Physician Supply and Demand: Projections to 2020

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Background

The United States continues to debate the adequacy of the current and future supply of physicians. While the general consensus is that overall physician supply per capita will remain relatively stable over the next 15 years, there is less agreement on future demand for physician services. This paper presents projections of physician supply and requirements for 18 physician specialties using the Physician Supply Model (PSM) and the Physician Requirements Model (PRM) developed by the Health Resources and Services Administration (HRSA). In this paper, we describe the data, assumptions and methods used to project the future supply of and requirements for physician services; we present projections from these models under alternative scenarios; and we discuss the implications of these projections for the future adequacy of physician supply.

Accurate projections of physician supply and requirements help preserve a physician supply that is balanced with demand and help the Nation achieve its goal of ensuring access to high-quality, cost-effective healthcare. The length of time needed to train physicians, as well as the time needed to change the Nation's training infrastructure, suggests that we must know at least a decade in advance of major shifts in physician supply or requirements. The U.S. Government Accountability Office noted in their February 2006 report "*Health Professions Education Programs – Action Still Needed to Measure Impact*," that regular reassessment of future health workforce supply and demand is key to setting policies as the Nation's health care needs change.

Past projections of impending physician shortages and surpluses have influenced policies and programs that, in turn, helped determine the number and specialty composition of physicians being trained. During the 1950s and 1960s, projections of a growing physician shortage helped motivate an expansion of the Nation's medical schools, an increase in government funding for medical education, and the creation of policies and programs that encouraged immigration of foreign-trained physicians. Efforts to increase the physician supply proved so successful that, by the late 1970s, many predicted a growing oversupply of physicians (GMENAC, 1981).

Rising healthcare costs paved the way for managed care and its promises to improve the efficiency of the healthcare system. Enrollment in health maintenance organizations (HMOs) during the 1980s and 1990s prompted reexamination of physician supply adequacy. The greater reliance of HMOs on the use of generalists and the prediction of decreased use of specialist services under managed care led to projections that the United States would have a large surplus of specialists (e.g., COGME, 1992, 1994; Weiner, 1994; IOM, 1996). However, the perceived limitations of the more restrictive forms of managed care prompted a public backlash against many of the forces predicted to decrease healthcare use. Also, some researchers have argued that physician projections that relied heavily on HMO staffing patterns underestimated physician requirements by failing to adequately control for out-of-plan care (Hart et al., 1997) and systematic differences in the health status of the population enrolled in HMOs and the population receiving care under a traditional fee-for-service arrangement.

Cooper et al. (2002) contributed to another round of discussions regarding the adequacy of the future supply of physicians projecting a significant shortage of physicians—particularly specialists—over the foreseeable future. Other researchers have expressed concerns with the assumptions and conclusions used by Cooper et al. (Barer, 2002; Grumbach, 2002; Reinhardt, 2002; Weiner, 2002), but a growing consensus is that over the next 15 years, requirements for physician services will grow faster than supply—especially for specialist services and specialties that predominately serve the elderly. COGME joined the debate using preliminary projections from BHPr's PSM and PRM, adjusted for COGME's assumptions regarding the effects of key determinants of supply and requirements, projecting a modest shortfall of physicians by 2020. These projections helped influence the Association of American Medical Colleges (AAMC) decision to encourage growth in the Nation's medical school training capacity by approximately 15 percent (or 3,000 physicians per year). The primary contributions of our study are (1) projections of overall physician supply and requirements to inform the debate on the Nation's medical school capacity, and (2) specialty-specific projections of physician supply and requirements under alternative scenarios.

ACKNOWLEDGEMENTS

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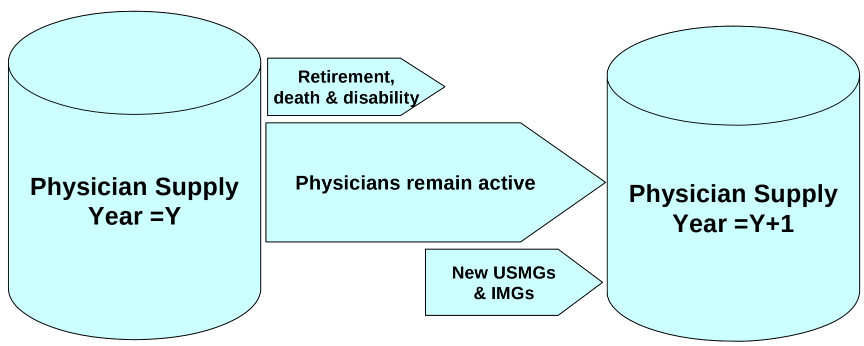
Physician Supply Model

BHPr's Physician Supply Model produces national projections of physician supply for 36 medical specialties through 2020, which are aggregated into 18 specialties for comparison to the PRM projections. The PSM is an inventory model that tracks the supply of physicians by age, sex, country of medical education (whether United States medical graduates [USMG] or international medical graduates [IMG]), type of degree (i.e., Medical Doctor [MD] or Doctor of Osteopathy [DO]),[2] medical specialty, and primary activity (e.g., patient care or non-patient care).

Exhibit 1. Overview of the Physician Supply Model



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),
- Number of new USMGs and IMGs, and
- Attrition due to retirement, death and disability.

The PSM produces two measures of physician supply: (1) the number of active physicians and (2) the number of full-time equivalent (FTE) physicians. One FTE is defined as the average annual hours worked in patient care per physician in 2000, and these estimates vary by specialty. Women and older physicians historically have worked fewer patient care hours, on average, compared to male and younger physicians, and because a growing proportion of the physician workforce is female and older the FTE supply of physicians is growing slightly slower than the number of active physicians. Below, we describe the major components of the PSM and our findings.

[2] The education, training, credentialing, and licensing of MDs and 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.

Current Physician Workforce

The starting point for projecting physician supply is estimating the size and characteristics of the current physician workforce. The primary sources for this information are the American Medical Association (AMA) and the American Osteopathic Association (AOA). As of the base year (2000), an estimated 756,000[3] active physicians under age 75 were practicing in the United States. Approximately 95 percent are MDs and 5 percent are DOs. PSM projections suggest that the current number of active physicians under age 75 (as of 2005) is approximately 817,500. Slightly over one third are generalists (family practice, general pediatrics or general internal medicine); the remaining two thirds are specialists (Exhibit 2).

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

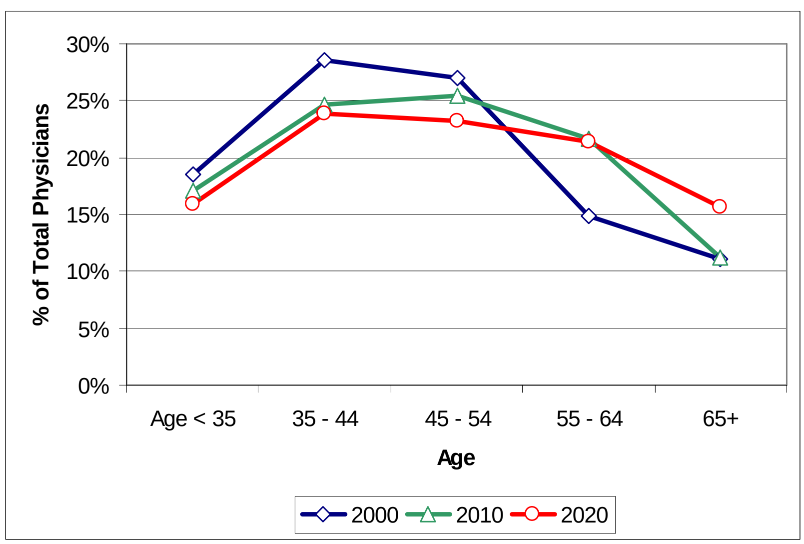
Specialty	MDs	DOs	Total
Primary Care	271,400	34,700	306,100
Non-Primary Care	491,800	19,600	511,400
Total	**763,200**	**54,300**	**817,500**

Source: Projections from the BHPr Physician Supply Model.

Physician demographics have important supply implications. Physician age is correlated with retirement probability and annual hours worked, and a growing proportion of physicians are nearing historical retirement age as illustrated by the shifting physician age distribution (Exhibit 3).

Currently, one in four physicians is female, but two factors are contributing to a rise in female representation. First, during the past three decades the proportion of new medical graduates who are female has risen from 10 percent to close to 50 percent. Second, the growth in female representation is a relatively recent phenomenon, and it is predominantly male physicians who are nearing retirement age. Although one in three active male physicians is age 55 or older, only one in eight active female physicians is age 55 or older.

Exhibit 3. Age Distribution of Physician Workforce under Age 75, 2000 to 2020



Source: Physician Supply Model.

Because work and retirement patterns differ systematically for male and female physicians, the increasing proportion of physicians who are female

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

has profound implications for the overall supply of physician services. Female physicians are more likely than their male counterparts to choose non-surgical specialties and to spend fewer hours per year providing patient care. They are also less likely to work in rural areas, and they tend to retire slightly earlier.

The PSM also tracks primary activity (patient care or other). An estimated 94 percent of active physicians are engaged primarily in patient care activities, while the remaining 6 percent are engaged primarily in non-patient care activities such as administration, teaching, research, and others.

New Entrants and Choice of Medical Specialty

Almost 24,000 physicians complete their training through programs of graduate medical education (GME) each year. Before completing residencies and fellowships, new physicians must earn a four-year college degree and complete four years of medical education. Four out of five physicians completing GME are graduates of United States medical schools. Most are graduates of schools of allopathic medicine, which annually graduate approximately 15,000 to 16,000 MDs. This number has been relatively stable since 1980, and the baseline projections assume that the U.S. will continue to graduate approximately 16,000 MDs per year through 2020. Schools of osteopathic medicine graduate approximately 3,000 DOs per year, and the baseline supply projections assume that this number will steadily increase to approximately 4,000 per year over the next decade.

Over 5,000 IMGs are accepted into United States GME programs each year. An increasing percentage of IMGs are citizens or permanent residents (US IMG) who graduated from medical schools in other countries. Foreign IMGs under enter the United States for GME under the temporary work (H) or training (J) visa programs. Foreign IMGs with a J visa can participate in the J-1 Visa Waiver Program, which allows physicians to remain in the United States, if they agree to provide primary care services in federally-designated health professional shortage areas (HPSAs) for a minimum of three years after completing their residency. The PSM projects the number of IMGs who will remain in the United States based on historical patterns that vary by specialty.

The PSM models specialty choice based on the number of medical graduates entering different GME residency programs, historical trends of specialization as estimated through an analysis of the AMA Masterfile data, and data from the AAMC medical school Graduation Questionnaire. A more complete description of the specialty allocation is provided in other reports (e.g., Altarum, 2000). Specialty choice varies substantially by gender and by whether students are USMGs or IMGs. Among USMGs, for example, female physicians are three times more likely to become pediatricians than are male physicians.

Separations from the Physician Workforce

Physicians leave the workforce through retirement, mortality, disability, and career change. An accurate estimate of separation rates is crucial for projecting physician supply when a large number of physicians are approaching retirement. The PSM combines estimates of physician retirement rates with mortality rates for college 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 and sex will remain active in the workforce from year to year.

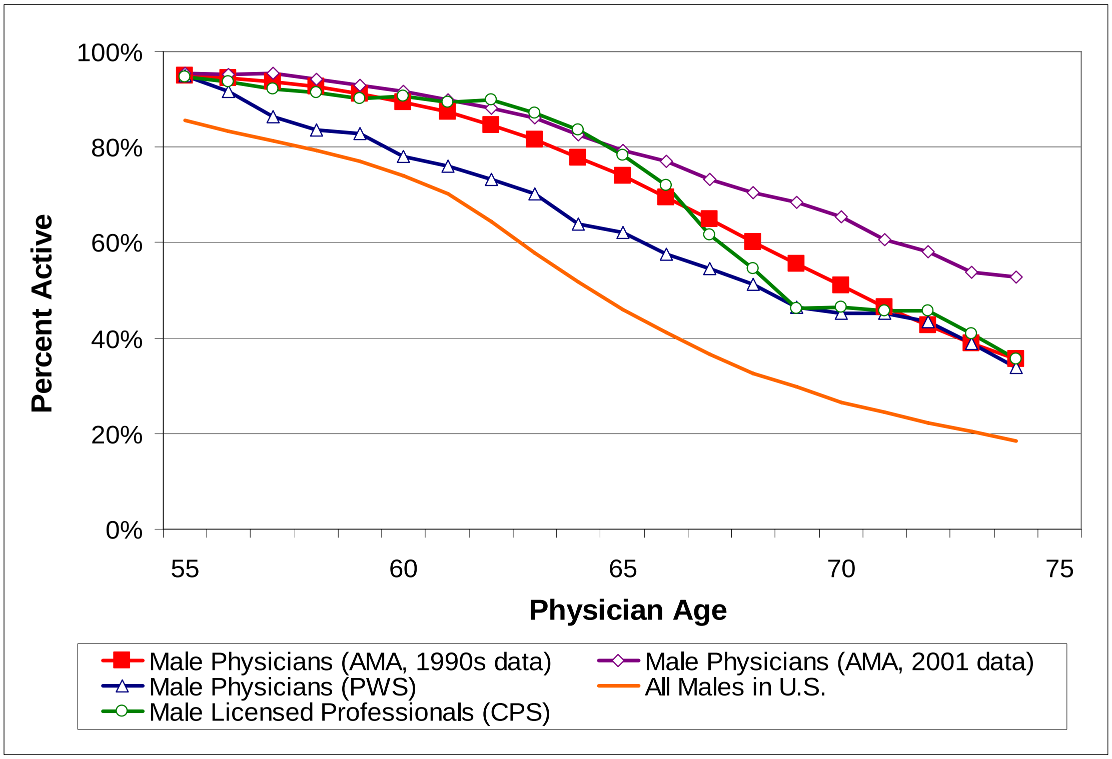
Concerns that the current AMA Masterfile overstates the likelihood that older physicians are still active prompted consideration of two alternative sources of retirement rates: the Physician Worklife Survey (PWS)[4] and the Current Population Survey (CPS)[5]. Retirement rates estimated with AMA Masterfile data from the early to mid 1990s were found to be relatively consistent with rates estimated with PWS and CPS data. We use the AMA-based retirement rates in the PSM (Exhibit 4). We obtained much lower retirement rates when using more recent data from AMA, and concluded that the process AMA currently uses to update its records results in a lag 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. For our projections, we assume that that all physicians retire by age 75.

The data suggest that physicians continue working to an older age than do people in other professions. Other analyses not presented here find that female physicians retire slightly earlier than do male physicians.

[4] The PWS was conducted by The Sheps Center at the University of North Carolina on behalf of BHPr's National Center for Health Workforce Analysis. Estimates of physician retirement rates were obtained via personal correspondence with Bob Konrad, principal investigator for the PWS.

[5] The CPW combines physicians, lawyers, accountants, architects, and other licensed professionals into an occupation entitled *licensed professionals*, and we estimate retirement rates for this group as a proxy for physician retirement patterns.

Exhibit 4. Percent of Physicians Active in the Workforce, by Physician Age



Anecdotal evidence and economic theory suggest that retirement patterns will fluctuate due to changes in economic factors and physicians' overall satisfaction with the healthcare operating environment. For example, recent declines in the wealth of physicians due to adverse economic conditions and a decline in practice valuation might delay retirement plans for some physicians. For modeling purposes, we focus on long-term trends that affect retirement patterns (e.g., the increasing number of women in the physician workforce) rather than factors that cause short-term fluctuations in retirement patterns.

Trends in Physician Productivity

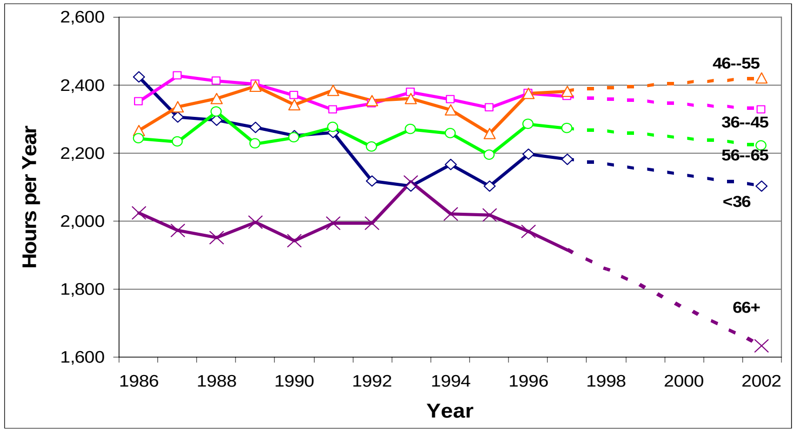
Trends in physician productivity are important to consider when projecting supply of physician services. If physicians are more (or less) productive in future years, then more (or less) services can be provided with any given number of active physicians. Measures of physician productivity in the literature include the following:

- **Hours spent providing patient care.** Projected changes over time in average hours worked are incorporated into the PSM. Our analysis of AMA's 1998 Socioeconomic Monitoring System (SMS) file finds that female physicians tend to work approximately 15 percent less time in patient care than do their male counterparts after controlling for age, specialty, and IMG status. Physicians over age 65 and under age 36 work fewer hours per year than their middle-aged colleagues, and over time average hours in direct patient care for these two groups has been declining (Exhibit 5). Part of the decline for the younger group reflects a growing proportion of women in the workforce.

- **Number of patients seen.** Changes in the use of non-physician clinicians (NPC) and other health workers, technological advances, epidemiological trends, amount of time spent with patients per visit, and changes in the healthcare operating environment could all affect the average number of patients seen per physician during a given period of time. AMA publications show that the average number of patient visits declined during the 1990s (Exhibit 6) due mainly to a decline in hospital round visits (Exhibit 7), with office visits per physician remaining relatively constant (Exhibit 8). Unfortunately, these statistics are no longer collected by AMA.
- **Resource-Based Relative Value Scale.** A set of codes developed by the Center for Medicare and Medicaid Services (CMS), the Resource-Based Relative Value Scale (RBRVS), helps determine the Medicare fee schedule. (Many private insurers also use a form of the RBRVS). The RBRVS has three cost components, one of which is the Relative Value Unit (RVU) that measures physician work as a function of both the time and skill necessary to provide a particular service. More complex and time consuming services have higher RVUs. Data from the Medical Group Management Association (MGMA) cost survey suggest that between 1998 and 2002 the median annual work RVUs per physician were either constant or possibly increasing slightly (Exhibit 9). For example, during this period 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 four-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 10). Between 1996 and 2002, the number of support staff per FTE physician in multi-specialty practices increased 1.4 percent annually. The annual growth rate for family practice groups over this six-year period was 1.2 percent. To capture these trends in greater physician productivity, for our sensitivity analysis, we project a physician supply scenario under the assumption that productivity will increase by 1 percent annually.[6]

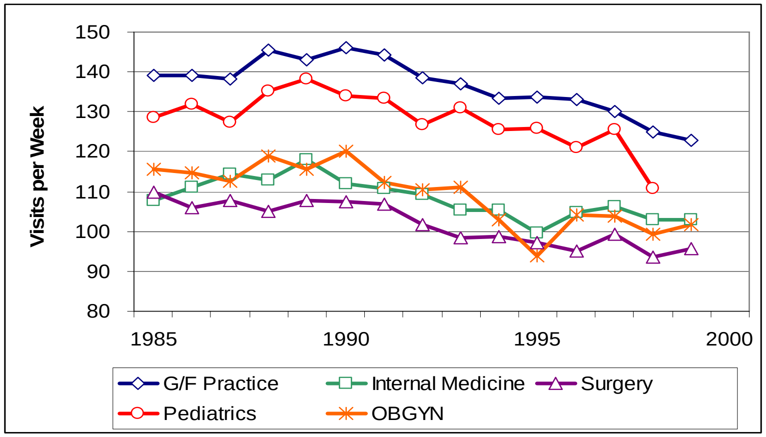
[6] The Congressional Budget Office (CBO) projects a 3% annual growth rate in real Gross Domestic Product (GDP) between 2003 to 2013, which is about 2% average annual growth in real GDP per capita. Real economic growth, controlling for changing demographics, occurs through an increase in productivity.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

Exhibit 5. Trends in Annual Hours Worked



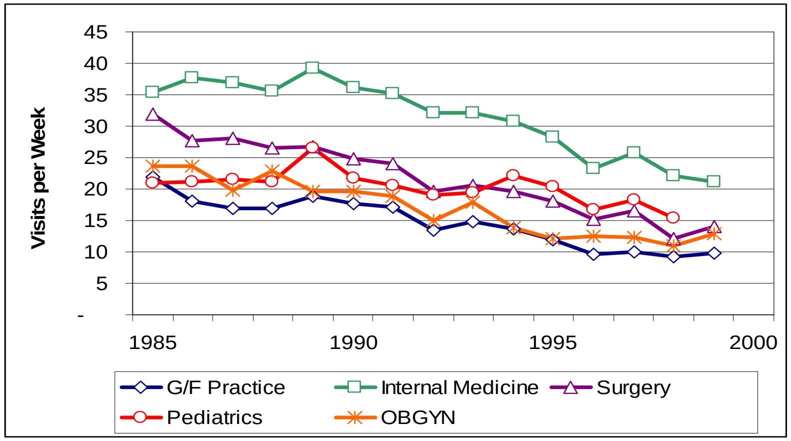
Source: AMA Physician Socioeconomic Statistics, various years; 2002 estimates from BHPr.

Exhibit 6. Average Total Visits per Week



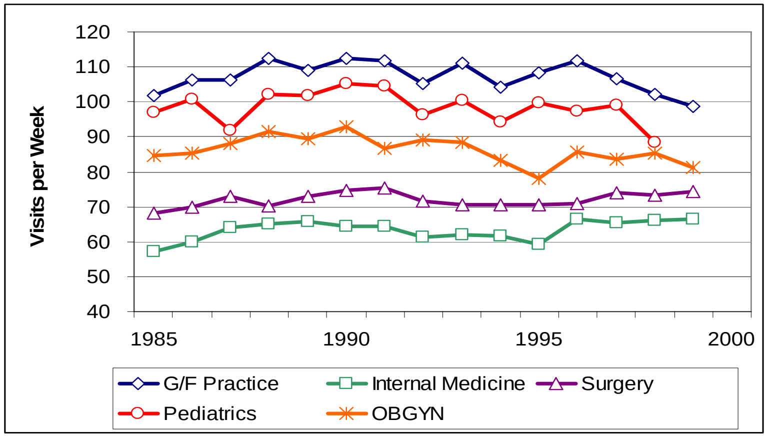
Source: AMA Physician Socioeconomic Statistics, various years.

Exhibit 7. Average Hospital Round Visits per Week



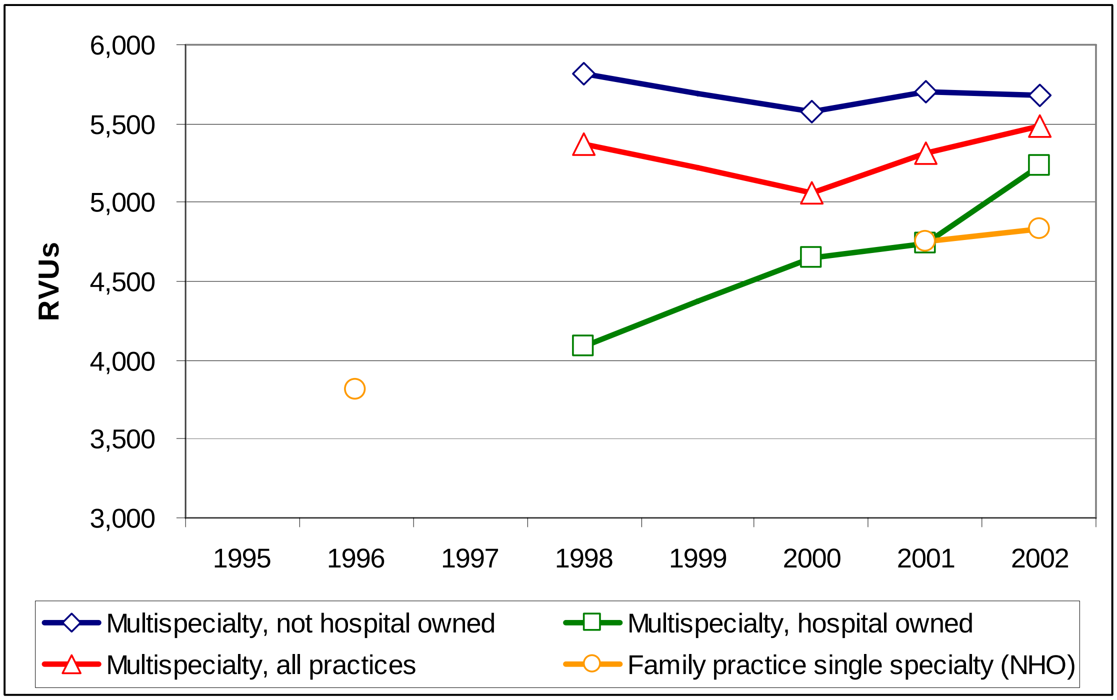
Source: AMA Physician Socioeconomic Statistics, various years.

Exhibit 8. Average Office Visits per Week



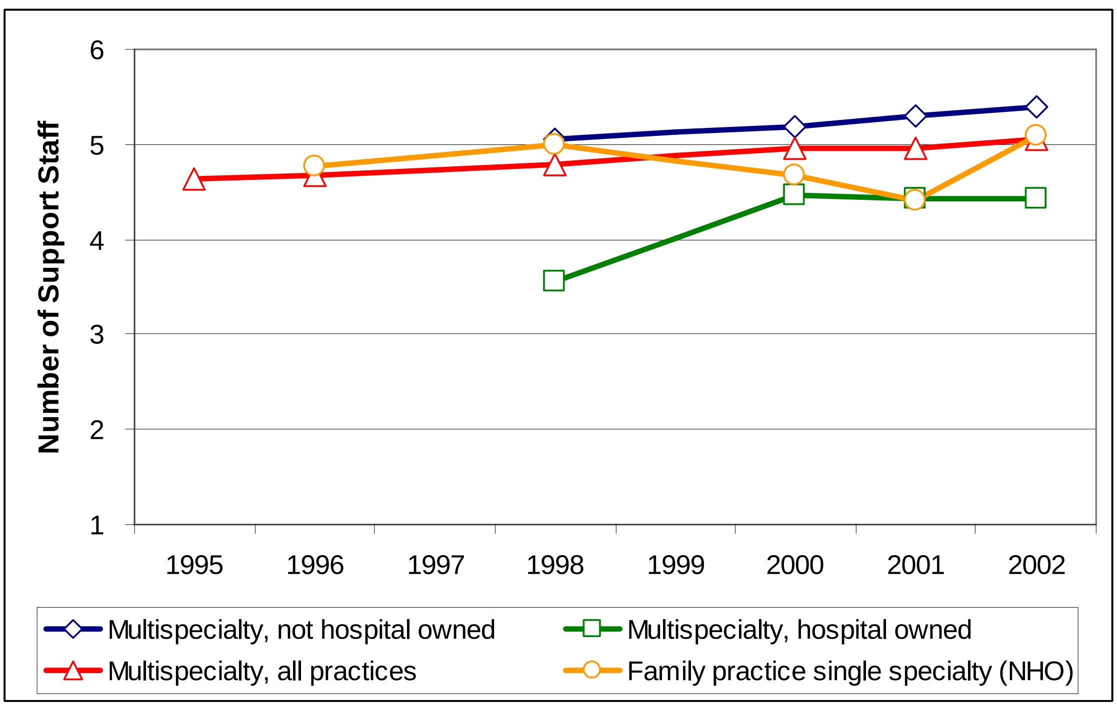
Source: AMA Physician Socioeconomic Statistics, various years.

Exhibit 9. Physician Work RVUs per FTE Physician



Source: MGMA Cost Survey, various years.

Exhibit 10. Total Support Staff per FTE Physician



Source: MGMA Cost Survey, various years.

Physician Supply Projections

The baseline projections of physician supply assume that current patterns of new graduates, specialty choice, and practice behavior continue.[7] 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 is projected to grow to approximately 951,700 by 2020 if current trends continue (Exhibit 11).

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.[8] The estimated number of physicians in clinical practice (which excludes residents and physicians primarily in non-patient care activities, increases from approximately 635,800 in 2005 to 719,800 by 2020 (Exhibit 12). FTE supply of physicians engaged primarily in patient care activities (including residents) grew from approximately 714,000 in 2000 to approximately 764,000 by 2005 (Exhibits 13, 14, and 15). Although total physicians engaged primarily in patient care grew by approximately 56,000 between 2000 and 2005, the estimated 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. By 2020, FTE physicians engaged primarily in patient care is projected to reach 866,000 (a 10 percent increase from current levels).

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; over 95 percent of these positions were 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.

The United States Census Bureau's middle series population projections suggest that the United States population will grow by approximately 14 percent between 2005 and 2020, approximately

[7] More detailed supply projections are reported in *The Physician Workforce: Projections and Research into Current Issues Affecting Supply and Demand* (BHPr, 2006).

[8] To obtain hours worked per week by patient care specialty for the FTE conversion, we regressed the log of total hours worked per week (by post residency patient care MDs by specialty) on age variables, sex , and country of medical education (USMG,IMG) using 1998 data from the American Medical Association's Patient Care Physician Survey. The data contains estimates for 13 specialty categories: general/family practice, general internal medicine, medical subspecialties, general surgery, surgery subspecialties, general pediatrics, obstetrics/gynecology, radiology, psychiatry, anesthesiology, pathology, emergency medicine, and "other" specialties. Data for these specialties were mapped into the 37 specialties projected in the PSM. FTEs are defined to be equal to head counts in base year 2000, and thus for each specialty and physician type (USMG or IMG) the number of FTEs equals the head count in the base year. For each projection year, the number of physicians projected for each combination of physician type, specialty, sex and age is multiplied by the expected hours worked for the appropriate combination, and the sum of the products by specialty and physician type is divided by the baseline FTE definition in terms of hours worked per week for each specialty to produce projections of FTE physicians by year, physician type, and specialty.

the same rate as FTE physician supply, resulting in a relatively constant FTE patient care physician per 100,000 population ratio of approximately 259 (Exhibits 16 and 17).

Exhibit 11. 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%
Cardiology	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%

*Includes total active MDs and DOs. Physicians age 75 and older are excluded.

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

Exhibit 12. 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%

*Includes MD and DO office-based and hospital staff physicians. Excludes residents, and those in nonpatient care. Physicians age 75 and older are excluded.

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

Exhibit 13. FTE Supply of physicians in clinical practice, and residents*: 2000, Projected to 2020

Specialty	Base Year	Projected				Percent Change from
	2000	2005	2010	2015	2020	2005–2020
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%

*Includes MDs and DOs. Residents are not FTE-adjusted. Specialties are grouped to agree with those groupings shown in the projected requirements tables, Exhibits 30 and 32. Physicians age 75 and older are excluded.

Note: Totals might not equal sum of subtotals due to rounding. Specialties are aggregated to be comparable to the specialty categories from the Physician Requirements Model (see Exhibit 30).

Exhibit 14. Baseline FTE Physician Supply Projections

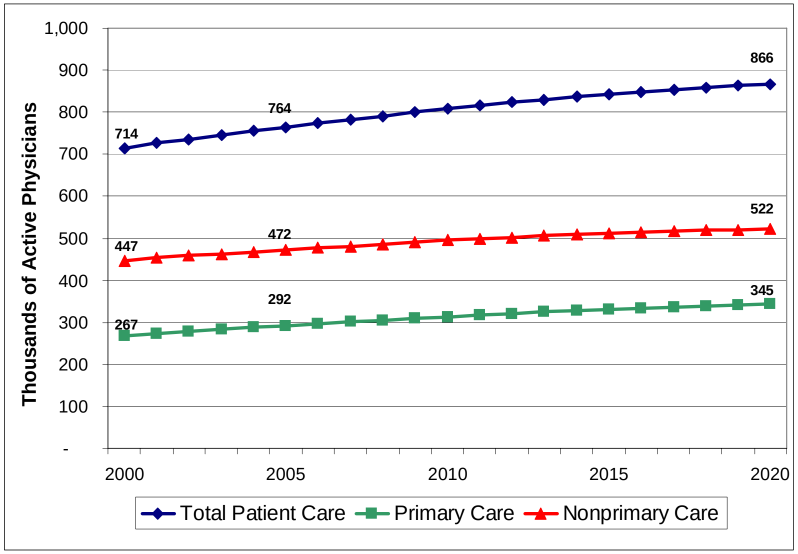


Exhibit 15. Percentage Growth in FTE Physician Supply

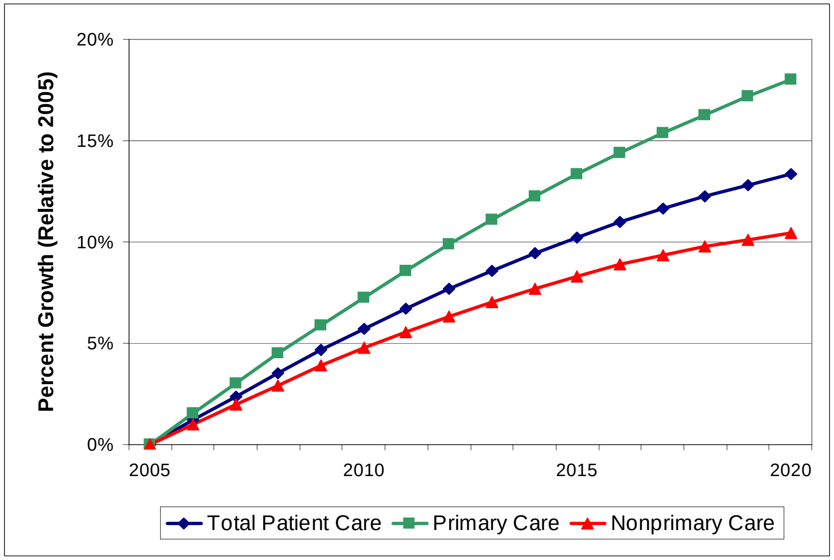


Exhibit 16. FTE Physicians per 100,000 Population

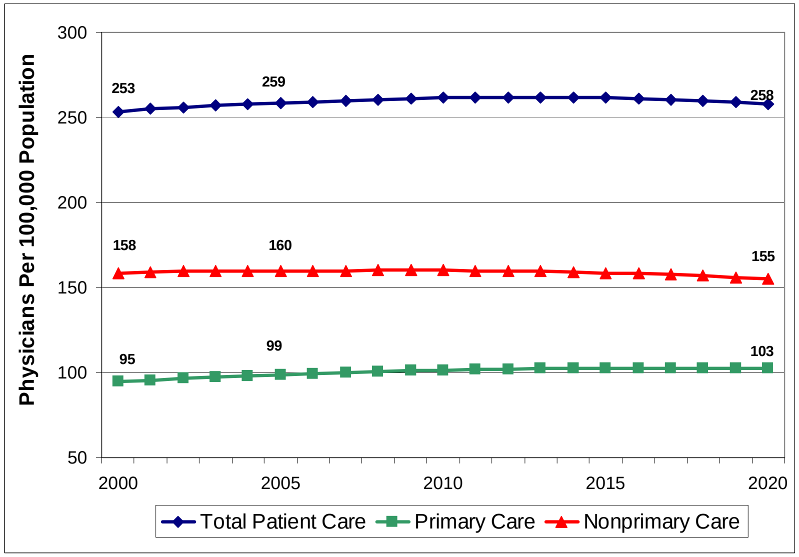
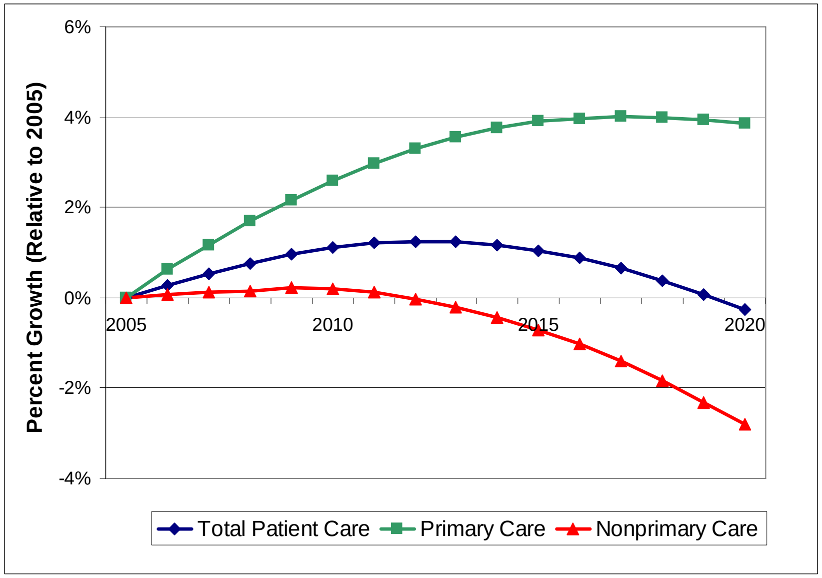
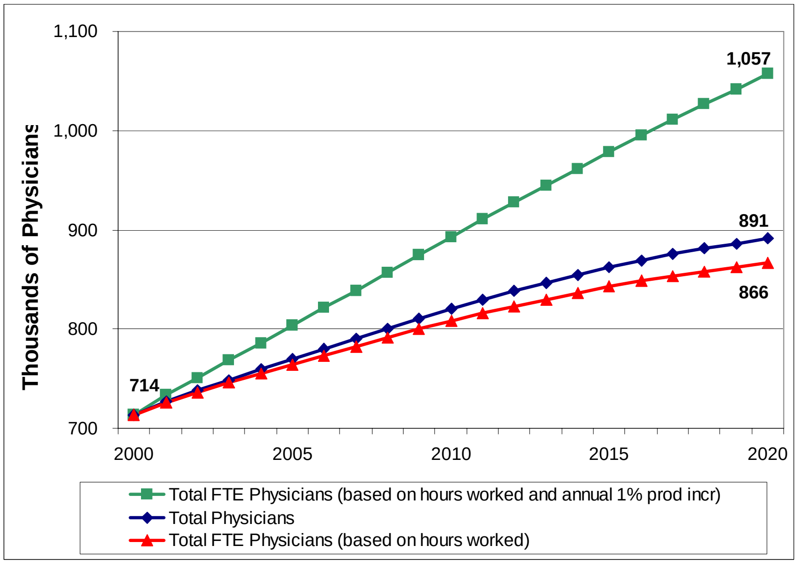


Exhibit 17. Percentage Growth in FTE Physicians per Capita



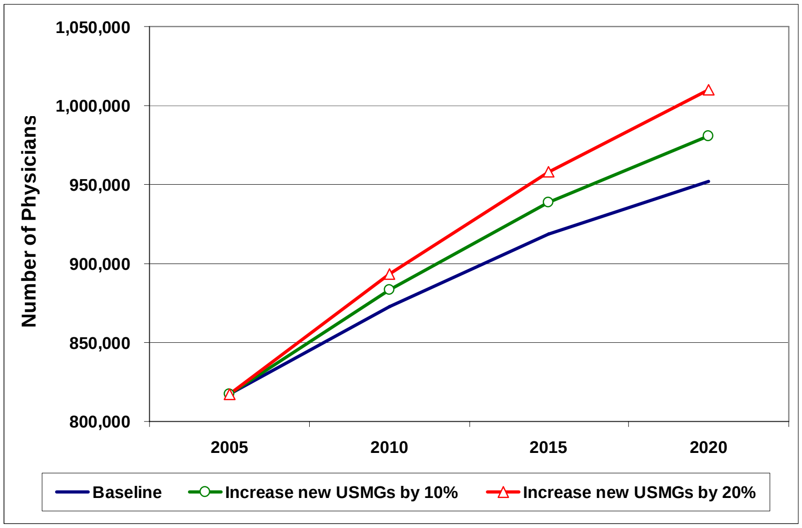
Total active, patient care physicians are projected to increase to 891,000 by 2020, but the number of FTE physicians is projected to increase to only 866,000 (Exhibit 18). Under the assumption that physician productivity increases by 1 percent annually (e.g., through improved training, technological advances, and increased use of other health professionals), by 2020 the actual physician supply would be equivalent to approximately 1,057,000 physicians (in comparison to year 2000 physicians).

Exhibit 18. Alternative Patient Care Supply Projections



The PSM can also be used to project supply under alternative United States medical school output scenarios. As shown in Exhibit 19, if medical schools could instantaneously increase the number of graduates by 10 to 20 percent, the impact on physician supply by 2020 would be approximately 30,000 to 60,000 additional physicians.

Exhibit 19. Increased Output from U.S. Medical Schools



While the future national supply of physicians is relatively straightforward to project in the aggregate, projections by medical specialty are more difficult to calculate because a large number of factors influence specialty choice. Furthermore, the number of medical school graduates has been relatively constant over the past two decades while the number of physicians choosing a particular specialty can vary substantially from year to year.

If specialty choice trends from the late 1990s and early 2000s continue, the number of FTE physicians in primary care specialties will grow approximately 18 percent between 2005 and 2020, compared to a growth rate of 10 percent for non-primary care physicians. There appears to have been a swing back towards specialization in the past few years, reflecting the dynamic nature of specialty choice.

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.

Physician Requirements Model

The PRM uses a utilization-based approach to estimate physician requirements.[9] The PRM projects requirements for 18 medical specialties through 2020 based on current use patterns of physician services and expected trends in United States 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 three major components of the model are:

(1) Population projections by age,[10] 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 20).

Exhibit 20. Overview of the Physician Demand Model

Population projections by age, sex, and metro/ non-metro	X	**Insurance distribution** by age, sex, and metro/ non-metro	X	**Physician-per-population ratios** by age, sex, metro/non-metro, insurance, and physician specialty	=	**Physician requirements** by population characteristics and physician specialty

[9] Alternative approaches described in the literature to estimate physician requirements include a needs-based approach and use of benchmarking (i.e., a specific form of the utilization-based approach). The needs-based approach defines physician requirements based on a clinical assessment of prevalence rates for medical problems and the amount of time physicians need per patient encounter. This approach has been criticized because it ignores the economic realities that influence use rates. The benchmarking approach was used extensively in the 1990s by applying HMO physician-to-enrollee estimates to the United States population under a scenario with projected growth in managed care enrollment.

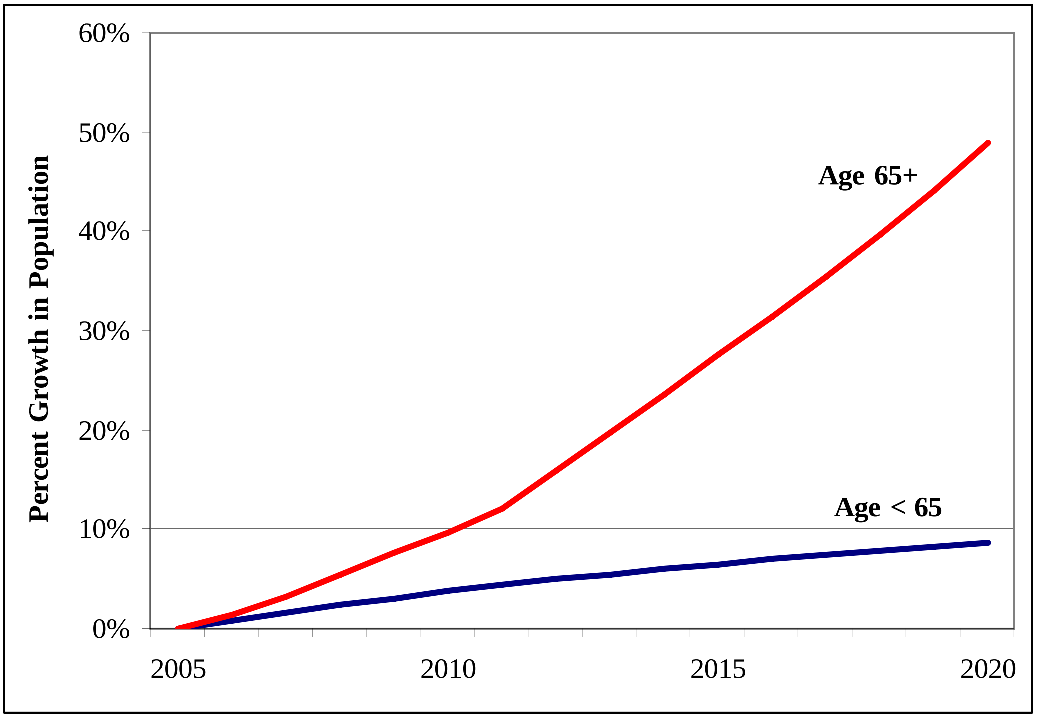
[10] The eight categories are ages 0–4, 5–17, 18–24, 25–44, 45–64, 65–74, 75–84, and 85 and older.

Below, we explore trends in major determinants of physician requirements as well as potential impact of alternative assumptions regarding these trends.

Growth and Aging of the Population

The United States Census Bureau projects a rapid increase in the elderly population beginning in 2012 when the leading edge of the baby boom generation approaches age 65 (Exhibit 21). Between 2005 and 2020, the population younger than age 65 is expected to grow by about 9 percent, while the population age 65 and older is projected to grow by about 50 percent.

Exhibit 21. Population Growth, 2000 to 2020



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

The elderly 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 (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 22). 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.[11] 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 22. 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.

Medical Insurance Trends

Insurance status and type are important determinants of use patterns. Insurance greatly reduces the marginal cost of obtaining physician services, and cost sharing (deductibles, coinsurance) and plan restrictiveness (managed indemnity versus closed network HMOs) can affect access to certain physician specialties and practice settings.

The PRM divides the United States population into four mutually exclusive insurance groups:[12]

(1) Insured under a fee-for-service arrangement;

(2) Insured in an exclusive network HMO (e.g., group-, staff-, network-, or mixed-model HMO);

(3) Insured under a different type of managed care plan (e.g., preferred provider organization [PPO], point of service [POS] organized as open-ended HMO, non-HMO POS, and other HMO/managed care plans); and

(4) Uninsured.

In the baseline scenario, we assume a constant insurance probability for each population group defined by age and sex using the year 2000 insurance distribution.

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

[12] For the three insured categories, the PRM further distinguishes between private health insurers and government-sponsored insurance plans for a total of seven insurance categories.

Based on use patterns determined through an analysis of the NIS, NHAMCS, NAMCS, NNHS and other sources, we estimated how per capita use of physician services compares under these four insurance types after controlling for population age and sex (Exhibit 23). For example, individuals in an exclusive network HMO use 86 percent as many anesthesiology services as individuals in a plan modeled after a traditional fee-for-service arrangement (controlling for age and sex). Individuals insured under other types of managed care plans and uninsured individuals use 98 percent and 29 percent as many anesthesiologist services, respectively, as individuals insured under the fee-for-service type plan.

Exhibit 23. Per Capita Use of Physician Services
(as a percentage of per capita use under an insured, fee-for-service arrangement)

Specialty	Exclusive Network HMO	All Other Managed Care	Uninsured
Anesthesiology	86	98	29
Cardiology	92	100	18
Emergency Medicine	41	47	78
General/Family Practice	87	99	60
General Internal Medicine	103	118	25
General Surgery	86	98	33
Obstetrics/Gynecology	83	95	30
Ophthalmology	100	100	67
Orthopedic Surgery	78	90	22
Other Internal Medicine Subspecialties	90	100	24
Other Specialties	59	68	32
Other Surgical Specialties	86	98	33
Otolaryngology	66	76	45
Pathology	86	98	27
Pediatrics	100	100	62
Psychiatry	65	75	100
Radiology	86	98	22
Urology	94	100	21

Economic Factors

Recently, Cooper et al. (2002) started another round of discussions regarding the adequacy of the future supply of physicians arguing that economic growth is the major determinant of growth in per capita demand for physician services and that continued economic growth will contribute to a significant shortage of physicians—and in particular specialists—over the next decade. Historically, economic growth per se has not been a component of the PRM, although the PRM models trends in insurance patterns that arguably capture some of the historical relationship between economic growth and demand for healthcare services. Below, we consider some arguments for and against including economic growth as a determinant of demand in the PRM.

Reasons why economic growth might increase physician requirements:

- **Theory.** Like most goods and services, healthcare is considered a "normal" good where individuals consume larger amounts as their ability to pay rises. At the household level, increased income allows individuals greater opportunities to obtain medical insurance and afford copays and deductibles. At the national level, economic growth allows governments and employers to expand and provide more generous medical insurance coverage.
- **Empirical correlation**. Time series and cross-sectional analyses using States and countries[13] as the unit of analysis find a positive correlation between the number of physicians per capita (a supply measure used as a proxy for demand) and economic wellbeing (measured as income per capita or GDP per capita). Cooper et al. operate on the assumption that historical rates of physicians per capita reflect per capita demand for physician services and estimate the relationship between physicians per capita and GDP per capita using annual data from 1929 to 2000. The authors conclude that each 10 percent increase in GDP per capita results in a 7.5 percent increase in demand for physician services (i.e., an *income elasticity* of 0.75). This income elasticity estimate is similar to that obtained by Cookson and Reilly (1994) and Koenig et al. (2003); however, all of these studies faced significant data limitations. Other researchers have questioned Cooper et al.'s approach, assumptions, and conclusions (e.g., Barer, 2002; Grumbach, 2002; Reinhardt, 2002; Weiner, 2002).

  We conducted preliminary analyses using cross-sectional data for States and countries and found income elasticity estimates approximately half the size of Cooper et al.'s estimates. This finding is consistent with an income elasticity estimate of 0.31 by Koenig et al. (2003) when they examined the relationship between income per capita and expenditures for physician services. The standard errors of our estimates are large, however.

Reasons why economic growth might fail to increase physician requirements:

- **Increased productivity**. Real per capita economic growth occurs through increased productivity. If physicians become more productive over time, their increased productivity will partially offset any increase in demand for physician services due to economic growth. If, for example, as Cooper et al. estimate, the income elasticity of demand for physician services is 0.75, then an increase in physician productivity that is at least 75 percent of the national average increase in productivity would exactly offset any effect of economic growth on demand for services, thus resulting in no change in physician requirements per capita.
- **Improved health**. Economic growth allows individuals and communities to live healthier lives. Examples include improved diet, improved access to preventive medicine, and increased support for public health initiatives that might, in turn, reduce physician requirements.
- **Counter-cyclical insurance patterns**. One explanation for a positive, causal correlation between economic wellbeing and physician requirements is that economic growth allows governments and employers to expand insurance coverage. Holahan and Pohl (2002) find, however, that changes in GDP per capita in the United States during the period 1994 to 2000

[13] Differences in healthcare systems make comparing use of physician services difficult. Also, measuring GDP and other measures of economic wellbeing across countries is an inexact science.

results in little change in the overall number of insured persons. Although 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 relationship between economic wellbeing and healthcare utilization is likely non-linear, with the correlation becoming weaker at higher income levels as a saturation point is reached. That individuals with greater income will respond by purchasing more routine physician services if they are already well insured is unlikely. Thus, any relationship between economic wellbeing and demand for physician services is likely to be stronger for specialist services than for primary care services.

In summary, additional empirical research is required to estimate the long-term relationship between economic growth and physician requirements. This issue also raises numerous political questions regarding whether projections of the adequacy of physician supply should incorporate patients' increased appetite for a more expansive healthcare system as the Nation becomes wealthier. For comparison, we project future requirements using Cooper et al.'s assumption of a 0.75 elasticity and the assumption of annual 2 percent growth in real per capita GDP based on Congressional Budget Office (CBO) projections.

Other Potential Determinants of Demand for Physician Services

One of the challenges in projecting physician requirements is that changes in technology, the use of non-physician clinicians (NPCs) and other health workers, public expectations, and government policies all can alter use patterns and the way care is delivered. Because of uncertainties regarding what new developments might occur and their impact on demand for physician services, the baseline projections assume constant physician per population ratios over the two decades of projections. Below, we describe trends that could affect physician requirements.

- **Technological advances.** Technological advances continue to change the way in which healthcare services are delivered. Some new technologies create immediate additional demand for physician services (e.g., advances in fertility technology); other advances hold the potential to prevent costly medical conditions (e.g., gene therapy), thus immediately reducing the demand for selected services. Predicting how such advances will change the long-run demand for physician services is difficult. For instance, new techniques in invasive cardiology might help prevent costly surgeries and their comorbidities, but the added years of life gained from such procedures might translate into greater use of services over an individual's lifetime. Similarly, telemedicine has the potential to reduce access barriers thus increasing demand for physician services.
- **Non-Physician Clinicians.** The NPC workforce continues to grow as does the proportion of healthcare services NPCs provide (Cooper, Laud, and Dietrich, 1998; Druss et al., 2003). Although NPCs sometimes compete with physicians, they also complement physicians by providing services within the scope of their training with physicians directing overall care and handling the more complex cases. Increased use of NPCs allows physicians to become more productive (e.g., in terms of seeing more patients), which increases the supply of physician services but also means we need fewer physicians to provide care to a given population.

- **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 others have improved quality of life for many individuals. The Institute of Medicine (IOM) has highlighted the prevalence of medical errors, leading to increased scrutiny of quality of care by the public and by policymakers. The elderly baby boom population will have experienced different hardships than their grandparents, which might also affect their expectations of the healthcare system. Physician specialties involved in both acute and long-term care of the elderly will be affected.
- **Policy changes.** The changing role of government, which is closely linked to public expectations, might also exert a significant impact on demand for physician services (e.g., through the impact of regulation as well as payment policies).

Physician Requirements Projections

The baseline projections suggest that between 2005 and 2020 overall requirements for physicians engaged primarily in patient care increase 22 percent, from approximately 713,800 to 921,500 (Exhibits 24, 26, and 27). In percentage terms, growth is lower for primary care (20 percent) than for non-primary care (23 percent). If we assume 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 756,100 to 976,000 during this period.[14]

On a per capita basis, demand for physicians is increasing as a result of an aging population (Exhibits 25, 28, and 29). For example, under the baseline scenario, requirements for physicians engaged in patient care increases from approximately 259 to 281 (8 percent) per 100,000 population between 2005 and 2020. In percentage terms, the increase is greater for non-primary care (9 percent) than for primary care (7 percent).

Projected growth in requirements between 2005 and 2020 varies substantially by specialty (Exhibit 30). 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).

[14] 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% to its current level of about 6%.

Exhibit 24. Baseline Projections of Physician Requirements

	Patient Care			Non-patient Care	Total
Year	Primary Care	Non-primary Care	Total		
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 25. Baseline Physician Requirements per 100,000 Population

	Patient Care			Non-patient Care	Total
Year	Primary Care	Non-primary Care	Total		
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.

Exhibit 26. Patient Care Physician Requirements

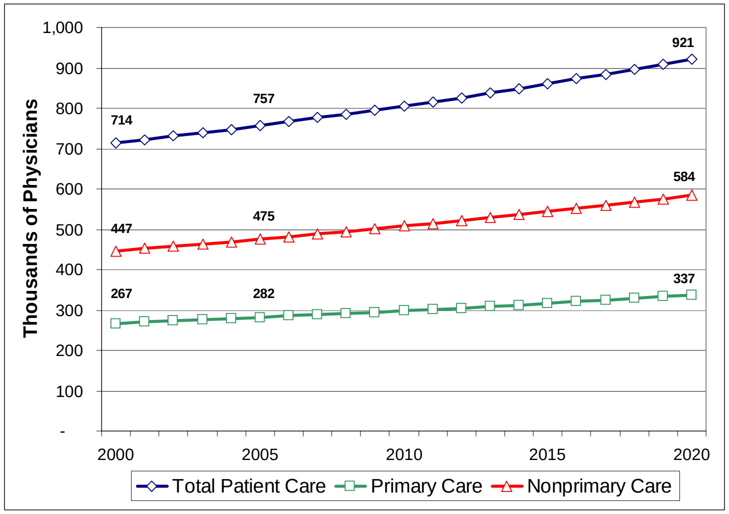


Exhibit 27. Percentage Growth in Patient Care Physician Requirements

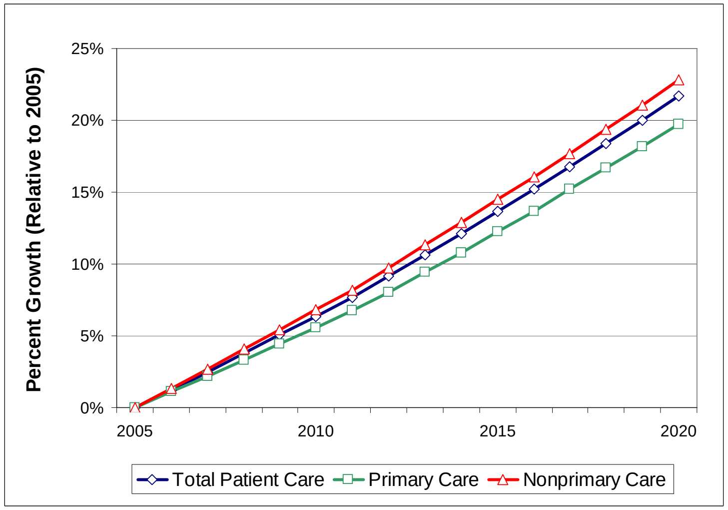


Exhibit 28. Patient Care Requirements per 100,000 Population

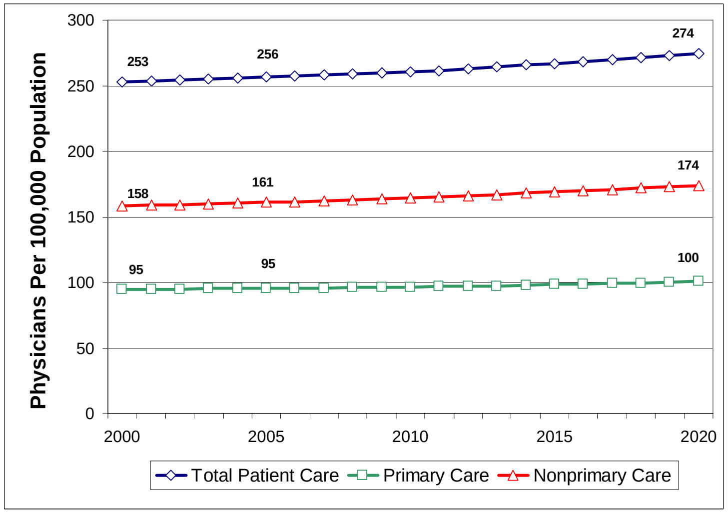


Exhibit 29. Percentage Growth in Patient Care Requirements per Capita

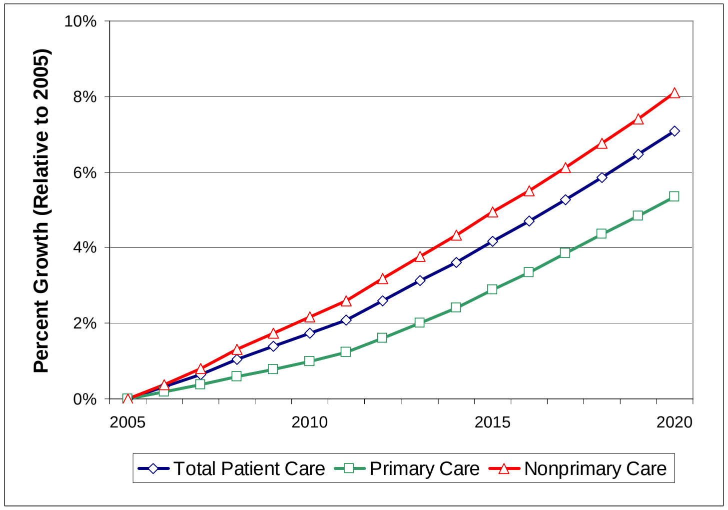


Exhibit 30. Physician Requirements by Medical Specialty: Baseline Projections

	Base Year	Projected				
Specialty	**2000**	**2005**	**2010**	**2015**	**2020**	**Percent Change from 2005–2020**
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%
Non-primary 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%
Obstetrics/Gynecology	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%

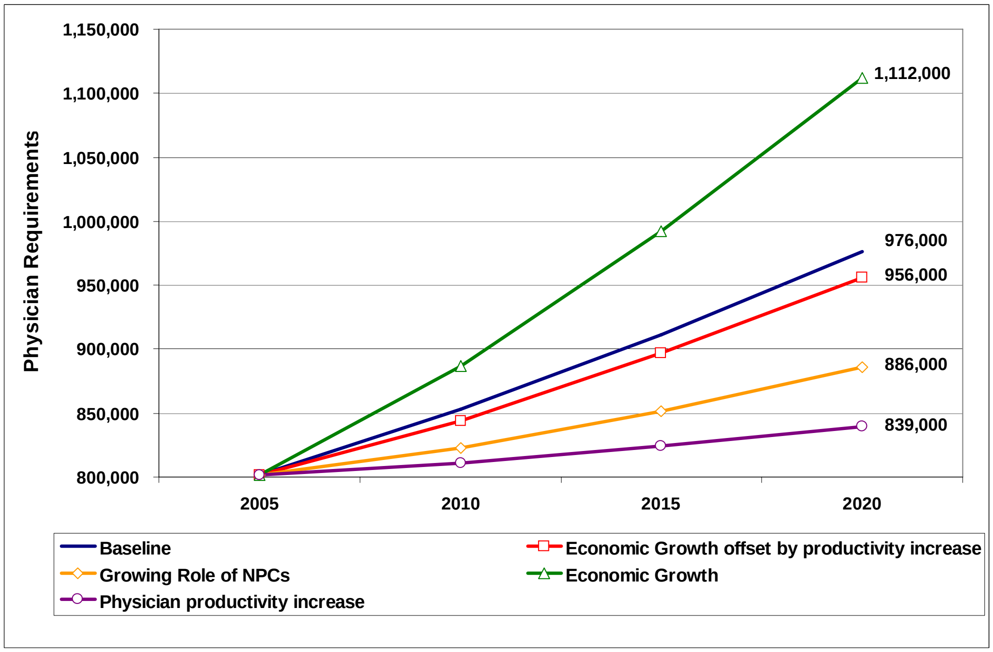
Note: Due to rounding, sum of subtotals may not equal totals.

The baseline projections assume that patterns of healthcare 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 we project physician requirements from 2005 to 2020 under alternative scenarios (Exhibits 31 and 32).

- **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 healthcare system. This new healthcare system will require more physicians 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)[15], modestly sensitive (elasticity=0.50)[16], or more sensitive (elasticity=0.75)[17] to economic growth. The latter scenario produces the highest projections, with requirements growing to 1.1 million physicians in 2020 (136,000 higher than the baseline projection). Projections by specialty are provided in Exhibit 32.
- **Physician productivity increase.** Requirements are projected under the assumption that physician productivity will increase 1 percent per year (i.e., each physician can see 1 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 projection suggesting 137,000 fewer physicians than projected under the baseline scenario in 2020.
- **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 31. Alternative Requirements Projections



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

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

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

Exhibit 32. Physician Requirements by Medical Specialty: High Economic Growth Series

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

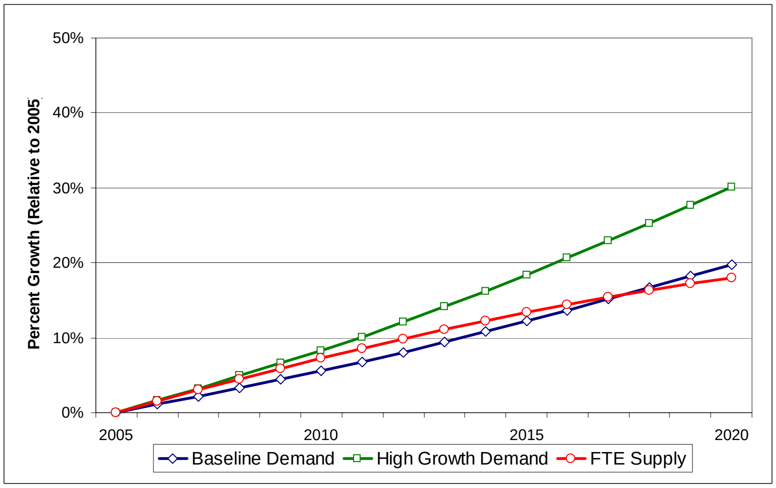
Note: Due to rounding, sum of subtotals may not equal totals.

Assessing the Adequacy of Current and Future Supply

The PRM uses current patterns of healthcare use and delivery of care to project future demand for physician services. This utilization-based approach relies on the assumption that healthcare utilization and service delivery patterns in the base year (2000) are "adequate." That is, the PRM relies on the implicit assumption that physician supply is in balance with physician requirements in the base year at the national level. Inefficiencies in the market resulting from current oversupply or undersupply of physicians are extrapolated into the future.

The baseline projections suggest that if current trends continue, overall primary care physician supply and requirements will grow at about the same rate over the next 15 years at which time requirements will grow faster than supply (Exhibit 33). These national projections mask the geographic variation in adequacy of supply. HRSA estimates that approximately 7,000 additional primary care physicians are currently needed in underserved areas to de-designate federally-designated shortage areas.

Exhibit 33. Growth in Primary Care Supply and Demand

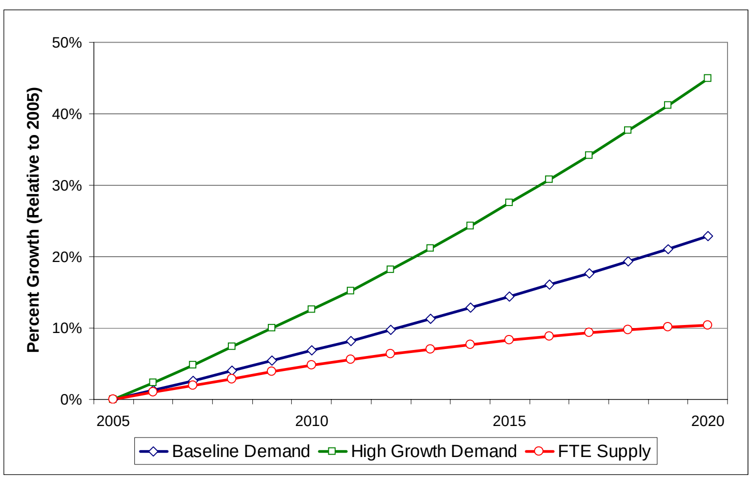


Because the national supply of primary care physicians is growing at roughly the same rate as requirements, there will likely be little change in market pressures to improve the undersupply of primary care physicians in rural and other underserved communities.

Under the high-demand growth scenario, growth in demand for primary care physicians exceeds growth in supply.

Between 2005 and 2020, demand for non-primary care physicians will grow faster than supply (Exhibit 34).

Exhibit 34. Growth in non-Primary Care Supply and Demand



These national projections mask the projected inadequacies in individual specialties, with specialties such as general surgery, urology, ophthalmology, cardiology, pathology, orthopedic surgery, other internal medicine subspecialties, otolaryngology, radiology, and psychiatry seeing demand grow much faster than supply.

Summary

The growth and aging of the United States population will cause a surge in demand for physician services. If current healthcare utilization and delivery patterns continue, the overall supply of physicians should be sufficient to meet the expected demand through the next 10 years. This finding suggests the need for modest increases in United States medical school capacity. Currently, one in four physicians in a residency programs graduated from a foreign medical school, and a large portion of IMGs remain in the United States after completing their graduate training. If the United States desires to rely less on IMGs to meet the growing demand for physician services, then United States medical school capacity must be expanded beyond the expansion necessary to meet the needs of a growing and aging population.

The baseline projections suggest the possibility of future realignments in graduate medical training, expanding the number of physicians trained in some specialties (e.g., general surgery, urology, ophthalmology, cardiology, pathology, orthopedic surgery, other internal medicine subspecialties, otolaryngology, radiology, and psychiatry).

Models to project physician supply and demand are often sensitive to assumptions regarding the characteristics of the future healthcare system and whether current trends will persist. Replete with examples of projected trends that failed to fully materialize and the emergence of trends that were never anticipated, the history of the United States healthcare system shows a system that is continually evolving. As Uwe Reinhardt (2002, p. 196) states: 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.” This fact is especially true when projecting demand for physician services, where much uncertainty exists regarding the characteristics of the future healthcare 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)***

Factors leading to potential underestimates of physician requirements include: (1) underestimates by the United States Census Bureau of actual population growth, (2) overestimates of the proportion of population insured through plans with aggressive managed care practices, (3) overestimates of proportion of care provided by NPCs, (4) underestimates of increased per capita use of physician services over time, and (5) overestimates of increases in physician productivity. Although we are unable to predict with certainty whether current trends in the healthcare operating environment will persist and what new trends will emerge, efforts to model physician supply and demand require educated predictions of major trends that affect the physician workforce. These uncertainties, combined with an ever changing healthcare system, highlight the need to frequently reassess supply and requirements projections.

In addition to the uncertainties mentioned above that affect the accuracy of projections, the PSM and PRM, like all projections models, have their limitations. For example, both models are static in that they do not model how physicians, patients, and insurers will react to changing conditions. As an example, physician earnings tend to increase as demand exceeds supply, resulting in financial incentives for physicians to enter specialties with a shortage of physicians rather than entering specialties with a surplus of physicians. Similarly, the scope of practice in particular specialties is changing over time. An expanded scope of practice could result in greater physician requirements for that specialty, with the possibility that requirements might fall for a specialty with an overlapping scope of practice that competes for many of the same patients.

A limitation of a utilization-based approach to model physician requirements is that, by definition, the approach assumes that the physician labor market is in balance in the base year. Inefficiencies in the delivery of care are extrapolated into future years' projections.

Another limitation is that the PSM and PRM are national models. Although they can be adapted to project supply and demand for smaller geographic regions such as States, the models do little to inform the debate regarding the future adequacy of physician supply in currently underserved areas. Past government policies to improve physician supply in underserved areas have relied in part on the assumption that physician surpluses (especially surpluses of primary care physicians) will create financial motivations for physicians to gravitate to underserved areas. The baseline projections suggest that the supply of primary care physicians will grow at about the same rate as demand through 2020, which will create little financial pressure for primary care physicians to disperse to traditionally underserved areas.

Additional research that might improve the supply projections include the following:

- **Estimating more exact retirement patterns**. As discussed, the PSM uses historical data to estimate separation rates that we think reflect long-term trends, rather than short-term fluctuations reflecting current market conditions. Preliminary results from the PWS are consistent with the concern that AMA Masterfile data underestimate the number of retired physicians, which could lead to overestimates of physician supply.
- **Modeling specialty choice**. The PSM uses historical data to estimate the distribution of new physicians into various specialties. This reliance on historical data might understate the importance of new trends in specialty choice—especially as it pertains to relatively new specialties such as critical care.
- **Estimating long-term trends in physician productivity**. With the exception of modeling trends in average hours worked as women and older physicians constitute a growing portion of the physician workforce, the PSM does not explicitly model changes in physician productivity. We calculated the productivity scenario presented in this paper outside the model and assumed a 1 percent annual increase in physician productivity. Improved training, technological advances, and increased use of NPCs and other health workers could lead to increased productivity, and additional research could inform how such productivity increases should be incorporated into the physician supply projections.

Additional research that might improve the demand projections includes the following:

- **Estimating the impact of economic growth on physician requirements**. Economic growth could change patient expectations and the ability of patients, employers, and the government to purchase additional physician services. The recent work by Cooper et al. has opened the debate on this topic, but the research community is far from reaching a consensus on the implications of economic growth for the future adequacy of physician supply.

- **Estimating the impact of growing NPC supply on physician requirements**. Expansion of the clinical or business autonomy of NPCs could increase competition between NPCs and certain physician specialties, resulting in slower growth in physician requirements. Similarly, collaboration between NPCs and supervising physicians can increase physician productivity, which in turn reduces physician requirements.
- **Estimating the impact of new technologies on short-term and long-term requirements for physicians**. New technologies could allow physicians to provide new services, and they could reduce mortality, increasing long-term requirements. Likewise, new tests, procedures, pharmaceuticals, or equipment could provide a substitute for some physician services thus slowing the growth in physician requirements.

Despite the limitations of projection models like the PSM and PRM, and despite the uncertainties of how the healthcare system will look in the future, these two models are powerful tools for understanding the implications of changing demographics, changing government policies, and other trends on the future adequacy of physician supply.

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