaded from entering a surgical specialty. Of those new enrollees in medical school who expressed an initial preference for a surgical specialty, the proportion that eventually entered a non-surgical residency program was higher for women than men. Similarly, of those new enrollees in medical school who expressed an initial interest in a non-surgical specialty, the proportion that eventually entered a non-surgical residency program was higher for women than for men.

Exhibit 65. Percent of Physicians who are Women: 2004



Source: *Physician Characteristics and Distribution in the US, 2006 Edition* (AMA, 2006)

Nonnemaker (2000) tracked the appointments of medical school graduates to medical school faculties from the years of 1979 to 1993 and found that female associate professors were significantly less likely than males to be promoted to full professor. Although women are under represented in academic medicine, their ranks are growing. In 1979, only 647 women were full professors; by 1997 that number had increased almost four-fold to 2,335.

Geographic Location

There is considerable evidence to show that female physicians are less likely to practice in non-metropolitan areas compared to their male colleagues. Randolph and Pathman (2001) find that women, who make up approximately two thirds of pediatric residents, are 50 percent less likely to practice in rural areas than are male pediatric residents.

Ellsbury et al. (2002) describe reasons why female physicians may be more hesitant to practice in non-metropolitan areas compared to male physicians. Female physicians considering practice in a non-metropolitan area typically have greater concern about

1. spousal employment opportunities (58 percent of women compared to 26 percent of men),

2. flexible hours (66 percent versus 25 percent),

3. availability of child care (33 percent versus 3 percent), and

4. opportunities for part-time employment (38 percent versus 14 percent).

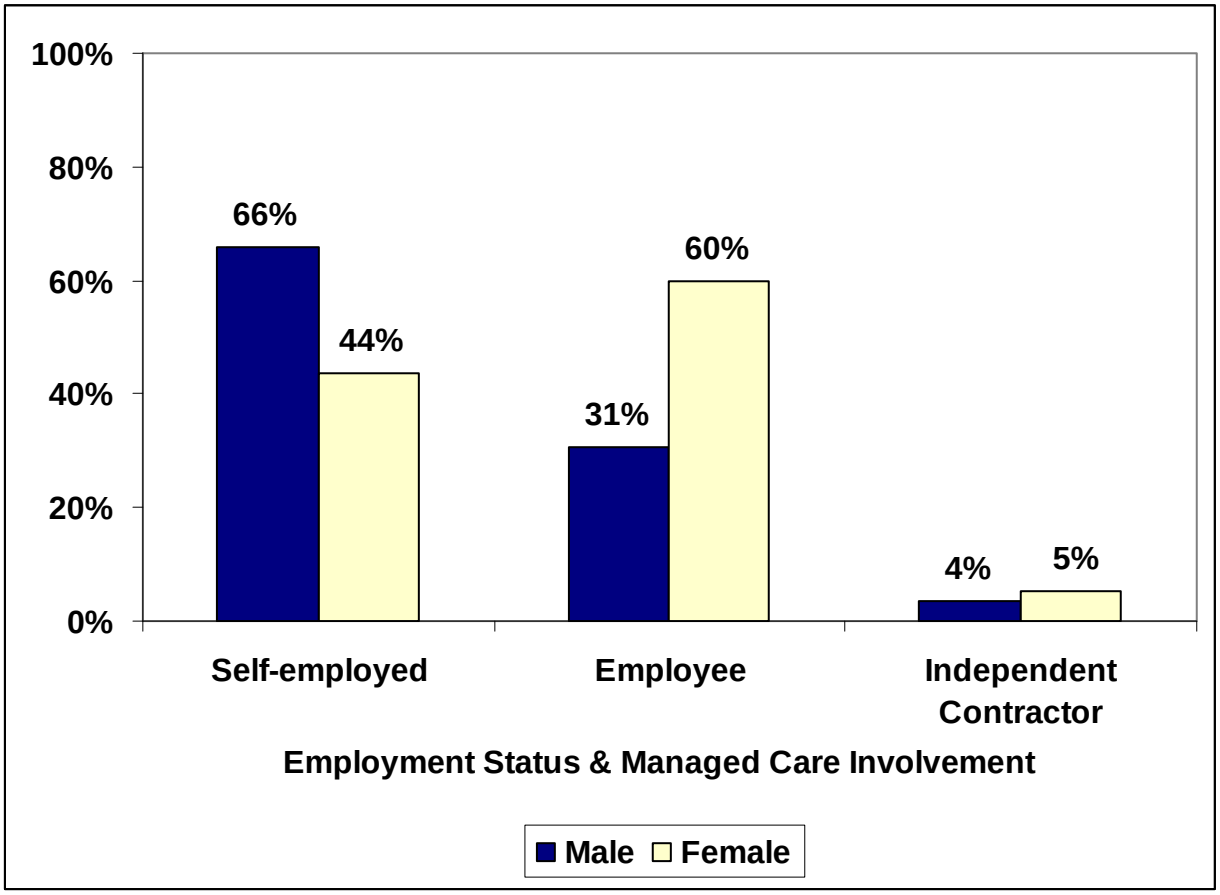
Physicians in non-metropolitan areas work longer hours and work in smaller practices, on average, compared to physicians in metropolitan areas. These factors possibly have a greater disincentive effect on female physicians who tend to have greater preferences for flexibility in hours to bear children and raise families.

Mitka's (2001) study of physicians in rural communities in the Pacific Northwest finds that 52 percent of women and 24 percent of men expressed that they had a partner or spouse looking for work when considering the location for their own practice. Ellsbury et al. report that 54 percent of respondents to a question about spousal assistance found that their non-metropolitan community provided no assistance to help a spouse or partner find employment when relocating to the area. The rising proportion of women in medicine and the higher propensity of female physicians to practice in metropolitan areas could hinder the national goal of improving physician supply in rural areas. Although women are less likely to work in rural areas, according to study by Bickel and Ruffin (1995) women are more likely than men to work in clinics providing health care to medically indigent patients.

Employment Status

Female physicians are more likely than their male counterparts to work in salaried, office-based settings. AMA (2001) reports that approximately two thirds of female physicians and one third of male physicians are salaried (Exhibit 66). Although salaried physicians tend to earn less than self-employed physicians, salaried physicians tend to have more predictable and flexible work hours, factors that studies have found appeal more to women than to men.

Exhibit 66. Employment Status of Male and Female Physicians



Source: Physician Socioeconomic Statistics (AMA, 2001).

B. Productivity

AMA (2002) reports that female physicians work 49 hours per week, on average, compared to 57 hours for male physicians. Female physicians also tend to work fewer weeks per year. Estimates of patient care hours worked per week from an unpublished HRSA survey (2002 data for approximately 46,800 physicians) shows that even controlling for age and specialty women tend to work fewer hours per year than do men (Exhibit 67). Perhaps resulting from differences in treatment styles, Roter et al. (2002) find that female physicians average about 2 minutes (10 percent) longer than male physicians in terms of the average length of a patient visit.

Exhibit 67. Mean, Patient Care Hours per Week, 2002

Specialty		Physician Age		
		36 to 45	46 to 55	56 to 65
General Pediatrics	Male	44	46	39
	Female	35	40	34
General Surgery	Male	56	54	42
	Female	49	48	39
General/ Family Practice	Male	45	45	39
	Female	36	37	37
General Internal Medicine	Male	48	49	40
	Female	39	42	38
Obstetrics & Gynecology	Male	51	52	40
	Female	46	44	37
Pathology	Male	43	45	40
	Female	35	39	36
Radiology	Male	50	48	41
	Female	38	40	41

Source: Unpublished HRSA Survey of Physician Work Hours (total sample is approximately 46,800 physicians; hours for only selected specialties presented here).

Because female physicians provide care to fewer patients per year, on average, compared to male physicians, the supply of physician services is growing more slowly than the number of active physicians in percentage terms. As discussed in Chapter II, between 2005 and 2020 the overall supply of physicians is projected to grow by 16 percent, while the FTE supply is projected to grow by 14 percent. Part of this discrepancy is due to the increasing proportion of women in the workforce, while part is due to the aging of the physician workforce.

C. Compensation

Novielli et al. (2001) find that female medical students have lower earnings expectations than do male medical students, even after controlling for whether the student plans to pursue a high-paying surgical specialty or a non-surgical specialty. Ness et al. (2000) analyzed salary information for 455 internists in Pennsylvania and found that male internists earned 53 percent more than female internists. However, the authors identify numerous systematic differences between men and women that help explain the disparity in earnings. Compared to their male colleagues, on average, female physicians:

- Are more likely to practice in lower-paying medical specialties,
- Have fewer years in practice,
- Are less likely to be in a partnership,
- Work fewer hours per week in professional activities, and
- Are more likely to take time off or work part time.

After adjusting for age, training, and practice characteristics the authors report an unexplained 14 percent disparity in earnings.

Ross (2001) notes that payment for services rendered do not discriminate by physician gender and proposes that income differences between men and women likely reflect a voluntary tradeoff between earnings and lifestyle beyond those factors controlled for by Ness et al. Additional factors that might explain the difference in average earnings of male and female physicians are that, compared to their male colleagues, female physicians might see fewer patient per hour and be less likely to participate in night and weekend call activities.

Analysis of the AMA's 1998 SMS file explains part of the difference in earnings between male and female physicians. The SMS is a sample of approximately 3,000 office-based physicians who provide at least 20 hours of patient care per week. As described in Chapter V, a regression equation was estimated to quantify the relationship between annual net earnings and its determinants. Explanatory variables include physician characteristics and practice patterns, practice characteristics, medical specialty, and geographic location. Two-thirds (n=2,055) of SMS respondents reported data on net earnings and the explanatory variables of interest. Approximately 17 percent (n= 341) of usable surveys were from female physicians.

Female physicians had average annual earnings of approximately $149,000 compared to $208,000 for male physicians (Exhibit 68). This difference of over $59,000 (29 percent) per year can be partially explained by differences in average hours worked. Female physicians in this sample worked 11 percent fewer hours per year, on average, compared to male physicians (2,412 versus 2,725 hours), and after adjusting for hours worked the difference in annual earnings falls to $45,000 (or 21 percent). Controlling for many of the systematic differences between male and female physicians in terms of practice patterns and medical specialty (as noted by Ross and by Ness et al.), it was found that female physicians still earn $38,000 (18 percent) less than male physicians. Data limitations prevent us from controlling for systematic differences in additional factors that might explain even more of the differences in compensation.

Exhibit 68. 1998 SMS Physician Compensation Comparison

	Unadjusted Annual Earnings	Adjusted for Differences in Hours Worked	Adjusted for Differences in Experience, Specialty, Hours, and Other Practice Characteristics
Female	$148,990	$167,099	$173,279
Male	$208,462	$212,269	$211,039
Difference	$(59,472)	$(45,169)	$(37,760)
% Difference	-29%	-21%	-18%

Source: Analysis of the 1998 AMA Socioeconomic Monitoring System file.

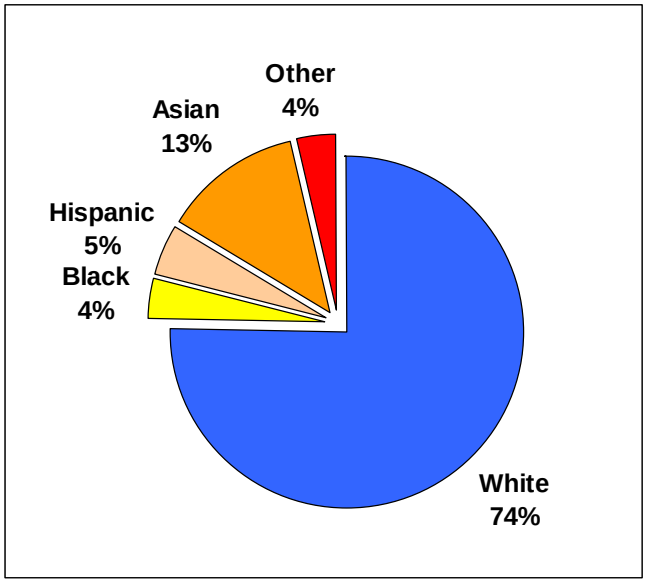
VII. MINORITY PHYSICIANS

This section explores physician supply and demand issues as they pertain to minority physicians and discusses the implications for a country that is growing more racially and ethnically diverse.

A. Minority Representation in the Physician Workforce

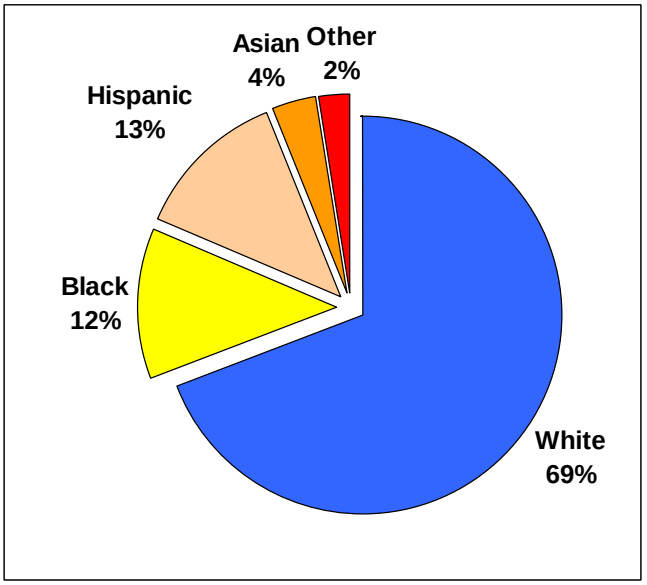
Approximately one in four Americans is either Black or Hispanic, yet together these two minority groups constitute only 9 percent of the physician workforce (Exhibits 69 and 70). Advocates for increased minority representation in the physician workforce argue that minority under representation is more than simply an equity concern, but that increasing minority representation among physicians will improve access to care for minorities and vulnerable, underserved populations.

Exhibit 69. Physician Workforce, 2000



Source: AMA (2002)

Exhibit 70. U.S. Population, 2000



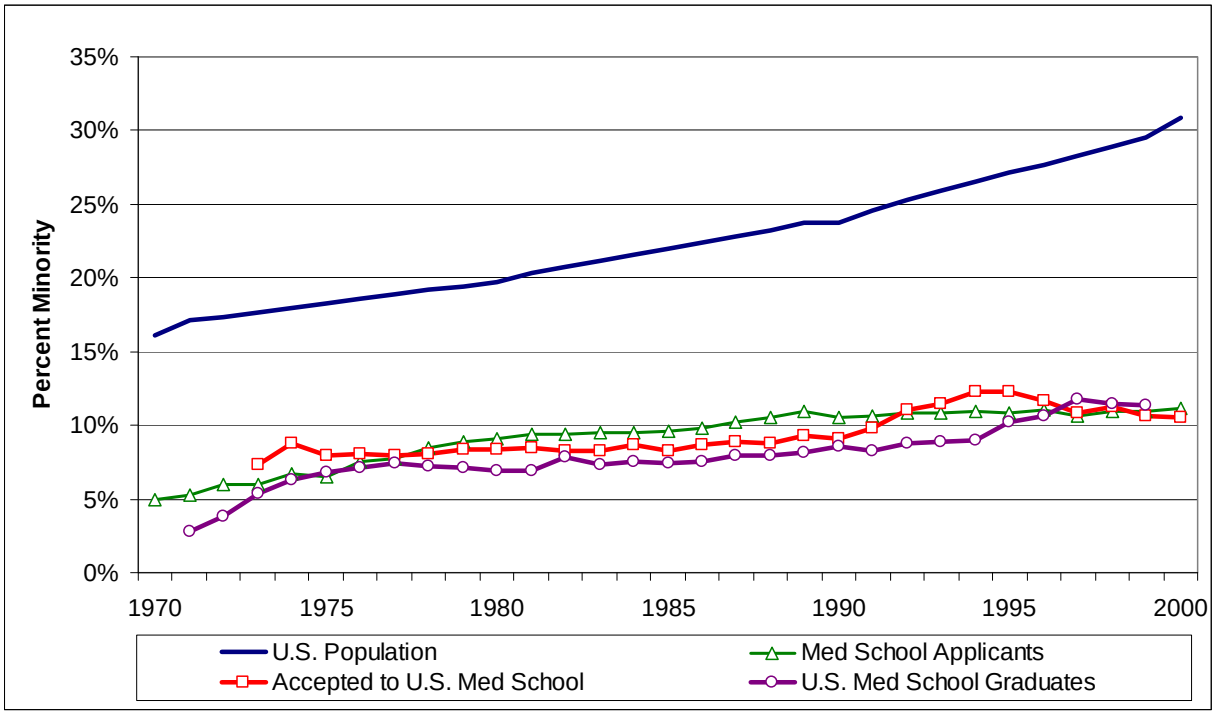
Source: U.S. Census Bureau

During the last 3 decades, racial and ethnic minorities doubled as a proportion of the U.S. population from approximately 16 percent in 1970 to 31 percent in 2000. Minority representation among U.S. medical school applicants, candidates accepted, and graduates also increased during this time; however, this representation remains substantially below the proportion of racial and ethnic minorities in the U.S. population (Exhibit 71).

Even if there were a dramatic increase in minority representation in U.S. medical schools, the overall racial/ethnic composition of the physician workforce would change slowly because of

the long length of time to train new physicians and because only a small portion of the current workforce retires each year.

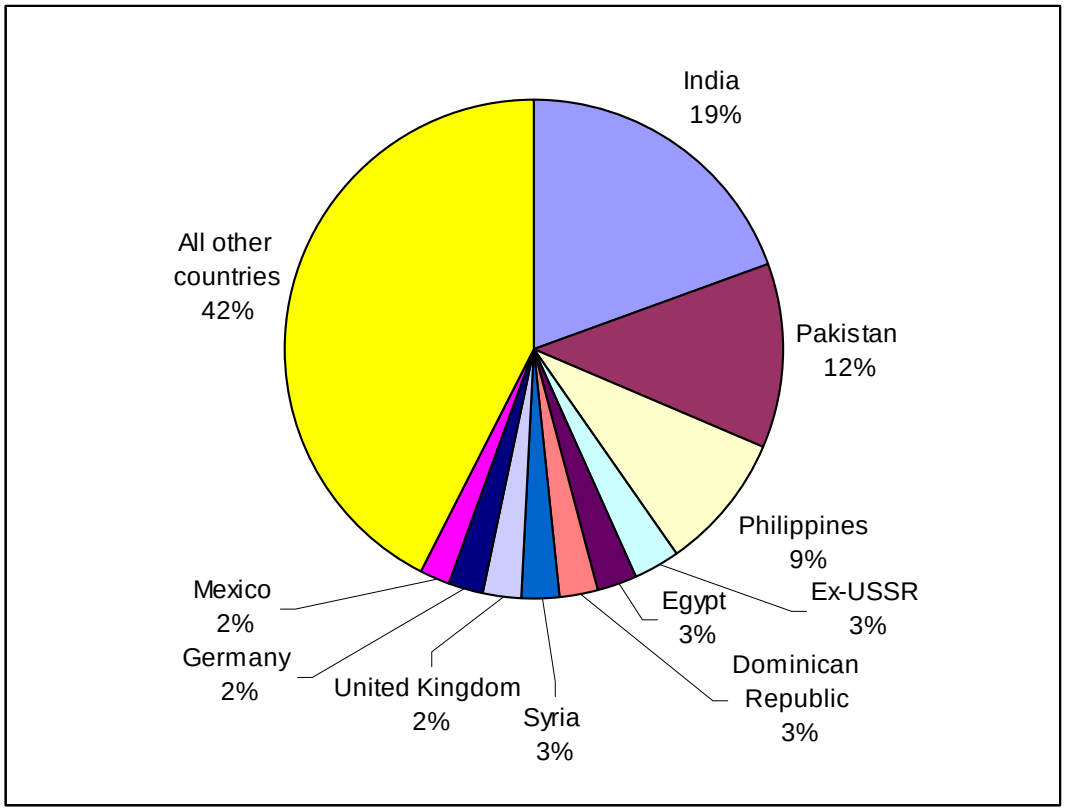
Exhibit 71. Minority Graduates from U.S. Medical Schools: 1970-2000



Sources: Census Bureau, AAMC (2001).

Although minorities are underrepresented in U.S. medical schools, approximately one in five practicing physicians in the United States graduated from an international medical school, and the majority of these IMGs are racial or ethnic minorities. India, Pakistan, and the Philippines together produce approximately 40 percent of the IMGs practicing in the United States (AMA, 2002).

Exhibit 72. Distribution of IMGs by Country of Graduation



Source: AMA (2002) fact sheet.

Minority physicians are under represented in academic medicine and relatively few hold senior positions. Palepu et al. (1998), in their study of medical school faculty, find statistically significant differences between minority and non-Hispanic White physicians in promotion rates and representation in senior positions. The authors report that controlling for tenure, White faculty are more likely to attain a senior position and are more likely to be tenured or on a tenured track than are minority physicians. While White faculty had more first-authored and total peer-reviewed publications than their minority colleagues, there were no differences in the types of research grants or the median number of grants held. In terms of academic productivity, all groups reported similar hours for a typical work week, although minority physicians in academic medicine spend more time in patient care and less time in research activities compared to their non-minority colleagues (Palepu et al., 2000). Controlling for differences in productivity, the authors still find that minority faculty are less likely to be promoted to associate or full professor positions as compared to non-Hispanic white faculty. Black faculty are significantly less likely than White faculty to hold a senior position. Hispanic and Asian faculty are also less likely than their non-Hispanic White colleagues to hold a senior position, but this difference is not statistically significant. Some have argued that increasing the number of minority physicians in higher levels of academic medicine provides role models that can help to recruit more minorities into the medical profession.

The percent of physicians who are either Black or Hispanic differs significantly by specialty. AMA (2004) reports that although Blacks constituted 4 percent of the physician workforce in 2002 (for those physicians who report race and ethnicity), Blacks had greater representation in general preventive medicine (8 percent), obstetrics/gynecology (7 percent) and public health (5 percent). Blacks had lower representation in specialties such as medical genetics (2 percent), radiation oncology (2 percent) and allergy and immunology (2 percent). Similarly, Hispanics constituted 5 percent of the physician workforce in 2002, but Hispanics had greater representation in general and family practice (11 percent), child psychiatry (7 percent) and pediatrics (7 percent). Hispanics had lower representation in orthopedic surgery (2 percent), radiology (3 percent), and dermatology (3 percent).

There exists a paucity of research on the specialty choice of minority physicians and the reasons why minority representation differs substantially by specialty. One possibility is that minority physicians have a greater propensity to choose primary care specialties that are in high demand in largely minority, rural and inner-city areas that are Federally designated as health professional shortage areas (HPSAs). Studies have found that minority physicians have a greater propensity than do White, non-Hispanic physicians to practice in HPSAs and to serve uninsured and Medicaid patients.

- Komaromy et al. (1996), in a study investigating the association between physician supply and the demographics of 394 communities in California, found an inverse relationship between the concentration of Blacks and Hispanics and the number of physicians per population. In urban areas, a 10 percent increase in the proportion of residents who are Black is associated with an 8.9 decrease in the number of primary care physicians per 100,000 residents. This inverse relationship is also present in rural communities.

- Keith et al. (1985) also find that new, minority physicians are more likely to practice in Federally designated HPSAs than are non-Hispanic Whites (11.6 percent versus 6.1 percent of new physicians). Furthermore, among those who were Black and Hispanic, physicians generally practiced in areas with relatively high proportions of their own race and ethnic group. In fact, Black physicians practiced in areas where the mean percentage of black residents was four times as high as in areas where other physicians practiced ($P < .001$) and Hispanic physicians practiced in areas where the mean percentage of Hispanic residents was considerably higher than in areas where non-Hispanic physicians practiced ($P < .001$).

- Moy and Bartman (1995) find that minority physicians are more likely than are non-minority physicians to provide care to Medicaid beneficiaries. This finding is consistent with those of Komaromy et al. who find that Medicaid beneficiaries accounted for 45 percent of patients of Black physicians, 30 percent of patients of Asian physicians, 24 percent of patients of Hispanic physicians, and 18 percent of the patients of non-Hispanic White physicians. Hispanic physicians had the highest percentage of patients who were uninsured compared to physicians of other racial/ethnic groups. Moy and Bartman find that medically indigent patients are between 1.4 and 2.6 times more likely to receive care from non-White physicians than are affluent patients.

Thus, increasing minority representation in medical schools could help to reduce geographic imbalances in physician supply and, in particular, could improve supply in areas with large, vulnerable populations.

B. Minority Patients and Demand for Physician Services

Demand for health care services by minorities is increasing as the population of minorities grow and become a higher percentage of the U.S. population. Between 2000 and 2020, the percentage of total patient care hours physicians spend with minority patients will rise from approximately 31 percent to 40 percent (BHPr, 2003).

Because age distribution and health care utilization patterns differ substantially by race and ethnicity, there is substantial variation across physician specialties in the percent of total patient care hours spent serving minority patients (BHPr, 2003). For example, in 2000 an estimated 13 percent of total patient care hours were spent providing care to Black patients (Exhibit 73). Black patients' percent of total patient care hours was highest in emergency medicine (38 percent), obstetrics/gynecology (17 percent) and pediatrics (16 percent). The percent of total patient care hours spent providing care to Black patients was lowest in the surgical specialties.

The percentage of total physician time spent caring for Hispanic and other non-Black minority patients in 2000 was 21 percent. The proportion of patient care hours provided to non-Black minority patients was highest for radiology (31 percent), pathology (29 percent) and pediatrics (23 percent), and lowest for urology (11 percent), ophthalmology (11 percent) and general and family practice (13 percent).

Research suggests that there is a strong tendency for minority patients to use minority physicians as their usual care providers. What is not clear is whether this is a supply or demand phenomenon. In a study investigating the relationship between physician race and the care of minority and medically indigent patients, Moy and Bartman (1995) determined that more than a third of minority patients are treated by minority physicians. Only 11 percent of non-Hispanic, White patients are treated by minority physicians. The authors also find that minority physicians, in particular Asian and Black physicians, are more likely to care for patients outside their own minority group than are non-Hispanic, White physicians.

Much attention has been paid to the issue of culturally competent care, which argues that more effective care is provided when clinicians and patients have similar cultural backgrounds and speak the same language. To the extent that minority physicians provide more culturally competent care than do non-minority physicians, or that patients prefer to receive care from physicians of similar race or ethnicity, significant increases in the number of minority physicians—and in particular Black and Hispanic physicians—are needed to meet the growth in demand for physician services by minority populations.

Exhibit 73. Estimated Percentage of Patient Care Hours, by Race of Patient

Physician Specialty	2000			2020[a]		
	Non-Hispanic White	Non-Hispanic Black	Hispanic and All Other	Non-Hispanic White	Non-Hispanic Black	Hispanic and All Other
Total Patient Care Physicians	**69**	**13**	**18**	**60**	**14**	**26**
General Primary Care	**72**	**13**	**15**	**63**	**14**	**24**
GP & FP	78	10	13	69	11	20
General Internal Med.	72	14	14	63	15	23
Pediatrics	61	16	23	51	17	32
Medical Specialties	**71**	**13**	**16**	**62**	**13**	**25**
IM Subspecialties	71	13	16	62	13	25
Cardiovascular Diseases	73	11	15	64	12	24
Other Medical Specialties	70	13	17	60	13	26
Surgery	**71**	**12**	**17**	**62**	**12**	**26**
General Surgery	70	9	22	59	9	32
Obstetrics/Gynecology	66	17	17	57	18	25
Otolaryngology	75	11	14	67	12	21
Orthopedic Surgery	72	11	17	62	11	27
Urology	78	11	11	71	12	17
Ophthalmology	78	10	11	71	11	18
Other Surgical Specialties	73	8	19	62	8	30
Other Patient Care	**64**	**15**	**21**	**53**	**15**	**32**
Psychiatry	73	11	16	62	11	26
Anesthesiology	66	14	21	56	13	31
Emergency Medicine	47	38	16	39	39	22
Radiology	56	14	31	45	12	43
Pathology	60	11	29	48	10	42
Other Specialties	67	13	20	57	13	30
Total U.S. Population	**69**	**12**	**19**	**61**	**13**	**26**

Source: BHPr (2003). [a] These projections assume that per capita utilization patterns remain constant over time, although utilization patterns can differ by patient age, sex, and race/ethnicity. Note: percentages might not sum to 100 percent due to rounding.

VIII. CONCLUSIONS

A. Summary

An adequate supply of physicians is needed to help ensure access to affordable, quality care. Over the past 70 years since the Committee on the Costs of Medical Care (CCMC, 1933) conducted the first major scientific study of the adequacy of physician supply in the United States, the approach to modeling physician supply and demand has evolved to reflect improvements in our understanding of the determinants of physician supply and demand, improved data collection, and improved analytical techniques. Still, workforce modeling remains as much art as it is science. As stated by Uwe Reinhardt (2002): it is a "daunting enterprise…to estimate the physician surplus or shortage one or two decades into the future. Any of the variables in the equation can change over time, sometimes in unforeseen ways (p. 196)." This is especially true when projecting demand for physician services, where there is much uncertainty regarding the characteristics of the future health care system.

> ***[It is a] daunting enterprise…to estimate the physician surplus or shortage one or two decades into the future. Any of the variables in the equation can change over time, sometimes in unforeseen ways.***
>
> Uwe Reinhardt (2002, p. 196)

While there is generally consensus with physician supply projections, physician requirements projections are often controversial. The lack of consensus on requirements projections reflects differences in assumptions about the major determinants of demand for physician services, incomplete information on future trends in health care utilization and delivery of services, different but valid approaches to modeling future requirements, and philosophical differences on the definition and purpose of requirements projections.

> ***Models are not intended to capture every complexity of behavior; instead, they are created to strip away random and idiosyncratic factors so that we can focus on general principles.***
>
> Ehrenberg and Smith (1991, p. 5)

HRSA's Physician Supply Model and Physician Requirements Model, like all models, are simplified versions of a complex health care system that generalizes the millions of decisions made by physicians, patients, insurers, and other entities into probabilities that certain events will occur based on historical patterns of behavior. As stated by Ehrenberg and Smith (1991, p. 5), "models are not intended to capture every complexity of behavior; instead, they are created to strip away random and idiosyncratic factors so that we can focus on general principles." The PSM and PRM attempt to capture these major factors as identified based on theory, a review of the literature, and original analysis. The major trends with implications for the physician workforce include:

- **Changing demographics**. The U.S. population is growing, aging and becoming more racially and ethnically diverse. The physician workforce is also aging, and women constitute a growing proportion of physicians.

- **Rising cost of government programs for the elderly**. The aging population will place increasing cost pressure on State and Federal government retirement plans and social programs that serve the elderly (e.g., Medicare, Medicaid, and Social Security).

- **Increased cost consciousness**. Rising health care costs is spurring efforts by insurers to find new ways to contain costs.

- **Economic growth**. Increased prosperity has the potential to increase public expectations and demand for physician services.

- **Proliferation of health care specialties—including nonphysician clinicians**. The past few decades have seen a proliferation of health care specialties—both within the physician community and among NPCs—which both increases competition among health care providers but also provides patients with a broader range of health care services.

- **Scientific and technological advances.** Technological breakthroughs continue to change both demand for health care services and the way in which services are delivered.

For this study we computed a range of supply and requirements projections for scenarios reflecting different assumptions about the future health care system, the evolving role of physicians, and trends in other supply and demand determinants. The baseline projections assume that over the next 1 to 2 decades things will continue largely as they are. The Nation will continue to graduate a slightly growing number of new physicians, health care utilization and practice patterns will reflect current patterns, and the main driver of changing demand for physician services is the growth and aging of the population. Alternative supply and demand scenarios model the sensitivity of projections to these assumptions, as well as reflect differences in the literature on the main determinants of physician supply and demand.

The baseline projections suggest that overall demand for physician services is growing faster than supply. Without a modest increase in number of new graduates from U.S. medical schools, the Nation cannot continue to provide the same level of health care unless the health care system becomes more efficient at delivering care traditionally provided by physicians; reduces demand for physician services through improved science, technology, or use of other inputs to care; or becomes more dependent on foreign-trained physicians.

B. Policy Implications

The Federal Government, as a major player in the health care system via its role as health care insurer, subsidizer of physician training, and role to improve access to care to underserved populations has often exerted its influence in an attempt to create a coherent national workforce policy and to improve access to affordable, quality health care.

The modest but growing projected shortfall of physicians could impede national health care goals, if left unchecked, by contributing to greater geographic disparities in physician supply. For several decades the United States has been a net importer of medical school graduates. A growing demand for physicians that exceeds production from U.S. medical schools could make the Nation even more reliant on international medical schools, and this at a time when other nations face greater health workforce inadequacies.

As the population ages and places greater pressures on the health care system, economic realities will require some form of cost containment. Because physicians directly account for an estimated 20 percent of health care expenditures and indirectly account for the majority of health care spending, any attempt to control health care costs will directly affect physicians.

C. Areas for Future Research

Although the physician workforce literature continues to grow, there is still a need for additional research on the relationship between physician supply and its determinants, and between physician requirements and its determinants. Lack of data continues to be a major hindrance to conducting research on physician behavior and how practice patterns change over time and in response to changes in the health care operating environment. The high cost to collect such data in a timely and consistent manner requires collaboration on the part of payers, provider associations, researchers, and Federal and State stakeholders.

The health care system continues to evolve as does the role of physicians. Because of the long length of time needed to train physicians and to change the education infrastructure, policymakers, educators, physicians, and other stakeholders need to know at least a decade in advance how changes in the health care system and other trends will affect the adequacy of physician supply. Physician supply and demand projections should be updated every few years to reflect the latest trends and to provide this advance warning of changes in the adequacy of physician supply.

Finally, it should be remembered that the physician workforce is only one part of an increasingly complex health care system in which the final goal is a healthier society. The link between number and type of physicians, as well as the content of their education, and the health status of the populations they serve has yet to be completely understood. Further investigation regarding the impact of the physician workforce on health will better inform workforce planning.

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