The Physician Workforce of the United States
A Family Medicine Perspective

October 2004

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Policy Studies in Family Medicine and Primary Care
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Executive Summary

Purpose

This is the report of a study chartered by the American Academy of Family Physicians (AAFP) to review prior physician workforce studies, characterize the current family medicine workforce, and assess the supply, demand and need for family physicians in the next 5 to 15 years. The study was organized to include information about other primary care professionals, and to incorporate the views of workforce policy experts of these professions.

Methods

The study reviewed the methods and results of primary care physician workforce studies since 1981, and reviewed the recent trends in the numbers of medical students, medical residents, nurse practitioners, physician assistants, and primary care physicians. It also reviewed recent demographic trends that influence the physician workforce, and projected the primary care physician workforce using demand/supply, planning and need models developed as part of the study, and updated models from prior studies. An expert advisory committee reviewed and commented on study findings.

Some Background

During the last 25 years, most physician workforce studies have concluded that primary care physicians were not being supplied in sufficient numbers. The most recent studies, however, presents a mixed picture in which primary care physicians may be in sufficient supply, with disagreement on the numbers of physician types that will be needed in the years ahead. There has been and remains doubt that market forces alone will yield an appropriate primary care physician workforce without assistance.

Of particular interest is the relative silence in prior workforce reports on exactly what a primary care physician will do in the future. The number of physicians depends to a large extent on what they will do. The recently published Future of Family Medicine

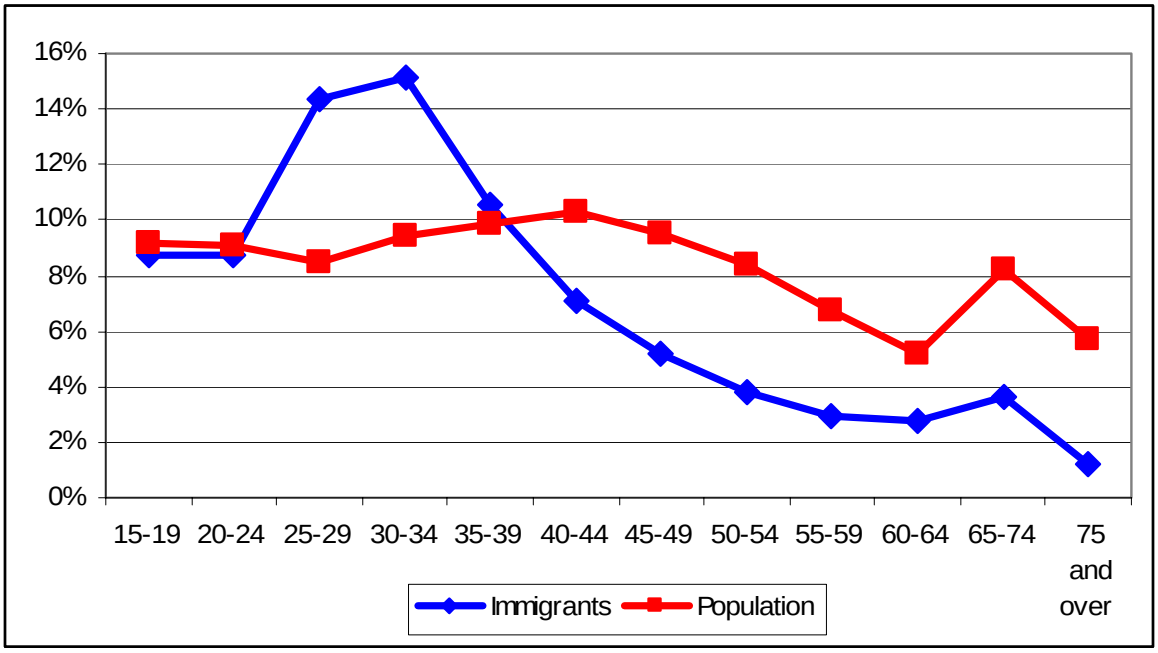
(FFM) report proposes a basket of services and a new model of practice for family physicians that makes timely the reconsideration of workforce policy by the AAFP and others committed to improving family medicine and primary care.

Main Findings

The main findings of the study are:

1. **Family physicians are now in the enviable position of having accomplished to a large extent their prior workforce goals**. During the last two decades of the 20th century, there has been substantial growth in the physician workforce that included a resurgence of family physicians more than sufficient to replace the decline in the number of physicians in general practice. In 2004 in the U.S., there are 31.2 active family physicians/general practitioners per 100,000 people. If all active physicians and residents in family medicine are incorporated, there are 36.2 family physicians per 100,000 people. The 1998 Kindig study projected a demand for family physicians of 35.1 physicians per 100,000 people by 2015, a ratio very similar to what now exists. Accompanying the growth in the physician workforce has been an increase in office visits to physicians, but a persistent decline in the proportion of these visits being made to family physicians.
2. **The population of the United States is growing, becoming more diverse, and will include a larger cohort of older people, not only as the baby-boomers age, but continuing past the baby-boomers with a new cohort of immigrants** (See figure 1). A large need for medical care by an older population probably will continue for at least half a century. A larger population implies additional physicians will be needed to provide health care services. An older population implies not only that additional physicians will be needed because the elderly population utilizes a relatively higher proportion of health services, but also a need for additional physicians prepared to care for the elderly for a longer period than was earlier thought .

Figure 1: Comparing the age distribution of Immigrants to that of the general U.S. Population (2002)



Data Sources: Department of Homeland Security and U.S. Bureau of the Census; Analysis by The Robert Graham Center, 2004.

3. **Millions of people rely on family physicians as a usual source of care across the entire nation, and the versatility of family physicians positions them well to serve any segment of the population. Family physicians are critically important physicians for people in rural areas, those receiving care in community health centers, and an older and more diverse population.** The case of rural populations requires particular attention from family medicine, and the number of family physicians needed in rural areas is a floor beneath which the family physician workforce cannot be permitted to fall because of rural America's continuing reliance on family physicians. On the other hand the recent evidence is that there has been a decrease in medical students from rural backgrounds, without a decrease in their applications.

4. **Projections of the numbers of family physicians that might be in practice in the next 15 years vary substantially according to the methods and assumptions used**. It is probably best to avoid claims of shortage or surplus with even moderately distant forecasts. Interestingly, the GMENAC (1980), AMA (1988) and COGME (1994) projections of physician supply were all within 5 percent of the actual number of physicians caring for patients in 2000 when assessed using their own methods.

   This study also compared the results from the demand/supply model developed as part of this study, to updates of the planning model and the needs model based on the FFM basket of services. The results are presented in table 1.

Table 1: Comparison of Projected Number of Family Physicians from the Supply/Demand, Need, and Planning Models

Year	Supply/Demand Model	Need Model[1]	Planning Model
2004	93,837[2]	83,300	93,837[2]
2005	96,668	84,100	Not Projected
2010	112,160	88,000	105,757
2015	130,134	91,700	116,838
2020	150,989	95,600	129,081

Notes: [1] The Number of Family Physicians Needed = Projected total U.S. Population multiplied by 0.341(current "market share" estimate) divided by 1,200.
[2] Represents actual number of Family Physicians (not projection).
Data Source: Analysis by The Robert Graham Center, 2004.

Table 1 may be alarming or misunderstood by some, but it should not be. It assumes that a family physician can, on average, adequately provide family medicine's proposed basket of services in the "new model" practice to 1,200 persons in a year. It then simply shows that if this were the case, then the present and projected estimates of family physicians from both the supply/demand and the planning models exceeds the number of family physicians required to provide that basket of services for the proportion of the population they presently care for. Any decrease in

the average number of people served or in work effort by family physicians or an increase in the proportion of the population served by family physicians would elicit a further increase in the number of family physicians needed.

This comparison presents an opportunity to reconsider workforce policy, but does not necessarily imply a need to curtail the number of family physicians supplied. Need is not an absolute concept. Its measurement always depends on assumptions. The assumptions in this case include a constant market share and are not based on substantial experience with "new model" practice. Furthermore, given that the nature of medical practice is not knowable with certainty 15 years into the future, a possible excess of family physicians might well be a critical national asset. Their versatility to accommodate may be used to meet requirements not now foreseen.

5. **Targeting a specific number of people for whom family physicians can provide their full basket of services, on average, is a readily understandable way to estimate the need for family physicians**. A reasonable ratio that can be tested is 1,200 patients for each family physician.

6. **The current stock and expected supply of family physicians is reasonable, given the current context that includes one primary care physician whose main professional activity is patient care for every 1,321 persons in the United States**. In addition to general internists and general pediatricians, there is a large and growing number of physician assistants and a large number of primary care-oriented nurse practitioners with whom family physicians can work effectively to the benefit of people.

The training capacity and workforces of NPs and PAs grew very rapidly over the last 15 years. Their combined number in primary care (a majority of NPs and a large minority of PAs) now rivals the number of family physicians. Most NPs and PAs work collaboratively with physicians and are positioned to make further, important contributions in the primary care setting. Calls to improve the interdisciplinary nature of primary care and to assure a full basket of services have never had such a large workforce positioned to respond. With their shorter training periods, PAs and NPs represent a relatively flexible workforce that can adapt quickly to needs and demands in either primary care or subspecialty medicine.

7. **Sustaining 3,200 family medicine residency positions is sufficient to maintain the current family physician workforce**. There have been increases in family medicine residency positions filled outside the National Residency Matching Program and in numbers of International Medical Graduates (IMG). IMGs now fill nearly 25% of family medicine residency positions. As osteopathic medical schools have increased enrollment, the proportion of osteopathic graduates entering family medicine residencies has decreased. However, because of a decade of increased training positions in family medicine and increased entry of IMGs into these positions, the growth rate of the family medicine workforce is still greater than a decade ago. Even without the growth of allopathic medical school enrollment or increases in GME positions as proposed recently by COGME, the overall physician workforce has grown at a rate twice that of the population for the last decade and is projected to continue to outpace the growth of the U.S. population.

8. **A large increase of international medical graduates filling family medicine residency positions is a significant change, and its impact on the U.S. and other nations is not completely positive.** An increase in the number of U.S. medical school graduates might increase the number of U.S. seniors entering family medicine. There are already a sufficient number of GME positions to absorb an increase in U.S. medical graduates.
9. **The basic workforce requirement of family medicine has shifted from production of more family physicians to their effective deployment. The key task of family physicians now is to implement new models of practice and effectively provide a basket of important, necessary services in collaboration with each of their patients and other members of the health care team.** While there is no apparent agreement now about the right balance between primary care physicians and other specialties, there is agreement that there must be one. The unilateral practice of birth control by one specialty, with a steady or reduced supply of new trainees, would almost automatically lead to increases, possibly not needed, in other specialties and promote un-useful competition that could thwart the integrated care people deserve. These analyses suggest that family medicine has entered a new era in which a steadily increasing “head count” is not necessarily the primary objective. Perhaps a period has arrived when further attention can turn to enhancing practice performance and the work-life of family physicians and improving the interfaces between primary care and the rest of the health care enterprise.

Recommendations

1. Family medicine should recast its gaze from growing a family physician workforce to sustaining and enabling the workforce that already exists, and from an emphasis on producing physicians to an emphasis on producing critical services of great benefit to people.
2. Test new models of family medicine and secure family medicine's basket of services for people of all backgrounds and circumstances, with an open door to careful assessments of capacity and performance, and to collaborations with others--particularly physician assistants, nurses, medical sub-specialists, and experts in behavioral science, economics, genetics, and information technology.
3. Aggressively advocate for sufficient revisions in payment and financial models to establish and sustain new model family medicine, prepare health care professionals to work together in the new model, and discover the knowledge necessary to constantly improve medicine and health care.
4. Vigilantly monitor the market share of family physicians (proportion of population served/proportion of services rendered); the number of physicians and their distribution by race and ethnicity, specialty and geography; the number and distribution of GME positions, and the number of health professional shortage areas.
5. Advocate for increased education and training in family medicine residencies focused on the care of older people, people of all ages with chronic conditions, and evidence based health promotion and disease prevention.
6. Support modest expansions of the number of allopathic medical students without expansion in GME positions to decrease the United State's reliance on international

medical graduates. With or without medical school expansion, advocate for increased emphasis on selection of a more diverse student population and students inclined for rural practice and serving older people.

7. Evaluate workforce policies realizing that rural people and other underserved populations are depending on family physicians like no other medical specialty.
8. Avoid over-reacting to the workforce study of the day.

As part of this study, a physician workforce projection tool was developed (using Microsoft EXCEL software). This tool provides the “engine” of the demand/supply physician workforce model. It is available for anyone to project physician workforce numbers into the future under their own set of assumptions. In conclusion, Family Medicine can now declare victory concerning prior workforce priorities and announce new priorities when ready.

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

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Introduction

Having replenished the ranks of general practitioners with family physicians, family medicine is now in the enviable position of being able to reconsider its contributions to the health of the people of the United States and establish its next workforce objectives.

With substantial evidence of the salutary effects of primary care and its critical role in effective, sustainable health care systems[1], family physicians currently practice on a platform of relevance. Because of their versatility and distribution across the entire country, largely in proportion to the distribution of the population, family physicians can help people in virtually any situation as they strive to solve their health problems. They can also help address, not just a single issue, but a spectrum of challenges faced by an under-performing health care system. With strong, ongoing demand for their services, albeit thwarted by perverse and unduly complicated administrative burdens, family physicians are in a sufficiently strong "market position" not to have to defend a single position or role.

Revision and reform in how health care is both rendered and financed is being sought[2] by prestigious groups, such as the Institute of Medicine, as well as state and federal government, employers, payers, and, most importantly, dissatisfied patients. Fortunately, family medicine is poised to advance into its next adaptation in behalf of best health care policies. Informed by the recent Future of Family Medicine Study[3], the American Academy of Family Physicians (AAFP) concluded that it would be timely to reconsider its workforce policies. A workforce policy review was further stimulated by

changing positions concerning the primary care workforce expressed by the Council on Graduate Medical Education and the Association of American Medical Colleges[4].

To this end, the AAFP chartered a study by the Robert Graham Center in Washington, D.C. to review prior physician workforce studies, characterize the current family medicine workforce, and assess the supply of and demand and need for family physicians in a 5-15 year time frame. Recognizing that in the future, best health care will be a "team-sport" with various health professions playing their position on a field created by the information age, the study was organized to include information about other primary care fields, and to incorporate the views and expertise of internists, pediatricians, physician assistants, nurse practitioners, and workforce policy experts.

This is the report of the Graham Center study. It includes background material that reviews the methods and results of some prior physician workforce studies from the report of the Graduate Medical Education National Advisory Committee (GMENAC) in 1981 to reports by Shipman and The Council on Graduate Medical Education (COGME) in 2004. It also includes reviews of the recent trends in the physician workforce, medical students, medical residents, nurse practitioners and physician assistants. The rest of the report reviews demographic trends that influence the physician workforce, updates and extends recent projections of other authors, and presents physician workforce models and projections.

Background

In 2004 there are approximately 620,627 active physicians whose major professional activity is direct patient care, a physician for about every 473 persons in the United States. About 91,627 of these physicians are family physicians or general practitioners (FPs) representing 14.8% of the physician workforce--an FP for approximately every 3,202 persons. These numbers contrast with the beginning of the last century when there were about 132,000 physicians, one for approximately every 590 persons, with more than 85% of the workforce comprised of FPs.[5;6] The current FP workforce consists of 78,045 medical doctors (MDs) and 13,582 osteopathic doctors (DOs). About 16.7% of FPs are international medical graduates (IMGs).

In 2004, family physicians work along side other types of physicians also considered to be primary care physicians. There are 85,293 general internists (IM), of whom 67.1% are U.S. medical school graduates, and 45,139 general pediatricians (GPEDS), of whom 72.2% are U.S. medical school graduates. Thus, there is a general internist for every 2,556 persons 18 years of age or more and a general pediatrician for every 1,670 persons less than 18 years of age. All together there are 222,059 primary care physicians actively caring for patients in the United States, or one primary care physician for every 1,321 persons. Almost all of these physicians have completed a three-year rigorous training program following medical school designed to prepare them for general medical practice. They represent a precious national resource.

In addition to these physicians, there are two other health professions explicitly prepared for primary care practice, physician assistants (PAs) and nurse practitioners (NPs). Both of these groups emerged in the late 1960s, and in 2004 there are approximately 50,121 PAs[7] of whom about 44% (more than 22,000) work in primary care, and 115,000 NPs[8] of whom about 80% (approximately 92,000) practice in primary care. PAs and NPs differ from each other in their training and their politics, and they are not completely interchangeable, anymore than the various primary care physician groups are interchangeable. When added to the primary care physicians, this group of approximately 336,000 primary care clinicians probably represents the largest and best-trained primary care workforce that has ever existed in the United States.

Each of these professional groups organize their own professional societies which often cooperate in pursuit of the common good and sometimes compete for position, prestige, and power. Of these professional societies, only one is unencumbered by substantial subsets of members committed to clinical subspecialization, and that is the AAFP.

Accordingly, the AAFP's announced commitment to assure everyone a medical home with a primary physician[3] relies on policy and strategy to secure an adequate number of appropriately educated family physicians. To inform its policies, the AAFP chartered this report with a primary question of:

Based on (1) recent experience and trends in health care and the health care workforce in the U.S. and (2) the declared future directions for family medicine (FFM), how many family physicians are required to meet the needs and the demands of the U.S. public?

The precise number for which the AAFP yearns is unattainable. However, a contemporary understanding of the primary care workforce and its potential evolution can be established, and that is the purpose of this report.

U.S. Physician Workforce Analyses from the Study of the Graduate Medical Education National Advisory Committee (GMENAC) to the Present

Analyses of the U.S. physician workforce in studies since GMENAC reviewed in this section have used four major models, alone or in combination. These are:

1. An age cohort flow or inventory model that estimates the current year's supply of physicians by adding new physicians to the prior years' supply and subtracting attritions.
2. An adjusted needs model that estimates the number of physicians that are needed to deal with a perceived burden of disease.
3. A demand-utilization or requirements model that estimates the number of physicians required to provide health care services at various levels of utilization.
4. A socio-demographic model that estimates the number of physicians through the effects of socioeconomic and demographic factors on the availability of future physician practice opportunities.

The age cohort flow model has been used mainly to determine the number of physicians supplied. The other three models have been used mainly to determine the number of physicians in demand.

In the age cohort flow model the number of new physicians is estimated and added to the prior years' supply of physicians, and the number of attritions is subtracted. Attrition consists of retirements or deaths of physicians, and usually is adjusted for physicians re-entering the workforce after an absence. Projections may also adjust for changes in professional effort away from active patient care. While in many previous studies the model was used to project total physician supply, most studies used the model to project full-time-equivalent (FTE) physician supply.

In the adjusted needs model, "need" is based on obtaining an accurate estimate of the number of individuals with diseases that should be treated by the disciplines being studied, the time required to treat the conditions, and the number of physicians required to provide that care. Authors may use the Delphi technique to build a consensus regarding these items. Several studies have used this model with modifications (e.g., basing need on an ideal of what should be, rather than on a consensus of what is likely). This dependence on a hypothetical structure of the system, in which care is provided, has been this model's handicap in forecasting what actually occurs.

In the demand-utilization model, "demand" is based on the current levels of utilization. The model considers persons who are treated or who might have benefited from

treatment. It then projects future use based on anticipated changes in demography, financial access, and productivity.

The socio-demographic model establishes the historic relationships between physicians' decisions to practice in particular communities and the characteristics of those communities. It then projects the number of physicians needed to provide care in the future based on the prevalence of geographic units with the characteristics that have attracted those physicians in the past.

In the next part of this background section are reviews of the findings of prior physician workforce studies from GMENAC (1981) to the present.

GMENAC, 1981[9]

In 1976, the Secretary of the Department of Health and Human Services (DHHS) charged the Graduate Medical Education National Advisory Committee with predicting physician workforce needs and supply to the year 2000. The Committee used an adjusted needs model with explicit assumptions. The panel designed four scenarios to describe the ways supply might evolve and selected the following three as the most likely:

1. Allopathic enrollment will increase 2.5% per year over the 1978-79 number of 16,501 until 1982-83 for a 10% total increase, then stabilize at 18,151 per year.
2. Osteopathic enrollment will increase 4.6% per year over the 1978-79 number of 1,322 until 1987-88 for a 41% total increase, then stabilize at 1,868 per year.

3. Foreign medical graduates will enter the residency pool at 3,100 per year starting in 1979, and increase to 4,100 per year in 1983 then stabilize.

For all scenarios, medical residents were judged to provide 35% of a full-time equivalent physician, and those engaged in teaching, research and administration were included in the workforce. Finally, all medical students graduating medical school were assumed to go on to graduate medical education (GME) and graduate on time. Considerable effort was expended attempting to quantify the health care needed for the disease burden of the U.S. population and estimating the numbers of physicians necessary to provide it.

GMENAC predicted a surplus of 70,000 physicians by 1990 and 145,000 by 2000. The most important recommendations were to: decrease medical school enrollment by 10%; restrict the entry of both U.S. and international medical graduates (IMGs), and change the mix of residency positions to address predicted specialty-specific shortages and surpluses.

The Committee recommended that current numbers of generalist residency positions be maintained. It also recommended support for generalist training and family medicine programs, training for all fields in ambulatory care and physicians who would work in underserved areas outside tertiary care centers, and support for the education of non-physician providers. The Committee further recommended research into geographic distribution of physicians and replicability of the Washington, Alaska, Montana, and Idaho training network (WAMI), and Area Health Education Centers (AHEC) and related

programs. GMENAC is probably the most robust effort to date to study the physician workforce and relate it to need, and it strongly favored primary care with a vision of primary care physicians as “gatekeepers.”

Health Resources and Services Administration (HRSA), 1988[10]

The HRSA Sixth Report to the President and Congress on the Status of Health Personnel in the United States was submitted by the Secretary of the DHHS as required by the Public Health Service Act. For allopathic and osteopathic medicine, it used the Bureau of Health Professions (BHPr) Physician Supply Forecasting Model and demographic or demand utilization model. The methods explicitly assumed that:

- Medical school enrollment would decrease by 5% over 10 years, but due to admission of students with advanced standing, net United States medical graduates (USMGs) would decrease by less than 5%.
- United States IMGs (USFMGs) would stay stable at 1,134 per year over 10 years.
- The number of foreign national international medical graduates (FNIMGs) would stay stable with 1,604 entering medical practice per year and 720 returning to their countries of origin.
- Ninety percent of the physicians whose specialty classification or address was unknown were actually active physicians.
- Men, women, USMGs, and IMGs all retire at the same rates.
- Coinsurance rates would continue to decline.
- Per capita utilization of outpatient departments would rise.

- Per capita primary care office visits would increase, but not as fast as specialist office visits, while inpatient services and specialist utilization would remain at current levels.
- Demographic changes would influence utilization changes.
- “There will be no major changes in prices, incomes, epidemiology, or other factors that would significantly affect utilization patterns.”

The resulting projections found that physician requirements would grow at 1.3% per year, insufficient to prevent a nascent physician surplus in 1990, that would grow to 70,000 physicians by 2000. No recommendations were made, nor was HRSA charged with making any.

While the Sixth HRSA Report forecasted a growing need for primary care providers based on the expansion of managed care and demographic changes, the shift to outpatient care for specialists still granted those branches of medicine domination in office visits. A Robert Wood Johnson Report, which noted declining access to care for minority and low-income populations from 1982-86, was cited without a prescription for reversing the trend.

The American Medical Association (AMA), 1988[11]

In 1988, the American Medical Association (AMA) undertook a workforce study using a demand utilization model. Sensitivity analyses were conducted; assumptions in their "Best Projection Model" were as follows:

- USMGs would decrease 10% over 10 years.
- USIMGs would decrease 33% over two years, then stabilize.
- FNIMGs would remain stable over 10 years.
- Residents and non-patient care physicians were active.
- Internists and psychiatrists had lower retirement rates than hospital-based MDs.
- Women's retirement rates were higher than baseline.
- IMGs retirement rates were lower than baseline.
- No major changes in technology, policy, or treatments were assumed.

The study elected not to define findings in terms of a surplus or shortage because these were judged to be normative evaluations of the appropriateness of current levels of supply and demand. Instead, it was noted that supply would increase by 23.8% whereas utilization would increase by only 14.5% over ten years. Most of the utilization increase could be attributable to a 10% population growth over 10 years, although utilization rates of non-white patients were projected to approach those of white patients, causing another component of the increase.

Third, Fourth and Eighth Reports of COGME 1994[12-14]

Under Title VII of the Public Health Service Act, the Council on Graduate Medical Education was charged in 1988 with providing ongoing assessment of the physician workforce. Fifteen reports and numerous resource papers and updates have been issued in response to that charge. The third and fourth reports used the same model as HRSA for supply and demand, and calculated supply projections based on two different sets of assumptions. The first projections were for current trends, and the second were goal-oriented supply projections as follows:

Trends Projections	Goal-Oriented Supply Projections
• MD to population ratio will rise from 240 to 298 per 100,000 by 2020. • 1/3 of practicing physicians will be generalists (59% will enter generalists training, but by PGY-10, only 30% will be generalists).	• A decrease in USMG and IMG entry to medicine will result in a 242 MD to population ratio in 2020. • Osteopathic graduates will be reduced by the same percentage as allopathic graduates. • Allopathic GME spots will equal USMGs plus 10%. • 800 exchange visitor spots will be held for IMGs who will return to country of origin following GME. • 50% of physicians will enter generalist training and be generalists at PGY-10; half of those will be FPs.

Predictions of COGME for the 1990s included a surplus of specialists and shortage of generalists, an adequate physician to population ratio; poor access in rural and inner-city areas despite increased nationwide physician supply; and a physician workforce whose racial and ethnic composition was not representative of the population and contributing to access problems for minorities. COGME also predicted: shortages in

general surgery, adult and child psychiatry, preventive medicine, and generalists with additional geriatric training; an inadequately responsive medical education system; and barriers to reform in the shape of the absence of a national physician workforce plan, reimbursement patterns, and administrative burdens.

COGME recommended establishing national and state physician workforce commissions whose plans would be implemented through consortia of providers, insurers, and training institutions. Medical schools were encouraged to maintain enrollment without increases. GME positions were to be reduced to the number of USMGs plus 10% then allocated according to regional needs and national goals. Financial incentives in undergraduate medical training, GME and practice were to recruit and retain generalists and minority physicians. Primary care training and family medicine in particular were favored by COGME instead of specialty training, with generalists training positions recommended for funding at 150% the level of specialty training positions.

Weiner, 1994[15]

In an article, "Forecasting the effects of health reform on U.S. physician workforce requirement: Evidence from HMO staffing patterns," Weiner (1994) used a requirements model to extrapolate HMO staff ratios from the HMO experience to the United States as a whole. He added data from the Group Health Association of America (GHAA) in addition to the usual data sources. To extrapolate appropriately, he used the following

adjustments to HMO data to accommodate known differences between the general population and those receiving care paid for by HMOs:

- age/gender differences HMO to USA 1.08
- addition of the Medicaid and uninsured populations 1.04
- out-of-plan use 1.10
- reduced productivity of HMO-employed physicians 0.85

Further assumptions included:

- Stable USMG production for the forecasting period.
- Universal insurance coverage.
- 40-65% managed care penetration.
- Exclusion of medical residents and federally employed physicians from the workforce.

Sensitivity analyses included the status quo, COGME recommendations, and a middle ground assessment.

Weiner's (1994) projections were strikingly similar to the GMENAC 1981 projections even though they used different methods. He projected a surplus of 165,000 physicians by the year 2000. He also noted that a broad range of staffing ratios would be enough to meet demand for physician services. His recommendations included a moderate expansion of generalist training and a significant contraction of specialist training except for obstetrics/gynecology and dermatology. He was still optimistic that the market would provide the adjustments necessary to address physician maldistribution. He also recommended expansion of family medicine, internal medicine, and pediatric training programs, and assumed a larger pool of candidates from which to draw on the basis of fewer available specialist spots.

Cooper, 1995[16]

Cooper (1995) provided another perspective with his paper, “Perspectives on the physician workforce to the year 2020.” His model of trend analysis relied upon data from the Group Health Association of America (GHAA), like Weiner (1994), and assumed that:

- The number of USMGs would be stable over the projection period.
- IMGs would increase the number of U.S. physician supply by 3-6% over the period.
- Medical residents are 0.67 of a full-time equivalent physician.
- A shift into primary care would result in shorter residencies and a reduced contribution of medical residents over time from 18% in 1995 to 11% by 2010.
- The Bureau of the Census projections for fertility and life expectancy were too conservative based on 1995 data, and needed to be adjusted upward.

His predictions included a modest physician surplus which was expected to resolve itself after 2010. Moreover, Cooper (1995) asserted that when new census projections and other adjustments of the trend model were applied to the predictions of GMENAC, BHPr, COGME, and Weiner (1994), predicted surpluses shrank or disappeared. Primary care was judged to be in balance from a manpower perspective. Cooper (1995) also noted that demand for physician services is driven by economic growth, and that economic expansion drives demand for specialty services preferentially over primary care.

Cooper (1995) also noted that physicians had been relocating to smaller communities since 1980 and recommended allowing market forces to continue to redistribute physicians. He also recommended including non-physician providers in physician

workforce planning efforts given their increasing numbers and contribution to the provision of health care.

Institute of Medicine, 1996

"Primary Care: America's Health in a New Era,"[17] published in 1996 by the Institute of Medicine with private and public sponsorship, was undertaken to reassess primary care in the United States and make recommendations for its further development. It synthesized studies conducted from 1981 to 1995.

This report concluded that there was a moderate shortage of primary care providers. This was judged likely to resolve in the short term because of the growth of managed care, changes in the nature and benefits of insurance coverage, innovative models of personnel substitution in managed care, increased use of team-based care, and cuts to Medicare and Medicaid which seemed likely to attenuate demand from the poor and elderly. From the supply side, specialist provision of primary cares services, growth of interest in primary care among medical students noted in the mid-1990s, and growth in the availability and use of non-physician clinicians were also expected to reduce any shortage.

The report recommended continuing to increase the supply of primary care clinicians, close monitoring of supply and demand, focusing on increasing the competency of primary care clinicians, reducing barriers to cooperation with non-physician clinicians, assuring access to care, and studying means by which to alleviate geographic

maldistribution. It was hoped that primary care would be bolstered by continued support for training and competency development and augmented by the recommended increased cooperation with non-physician providers.

These findings were consonant with contemporaneous recommendations from another IOM committee in January of 1996, "The Nation's Physician Workforce: Options for Balancing Supply and Requirements." This report unanimously concluded that an approximately 4% increase in residency training positions as existed at the time, largely attributed to increased numbers of IMGs, would produce a surplus of physicians, regardless of the structure of the health care system. They also found no firm evidence that having very large numbers of physicians necessarily reduces costs, increases access, or improves the quality of health care. This committee concluded that "it is in the national interest to avoid a serious oversupply of physicians."[18] This report recommended that no new medical schools be opened and that medical school class sizes not be increased.

AAFP (Kindig), 1998[19]

Dr. David Kindig (1998) reported on an application of the BHPr Physician Supply Projection Model commissioned by the American Academy of Family Physicians (AAFP) to forecast a range of family physicians up to 2015. He assumed:

- COGME's goal of 80 generalists per 100,000 population was the best goal because of higher rates of retirement and part-time work, a trend to fewer hours

for an FTE with fewer patients seen, the rise of managed care, aging population, and a charge to provide FPs for undersupplied areas.

- An increase in family physicians to account for teaching, research, and administration of 1.04,
- Fifty percent of all generalists would/should be family physicians.

The Kindig (1998) analysis predicted a demand for 35.1 family physicians per 100,000 population by 2015. To accomplish this, he recommended the maintenance of COGME's 110% rule for GME positions, an increase to 7.9 osteopaths per 100,000 population (from 6.8), and an increase to 4.6 nurse practitioners and physician assistants per 100,000 population (from 2.6). He also recommended changes to the treatment of IMGs in the U.S. medical system. He envisioned a GME system funded by all health care payers, and in the event of downsizing, recommended the preferential protection of programs that had a recent history of training generalists, minority physicians, and those who chose to work in rural and inner-city locations. The implications for primary care included an improved lot for GME programs in general on the basis of a reliable payer-funded funding source and primary care programs in particular based on the fact that the institution overseeing the GME fund was charged with protecting them.

COGME Update, 2000[20]

In 2000, COGME published an update of their earlier physician workforce forecast. This update was based in part on work by Libby and Kindig on physician requirements pending universal coverage, and Colwill and Cultice on the impact on rural America of the increasing numbers of family physicians. Libby and Kindig applied the BHPr Integrated Requirements Model and included obstetricians in primary care, then separated them out for comparability to other studies. Colwill and Cultice used the BHPr Physician Supply Model. Assumptions included:

- Women would persist in having a longer work life, less rural practice, and less specialty switching.
- Rates of specialty switching would remain at historically low levels and perhaps decrease.
- Physicians in medical residency, teaching, research, and administration were excluded.

Libby and Kindig predicted a shortage of about 35,000 generalists and a surplus of 115,000 specialists if the 2000 patterns persisted as well as shortages of generalists in all but non-poverty tracts of core metro areas. Their recommendations included refining requirements standards for different areas of the country, obtaining better data about practice locations, modeling the extent to which the need for safety net services will decrease with universal coverage, and better definitions for well-defined primary care service areas.

Colwill and Cultice predicted an increase from 31.1 FPs per 100,000 population to 36.1 FPs per 100,000 population in rural settings by 2020 given the 2000 upward trends in family medicine graduates. Given the decrease in matching into primary care specialties in the three years just prior to the report, they recommended that medical schools select students with rural backgrounds, provide educational experiences in rural settings, and emphasize opportunities in family medicine. They also recommended the preservation of existing incentives to maintain family medicine training such as Title VII grants.

Lurie, 2002[21]

In "Benchmarking the Future Generalist Workforce," Lurie (2002) applied a benchmarking model to the question of physician workforce supply and demand. His model excluded residents, fellows, and those practicing less than 20 hours per week and assumed:

- Five percent of FP, 7% of internal medicine, 7% of pediatrics workforce would enter teaching, research, administration.
- Only U.S. citizens and permanent residents would stay in the U.S. workforce.
- An upper age limit of 75 for clinically active generalists.
- Average weekly work hours within age- and gender specific strata.
- U.S. Census Bureau's mid-range projection for population growth.

At 2002 GME levels, the number of generalists was projected to grow to 88 per 100,000 population by 2025 (from 66). Even when adjusted, this ratio exceeds the COGME high-end estimate of requirements (80 per 100,000 population) and most current regional benchmarks. Low benchmarks (like 58 per 100,000 population in Houston) and high benchmarks (like 98 per 100,000 population in Philadelphia) would be

maintained in this scenario. Lurie (2002) recommended that workforce planners reconsider the size of the generalist workforce and the mix of generalists and specialists. He also proposed allocating funds to maximize population health, potentially funding some traditionally non-reimbursable activities. He questioned the utility of increasing the primary care workforce, given that places with high benchmarks like Miami (92 per 100,000 population) saw no improvement in mortality rate, patient satisfaction, or performance on quality indicators.

United States General Accounting Office, 2003[22]

The United States General Accounting Office (GAO)(2003) submitted a report to the U.S. Senate Chairman of the Committee on Health, Education, Labor, and Pensions entitled, "Physician Workforce: Physician Supply Increased in Metropolitan and Nonmetropolitan Areas but Geographic Disparities Persisted." Their model calculated past supply and made no effort at demand calculation projection or forecasting. Assumptions were not made explicit.

The report found that the supply of physicians increased at twice the rate of U.S. population growth from 1991-2001. During that time, the generalist–to-specialist ratio remained stable at 33:67. An increased supply of physicians occurred in all geographic regions, but not evenly. Only 12% of the increase in physician supply went to rural areas, where 20% of Americans lived. During the decade the number of areas with fewer than 100 physicians per 100,000 population decreased. There was also an increase in the number of areas with greater than 300 physicians per 100,000

population. Disparities did not appreciably narrow between metropolitan and non-metropolitan areas, prompting concern among the primary care physicians who provide most care to the medically underserved. The GAO report made no recommendations.

Shipman, 2004[23]

Shipman et. al. (2004) addressed the question of the adequacy of the supply of pediatricians using a benchmarking model. They excluded residents, fellows and those working less than 20 hours per week and assumed:

- Six percent of pediatricians enter teaching, research, and administration.
- U.S. citizens and permanent residents stay in the workforce as do 75% of IMGs.
- An upper age limit of 75 for clinically active generalists.
- Average weekly work hours within age- and gender- specific strata.
- A projection of percent of visits by children to pediatricians by age: 83% of 0-4 year olds, 72% of 5-9 year olds, 57% of 10-14 year olds.

Their analysis, which was conducted with adjustments and sensitivity analyses for age- and gender of physicians, GME growth, retirement rates, population growth, market share, and the changing demographics of the U.S. population, projected a significant oversupply of pediatricians “in all probable scenarios” compared to the 2000 benchmark of 49 pediatricians per 100,000 children. The report recommended offering expanded services, including young adult care and/or competing for a greater share of the children currently cared for by non-pediatricians. For family medicine, this suggestion raises the possibility of open competition for the under-15 population. Alternatively, any shortage of family physicians might be offset by the oversupply of pediatricians if FPs were willing to see fewer children and more adults needing a primary physician.

COGME, 2004[4]

In 2004, the Center for Health Workforce Studies at the University of Albany produced a draft report for COGME entitled “Physician Workforce Policy Guidelines for the U.S. 2000-2020. This study built upon the BHPr Physician Supply Model and Physician Demand Model and assumed:

- Stable supply of USMG MDs.
- Thirty percent increase in DO output over 9 years followed by stabilization.
- Stable supply of FMGs.
- A decrease in the FTE:MD ratio because of the increased contribution of women to the physician workforce.

Scenarios relating to major changes in lifestyle, productivity, and a hybrid thereof were considered with sensitivity analyses.

In a dramatic about-face relative to all previous COGME output, the report projected a 24% increase in physician supply in 2000-2020 which it said would slow after 2010. It said that population growth, an aging population, and related utilization changes will cause demand to increase at a rate faster than supply, and that need will grow yet faster. The end result is a projected shortage of about 85,000 physicians by 2020 (ranges were offered consistent with the results of sensitivity analyses).

The draft report recommended abandoning the 110/50:50 rule to which COGME had adhered for the last decade. It recommended adding 3,000 residency spots per year by 2015 facilitated by a phase-in of Medicare funding-eligible positions, increasing medical school enrollment by 15% by 2013 concentrated where demand is highest, maintaining

a fluid balance between generalists and specialists and reassessment every 4 years, facilitating increases in productivity, promoting non-physician provider training, and promoting programs to reduce maldistribution like the National Health Service Corps. Questions remain about the impact of boutique medicine, non-physician clinicians, and the ideal mix of generalists and specialists, the answers to which are unclear.

Concurrent Analyses, 2004

Further analyses concerning the U.S. physician workforce and the challenges facing the health care system are being undertaken concurrent with this study, including work by Colwill and Cultice[6]. Colwill and Cultice are evaluating the supply of generalist physicians who are pediatricians, internists and family physicians in order to project the future supply of these physician groups to 2020, including an analysis projecting the supply of rural generalists.

Based on their projections and experience, these veteran workforce analysts are expected to conclude that the overall production of generalists is probably adequate, with the production of general internists possibly entering a period of decline, the production of general pediatricians in excess, and the production of family physicians about right and essential for providing rural health care.

Selected projections or predictions from various workforce studies are presented in table 1[4;9-11;13;15-17;19-23] to facilitate comparison. Of course, it is not entirely appropriate or fair to compare these various studies “head to head” as their methods and

approaches varied. For example, the GMENAC 1980 report, the AMA 1988 report, and the COGME 1994 report all offer estimates for the year 2000, but their definitions and approaches varied. Using the same definitions and units of analysis, their predicted numbers of physicians are compared to the actual numbers of physicians providing patient care, in table 2.

Table 1: Workforce Predictions 1990 - 2020

Study	1990 Total Physicians	1990 Primary Care Physicians	1990 MD Family Physicians	1990 DO Family Physicians	2000 Total Physicians	2000 Primary Care Physicians	2000 MD Family Physicians	2000 DO Family Physicians	2010 Total Physicians	2010 Primary Care Physicians	2010 Family Physicians	2020 Total Physicians	2020 Primary Care Physicians	2020 Family Physi-cians
GMENAC 1981	535,750	175,950	64,400	23,850	642,950	-	-	-	-	-	-	-	-	-
HRSA 1988	597,040	-	-	-	708,600	[223,920]	[82,780]	-	[810,160]	-	-	820,810	[262,010]	[97,520]
AMA 1988	563,700	194,000	71,200	-	653,000	227,000	77,000	-	715,200	253,200	82,400	-	-	-
COGME 1994	547,310	183,349	70,602	12,550	*700,000	-	-	-	-	-	-	875,920	262,313	-
Weiner 1994	No	Absolute	Numbers	In	Report	-	-	-	-	-	-	-	-	-
Cooper 1995	-	-	-	--	631,000	-	-	-	765,000	-	-	816,000	-	-
IOM 1996		183,294	70,480		731,897	-	-	-	837,863		-	881,149	-	-
Kindig 1998	-	-	-	-	663,943 (1996)	216,446 (1996)	79.009 (1996)	19,701 (1996)	-	-	-	-	-	-
COGME 2000	-	-	-	-	-	168,039 (1995)	81,000	-	-	-	*98,000	-	-	111,870
Lurie 2002	-	-	-	-	-	190,235	79,738	-	-	-	-	-	286,246	-
GAO 2003	541,000	-	-	-	681,000	-	-	-	-	-	-	-	-	-
Shipman (pediatrics only) 2004	-	-	-	-	-	38,457	-	-	-	50,498 (40,790 to 51,481)	-	-	59,619 (40,902 to 63,425)	-
COGME Draft 2004					781,227				899,540			971,817 (972,000 to 1,077,000)		

- Shaded areas are statements of fact rather than projections
- * indicates number is estimated from a graph in the report for lack of a better source
- [ ] indicates number taken from 7th report. 6th report unavailable at time of printing.
- - indicates number not available in report or calculable based on available data therein

Table 2: Prior Study Projections of U.S. Physicians vs. Actual Number in 2000

GMENAC (1980)	# in 2000
Number of physicians projected	643,000
Actual number of physicians by study definition*	674,000
Underestimation	3.3%
AMA (1988)	
Projection	633,000
Actual by study definition**	654,000
Underestimation	4.8%
COGME (1994)	
Projection	550,000
Actual by study definition***	574,000
Underestimation	4.4%

* All active MDs and DOs (0.35 for a resident).
** All active direct patient care MDs (1.0 for a resident).
*** All active direct patient care MDs and DOs (excludes residents).

As can be seen, when an "apples to apples" comparison is made, the predictions from these studies are closer to correct than is often assumed. All of the studies underestimated the actual number of physicians in 2000 by approximately 3 to 5% (3.3%, 4.8%, 4.4%, respectively).

Because GMENAC so vigorously struggled to estimate need for physicians of various types and made explicit recommendations about the numbers of physicians needed to serve the population, we show in the second column of table 3 the actual number of physicians in various specialties in the United States in 2004. In the third column we present the numbers of people in the U.S. per each of these types of physicians, and in the fourth column show the number of persons GMENAC estimated to be appropriately cared for by one such physician based on the population's need for their services. This analysis is relevant to current claims that the United States faces a specialty, not

primary care, physician shortage. As can be seen, there are some specialty areas that today, using GMENAC methods, would be judged to be in inadequate supply (*). There are more specialty areas that would be judged to be in excess.

Table 3: GMENAC Estimated Numbers of Persons Required To Support Specific Physician Specialties, Projected To 2004

Medical Specialty	# of Physicians in Specialty in 2004	# of Persons per Physician in 2004	# of Persons Who Could be Served per Physician According to GMENAC
Allergy & Immunology	2,935	99,973.6	119,000
Anesthesiology	38,729	7,575.4	11,436
Cardiology	22,301	13,156.1	31,420
Child Psychiatry*	7,236	40,543.0	27,000
Emergency Medicine	28,047	10,460.4	18,000
Endocrinology	4,680	62,686.9	119,000
FP/GP	106,101	2,765.2	3,968
Gastroenterology	11,619	25,250.8	37,000
Hematology-Oncology*	2,904	101,028.7	27,000
Infectious Diseases	5,858	50,085.8	108,000
Internal Medicine	107,948	2,717.9	3,461
Neurology	12,636	23,217.6	44,000
Nephrology	6,783	43,254.3	89,000
Nuclear Medicine*	1,690	173,607.2	61,000
Neonatology	3,799	77,217.4	187,000
Neurosurgery	5,298	55,373.9	92,000
Obstetrics/Gynecology	38,642	7,592.4	10,150
Ophthalmology	19,607	14,963.7	20,234
Orthopedic Surgery	22,038	13,312.6	16,130
Otolaryngology	9,834	29,833.4	29,227
Psychiatry*	41,077	7,142.4	6,300
Pediatrics	54,760	5,357.7	7,900
Pediatric Allergy*	236	1,243,167.0	271,000
Pediatric Cardiology	1,739	168,691.0	212,000
Pediatric Endocrinology*	749	391,836.3	304,000
Pediatric Hem-Onc*	1,541	190,369.1	148,000
Physical Medicine & Rehab	7,789	37,668.3	76,000
Pediatric Nephrology	463	633,187.5	696,000
Plastic Surgery	6,406	45,801.3	90,000
Pathology	15,723	18,659.8	20,000
Pulmonary Diseases	6,995	41,943.0	67,640
Radiology*	6,236	47,044.7	13,844
Rheumatology	4,260	68,872.7	143,000
Thoracic Surgery	5,268	55,693.4	118,800
Urology	10,659	27,525.5	31,625
Total	779,771	376.3	522.6

Data Source: Medicus Partners[24]; Analysis by The Robert Graham Center, 2004.

* Inadequate supply according to GMENAC methods.

Summary Comments

The question of what constitutes enough doctors has many answers. These answers depend on what model, definitions, and assumptions are used to reach conclusions. It is neither appropriate nor fair to submit all these workforce studies to direct comparison because their approaches were so different. These prior studies reveal the large number of unknowable variables that influence the physician workforce and make quite clear that the assumptions and definitions will determine the results of projections. They suggest that it is probably best to avoid claims of shortage or surplus with even moderately distant forecasts, in favor of settling for projections of supply and demand for relatively short time frames. Interestingly, however, GMENAC, AMA, and COGME projections of physician supply were all within 5% of the actual number of physicians caring for patients in 2000 when assessed using their own methods.

During the last 25 years, most physician workforce studies have singled out primary care physicians and concluded that they were not being supplied in sufficient numbers. The most recent work, however, presents a mixed picture in which primary care physicians may be in sufficient supply, with disagreement about how many physicians of what type will be needed in the years ahead. There has been and remains doubt that market forces will yield an appropriate primary care physician workforce without assistance.

Of particular interest to this analysis is the relative silence in prior workforce reports as to exactly what it is that a primary care physician does and will do in the years to come.

Surely the number of family physicians and other primary care physicians depends directly on what they will do. The recently published Future of Family Medicine proposes a basket of services and a model of practice for family physicians that makes timely the reconsideration of workforce policy by the American Academy of Family Physicians and others committed to improved family medicine and primary care.

The Physician Workforce in the United States

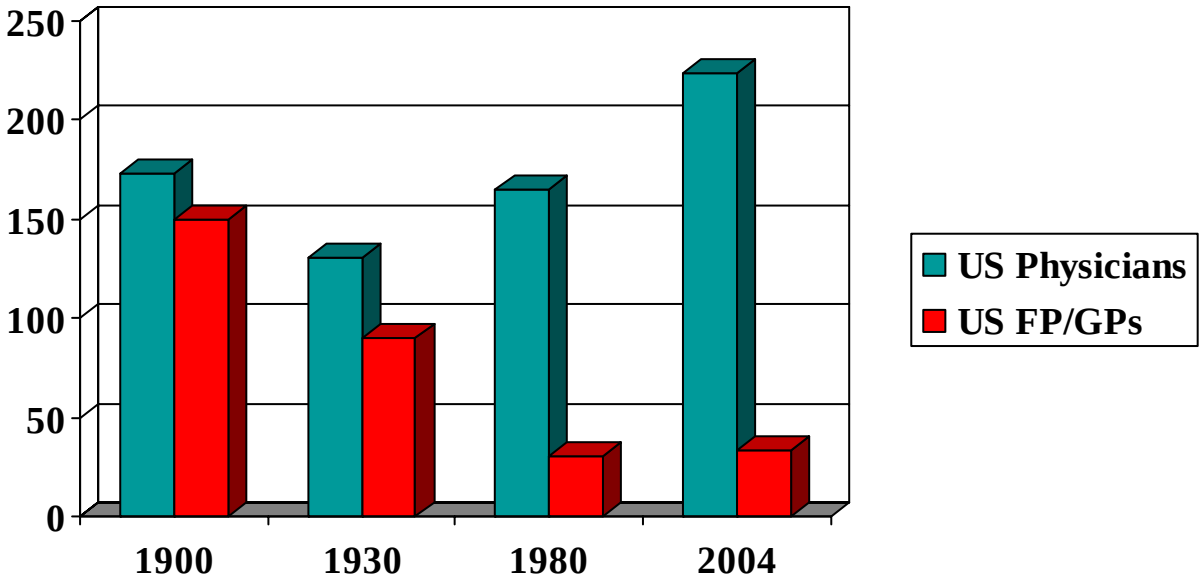
A broad overview of the evolution of the physician workforce and the portion of it comprised of family physicians and general practitioners is shown in table 4 and figure 1.

Table 4: Numbers of Patient Care Physicians in the United States (1900 – 2004)

Year	Type of Physician	Number of U.S. Physicians	Number of Family Physicians	
			Count	% U.S. physicians
1900	MD and DO	131,640	114,140	86.7%
1930	MD and DO	161,230	110,770	68.7%
1980	MD and DO	374,800	67,900	18.1%
2004	MD and DO	629,039	94,477	15.0%
	MD	596,131	80,774	13.6%
2004	All GME	106,729	10,342	9.7%
	MD only GME	100,225	8,941	8.9%

Source: Colwill and Cultice (2003)[6]
Note: Family physicians include FP and GP.

Figure 1: The Changing Face of Medicine: Doctors per 100,000 People



Source: Colwill and Cultice (2003)[6]

Obviously the 20th century was an age of ascendancy for medical specialization in the United States accompanied by a reciprocal decline in general medical practice.

During the last two decades of the 20th century, family medicine delivered on its promise to produce a replacement for the old-time general practitioner. As shown in table 5, from 1981 to the present, there has been substantial growth in the physician workforce and the persistent trend toward the near elimination of general practice continues. There has been a resurgence of family physicians, and growth in the primary care physician workforce at approximately the same rate as the growth for non-primary care specialties.

Table 5: The Number of Direct Patient Care Physicians (MD and DO) in the United States (1981-2001)

	GP	FP	GP+FP	FP+GP+GIM+GPEDS (Primary Care)	Specialists	All Physicians
1981	29,018	24,995	54,013	114,077	209,308	323,385
1986	25,695	34,616	60,311	131,252	247,264	378,516
1991	21,723	45,355	67,078	156,291	294,147	450,438
1996	19,367	57,818	77,185	180,352	343,857	524,209
2001	17,796	67,860	85,656	204,068	370,678	574,746
% Change 2001 vs1981	-39%	+172%	+59%	+79%	+77%	+78%

Source: AMA Masterfiles; Analysis by The Robert Graham Center, 2004.

Since family medicine was launched in 1969, the general pattern of exiting from practice has been the departure of retiring GPs and their replacement with young family physicians not anticipating retirement. Some thirty years later this pattern is changing with the aging of family physicians. Table 6 shows actual numbers of family physicians and primary care physicians departing active practice, showing a 5.7% exit rate for family physicians between 2000 and 2004, slightly lower than what was observed for all physicians, primary care physicians as a group, and physicians in other specialties.

Table 6: Direct Patient Care Physicians in June 2000 No Longer Active Direct Patient Care Physicians in March 2004

GP	FP	GP+FP	FP+GP+GIM+ GPEDS (Primary Care)	Specialists	All Direct Care Physicians
3,741 (18.9%)	3,827 (5.7%)	7,568 (8.7%)	13,976 (6.9%)	22,864 (6.2%)	36,840 (6.4%)

Source: 2000 and 2004 AMA Masterfiles; Analysis by The Robert Graham Center, 2004.

These counts make clear that the prior period of low exit rates from direct patient care by family physicians has now been replaced by a more “normal” pattern, similar to other physicians.

The Physician Workforce in 2004

There are multiple ways to count physicians, and variations in reports and results often derive from different conventions and methods of counting. The numbers in the following figure and tables, except where stated otherwise, represent actual individuals who were active patient care physicians, i.e. a head count of physicians who self-declare that their major professional activity is patient care. Figure 2 shows in 2004 the distribution of all physicians into subgroups: those who are direct patient care physicians, who are MDs and DOs, according to whether or not they are primary care or other specialists, and their distribution among the primary care specialties. It also shows the distribution of MD and DO residents.

Figure 2: The Number and Distribution of MD & DO Physicians and Residents in March 2004

I. Total U.S. Physicians in 2004: 936,178

883,532 MD (94.4%)	**52,646 DO (5.6%)**

II. In Direct Patient Care:629,039 (67.2% of Total US Physicians)

596,131 MD (94.8%)	**32,908 DO (5.2%)**
388,194 (65.1%) NOT Primary Care	**14,822 (45.0%) NOT Primary Care**
207,937 (34.9%) ARE Primary Care	**18,086 (55.0%) ARE Primary Care**
FM= 67,219(11.3%)	FM=10,310(31.3%)
GP = 13,001(2.2%)	GP = 3,305(10.0%)
IM=82,906(13.9%)	IM = 3,284(10.0%)
PD= 44,811(7.5%)	PD = 1,187(3.6%)
FM+GP=80,220(13.5%)	FM+GP=13,615(41.3%)

III. Medical Residents in Training in the U.S. in March 2004: 106,729

100,225 MD (93.9%)	**6504 DO (6.1%)**
61,643 (61.5%) NOT Primary Care	**3393 (52.2%) NOT Primary Care**
38,582 (38.5%) ARE Primary Care	**3111 (47.8%) ARE Primary Care**
FM= 8,834(8.8%)	FM=1,390(21.4%)
IM =21,891(21.8%)	IM =1,262(19.4%)
PD = 7,857(7.8%)	PD = 459(7.1%)

Data Source: March 2004 AMA Physician Masterfile; Analysis by The Robert Graham Center, 2004.

Figure 2 demonstrates the current relative sizes of the three primary care specialties. It shows that there are more physicians in family medicine (FP and GP) than there are in internal medicine, and there are more physicians in internal medicine than there are in

pediatrics. Looking at medical residents in primary care as the future supply of primary care physicians, the data show that in the future, more physicians would be expected in internal medicine than in family medicine, and more physicians would be expected in family medicine than in pediatrics.

Table 7 presents the data again for the actual number of direct patient care physicians in general practice and family medicine separately and combined, the primary care groups combined, all other specialists as a single group, and then the total for all physicians. In the third row of the table we present the physician data as the number of people per physician in each of the groups, and in fourth row we present the number of physicians per 100,000 people. Canada has similar people per physician for primary care (1,036) but not for specialists (1,103) and is currently implementing changes in medical education to accommodate what is perceived as a physician shortage (see Appendix F for full table).[25]

Table 7: The Number of Active Direct Patient Care Physicians (MD and DO) in the United States in 2004

	GP	FM	GP+FM	FM+GP+GIM+G PEDS (Primary Care)	Specialists	Total
Physicians in Specialty	14,977	76,650	91,627	222,059	398,568	620,627
People per Physician	19,589	3,827	3,202	1,321	736	472
Physicians per 100,000 People	5.1	26.1	31.2	75.76	135.96	211.52

Data Source: March 2004 AMA Masterfile; Analysis by The Robert Graham Center, 2004.

Family physicians distribute like the general population, and serve rural areas more so than other primary care specialists. Figures 1, 2, and 3 found in Appendix E illustrate the dependence of the population on family physicians. Figure 1 shows the distribution of the 1,695 (54%) counties that would become Primary Care Health Professional Shortage Areas, or HPSAs, (less than one primary care physician per 3,500 people) if there were no family physicians. In contrast, figures 2 and 3 show the distribution of the 84 and 300 counties that would become HPSAs if there were no pediatricians or internists, respectively.

In table 8 we show the impact of including a portion of medical residents (0.35) and physicians in addition to direct patient care physicians using the same methods as GMENAC to determine the "number of physicians" in 2004. As shown, there are a sufficient number of medical residents and other physicians that their inclusion or exclusion has substantial impacts on estimates.

Table 8: The Number of All Active Physicians (MD and DO) in the United States in 2004 Including Medical Residents*

	GP	FP	GP+FP	FP+GP+GIM+GPEDS (Primary Care)	Specialists	Total
Physicians in Specialty	17,176	88,925	106,101	268,809	510,963	779,772
Population per Physician	17,080.9	3,299.3	2,765.2	1091.4	574.2	376
Physicians per 100,000 People	5.9	30.3	36.2	91.6	174.2	265.8

*Using GMENAC's convention of adding to all active physicians medical residents in training, with each resident considered to represent 0.35 physician.

Data Source: March 2004 AMA Masterfile; Analysis by The Robert Graham Center, 2004.

To provide a sketch of the roles played by physicians we present in table 9 estimates for 1997 and 2002 of how many people in the U.S. population actually saw or spoke with different types of physicians in the 12 months preceding their being surveyed. The data show a pattern of increases in the percentage of adults, children and pregnant women seeing or talking with most physicians, the only exception being visits to generalists who see both adults and children, which declined over the period (1997 to 2002).

Table 9: Number of Adults and Children in 1997 and 2002 Who Saw or Talked with a Physician by Physician's Specialty in the Preceding 12 Months

	OB/GYN	Specialist	Generalist	Generalist Who Sees Children and Adults
Adults				
1997 (N=195,276,321)	44,061,679 (22.6%)	46,426,980 (23.8%)	128,680,380 (65.9%)	79,610,278 (40.8%)
2002 (N=205,825,095)	48,169,046 (23.4%)	53,631,633 (26.1%)	138,386,031 (67.2%)	77,108,246 (37.5%)
Children				
1997 (N=71,359,353)	836,629 (1.2%)	8,485,838 (11.9%)	55,748,247 (78.1%)	27,586,530 (38.7%)
2002 (N=72,969,942)	1,047,305 (1.4%)	9,638,254 (13.2%)	57,906,158 (79.5%)	23,119,539 (31.7%)
Pregnant When Asked*				
1997 (N=2,321,360)	2,025,324 (87.2%)	349,923 (15.1%)	1,328,184 (57.2%)	843,664 (36.3%)
2002 (N=2,510,757)	2,186,195 (87.1%)	436,149 (17.4%)	1,527,723 (60.8%)	876,117 (34.9%)

*Adult Women Only (18+ years of age)
Data Source: 1997 and 2002 National Health Interview Survey; Analysis by The Robert Graham Center, 2004.

Another way to assess the role of physicians in various specialties is to examine the percentages of visits being made by people to physicians' offices. Table 10 shows the percentage of all visits made by people in the U.S. to physicians' offices to family physicians, general internists, general pediatricians, the primary care physicians combined, and all other specialists combined. The data show a gradual increase in visits to specialists and a reciprocal decline in visits to primary care physicians. Among primary care physicians there have been increases in visits to general internists and general pediatricians, and a decline in visits to family physicians, a trend that seems entrenched over nearly a quarter of a century.

Table 10: Visits to the Offices of Various Specialties as a Percentage of Visits Made to All Physicians Offices

	FP/GP	GIM	GPEDS	FP+GP+GIM+ GPEDS (Primary Care)	Specialists
1980-1984	32.9%	12.4%	10.9%	56.2%	43.8%
1985-1989	30.1%	11.5%	11.6%	53.2%	46.8%
1990-1994	26.7%	14.2%	11.4%	52.3%	47.7%
1995-1999	24.6%	16.0%	11.4%	52.0%	48.0%
2000-2003	24.0%	16.1%	12.1%	52.2%	47.8%

Data Source: 1980-2003 National Ambulatory Medical Care Survey; Analysis by The Robert Graham Center, 2004.

Summary Comments

During the last two decades of the 20th century, there was substantial growth in the physician workforce that included a resurgence of family physicians more than sufficient to replace the decline in the number of physicians in general practice. In 2004 in the U.S., there are 31.2 active family physicians/general practitioners per 100,000 people. If all active physicians and residents in family medicine are incorporated using GMENAC methods, there are 36.2 family physicians per 100,000 people. The 1998 Kindig study projected a demand for family physicians of 35.1 physicians per 100,000 people by 2015, a ratio very similar to what now exists. These family physicians are probably consulted each year by about 100 million people, most of whom identify a family physician as their usual source of care. This represents the current market share of family medicine in the U.S. market, which could increase or decrease substantially. Accompanying this growth in the physician workforce has been an increase in office visits to physicians, with a persistent decline in the proportion of these visits being made to family physicians.

The Current Student and Medical Resident Situation

The number of medical students is a critical determinant of the number of physicians. As shown in table 11, the total numbers of allopathic medical students increased from 55,818 in 1975 to a peak of 67,327 in 1983-4 and has remained remarkably steady at about 66,000 to the present. Osteopathic medical students comprise a much smaller proportion of medical students, but their numbers have grown progressively, more than tripling since 1975.

Table 11: Total Enrollment for Allopathic and Osteopathic Students from 1975 - 2002

Year	Allopathic	Osteopathic
1975-1976	55,818	3,443
1976-1977	57,765	3,671
1977-1978	60,039	3,926
1978-1979	62,213	4,221
1979-1980	63,800	4,571
1980-1981	65,189	4,940
1981-1982	66,298	5,304
1982-1983	66,748	5,822
1983-1984	67,327	6,212
1984-1985	67,016	6,547
1985-1986	66,585	6,608
1986-1987	66,125	6,640
1987-1988	65,735	6,586
1988-1989	65,300	6,614
1989-1990	65,016	6,615
1990-1991	65,163	6,792
1991-1992	65,602	7,012
1992-1993	65,575	7,375
1993-1994	66,175	7,822
1994-1995	66,788	8,146
1995-1996	66,942	8,475
1996-1997	66,926	8,961
1997-1998	66,896	9,434
1998-1999	66,539	9,882
1999-2000	66,377	10,388
2000-2001	66,160	10,817
2001-2002	66,253	

Data Source : HRSA[26]

During the early 1990s family medicine enjoyed a revival of medical student interest, students chose family medicine residencies in record numbers, and family medicine training positions increased by more than 900, some 34%, rivaling most other specialties. However, as shown in tables 12 and 13, there has been a precipitous decline in allopathic graduates' interest in family medicine since its height in 1996 when allopathic graduates filled 72.6% of family medicine training positions.

Table 12: Family Medicine Positions Offered and Filled in the March NRMP Match 1998 - 2004

	1998	1999	2000	2001	2002	2003	2004
Positions Offered	3,293	3,244	3,183	3,074	2,962	2,920	2,864
Positions Filled	2,814	2,683	2,584	2,346	2,342	2,227	2,256
% filled	85.5%	82.7%	81.8%	76.3%	79.1%	76.3%	79.1%
Filled U.S. Seniors	2,179	2,014	1,817	1,503	1,399	1,226	1,185
% Filled U.S. Seniors	66.2%	62.1%	57.1%	48.9%	47.2%	41.9%	41.4%
IMGs Filled	341	405	454	505	596	701	734
% Filled IMG	10.4%	12.5%	14.5%	16.4%	20.1%	24.0%	25.6%
Other	294	264	313	338	347	300	337
% Filled Other*	9.0%	8.1%	10.0%	11.0%	12.0%	10.3%	12.1%

*U.S. Physicians, 5th Pathway, Osteopathic Physicians, Canadian Physicians

Data Source: NRMP Results and Data 2004 Match (March Data)[27]

Table 13: First Year Family Medicine Positions Offered and Filled in July 1998 – 2004

	1998	1999	2000	2001	2002	2003	2004
Positions Offered	3,723	3,644	3,623	3,528	3,523	3,480	3,501
Positions Filled	3,575	3,538	3,475	3,399	3,360	3,329	3,275
% Filled	96.0%	97.1%	95.9%	96.3%	95.4%	95.7%	93.5%

Data Source: American Academy of Family Physicians[28]

Currently, graduates of U.S. allopathic schools fill less than half of the family medicine positions offered in the medical residency match. Overall, the absolute number of

allopathic students choosing family medicine now has only declined slightly when compared to the period prior to the 1990s growth phase; but in the context of medical residency positions available in 2004, the decline has been steep since 1998.

Medical students' interest in family medicine is influenced by many factors, particularly by market perceptions of demand for family physicians. The fickle shifts in student and market perception, though, are compounded by some ongoing problems, such as those identified in what is known as the Arizona Study.[29] It is documented that accepting students of rural background and lower socioeconomic status increases the probability that students will choose to be a family physician. Yet even as the rate of rural student applications to medical schools has not changed, their acceptance rate has declined. According to the Association of American Medical Colleges annual report, medical students with rural backgrounds decreased from 27% in 1983 to 16% in 1999.[30] This rural group with over 20% FP choice has been replaced by a 97% urban group with half the probability of FP choice. This decline in medical students with a rural background is confirmed by a second method, birth origin studies.[31] The average decline in medical students from rural origins is 47% for all medical schools from 1976 to 2000. Even the 47 medical schools with a rural application preference, those in the most rural states, and osteopathic schools experienced declines.[31] Expansions of medical schools and class sizes in the past 40 years have involved exclusively the admission of urban origin students. The AAMC reports that 47 schools claim a preference for rural students, however their admissions do not bear this out.[31] Also there are widely recognized needs for great diversification of the physician workforce in terms of race and ethnicity.

The Arizona study[29] highlighted the importance of the academic environment in influencing students' choices. Family medicine departments' leadership of predoctoral programs and in early mentoring and clinical experiences are important factors in the academic environment for primary care, and many of these departments are currently dependent on Title VII funding.

Table 14 shows that an increasing number of family medicine residency positions are being filled outside the NRMP or Military Matches—now about one in six.[32] The result is that family medicine is becoming more reliant on international medical graduates to fill positions available after the Match.[33] The combination of a substantial increase in family medicine training positions and a drop in USMG interest has yielded almost a three-fold rise in IMGs filling family medicine PGY1 positions. In 2003, IMGs were 30.3% of family medicine first-year residents, up from 9.9% in 1996-7, compared to 16% of the family medicine physician workforce.[32] USIMGs are a growing percentage of IMGs, now at 21%, and many of these international graduates go into family medicine. Family medicine attracts more U.S. IMGs than most other specialities[33], and these residents distribute themselves more like USMGs, especially in rural and underserved areas.[34] It remains to be seen how this internationalization of family medicine will affect the specialty.

The decline in allopathic student interest in family medicine has also coincided with the addition of new osteopathic schools. As the number of osteopathic graduates has grown, so has the number of DOs taking family medicine PGY1 slots. However

osteopathic students are also shifting away from family medicine. In 2003, nearly one-third (30.9%) of DOs became family medicine interns, a decline from 37.3% in 1996-97, comprising 13.7% of the family medicine residents in their class.[32]

Table 14:[32] Number of GYI IMGs Without Prior GME in the 12 Largest Specialties

Table 3. Number of GY1 IMGs Without Prior GME in the 12 Largest Specialties and Proportion of IMGs Within the Specialty, 1996-2002

	1996-1997		1997-1998		1998-1999		1999-2000		2000-2001		2001-2002		2002-2003	
Specialty	No. (%)	IMGs in Specialty, %	No. (%)	IMGs in Specialty, %	No. (%)	IMGs in Specialty, %	No. (%)	IMGs in Specialty, %	No. (%)	IMGs in Specialty, %	No. (%)	IMGs in Specialty, %	No. (%)	IMGs in Specialty, %
Anesthesiology	136 (2.7)	61.3	196 (3.7)	59.6	234 (4.6)	63.4	180 (3.2)	51.7	96 (3.1)	29.2	90 (1.7)	30.5	68 (1.2)	19.7
Emergency medicine	5 (0.1)	0.7	14 (0.3)	1.9	14 (0.3)	1.7	22 (0.4)	2.7	21 (0.7)	2.4	26 (0.5)	3.0	34 (0.6)	3.4
Family practice	316 (6.3)	9.9	321 (6.1)	9.8	425 (8.3)	13.2	577 (10.4)	18.0	348 (11.3)	12.6	758 (14.6)	26.5	897 (16.0)	30.3
General surgery	274 (5.4)	11.5	340 (6.5)	13.8	402 (7.8)	16.1	456 (8.2)	17.8	348 (11.3)	15.4	484 (9.3)	20.6	536 (9.5)	23.4
Internal medicine	2574 (51.1)	34.9	2713 (51.9)	35.2	2475 (48.2)	32.6	2676 (48.1)	33.9	1384 (45.1)	21.0	2485 (47.9)	32.5	2593 (46.1)	32.9
Internal medicine/ pediatrics	31 (0.6)	8.3	27 (0.5)	6.2	34 (0.7)	7.4	34 (0.6)	8.2	29 (0.9)	7.3	46 (0.9)	12.0	50 (0.9)	13.5
Obstetrics and gynecology	42 (0.8)	3.7	52 (1.0)	4.4	74 (1.4)	6.6	105 (1.9)	9.3	92 (3.0)	8.7	128 (2.5)	11.7	156 (2.8)	14.0
Orthopedic surgery	1 (0.0)	0.4	2 (0.0)	0.8	1 (0.0)	0.4	4 (0.1)	1.5	4 (0.1)	1.0	7 (0.1)	1.7	7 (0.1)	1.4
Pathology	168 (3.3)	36.4	244 (4.7)	53.6	255 (5.0)	57.2	300 (5.4)	58.9	155 (5.1)	42.9	222 (4.3)	48.9	221 (3.9)	46.1
Pediatrics	633 (12.6)	25.1	534 (10.2)	21.7	446 (8.7)	18.2	433 (7.8)	17.2	245 (8.0)	11.2	414 (8.0)	17.3	540 (9.6)	22.4
Psychiatry	433 (8.6)	42.8	415 (7.9)	40.5	454 (8.8)	45.5	488 (8.8)	42.5	227 (7.4)	26.3	359 (6.9)	37.6	352 (6.3)	34.3
Transitional year	355 (7.1)	28.5	317 (6.1)	26.2	251 (4.9)	21.7	205 (3.7)	17.3	89 (2.9)	8.0	118 (2.3)	9.4	108 (1.9)	9.2
All others	65 (1.3)	12.1	55 (1.0)	18.0	69 (1.3)	22.0	85 (1.5)	24.2	31 (1.0)	11.0	51 (1.0)	19.7	61 (1.1)	19.7
Total	**5033**	23.5	**5230**	24.0	**5134**	23.6	**5565**	24.9	**3069***	15.7	**5188**	24.4	**5623**	25.7

Abbreviations: GME, graduate medical education; GY1, graduate year 1 (the first year of education beyond medical school for which prior GME is not required); IMG, international medical graduate.
*Estimate is likely an undercount.

Source: JAMA, used with permission

After another period of growth of family medicine positions during the 1990s, family medicine residency positions declined in 1999-2000 by 4.2%, nearly double the attrition seen in all residency positions.[32] Attrition of training positions is not inherently a bad thing after a decade of rapid growth, but given current Medicare funding policies, lost positions will be nearly impossible to regain.

Recent analysis of interest in general internal medicine reveals a pattern of decline[6] In response to perceived demand in medical sub-specialties, increasing number of internal medicine graduates are entering sub-specialties. This trend has reduced the output of general internists by 35% between 2000 and 2003. This trend, if sustained, may result in an actual decline in general internists, rather than expansion as has been projected. Such a decline in general internal medicine, as well as, the projected increases in general pediatrics may have long term implications for family physicians.

In July 2004, the Council on Graduate Medical Education (COGME) made several revisions to its longstanding policies. As noted above, their previous reports had suggested that there was a general surplus of physicians and a maldistribution by both specialty and geography. As recently as March 1999, COGME expressed concerns about a surplus of physicians, particularly specialists, and the need to reduce residency training slots to 110% of graduating medical students with a 50/50 balance of generalists vs specialists.[35] Now COGME has called for a 15% expansion of medical student positions, a 12.5% increase in the number of residency positions over the next ten years and rolling assessments of the generalist-specialist mix rather than a targeted goal. How this latest report may affect the physician workforce remains to be seen.

Summary Comments

There has been a long period of stability in the numbers of allopathic medical students and a tripling of the number of osteopathic medical students since 1975. After a period of growth and interest that peaked in 1996, there has been a precipitous decline in student interest in family medicine, returning to the rates seen in the 1980s. The reasons for this decline have been explored and discussed in the Arizona study[29], and include concerns about the nature of the work and remuneration of physicians. Accompanying this decline has been a decrease of medical students from rural backgrounds, without a decrease in their applications, a group more likely to become family physicians. There is a slow decline in filled FP residency positions, at just under 94% in 2004. There has been an increase in family medicine residency positions filled outside the medical residency Match (about 1 in 6) and by IMGs who now fill nearly 25% of family medicine residency positions. As osteopathic medical schools have increased enrollment, the proportion of osteopathic graduates entering family medicine residencies has decreased. However, because of a decade of increased training positions in family medicine and increased entry of IMGs into these positions, the growth rate of the family medicine workforce is still greater than a decade ago. Even without the growth of allopathic medical school enrollment or increases in GME positions as proposed recently by COGME, the overall physician workforce grew at a rate twice that of the population for the last decade and is projected to continue to outpace the growth of the U.S. population. If medical school class sizes are increased or new schools of medicine accredited, an emphasis on underserved populations and

increased diversity might justify such expansion. Increases in medical student positions could occur without any increase in GME positions, thereby promoting less reliance on IMGs.

The Current Situation for Physician Assistants

Physician assistants (PA) are licensed health care professionals who practice medicine with the supervision of physicians. They provide a comprehensive and extensive range of medical and surgical services and exercise a degree of autonomy in the diagnosis and treatment of illness, as delegated by supervising physicians. The concept of a physician assistant was first suggested in 1961.[36] The profession was born, de novo, out of the combined opportunities of a physician shortage, the availability of a large group of trained military-trained corpsmen, and the embittered early battles of the NP profession (both in medicine and nursing). The PA profession was based on the hypothesis that physicians could treat more patients, utilize their time and talents more wisely, and provide better care, if they worked with individuals who were trained in medicine and practiced with physician supervision.[37]

Within the physician-PA team, the PA makes clinical decisions and provides a broad array of diagnostic, therapeutic, preventive, and health maintenance services. A study conducted by the Rand Corporation found that PAs can effectively perform many of the functions in a general medical practice and are widely accepted by patients.[38;39]

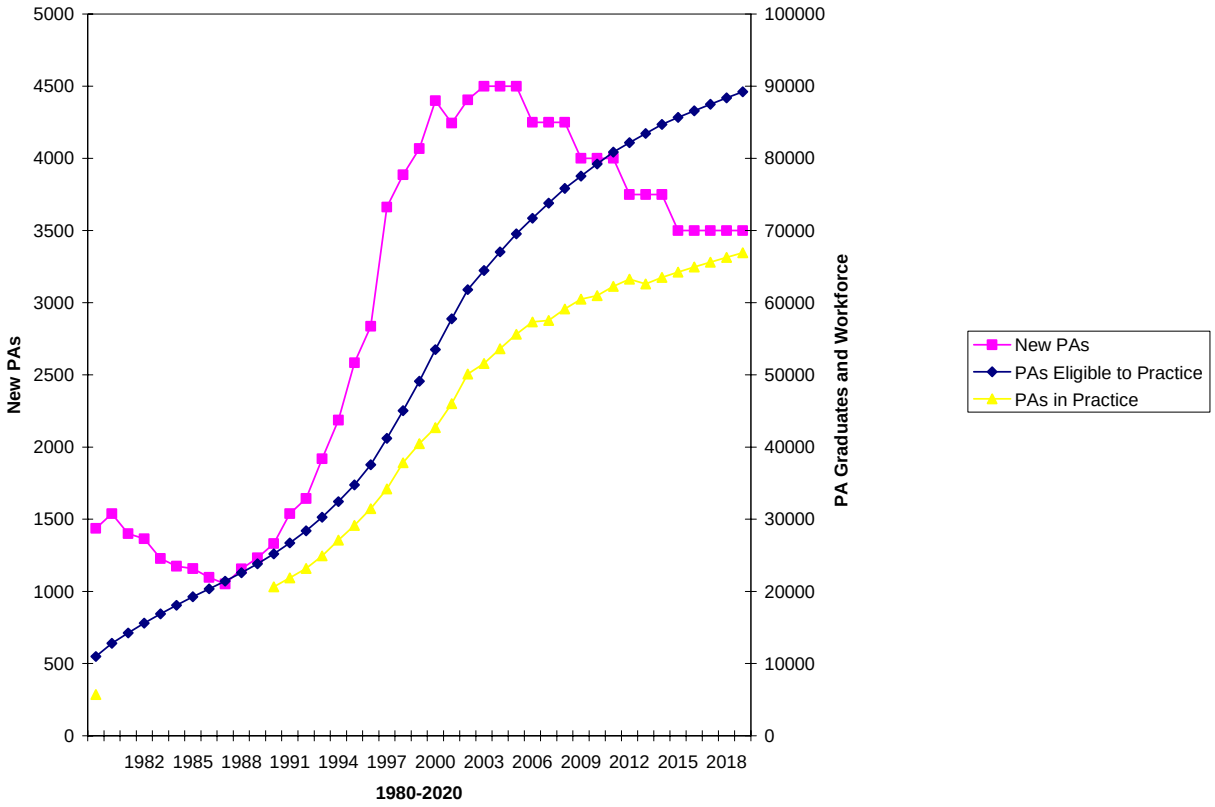
The American Academy of Physician Assistants (AAPA) estimates there were 50,121 people in clinical practice as PAs at the beginning of 2004. About 10,000 students are enrolled in PA programs. The number of new graduates in 2003 was approximately 4,415. According to the findings published in AAPA's Information Update: *Projected Number of People in Clinical Practice as PAs* as of January 1, 2004, 81% of all program graduates, and 90% of 2003 graduates, were estimated to be in clinical practice as PAs in 2004. The United States Bureau of Labor Statistics (BLS) projects that the number of PA jobs will increase by 49% between 2002 and 2012, while the total number of all jobs in the country will only grow by 15% over this 10-year period.[40] PAs practice in at least 61 specialty fields, and 44% of 2004 AAPA Census respondents reported that their primary specialty was one of the primary care fields: family/general practice medicine (31% = 15,538), general internal medicine (8%), and general pediatrics (3%). Other prevalent specialties for PAs were general surgery/surgical subspecialties (23%), emergency medicine (10%), obstetrics/gynecology (3%), and the subspecialties of internal medicine (10%).

Between 1993 and 2003, the number of PA programs more than doubled (grew by 131%), the number of PAs graduating each year grew by 172%, and the PA workforce grew by 118%.[7] Figure 3 extrapolates this fast-growing profession through 2020 with assumptions that the number of new graduates will fall by approximately 25% and those in active practice by 5-6% (by attrition or shift into other work) as production exceeds demand (per Bureau of Labor Statistics projection). The PA workforce will likely remain similar in size to the family physician workforce, but a large unknown is how many will

work in primary care. The output of PA programs will likely continue at least for the next several years resulting in about 87,000 individuals eligible to practice as PAs by 2010. If the Bureau of Labor projections of a decrease do not occur, as may be the case, the number of PAs could be larger.

PAs are well positioned to positively impact the supply of family medicine services. PAs always work with physicians in a team approach to the delivery of health care. In 2003, PAs in family medicine delivered about 80 million patient visits. Working with their supervising physician, PAs help to expand access, control the cost of service, and provide high quality health care. Family medicine can embrace the PA profession as a part of a solution to problems of access and cost rather than to view PAs as a competitive threat. Workforce analyses in the future must take into account the substantial and growing contributions of PAs to the production of required family medicine services if these analyses are to adequately reflect prevailing practice.

Figure 3: Growth of Physician Assistants 1980 - 2020

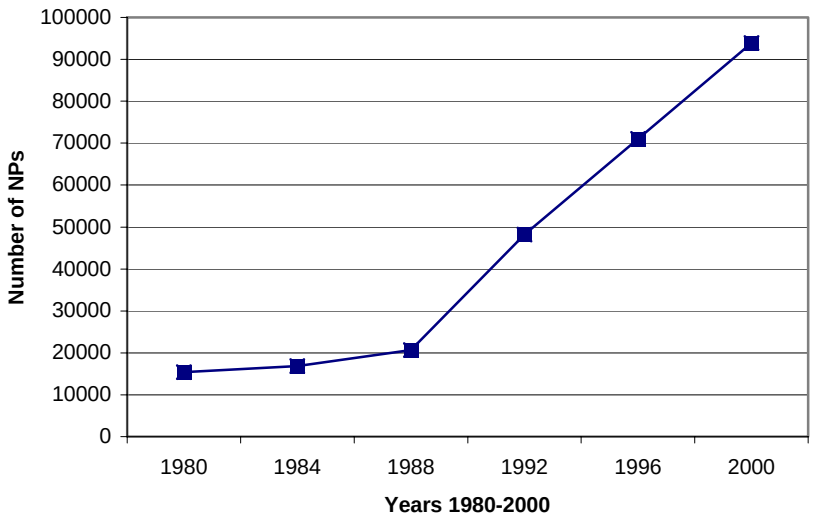


Data Source: Bureau of Labor Statistics and American Academy of Physician Assistants; Analysis by The Robert Graham Center, 2004.

The Current Situation for Nurse Practitioners

Nurse practitioners were created as a part of the profession of nursing in the 1960s in response to the shortage of physicians and the desire by nurses for more independent advanced practice roles in the delivery of care services. The number of NPs has increased dramatically since 1988 as shown in figure 4.

Figure 4: Historical Nurse Practitioner Workforce Growth



Data Source: Unpublished data from the National Organization of Nurse Practitioner Faculties; Analysis by the Center for the Health Professions, UCSF, 2004.

Originally the pathways to becoming a nurse practitioner were varied, but today students prepare for the role by completion of a Masters degree or higher. There are direct entry nurse practitioners, but they complete both training for becoming an RN and the Masters-level training in the same program after completion of a baccalaureate in some other field of study.

Unlike physician assistants who practice in both primary and specialized care settings the nurse practitioners more often prepare and identify themselves as primary care providers. The American Academy of Nurse Practitioners (AANP) describes the role of the nurse practitioner as:

> "According to their practice specialty these providers provide nursing and medical services to individuals, families and groups. In addition to diagnosing and managing acute episodic and chronic illnesses, nurse practitioners emphasize health promotion and disease prevention. Services include, but are not limited to ordering, conducting, supervising, and interpreting diagnostic and laboratory tests, and prescription of pharmacologic agents and non pharmacologic therapies. Teaching and counseling individuals, families and groups are a major part of nurse practitioner practice. Nurse practitioners practice autonomously and in collaboration with health care professionals and other individuals to diagnose, treat and manage the patient's health problems. They serve as health care researchers, interdisciplinary consultants and patient advocates." [41]

The limitations of the practice vary considerably by state and are determined by the respective nurse and physician practice acts at the state level. Unlike medicine where physician practice is limited by hospital and managed care credentialing and malpractice coverage, nurse practitioners may move their practice to different orientations and settings, constrained only by the practice acts and the ways in which

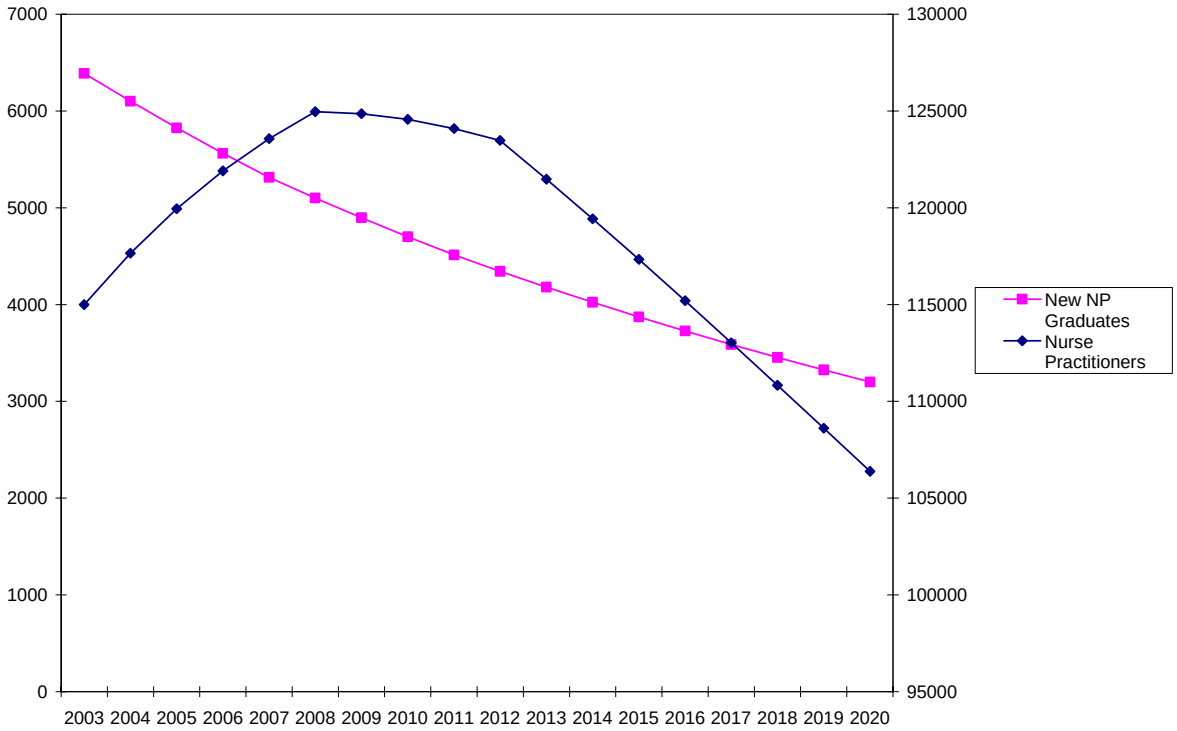
health care services are financed. This means that nurse practitioners may easily move from a more independent setting delivering primary care services to more highly organized settings in which they are a part of a team delivering specialized services. The relative short time from training to practice, six years post high school versus eleven for primary care physicians, also makes their role highly adaptive to the needs of the care system. Two examples point to this flexibility.

In response to the perceived shortfall of primary care providers the nurse practitioner population grew between 1996 and 2000 by 87% from 71,000 to 103,000.[8] Very few professions could respond as quickly and deeply to such demands. Today there is less demand for primary care providers and many nurse practitioners are finding new practice opportunities in tertiary care settings, reorienting their practice to meet changing needs.

This dynamic capacity of the profession to both change its number and reorient its practice makes long-term projections of size and scope of practice difficult, but some projections based upon a few assumptions can be made about the future supply of nurse practitioners. The number of NPs reached 115,000 nationwide in 2003. Using this as a base for future projections, figure 5 models the supply out to 2020. Several important assumptions are built into the model. A rate for retirement and leaving practice was imputed by taking the number of graduates between 2000 and 2003 and identifying the difference between the numbers of nurse practitioners between the same years as the effective rate leaving practice. This rate was 2.7% rounded up to 3%. As

the nurse practitioner population is aging the retirement rate grows to 5% by 2020 to reflect these changes. Currently the number of NPs graduating is declining at about 4.5% a year. This may be a short-term accommodation to the changing demand for primary care NPs and could change quickly with a change in demand for primary or specialty care. Nonetheless a rate of decline for the number of graduates is factored in at 4.5% decreasing to 3.75% by 2020.

Figure 5: NPs Graduates and Practitioners, 2003-2020



Data Source: National Organization of Nurse Practitioner Faculty; Analysis by Center for the Health Professions.

By these projections the total NP practice population would peak in 2008 at almost 125,000. If the trend in declining graduates continues, the rate of those leaving the profession will exceed new graduates, with the population of nurse practitioners increasing to almost 125,000 by 2008 before it reaches the point where the number of graduates fails to replace the number leaving practice. By 2020 the number of practitioners projected by this model would fall to about 106,000, approximately the number in 2001. It is also important to recognize that the opportunity and challenges associated with nurse practitioners, recognized for years[42-44], are pertinent to present opportunities to enhance primary care and family medicine.[45]

It is important to recognize both the elasticity and flexibility of nurse practitioner education and practice. Its capacity to grow in the nineties and contract in this decade is unmatched in medicine.

Summary Comments

The NP and PA workforces exploded over the last 15 years, both in production and in training capacity. Their combined number in primary care (a majority of NPs and a large minority of PAs) now rivals the number of family physicians. Most NPs and PAs work collaboratively with physicians and are positioned to make further, important contributions in the primary care setting. Calls to improve the interdisciplinary nature of primary care and to assure a full basket of services have never had such a large workforce positioned to respond. With their shorter training periods, PAs and NPs

represent a relatively flexible workforce that can adapt quickly to needs and demands in either primary care or subspecialty medicine.

Demographic Trends that Impact the Physician Workforce

Demographic factors influence both the demand and supply of physicians. The three main demographic factors that underlie the demand for physicians are:

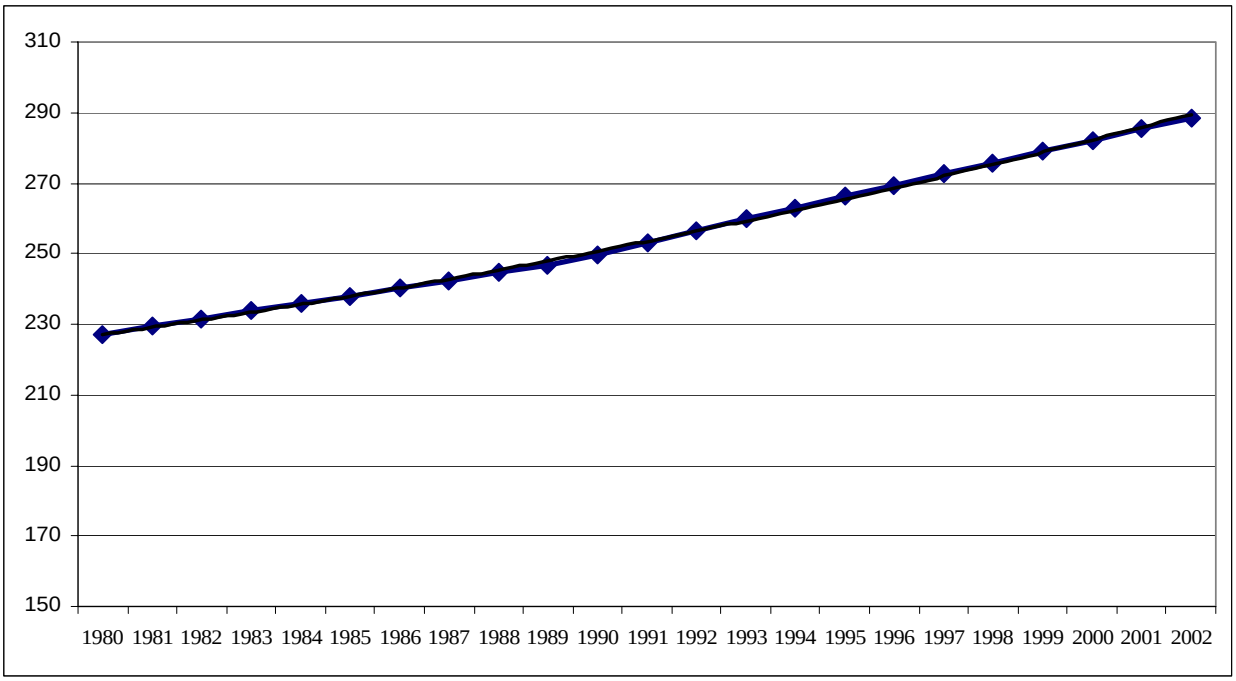
1. Growth in the size of the general population.
2. Age distribution of the population.
3. Regional distribution of the population.

In this section, we discuss trends in these factors since 1980.

Trends in the size of the general population

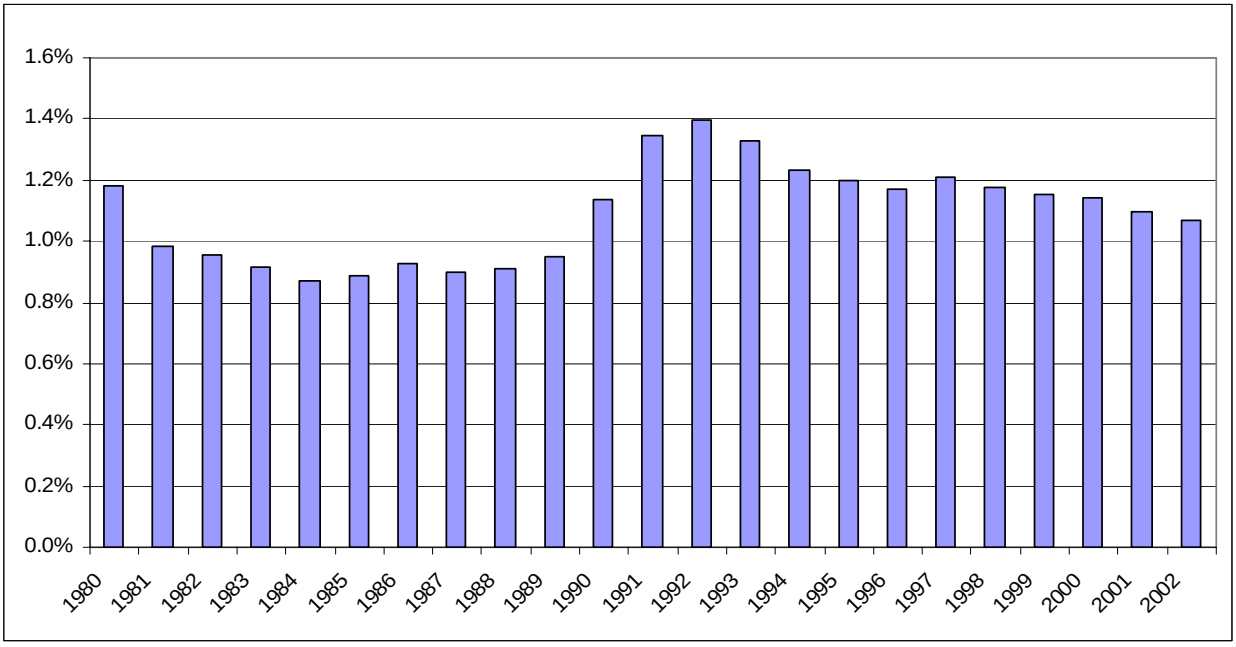
When the size of the general population increases, the demand for physician services increases.[46;47] In figure 6 and figure 7, we present two graphs depicting the trends in the general U.S. population and the rate of growth of that population since 1980. Over the period the aggregate size of the U.S. population has increased steadily by about 27%.

Figure 6: The Trend in the U.S. General Population (in millions)



Data Source: U.S. Bureau of the Census[48]; Analysis by The Robert Graham Center, 2004.

Figure 7: Annual Rates of Growth in U.S. General Population



Data Source: U.S. Bureau of the Census[48]; Analysis by the Robert Graham Center, 2004.

The highest rates of growth were during the early part of the nineties (1991 through 1993). Since then growth rates have diminished slightly even though the population continues to grow steadily.

Trends in the age distribution of the population

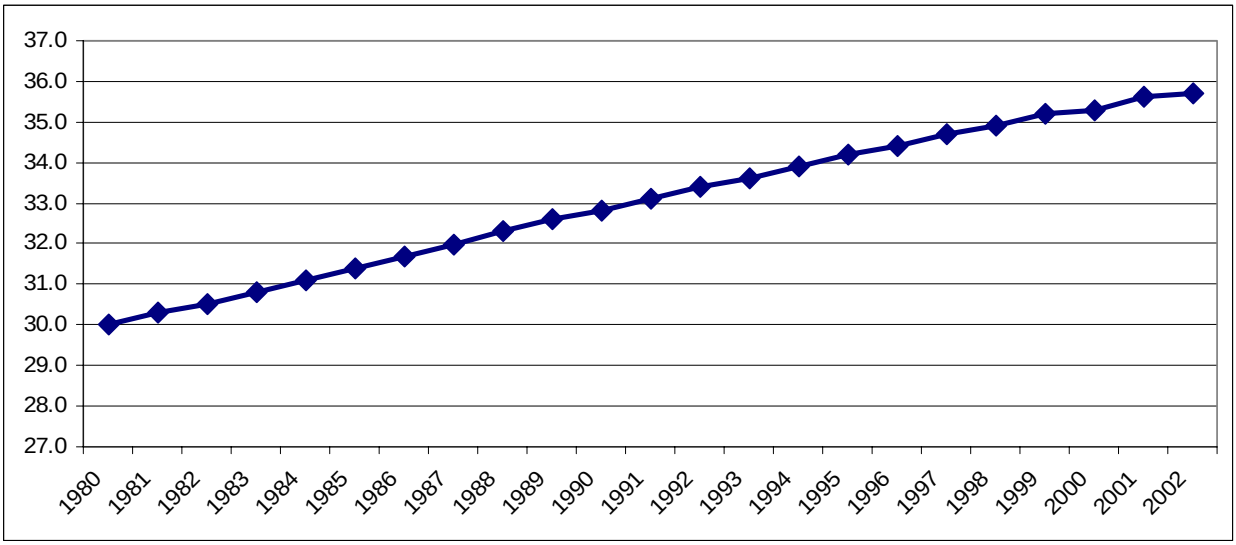
It is also important to characterize trends in the age distribution of the population because it has long been considered that the U.S. population is aging. More specifically it is thought that the relatively large baby boom generation is aging. If the elderly have greater and different health care needs than the non-elderly, then an aging of a large

age group cohort of the population would result in a general increase in health service needs and in a derived demand for physicians.

Evidence from the National Center for Health Statistics Advanced Data Reports[49-51] shows that over time (1992 to 2002) the highest health service utilization rates have been for the population 65 years and over. These utilization rates were estimated with respect to office-based physician services, hospital emergency, and outpatient department services. The existence of the Medicare program and various Medi-gap insurance programs for the population 65 years and over has meant lower out-of-pocket costs for that section of the population and increased demand for physician services.

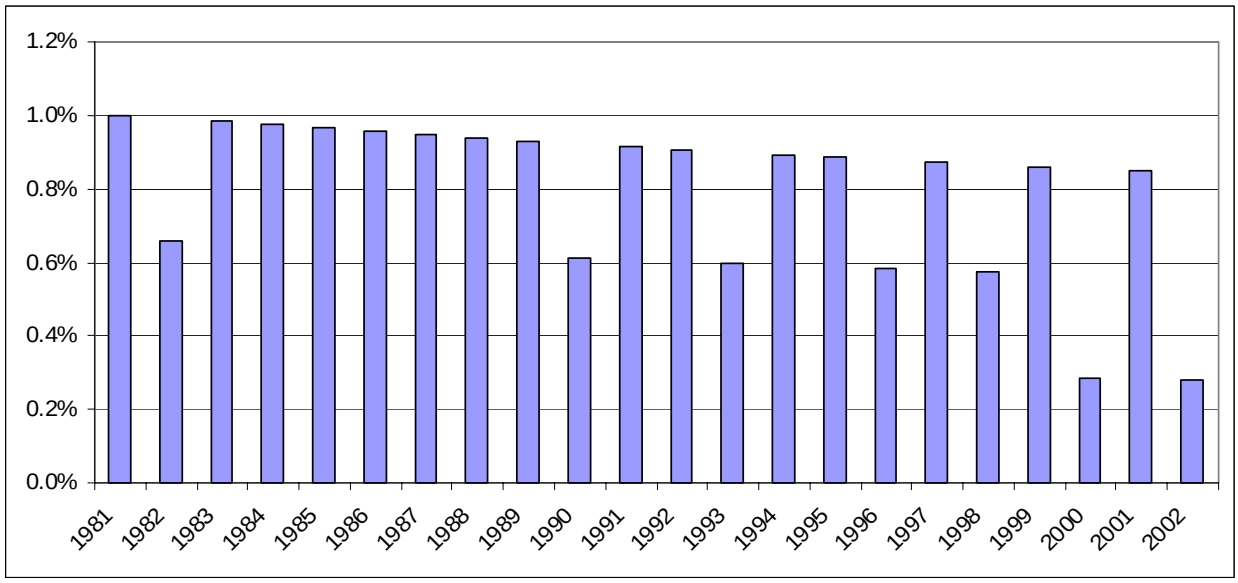
Figure 8 and figure 9 present the evidence on the trend in age distribution of the U.S. population. They show a steady upward trend in the median age of the population over the period since 1980 with intermittent growth spurts. Further evidence of the aging U.S. population is provided by figure 10 showing trends in the five-year cohorts from 40 to 64 years old, the ten-year age cohorts from 65 to 84 years old, and the population 85 and over. It shows the steady progress of the baby-boomer age group cohort as it ages. There has been growth in the relative size of three age cohorts between 40 and 54 years old throughout the period. Around 1999 however growth in the size of the 40-44 age cohort seemed to level off. The growth appears to have been passed on to the 55-59 age cohort around 1996 and the 60-64 years age cohort, five years later around 2001.

Figure 8: Median Age of U.S. Resident Population



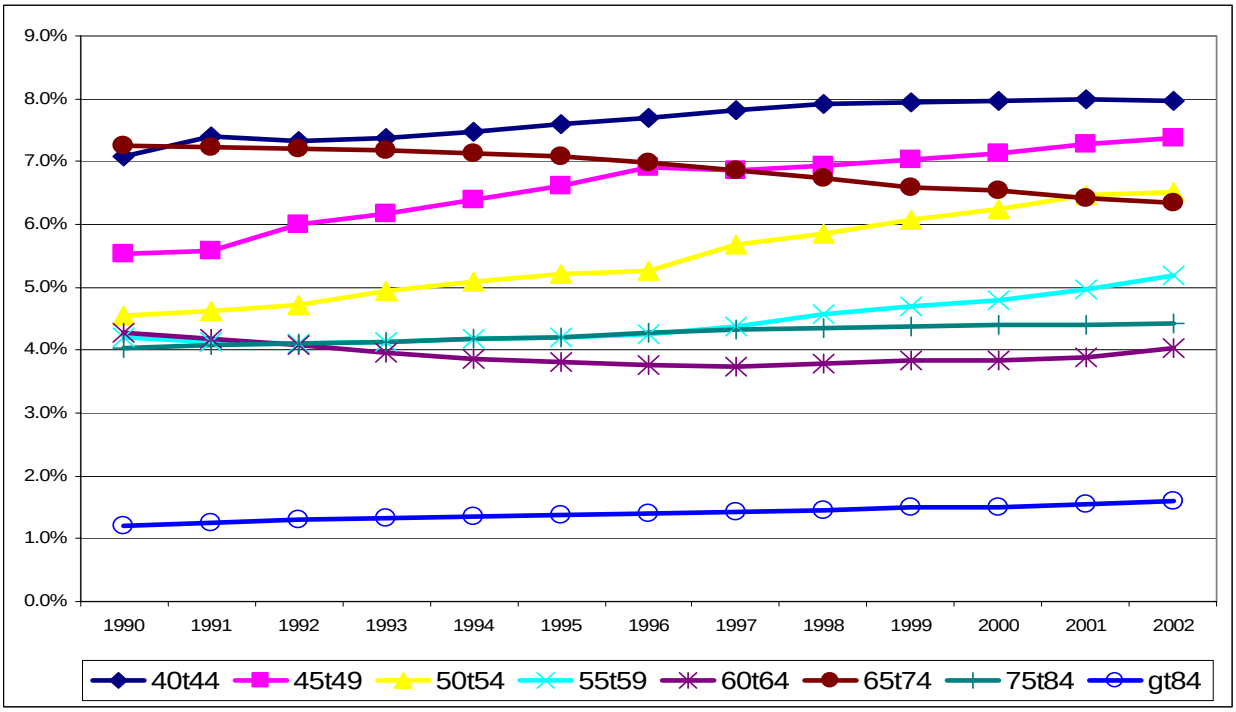
Data Source: U.S. Bureau of the Census[48;52]; Analysis by The Robert Graham Center, 2004.

Figure 9: Annual Rates of Growth in the Median Age of the U.S. Population



Data Source: U.S. Bureau of the Census[48;52]; Analysis by the Robert Graham Center, 2004.

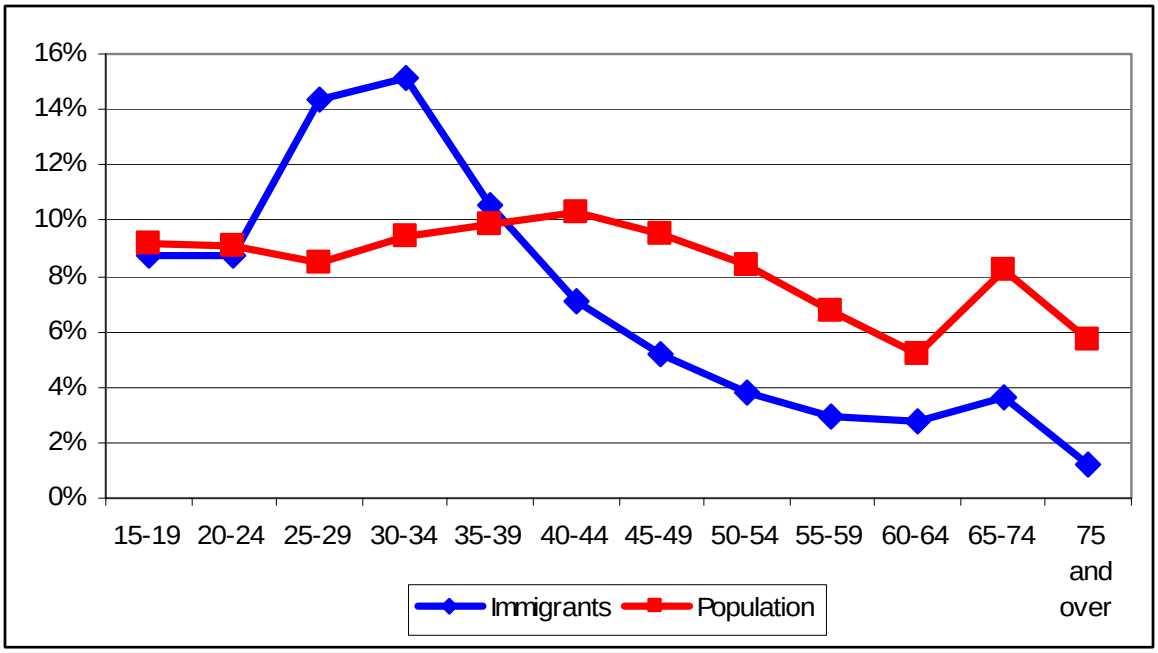
Figure 10: Trends in Age Groups as Percent of Population (1990-2002)



Data Source: U.S. Bureau of the Census[52]; Analysis by The Robert Graham Center, 2004.

A sizable proportion of the protruding effect of the aging of the baby-boomers has been offset by net international in-migration of younger age groups. Almost half of the net increase in the U.S. population has been from such net in-migration.[53] Almost half of these in-migrants are 25 to 44 years old with an average age of 38 or lower.[54] Figure 11 shows a comparison of the age distribution of these new immigrants to that of the general population. Almost a third are of Hispanic origin, having Mexico or a country in South America as their country of birth.

Figure 11: Comparing the Age Distribution of Immigrants to that of the General U.S. Population (2002)

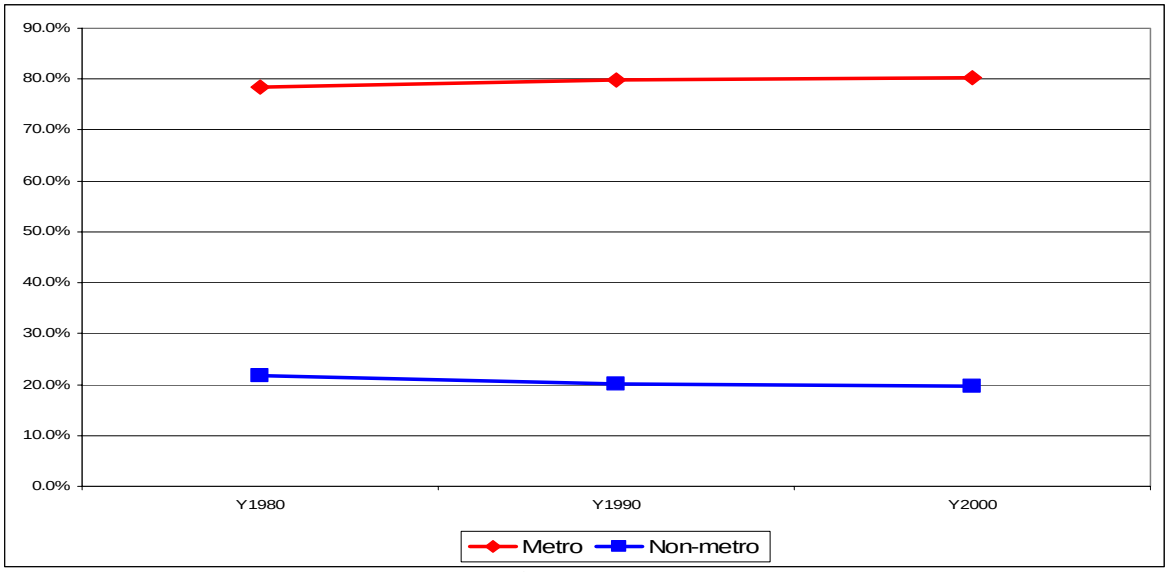


Data Source: Department of Homeland Security[55] and U.S. Bureau of the Census[52]; Analysis by The Robert Graham Center, 2004.

Trends in the regional distribution of the population

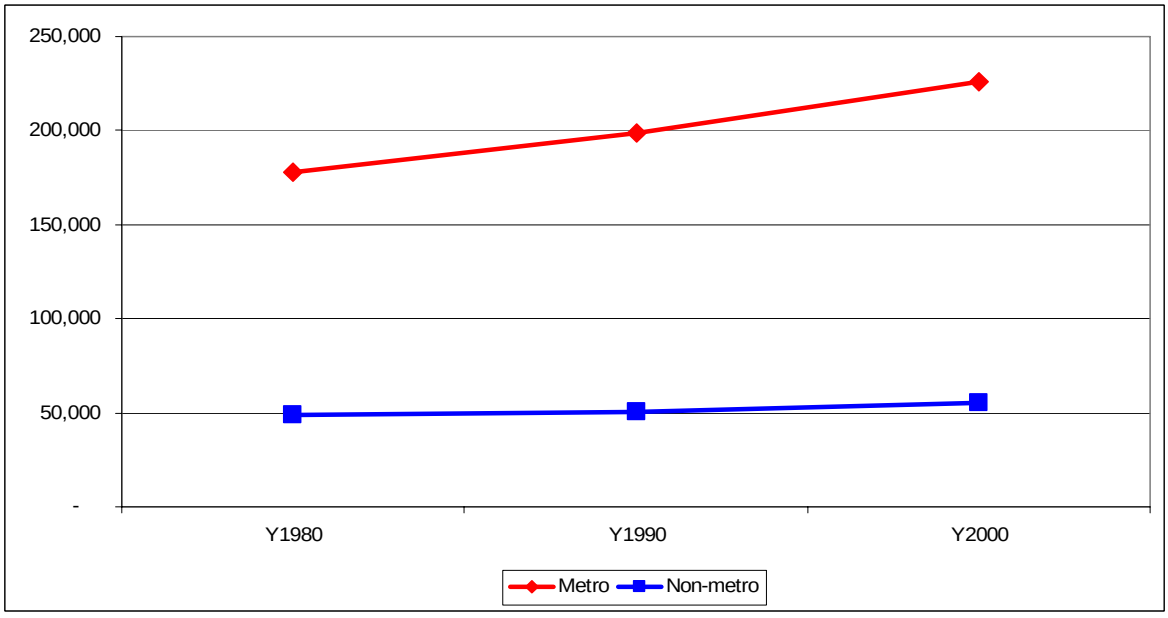
Figures 12 and 13 present the trends in regional distribution of the population between the metropolitan and non- metropolitan areas of the country since 1990. They show that even though there is a steady growth in the general population in both metropolitan and non- metropolitan areas, the proportion of the population living in non- metropolitan areas seems to have remained steady over the period. Suburbs, not central cities, account for most of the metropolitan growth.

Figure 12: Trends in Proportion of United States Population in Metro and Non-Metro Areas



Source: U.S. Bureau of the Census[56]; Analysis by The Robert Graham Center, 2004.

Figure 13: Trends in Size of Metro and Non-Metro Area Population (in thousands)

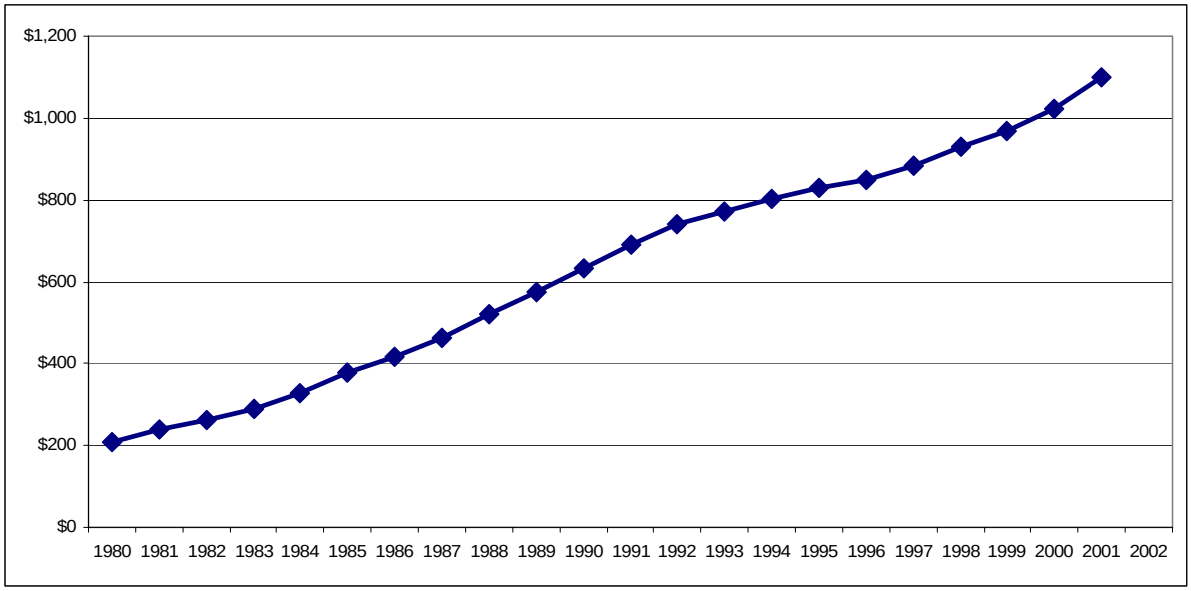


Data Source: U.S. Bureau of the Census[56]; Analysis by The Robert Graham Center, 2004.

Trends in factors that underlie the supply and production of physicians

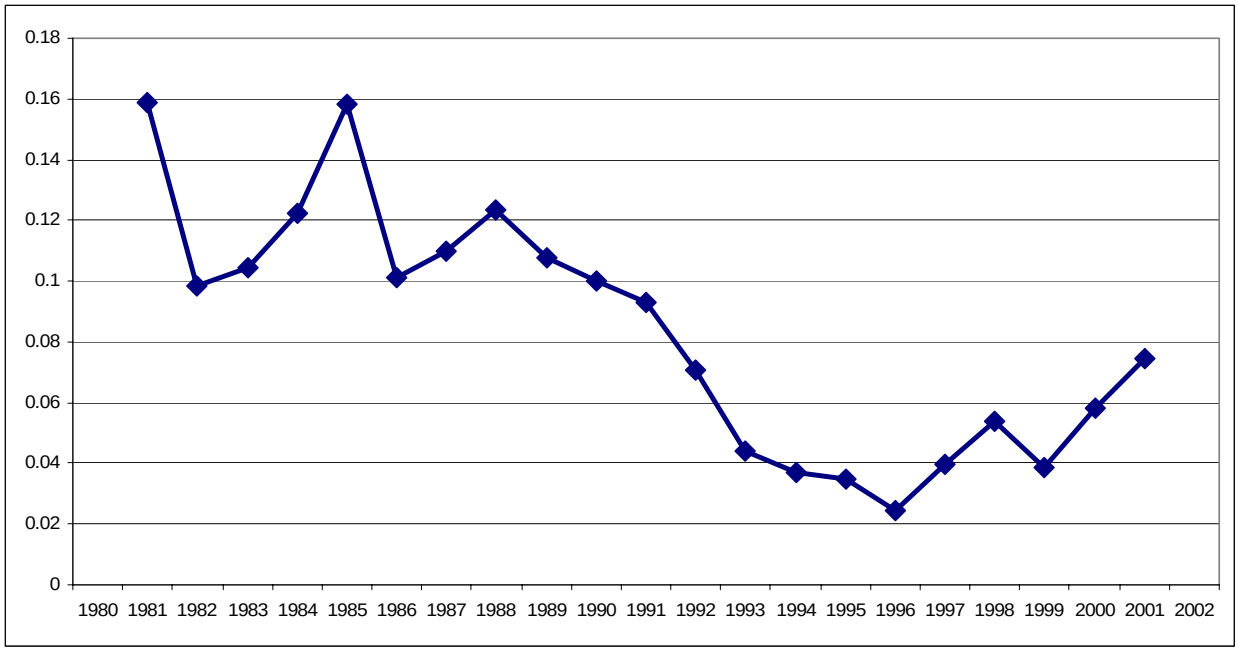
Due in part to the role played by government finance in the training of physicians, it has been argued that the supply of physicians is dependent on the status of the country's economy[57-61]. Figures 14 and 15 present the trends in aggregate expenditures on physician and clinical services. These expenditures include both private and public expenditures. Figure 14 shows a steady growth in expenditures over the period. Figure 15 shows however that the annual rate of growth in these expenditures decreased prior to 1996. Since 1996, however, these expenditures have started to increase again.

Figure 14: Trends in Expenditures on Physician and Clinician Services per Capita



Source: U.S. Bureau of the Census[62]; Analysis by The Robert Graham Center, 2004.

Figure 15: Annual Rates of Growth in Expenditures on Physician and Clinician Services per Capita



Data Source: U.S. Bureau of the Census[62]; Analysis by The Robert Graham Center, 2004.

Summary Comments

The U.S. population is increasing and is growing, older, more diverse, and more urban. The population is increasing and is more diverse because of a relatively large in-migration cohort. It is also older because of a relatively large age cohort of baby-boomers that is steadily aging. A larger population implies additional physicians will be needed to provide health care services. An older population implies not only that additional physicians will be needed because the elderly population utilizes a relatively higher proportion of health services, but also a need for additional physicians prepared to care for the elderly. There is also the likelihood that the current younger immigrant

cohort additions to the population will extend the impact of the baby-boomer cohort and the high demands on the country's health resources. Meanwhile both the metropolitan and non-metropolitan areas have maintained relatively constant proportions of the population, identifying a continuing need for physicians able to practice in non-metropolitan areas.

Models and Projections

Objectives of this study included developing models representing key elements that influence how many generalist physicians we have in the U.S. each year and using models to make projections, not forecasts and not predictions, of the physician workforce, with a particular focus on family physicians.

A projection is an extrapolation from the current conditions into the future based on clearly stated and assumed conditions about the future. Projections may assume the continuation of past conditions, present conditions, or trended changes in historical conditions or rates. They may also assume entirely new transition rates. Given the method and the assumptions, a projection is always correct if the operations of the projection method are carried out without error.

A forecast, on the other hand, is a probabilistic and often judgmental statement concerning the expected measurement of future conditions -- it is a prediction of what will happen in the future.

In this study, we used data representing conditions four years prior to the study to develop and assess supply and demand projections. In one of our projection examples,

we extrapolate or project into the future using our model and assuming a continuation of those conditions.

Background and Development of a Supply/Demand Model

In the background section, we discussed workforce analyses from GMENAC to the present, and we also presented a summary listing of the models that have guided those studies.[4;9-11;15-17;19-23] Those models have sometimes been referred to as the "planning models." There is another type of modeling that has guided health workforce studies, which we may call the "economic models."[63;64] These two types of models are at two ends of a spectrum as we explain with the help of table 15, a comparison table.

Table 15: Comparing Two Major Types of Models for Analyzing the Health Workforce

Features	Economic Models	Planning Models
Basis	(1) Economic Theory (2) Explanatory and predictive	(1) Planning Accounting (2) Predictive and Planning
Framework	Comprehensive market formulation with demand and supply components and inclusive set of variables.	Derives number of physicians supplied, and number demanded, but concentrates on relations involving some subset of variables.
Objectives	Derive market price and quantity based on assumptions that in the long-run "invisible hand" soaks up any short-run market shortages or surpluses in physician workforce.	Concern with predicting or forecasting shortages or surpluses in healthcare workforce. Projects short-run shortages and surpluses.
Components	Separate demand and supply components. Demand derived from utility function, and Supply derived from health production function.	Demand derived from "needs", utilization or socio-demographic factors. Supply derived from age-cohort flow analysis.
Expression of relations	Relations between variables represented by mathematical equations.	Broad relations, where there are data available. Relations not expressed mathematically.
Data Used	When estimated, have used survey or historical data.	Have used various data, including historical and hypothetical data, for example experts' consensus estimates of physician "need."

At one end of the spectrum, the economic models have been preoccupied with achieving economic and theoretical rigor and have focused on analytical derivations of the price and quantity of physician health services. At the other end of the spectrum, the planning models have focused on predicting physician shortages or surpluses, and have used broad planning concepts.

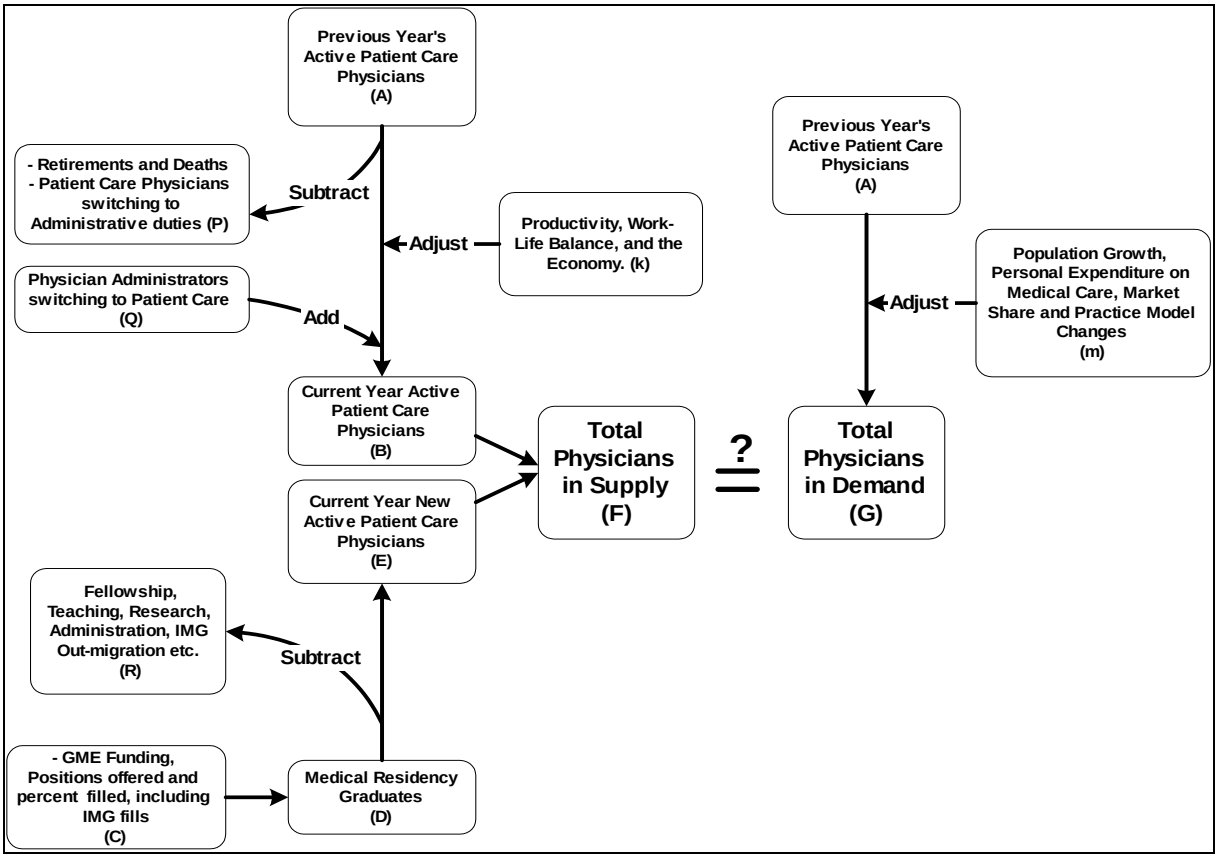
Our supply/demand workforce model is in the middle of this spectrum. In developing this model we have tried to retain the simplicity inherent in the planning models. Our model uses the basic age cohort flow concept and presents the addition and attrition rates for

implementation of the model and projections. On the other hand, like the “economic models,” our model has a comprehensive market formulation with separate demand and supply components that combine to better represent the physician workforce market. Implementation of the model involves a step-by-step process that attempts to mimic the mechanism of the physician workforce market.

The basic structure of the model is presented in figure 16. It seeks to explain the number of practicing physicians who are active and providing patient care in this country. These are physicians (not residents) providing patient care for more than 33 hours a week. For convenience, throughout the rest of this section, we will refer to these “active practicing patient care physicians” as “active physicians.” In this study, we specified a model for each of four groups of physicians. The first three groups are generalist physicians in family medicine, internal medicine, and pediatrics. The fourth is an aggregate group of active physicians in the first three groups inclusive. In each case, the number of active physicians determined by our model includes both allopathic and osteopathic physicians, and federal as well as non-federal physicians. It does not include physicians within any of the three primary care specialties who decide to provide patient care within any sub-specialty. For example, it does not include medical residents in internal medicine who decide to practice in hematology.

Our model encompasses both the demand and supply for physicians and uses real data from national surveys like the National Ambulatory Medical Care Survey (NAMCS) and physician databases like the American Medical Association (AMA) Physician Master files.

Figure 16: Supply and Demand Physician Workforce Model



Both our demand and supply models start from the prior year's active physician workforce. The supply model determines the current year's active physician workforce by adding new active physicians and subtracting physician attritions. It also adds or subtracts a number of physicians based on regression-estimated adjustment factors.

Our supply model subtracts the number of attritions including retirements and deaths in the current year from the prior year's stock of active physicians. It also subtracts the number of active physicians that changed from providing patient care to performing

administrative duties. It also adds in the number of physicians who changed from being administrators to providing patient care.

Our supply model also adds in medical residents who graduate, including international medical graduates (IMG), who decide to become new active physicians during the current year. Of course the number of these new active physicians depends on the number of residency positions offered and filled three years prior and the number of new graduating physicians who decide to actively provide patient care. The number of residency positions offered in turn depends on general medical residency funding from the various major sources.

To determine the “total number of active physicians supplied,” our supply model also adjusts the prior year’s stock of physicians using various regression-estimated factors. These factors represent the relation between the adjustment variables, the number of active physicians in demand, and the number supplied. We started by suggesting that the following variables may have significant influences on the number of active physicians supplied: (a) Changes in the general state of the economy; and (b) Changes in physician productivity and work-life balance. The general state of the economy was represented by the real Gross Domestic Product (GDP) measured using dollars from 2000. The duration of generalist medical residency training is three years, so we propose that the current number of active generalist physicians is influenced by the real GDP three years prior. Growth in the economy (or the GDP) is expected to affect the amount of resources committed to the production of active physicians. Physician productivity and work-life balance changes were estimated by the trends in the relative

number of hours physicians devote to patient care. We assumed that for physicians, the first quartile, which is 34 hours or less per week, or 47 weeks or less per year (or both), constitutes part-time practice. We expected to find a general decrease in trends of the number of hours physicians provide in patient care, even as the number of active physicians increased.

To determine the “total number of active physicians in demand” in the United States, in the current year, our model adjusts the prior year’s stock of active physicians using the following adjustment factors:

1. Rate of growth in the U.S. Population;
2. Rate of growth in real personal expenditure on medical services; and
3. The market share of physician services and practice model changes in any physician group.

We expect increases in the numerical size of the population to be associated with increases in the demand for health services and physicians. We expect that improvements in the economy will provide additional personal economic resources and increases in personal expenditure on medical services. We also expect such increases in personal expenditure to be associated with an increased demand for active physicians.

Data Sources and Method

A list of the main variables and the adjustment variables of our models and the sources of the data used to represent the variables are presented in table 16. The major sources consist of two databases (American Medical Association (AMA) Physician Master files and the U.S. National Resident Matching Program), two national surveys (Community Tracking Study (CTS), National Ambulatory Medical Care Survey (NAMCS)), and two sources of national government agency statistics (U.S. Bureau of Census, U.S. Department of Commerce).

Table 16: Key Data Variable List and Sources for Estimating Models

Variables	Data Source	Period
Main variables		
Number of medical residency positions offered and percent positions filled.	Data from the U.S. National Resident Matching Program	1998 - 2004
(1) Current and previous year number of patient care physicians (2) Number of medical residents who become new patient care physicians (3) Number of patient care physicians who become administrators, and vice versa (4) Physician deaths and retirements.	Physician-level data from AMA Physician Masterfiles	2000 – 2004
Adjustment variables		
Changes in physician productivity and work-life balance -- number of hours devoted to patient care	Community Tracking Study (CTS) – Physician Survey, center for Studying Health System Change	1996-1997, 1998-1999, 2000-2001
Market share of physicians' services (patient visits) for each physician group	National Ambulatory Medical Care Survey (NAMCS)	1980 – 2003
Health insurance (percent of U.S. population uninsured)	The Medical Expenditure Panel Survey (MEPS), Agency for Healthcare Research and Quality (AHRQ)	
(1) The economy (gross domestic product, lagged three years, and using dollars from 2000) (2) Real personal expenditures on medical services	U.S. Department of Commerce - Bureau of Economic Analysis	1994 – 2004
Population growth rate (U.S. permanent civilian resident population – 50 states & DC)	U.S. Bureau of Census	1980 - 2002

The AMA Physician Masterfile data indicate whether a physician is retired or semi-retired, and whether they are “presumed dead” or not. They also indicate if a physician is involved in mainly administrative duties or in direct patient care. In all cases, we determined a physician’s current year status (providing direct patient care, administrative duties, retired, presumed dead, etc.) by comparing the current year’s data to the subsequent year’s data. The AMA Physician Masterfile data are the most prominent, complete, current, and widely used data for analyses of the U.S. physician workforce. The AMA Masterfile used in this study contained data updated and available in the following months (points in time): June 2000; May 2001; May 2002; December 2002; and March 2004. Limitations of the data and data edit decisions are presented in Appendix B.

Deriving the Adjustment Factors For the Supply/Demand Model

We determined the magnitude of the adjustment factors by estimating the most recent historical trend relations between the adjustment variables and the active physician workforce for each of the four physician groups.

First we characterized the relations by plotting the data on each of the adjustment variables and the active physician workforce. We then estimated each relation quantitatively by fitting a statistical equation representing the relation. The equations were fitted using simple regression techniques. Linear (straight line) equations were fitted first and if judged to be inadequate fits, then non-linear (curve) equations were fitted instead.

We derived the adjustment factors for our models from the slopes of these fitted lines or equations. The methods of estimation, regression diagnostics and limitations of the regression methods are discussed in Appendix C. The results of the best-fit regression estimations are shown in Appendix table 5, and the estimated factors used are presented in table 17.

The results show that the main supply adjustment factor is the general state of the economy. There is evidence in the literature of a positive relation between the physician workforce and economic expansion.[57-61;65;66] Our results imply that a one billion dollar increase in real GDP is associated with a corresponding increase of six family physicians, eight general internists, and four pediatricians, three years later. Even though these results emanate from what seems like an apparently simple relation between the economy and the physician workforce, it is actually quite complex. It is important to note, however, it is not a simple cause-effect relation and it does not work in isolation.

Despite some literature on the expected role of physician work effort in influencing the number of physicians in the workforce[67-69] we found little evidence of that relationship. For example, Cull et all[70] found 11% of pediatricians working part-time in 1993 and 15% working part-time in 2000. In our study, we used data from the Physician Survey of the Community Tracking Study on the average hours generalist physician groups devote to patient care as a ratio of the national average. We found that the regression coefficients of our work-life variables were statistically not significant. This implies that in general changes in the number of hours the three physician groups were devoting to patient

care were not statistically different from zero. In other words there have been no significant changes in work-life balance for these three physician groups.

The evidence from our exploratory analysis of the data is that some physicians (especially pediatricians) seem to have started changing their work patterns, choosing to spend more time in family activities instead of work. Most of the changes seem to be by female physicians.[70] However, the effect of this on determining number of direct patient care physicians seems to be currently negligible. It is quite likely though that it will not stay negligible for long, and that in the future these changing patterns may start to influence physician workforce numbers.

On the demand side of our model, we assessed the relation between the annual change in number of persons in the permanent civilian population in the country and the active physician workforce. In our regression estimations, we found that the population growth variable is strongly related to the number of active physicians in the workforce of each of our three physician groups. The regression results imply that an increase of 4,000 persons in the population is associated with an increase of two family physicians, two pediatricians, and about three general internists.

We found that historically there is a negative relation between the proportion of the U.S. population that is uninsured and the number of physicians in demand. We also found that for each of the three primary care physician groups, changes in their market shares are not related in any way to the sizes of the workforce.

Table 17: Magnitude of the Adjustment Factors for the Supply/Demand Models

Factor Variables	Specialty	Parameter Estimate
Supply factors		
Economy three years ago ($billions GDP using dollars from 2000)	Family Medicine	5.040
	Internal Medicine	13.302
	Pediatrics	6.787
Demand Factors		
Population Growth (size of resident mid-year U.S. population)	Family Medicine	0.00042
	Internal Medicine	0.00101
	Pediatrics	0.00054
Percentage of U.S. population that is uninsured	Family Medicine	-1,642.4
	Internal Medicine	-1,162.9
	Pediatrics	-685.5

Source: Analysis by The Robert Graham Center, 2004.

In table 17 we present the results of the regression estimations and the adjustment factors from these estimations. The adjustment factors are the "parameter estimates" in the table. In summary, we identified the economy, or GDP, three years prior as the only statistically significant adjustment factor for our supply model. For our demand model we identified the size of the U.S. civilian population and the percentage of the population that is insured as statistically significant adjustment factors. The magnitude or adjustment effect of the market share was negligible and was not used in the model.

Estimating the Model

Using the physician-level data from the AMA Masterfiles for 2000 through 2004, and methods similar to those of micro-simulation, and SAS (a statistical analysis software package), we estimated the model.

For the supply model, we started by selecting all active physicians providing patient care in each period. From each prior period's stock of physicians, we subtracted all physicians who were designated as having either fully retired or died in the current period. We also subtracted physicians that changed from providing mainly direct patient care to administrative activities. We then added in all physicians who changed from being administrators to providing direct patient care.

For medical residents, we selected those who were not fellows, not involved as clinical administrators, not teaching, and not involved in research. From this universe of medical residents, we identified the medical residents who graduate and decide to become new active physicians during the current period. We added these to the group comprising the total physicians in supply. We transferred the output of the first phase into a spreadsheet. We then adjusted the previous period's stock of physicians using the economy, or GDP, adjustment factors derived earlier.

It is important to note here the significance of the adjustment factors in our model, using the economy or GDP adjustment variable as an example. The economy adjustment variable is the real GDP three years prior. We believe that the effect of the economy on the physician workforce is through a myriad of intermediate factors, such as the amount of public resources devoted to supporting GME residency training and the amount of private resources devoted to purchasing health care.

We capture this influence in two ways: (a) By accounting for the actual number of medical residency graduates who make the decisions to be new direct patient care physicians; and (b) by adjusting for any moderating or enhancement effects of the

economy minus the actual number of medical residency graduates joining the physician workforce. Thus, each adjustment factor is net of the actual accounting for new residency graduates joining the workforce.

To determine the total number of direct patient care physicians in demand in the current year, we adjusted the previous period's stock of active physicians using the population growth adjustment factors.

For the operation of this model, time is assumed to be discreet and the time between one period to the next is assumed to be the long-run. At the beginning of a period, we assume the physician workforce market is in economic equilibrium. At equilibrium, the market has neither a tendency to rise nor fall and there is neither an economic shortage nor a surplus. In other words the actual number of physicians supplied in the workforce is equal to the number in demand.

During the period however there is a lot of activity including physician attrition, new active physicians starting to practice, and influences from the economy. These activities create temporary shortages or surpluses nationally and regionally in the short-run. These activities also include the short-run interactions of the demand and supply components of the market.

In a shortage (or excess demand) for physicians one may observe increasing wait periods for a substantial number of physician appointments and physicians increasing their work periods. A surplus (or excess supply) of physicians is illustrated by an observation of a substantial number of physicians underemployed or unemployed. It is

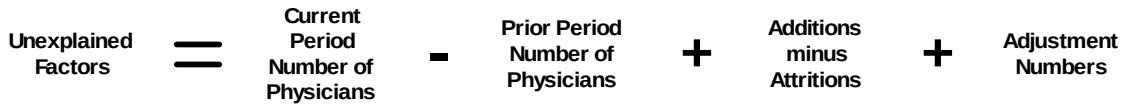
important to note that these activities may only be evident in the short-run. The process by which the market attains equilibrium in the long-run is explained in the paper by Grumbach (2002).[71]

By the end of the period (which is the beginning of the next period) however, the model assumes the long-run and also assumes that the physician workforce market is back in equilibrium. Which means the number of physicians supplied in the workforce is back to being equal to the number in demand again. Our model assumes that this step-by-step process mimics the mechanism of the physician workforce market. The model operates in that step-by-step fashion and the model estimations were done in the same way, one period at a time.

Results of our Modeling Estimations

Table 18 presents the results of our estimation of the supply model. Table 19 presents the results of our estimation of the demand model. They show the results for each of our three generalist physician groups (general practice or family medicine, internal medicine, and pediatrics) and generalist physicians combined from 2000 through 2004.

After the adjustments to each of the demand and supply models, we added up all the numbers for each physician group in each period, and subtracted it from the actual number of active physicians documented in the AMA Physician Masterfile for that period. The difference in number of active physicians, we have presented in tables 18 and 19 as “unexplained factors”. Thus in each case:



As an example, the last column of table 18 shows that in 2000 there were 202,212 generalist active physicians providing patient care in the country. In the following year (2001), 5.6% (4,324 graduating medical residents and 7,087 previous administrators) became generalist active physicians. In the same year 2.5% left the workforce (2,511 died or retired and 2,571 became administrators). We also adjusted our estimate of generalist active physicians up by 1.2% (2,429) due to growth in the economy (the GDP) three years prior. We present in the table age cohort flow and adjustment rates for the next three years: 2002, 2003 and 2004 separately for each of the three

generalist active physician groups (general practice or family medicine, internal medicine and pediatrics).

Table 18: Results from Estimation of the Supply Model

Data Date	Model Rates and Components	Fam Med/ Gen Pract	Internal Medicine	Pediatrics	Generalists
Jun 2000	Active patient care physicians	85,867	75,653	40,692	202,212
May 2001	Addition rate	5.2%	6.1%	5.6%	5.6%
	Attrition rate	-3.5%	-2.0%	-1.4%	-2.5%
	Adjustment rate	0.5%	1.9%	1.4%	1.2%
	Unexplained factors	-0.9%	-3.1%	-3.0%	-2.1%
	Active patient care physicians	87,016	77,877	41,753	206,646
May 2002	Addition rate	7.7%	8.2%	7.6%	7.8%
	Attrition rate	-4.6%	-2.9%	-2.4%	-3.5%
	Adjustment rate	0.0%	2.0%	1.4%	1.1%
	Unexplained factors	-0.8%	-3.5%	-3.1%	-2.3%
	Active patient care physicians	89,021	80,855	43,184	213,060
Dec 2002	Addition rate	7.4%	8.3%	7.3%	7.7%
	Attrition rate	-1.5%	-1.2%	-2.3%	-1.5%
	Adjustment rate	-0.9%	0.2%	0.8%	-0.1%
	Unexplained factors	-3.2%	-3.7%	-2.4%	-3.2%
	Active patient care physicians	92,096	83,757	44,633	220,486
Mar 2004	Addition rate	5.9%	6.1%	6.5%	6.1%
	Attrition rate	-4.5%	-2.7%	-2.6%	-3.4%
	Adjustment rate	-1.9%	-1.5%	-1.8%	-1.7%
	Unexplained factors	3.8%	4.4%	4.8%	4.2%
	Active patient care physicians	93,833	86,185	45,994	226,012

Data Source: Analysis by The Robert Graham Center, 2004.

Table 19: Results from Estimation of the Demand Model

Data Date	Model Rates and Components	Fam Med Gen Pract	Internal Medicine	Pediatrics	Generalists
Jun 2000	Active patient care physicians	85,867	75,653	40,692	202,212
May 2001	Adjustment rate	1.8%	3.2%	3.7%	2.7%
	Unexplained factors	-0.5%	-0.3%	-1.1%	-0.5%
	Active patient care physicians	87,016	77,877	41,753	206,646
May 2002	Adjustment rate	1.8%	3.1%	3.6%	2.6%
	Unexplained factors	0.6%	0.7%	-0.2%	0.5%
	Active patient care physicians	89,021	80,855	43,184	213,060
Dec 2002	Adjustment rate	1.4%	2.4%	2.8%	2.0%
	Unexplained factors	2.1%	1.2%	0.6%	1.4%
	Active patient care physicians	92,096	83,757	44,633	220,486
Mar 2004	Adjustment rate	1.7%	2.9%	3.3%	2.5%
	Unexplained factors	0.2%	0.0%	-0.3%	0.0%
	Active patient care physicians	93,833	86,185	45,994	226,012

Data Source: Analysis by The Robert Graham Center, 2004.

One way to assess our model is to calculate for each physician group and each year the percentage of the total number of direct patient care physicians that was accounted for by the model. In table 20 we present a table with those percentages.

Table 20: Proportion of Number of Active Physicians Accounted for by the Supply/Demand Models

Period and Model	Family Medicine/General Practice	Internal Medicine	Pediatrics	All Generalists
Supply Model				
Jun 2000 to May 2001	99.1%	96.9%	97.0%	97.9%
May 2001 to May 2002	99.2%	96.5%	96.9%	97.7%
May 2002 to Dec 2002	98.4%	96.3%	97.6%	97.4%
Dec 2002 to Mar 2004	96.2%	95.6%	95.2%	95.8%
Demand Model				
Jun 2000 to May 2001	99.4%	99.4%	99.2%	99.9%
May 2001 to May 2002	98.0%	99.2%	99.5%	98.8%
May 2002 to Dec 2002	97.3%	99.1%	99.3%	98.4%
Dec 2002 to Mar 2004	98.8%	99.8%	100.0%	99.6%

Data Source: Analysis by The Robert Graham Center, 2004.

The table shows that our supply model accounted for 95.2 to 99.2% of the total number of actual active physicians. The demand model fared even better, accounting for 97.9 to 100% of the total active physician workforce.

There are two main mechanisms for tuning our model to analyze its sensitivity and to use the model to make projections. It can be done by:

1. Keeping the rates in table 18 and table 19 unchanged but changing the magnitude of the various factors (or variables) in the model.
2. Changing the relationships underlying the model. This is the same as changing any of the rates in table 18 and table 19, without changing the magnitude of the variables.

Of course one can anticipate circumstances in which the nature of the relations (the rates), and the magnitude of the factors (GDP, population, physician retirement, etc.)

both change in various ways. Nonetheless, making projections with these models is straightforward.

The rates presented in tables 18 and 19 represent the main elements of our physician workforce model. Implementation of the model involves a step-by-step process that attempts to closely mimic the mechanism of the physician workforce market. A spreadsheet that does just this is explained in Appendix D and can be used to model a host of assumptions as desired by any user. We present below five examples for obtaining projections of the U.S. generalist physician workforce using the supply and demand models. These examples also illustrate some of the main features of the model.

1. Status Quo Projection Example

In the status quo example, we extrapolated or projected the direct patient care physician workforce into the future using our model and assuming a continuation of the conditions represented by the model. We assume that patterns of all the main factors of our model influencing the demand and supply of the patient care physician workforce remain constant over time. In other words, changes in both the adjustment factors and the main variables are set equal to zero. That means the current rates of direct patient care physician attrition and the current rates of getting additional patient care physicians stay constant, even though the components of attrition or addition may change in opposing or offsetting directions. For example, attrition rates are still constant even if deaths increase by 1,000 and retirements decrease by an equal 1,000 physicians.

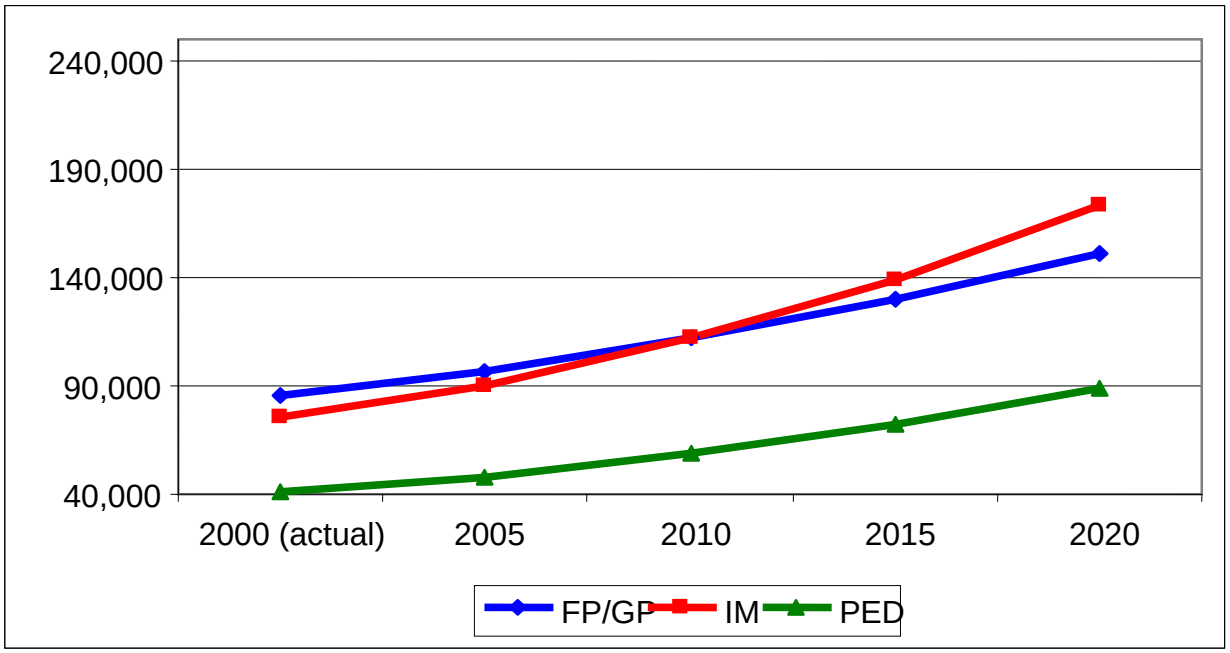
Table 21 and figure 17 present the results of the status quo projection example. It shows that the workforce of active family physicians increases from 93,837 in 2004 to about 151,000 in 2020, increasing by about 60% over the period or an average of three percent per year.

Table 21: Projected Physician Workforce Using the Supply/Demand Models – Status Quo Example

Year	Fam Med/ Gen Pract	Internal Medicine	Pediatrics	Generalists
2004 (Actual)	93,837	86,187	45,998	226,022
2005	97,000	90,000	48,000	235,000
2010	112,000	112,000	59,000	283,000
2015	130,000	139,000	72,000	341,000
2020	151,000	173,000	89,000	413,000

Data Source: Analysis by The Robert Graham Center, 2004.

Figure 17: Physician Workforce – Status Quo projection Example (2000 – 2020)



Data Source: Analysis by The Robert Graham Center, 2004.

In the status quo example, the total workforce of the primary care generalists increases from 226,022 in 2004 to about 413,000 physicians in 2020. Even more interesting are the results that the number of physicians practicing in internal medicine grows at a higher rate than the number practicing in family medicine. So prior to 2010 there are more physicians practicing in family medicine that in internal medicine. However this is reversed after 2010.

2. Increased Supply Example

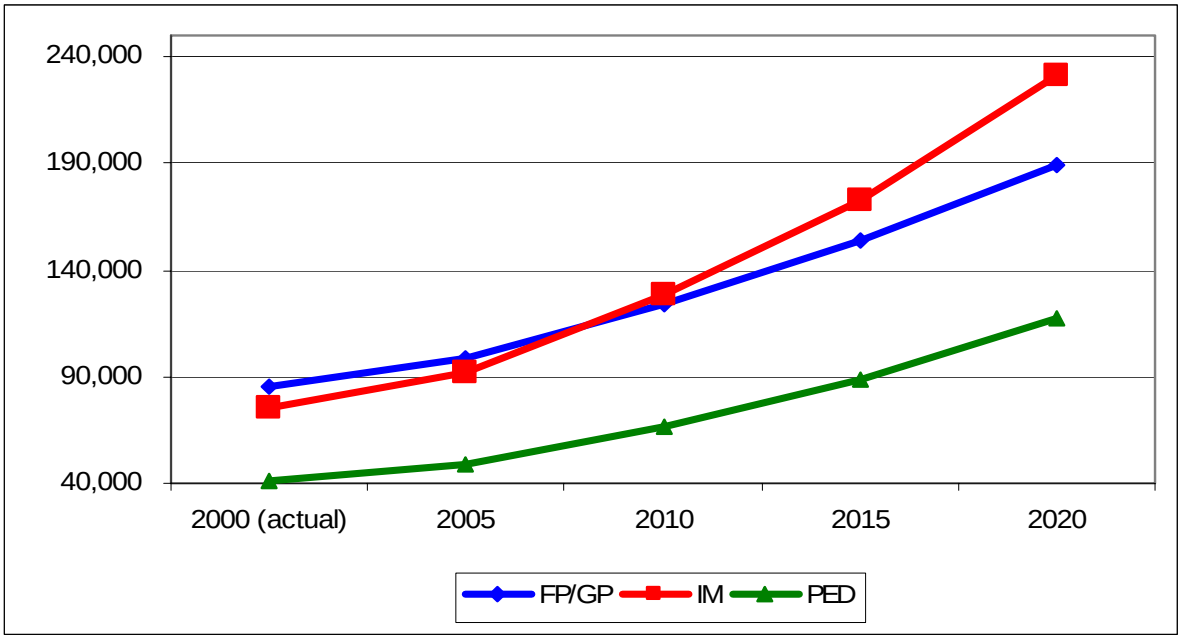
In the increased supply example, we increased real per capita GDP by using the GDP projections by the Congressional Budget Office (CBO), while we kept the adjustment factors constant. The resulting projections are presented in table 22 and figure 18 below.

Table 22: Projected Physician Workforce Using the Supply and Demand Models – Increased Supply Example

Year	Fam Med/ Gen Pract	Internal Medicine	Pediatrics	Generalists
2004 (Actual)	93,837	86,187	45,998	226,022
2005	98,000	92,000	49,000	239,000
2010	124,000	128,000	67,000	319,000
2015	154,000	173,000	89,000	416,000
2020	190,000	231,000	117,000	538,000

Data Source: Analysis by The Robert Graham Center, 2004.

Figure 18: Physician Workforce – Increased Supply Projection Example (2000 – 2020)



Data Source: Analysis by The Robert Graham Center, 2004.

In this example, the effect of the higher CBO projections of GDP is to adjust the rate of growth in the physician workforce upward for all physician groups. The results include having the number of physicians practicing in internal medicine exceed the number of physicians practicing in family medicine earlier than in the status quo example (i.e. prior to 2010).

3. Decreased Supply Example

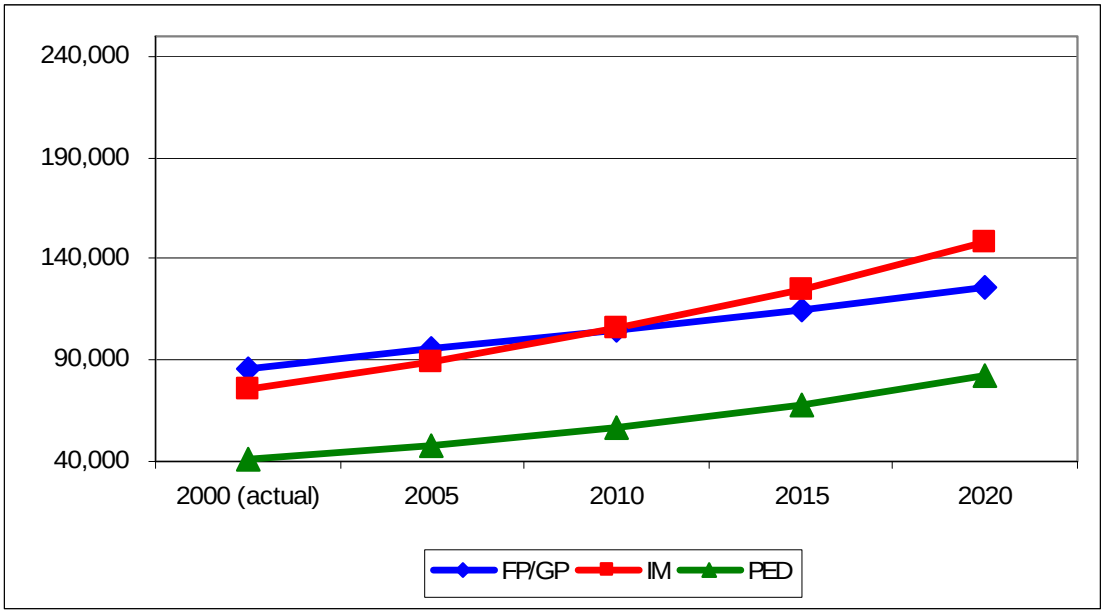
In the decreased supply example, we kept the main variables constant, and decreased the adjustment factors by a third (33.3%) over the projection period. The resulting projections are presented in the table 23 and figure 19 below

Table 23: Projected Physician Workforce Using The Supply/Demand Models – Decreased Supply Example

Year	Fam Med/ Gen Pract	Internal Medicine	Pediatrics	Generalists
2004 (Actual)	93,837	86,187	45,998	226,022
2005	95,582	89,142	47,691	232,415
2010	104,804	105,508	57,137	267,449
2015	114,916	124,878	68,455	308,250
2020	126,004	147,805	82,014	355,824

Data Source: Analysis by The Robert Graham Center, 2004.

Figure 19: Physician Workforce – Decreased Supply Example (2000 – 2020)



Data Source: Analysis by The Robert Graham Center, 2004.

This example illustrates the effect of changing the rate of the adjustment factors on the model. The rate of increase in the number of physicians projected in each physician group decreased.

4. Increased Demand Example

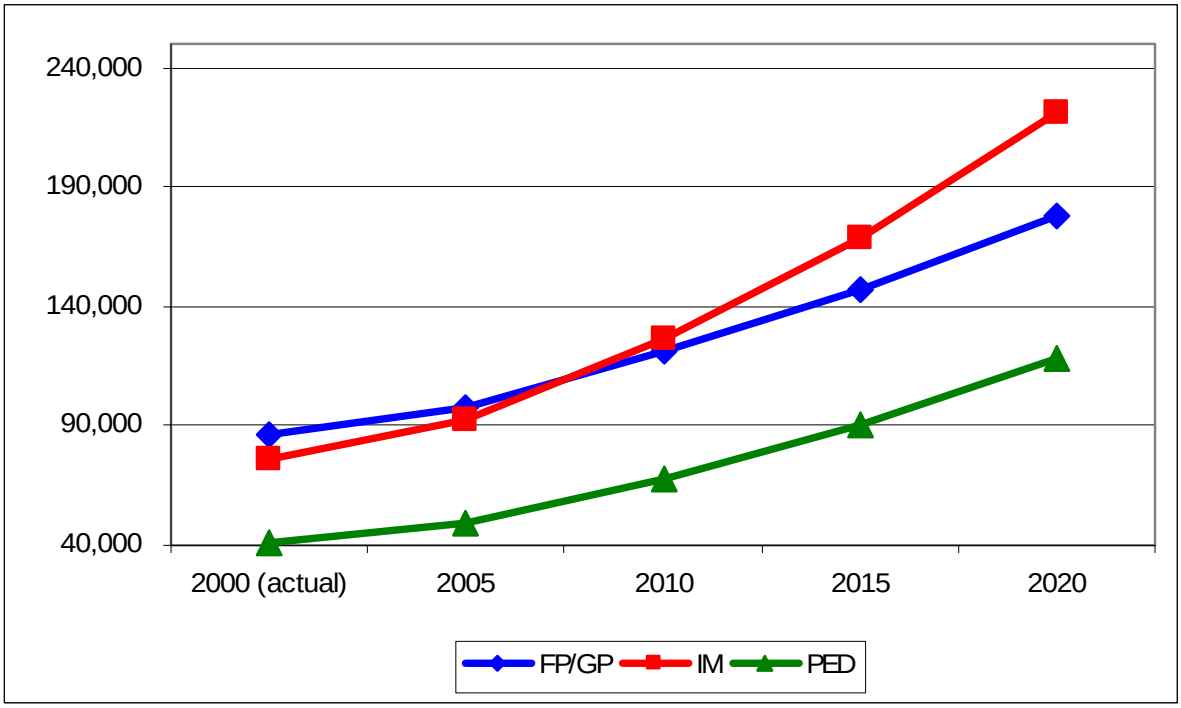
In the increased demand example, we increased the size of the population by using the population projections by the U.S. Census Bureau (Middle series) based on the 2000 Census, while we kept the adjustment factors constant. The resulting projections are presented in the table 24 and figure 20 below.

Table 24: Projected Physician Workforce Using the Supply/Demand Models – Increased Demand Example

Year	Family/General Medicine	Internal Medicine	Pediatrics	Generalists
2004 (Actual)	93,837	86,187	45,998	226,022
2005	98,000	92,000	49,000	239,000
2010	121,000	126,000	68,000	315,000
2015	147,000	169,000	90,000	406,000
2020	178,000	221,000	118,000	517,000

Data Source: Analysis by The Robert Graham Center, 2004.

Figure 20: Physician Workforce – Increased Demand Example (2000 – 2020)



Data Source: Analysis by The Robert Graham Center, 2004.

This example illustrates the similar effects of the demand and supply factors in our models. The effect of the higher U.S. Census Bureau projections of population are similar to these of the CBO projections of future GDP.

5. Decreased Demand Example

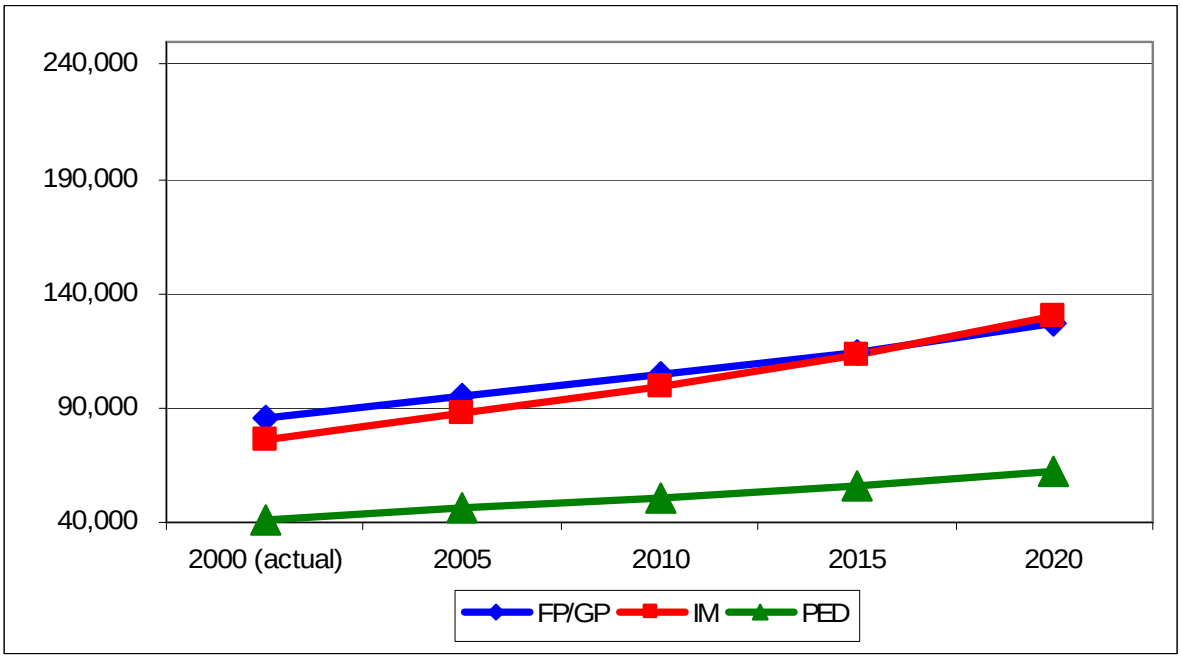
In the decreased demand example, we decreased the size of the Census Bureau projected population by 10% over the projection period, and kept the adjustment factors constant. The resulting projections are presented in the table 25 and figure 21 below.

Table 25: Projected Physician Workforce Using the Supply/Demand Models – Decreased Demand Example

Year	Fam Med/ Gen Pract	Internal Medicine	Pediatrics	Generalists
2004 (Actual)	93,837	86,187	45,998	226,022
2005	96,000	88,000	47,000	231,000
2010	104,000	99,000	51,000	254,000
2015	115,000	113,000	56,000	284,000
2020	127,000	130,000	62,000	319,000

Data Source: Analysis by The Robert Graham Center, 2004

Figure 21 Physician Workforce – Decreased Demand Example (2000 – 2020)



Data Source: Analysis by The Robert Graham Center, 2004.

This example illustrates the more dramatic impact of changes in the adjustment factor variables compared to the adjustment relations on rates. Cutting the U.S. Census Bureau-projected population by 10% was comparable to a 33% reduction in the model's population adjustment rate in reducing the rates of increase in the physician workforce.

A decrease in demand for physician services could come from the more recent increases in private health insurance premiums, increases in deductibles, and the decreases in comprehensive health insurance programs.

As stated earlier, a projection is an assumed continuation of clearly stated trends or assumptions. It contrasts with policy-based forecasts of what one expects to happen. Even though they are not policy-based forecasts, it should be noted that status-quo projections may indicate that the existing trends and policies may lead to outcomes judged desirable or undesirable by interested parties. Status quo projections are particularly important in that they often show the consequences of present trends with sufficient notice for any necessary action to be taken.

Summary Comments

We specified a physician workforce model with demand and supply components. Our model determines the current year's physician workforce for family medicine, internal medicine, and pediatrics by:

1. Adding and subtracting the workforce components from the previous year's workforce; and
2. Adjusting the previous year's workforce using regression-estimated adjustment factors.

We used AMA Physician Masterfile data to estimate the magnitude of the components to be added and subtracted. We used various other data sources to determine the statistically significant adjustment factors and estimate their magnitude. We found only

two significant adjustment factors – those for the economy and the population. The models explained from 95.2 to 100% of the primary care workforce numbers in each of the three years of estimation for the four physician groups. Using our model, in a status quo projection example, we illustrated that the internal medicine workforce would grow at a higher rate, even with existing trends and policies. The internal medicine workforce starts at 86,187 in 2004 compared to 93,837 for family medicine. However it catches up at 112,000 in 2010, and by 2020 surpasses the family medicine workforce of 151,000 with an internal medicine workforce of 173,000.

We also presented four examples of projections after increasing or decreasing demand or supply, based on either changing the adjustment factors while keeping the main variables constant or changing one or more main variables while keeping the adjustment factors constant.

Planning Models

A workforce model including economic principles of course assumes that market forces will effect supply and demand freely, unrestrained by "artificial" constraints, such as a cap on the number of residency positions. It makes the important, fundamental assumption that over the long run, supply and demand equilibrate. Such a model reflects how many people in the United States think about health care, and its results show why there are claims of imminent shortages of physicians, especially specialists, based on the powerful effects of a growing GDP and a growing population.

Of course, there are "artificial" constraints on the supply of physicians, such as the number of students enrolled in medical schools and the number of residency positions. There are multiple recent projections of supply reflecting these constraints, specifically analyses by Lurie, Shipman, and Colwill and Cultice.[6;21;23] Next, we repeat and extend this type of projection, starting the projection from 2004.

There were 7,190 more direct patient care FPGPs in the AMA Physician Masterfile in 2004 than in 2000. We used third year after graduation from medical school as an indication of the last year of residency training. Using this assumption, during the period 2000-2004 12,247 would have moved into the workforce, virtually all of whom began direct patient care. During that same period 7,904 FPGPs left direct patient care. The net effect of these phenomena account for 4,343 of the 7,190 FPGP difference. The 700 per year (2,800 divided by 4) average increase not attributable to the balance of the two forces constitutes less than 0.8% of FPGPs in direct patient care in 2004. This finding suggests that the year to year difference in the direct patient care FPGPs in the AMA Masterfile is a relatively sound basis for projections of the future workforce.

To update other projections, we used the rates of increase observed annually from 2000 to 2004, the first period for which the effect of the Balanced Budget Amendment of 1997 should be operating in full. Table 26 depicts projections of physicians and the population per physician for the years 2010, 2015, and 2020. Rates of increase used in projections are the ones recorded annually from 2000 to 2004. Data represent physicians not in residency training whose major professional activity will be direct patient care. Physician, but not population data for U.S. territories (Puerto Rico, Virgin

Islands, and Pacific Islands) have been included in table 26, the same as for products of all modeling analyses contained in this report. More than half of direct patient care physicians serving populations of these U.S. territories are graduates of U.S. schools of medicine. The 8,412 physicians practicing there account for 1.34% of all practicing in the U.S. and its territories. It is important to note that physicians for whom their major professional activity was ”unclassified” in the AMA Physician Masterfile have been excluded from the 2004 base of projection. In 2004, they constituted 8.0% of all physicians, 6.0% of primary care physicians, and 5.1% of FPGPs. This group is disproportionately large for physicians who have just completed residency training, and comprises a workforce segment probably, but not known to be, direct patient care physicians.

Table 26: Direct Patient Care Physician Projections For Years 2010, 2015, 2020 – Using a Planning Model

	2010		2015		2020	
	Physicians	Population/ Physician	Physicians	Population/ Physician	Physicians	Population/ Physician
FP/GPs*	105,757	2921.2	116,838	2759.1	129,081	2601.5
Primary Care**	264,631	1167.4	301,794	1068.2	344,175	975.7
All***	721,552	428.2	808,958	398.5	906,952	370.3

Notes: * 2.013% annual increase from 2004.
** 2.663% annual increase from 2004.
*** 2.3132% annual increase from 2004.

Source: U.S. Census Bureau; Analysis by The Robert Graham Center, 2004.

The Concept of Need and Future of Family Medicine: Another Approach to Projecting the Physician Workforce

Need is not an absolute concept. Its measurement always depends on assumptions. GMENAC took on the definition of need most comprehensively, using epidemiologic and demographic approaches to quantify need and articulating some sort of ideal. Despite efforts costing millions of dollars, GMENAC did not yield a nationally sanctioned answer to what people need in terms of physicians, and there is no such agreement now. Need is another of the concepts that is indeed, "in the eyes of the beholder." While it is beyond the scope of this analysis and not its intent to define the public's need for physicians, there is an opportunity, based on the recently published Future of Family Medicine (FFM) report, to reconsider how many family physicians the U.S. might need. FFM provides compass headings for the transformation of family medicine into the information age and specifically includes a basket of services that future family physicians expect to deliver, as seen in table 27. Furthermore, FFM sets out a new model of practice and contrasts its nature with traditional practice by family physicians. This new model of practice and its basket of service provide some guidance for *what family physicians are likely to be doing in the future*, permitting consideration of how many family physicians might be <u>needed</u>.

Table 27:[3] Family Medicine's "Basket of Services" in the New Model

Table 5. Basket of Services in the New Model of Family Medicine

Health care provided to children and adults
Integration of personal health care (coordinate and facilitate care)
Health assessment (evaluate health and risk status)
Disease prevention (early detection of asymptomatic disease)
Health promotion (primary prevention and health behavior/lifestyle modification)
Patient education and support for self-care
Diagnosis and management of acute injuries and illnesses
Diagnosis and management of chronic diseases
Supportive care, including end-of-life care
Maternity care; hospital care
Primary mental health care
Consultation and referral services as necessary
Advocacy for the patient within the health care system
Quality improvement and practice-based research

According to FFM recommendations, family physicians will accept as patients anyone in the general population and provide for them prevention and health promotion services, care for acute and chronic problems, referrals to specialists as needed, and integration of their care into a coherent whole that has meaning to them and the health care system. In the future, family physicians will care for patients in office settings, the hospital, and at home.

How many people can be served appropriately by a family physician and other primary care physicians is controversial. For example, as few as 600 children could represent a full clinical load for pediatricians in Ukraine. Within the past few years, there has been conjecture that with appropriate practice design and teamwork, a family physician in the U.S. might be responsible for as many as 6000 patients. For years, British general

practitioners had list sizes of approximately 3000, a midpoint in the ten fold variance between 600 and 6000. Any number within this range could, and probably would, be defended. There are reasons supporting a higher and a lower number.

A lower number might be justified. First, there are more things to do for patients that actually work and thus matter to them more now than in the past. Thus, the same number of patients probably merit more attention. Second, both patients and family physicians report a need for some additional time together, less rushed than the current U.S. practice environment. Third, there is a gap between what is recommended and what is accomplished, e.g. for chronic diseases. Fourth, there is a chronic neglect of prevalent mental health problems that reside in family medicine and the rest of primary care. Fifth, there is a need for new activity by family physicians to provide team leadership, assure patient safety, evaluate the performance of their practice, ask and answer questions about family medicine, and to bridge primary care to public health and subspecialty medicine. Sixth, there are non-medical considerations that are now recognized that might be expected to result in family physicians caring for fewer rather than more patients, such as a desire to work part-time.

A higher number of patients for each family physician might be justified. There are large numbers of other health professionals and other human resources that should enable family physicians to care for more, not fewer, patients. Some of the work previously done by family physicians and other primary care physicians could be transferred to others such as hospitalists, nurses, pharmacists, physician assistants, and subspecialty

physicians. There are new technologies that should facilitate timely service and practice efficiencies. These include the electronic health record, asynchronous communication via web portals and email, and advanced scheduling programs. On balance, it seems wise to avoid a particularly high or low number.

One way to approach estimating how many family physicians are needed is to base such an estimate on an approximation of the amount of time an average patient will need from their family physician to provide them with family medicine's basket of services. In this line of reasoning, the time needed for an "average patient" per year could be calculated as A + B + C, where:

A=the time required for evidence based health promotion and disease prevention (estimated to be 45 minutes per year for patients representative of entire U.S. population)[72],

B=the time for office visits for acute and chronic conditions,(estimated to be 50 minutes per year for patients representative of entire U.S. population, based on the National Ambulatory Medical Care Survey as 2.8 visits/year x 18 minutes), and

C=the time for emails and other asynchronous work and care in hospital and home. (estimated as 25 minutes/year per patient, in absence of representative empirical data).

This rationale leads to a conclusion that, while some patients will require almost no time and others many hours, on average for a group of patients representative of the U.S. population, a patient could need two hours of time from their primary physician in a year.

According to the AAFP annual survey, the average number of hours worked per year by family physicians is approximately 2400 hours. This figure is congruent with recent findings from the AMA's Socioeconomic Monitoring Survey. Therefore, if each patient needs on average 2 hours of their family physician's time each year, on average, a family physician could appropriately care for 1200 persons across the age spectrum. A family physician with a practice skewed toward mostly older patients with increased needs would not be able to care for as many, while another family physician with more middle-aged patients might care for more. This estimate of 1 family physician for 1,200 patients is close to ratios reported for primary care physicians in staff model HMOs.[73]

National data support the feasibility of this approach. Family physicians are the usual source of care or primary care physician (PCP) for the large majority of people who visit them, specifically 88.7% according to the National Ambulatory Care Surveys (NAMCS) from 1995 through 1999. Many of the small proportion of visiting patients for whom the family physician is not identified as the PCP in NAMCS records are seeing the family physician for the first time and have, therefore, not previously had the opportunity to establish him or her as their PCP. Furthermore, according to the National Health

Interview Survey, at least 100,000,000 people reported seeing or speaking with a generalist physician who sees both adults and children, most likely, a family physician.

When this rationale is applied to the current situation in the United Sates with family physicians continuing to care for their current patients (i.e. no assumptions about increased or decreased “market share” over the present), 83,333 family physicians are needed now, somewhat less than the 91,627 whose major professional activity is currently direct patient care. This comports with the belief articulated in the FFM report that new model practice should be, overall, a more efficient model of practice.

Figures 4 and 5 in Appendix E illustrate an application and the feasibility of this needs model. As shown in figure 4, if every person had a family physician, only 107 or 3.1% of counties would currently have the capacity to supply one family physician per 1200 people. However, as mentioned above, family physicians care for about 100,000,000 people, or 34.7% of the U.S. population. If family physicians only cared for this market share, county by county, the needs model could be implemented with one family physician per every 3,458 people. Figure 5 shows the 1,863 counties that currently have the capacity to supply one family physician per 3,458 people. Both figures illustrate the opportunity and the challenge faced by family medicine to implement this model.

It may be that family physicians cannot provide their full basket of services in new model practice for 1200 people, and, of course, they may be able to care for more. The arithmetic for estimating the number of family physicians needed for different practice sizes, assuming no growth or reduction in the overall numbers of people for whom they are the primary physician, is straightforward as shown in table 28:

Table 28: Number of Family Physicians Needed to Care for 100,000,000 People with Different Panel Sizes

# of People in Physicians Panel	Family Physicians Required to Care for 100,000,000 people
1000	100,000
1250	80,000
1500	66,666
1750	57,142
2000	50,000

Data Source: NHIS; Analysis by The Robert Graham Center, 2004.

We also calculated the number of family physicians required to service 1,200 persons in 2004 and beyond for their current "market share" of the population, based on projected U.S. population growth.[53] A comparison of those numbers with the yields of the status quo supply/demand model and the planning model are presented in table 29.

Table 29: Comparison of Family Physician Projections Derived from Supply/Demand, Need, and Planning Models

Year	Supply and Demand Model	Planning Model	Need Model[1]
2004	93,837[2]	93,837[2]	83,300
2005	96,668	Not Projected	84,100
2010	112,160	105,757	88,000
2015	130,134	116,838	91,700
2020	150,989	129,081	95,600

Notes: [1] The number of family physicians needed = projected total U.S. Population multiplied by 0.341(current "market share" estimate) divided by 1,200.
[2] Represents actual number of family physicians (not projection).

Data Source: Analysis by The Robert Graham Center, 2004.

Table 29 may be alarming or misunderstood by some, but it should not be. It simply shows that if a family physician can, on average, provide family medicine's proposed basket of services in "new model" practice to 1,200 persons, the present number of family physicians and the projected future stock of direct patient care family physicians estimated by both supply/demand and planning models exceeds the number necessary for the proportion of the population presently cared for by family physicians. Any decrease in the average number of people served or in work effort by family physicians would be expected to require a larger number of family physicians. Similarly, an increase in the proportion of the population served by family physicians would be expected to increase the number of family physicians needed.

This comparison presents an opportunity to reconsider workforce policy, but does not necessarily imply a need to curtail the number of family physicians supplied. As we

stated earlier, need is not an absolute concept. Its measurement always depends on assumptions. The assumptions in this case include a constant market share and are not based on substantial experience with “new model” practice. Furthermore, given that the nature of medical practice is not knowable for a 5-15 year time frame, a possible excess of family physicians might well be a critical national asset, using their versatility to accommodate requirements not now foreseen.

Special Case of Rural Populations

The versatility of family physicians and their history of service to rural populations merits special attention in considerations of the physician workforce.[74] The relatively dominant presence of general practitioners and now family physicians among primary care physicians in rural areas reflects family medicine's commitment to the health of residents of non-MSA and less densely populated counties. Family medicine has demonstrated a sustained emphasis on training to specially prepare for service in rural areas, e.g. through the development of rural training tracks. Currently, about 62 million people live in rural (non-MSA) America. While non-MSA counties are not the exclusive domain of family medicine, family medicine’s tradition of service to this population, training in maternity and newborn care, and willingness to accept patients of either sex and any age have made family physicians the preferred rural provider.

Consummating new model practice with family medicine’s full basket of services with rural communities could expand substantially the demand for family physicians and signal the need to expand and further institutionalize special training for family medicine

residents destined for rural practice. The requirement for family physicians using the need model (1 for every 1200 persons), were they the only primary care physicians for the almost 62 million residents of rural areas, is shown below. Table 30 indicates that in this extreme case with family physicians as the sole primary care physician responsible for the residents of non-MSA counties, rural populations could consume a majority of the current supply of family physicians.

Table 30: Family Physicians Required to Be the Primary Physician for Everyone Presently Living in Non-MSA Counties

# of Rural People in Physician Panel	# of Family Physicians Required
1000	61,578
1250	49,262
1500	41,052
1750	35,187
2000	30,789

Data Source: Analysis by The Robert Graham Center, 2004.

Perhaps a more realistic estimate of rural need for family physicians would be provided by using a more restricted definition of "rural." More than 35 million people presently reside in the rural counties with a community of at least 2500 population, but no town of as many as 20,000. In these areas presently served mostly by family physicians and general practitioners, more than 29,000 (29,214) FPs would be required to attend the population according to the allocation of 1200 patients per family physician. This number of needed family physicians increases with projected population growth in 2010, 2015, and 2020 to 30,824, 32,164, and 33,503 family physicians respectively. These

estimates based on Census Bureau projections of population growth are moderate, not extreme estimates, of need for family physicians for rural populations.

Reverting to a non-MSA designation as a definition of rural, table 31 quantifies the numbers of family physicians, general practitioners, primary care, and specialty physicians in rural counties as of 2004.

Table 31: The Number of Active Direct Patient Care Physicians (MD and DO) in Rural (Non-MSA) U.S. Counties in 2004*

	GP	FP	GP+FP	FP+GP+GIM+ GPEDS (Primary Care)	Specialists	Total
Physicians in Specialty	3,274	17,672	20,946	34,005	37,861	71,866
Population per Physician	18,808.2	3,484.5	2,939.8	1,810.9	1,626.4	856.8
Physicians per 100,000 People	5.3	28.7	34.0	55.2	61.5	116.7

*Excludes physicians in residency training.
Data Source: 2004 AMA Masterfile; Analysis by The Robert Graham Center, 2004.

With this liberal definition of rural, there are actually fewer primary care physicians in these counties than there are physicians in other specialties.

GMENAC's estimates of the numbers of persons for whom a physician in various specialties could care for appropriately can be extrapolated to current rural conditions. Table 32 shows the actual distribution of physicians in various specialties in non-MSA counties, providing a direct comparison of GMENAC's estimates to what has actually evolved as of 2004. This comparison indicates that family physicians and general

practitioners are the only physicians whose population to provider ratio was less than the GMENAC requirements when applied to rural (non-MSA) counties, confirming continuing reliance of rural people on family physicians.

Table 32: GMENAC Estimated Number of Persons Needed To Support Specific Physician Specialties, Projected To 2004, In Non-MSA Counties

Medical Specialty	# Physicians in Specialty in Rural Counties in 2004	# of Persons per Physician in Rural Counties in 2004	# of Persons Who Could be Served per Physician According to GMENAC
Allergy & Immunology	153	402,470	119,000
Anesthesiology	2966	20,762	11,436
Cardiology	1512	40,726	31,420
Child Psychiatry	444	138,7054	27,000
Emergency Medicine	3323	18,533	18,000
Endocrinology	184	333,937	119,000
FP/GP	22834	2,696	3968
Gastroenterology	848	72,590	37,000
Hematology-Oncology	244	252,317	27,000
Infectious Diseases	218	282,727	108,000
Internal Medicine	9954	6186	3461
Neurology	867	71,028	44,000
Nephrology	444	138,611	89,000
Nuclear medicine	66	928,078	61,000
Neonatology	126	486,975	187,000
Neurosurgery	330	186,713	92,000
Obstetrics/ Gynecology	3997	15,406	10,150
Ophthalmology	1867	32,987	20,234
Orthopedic Surgery	2837	21,706	16,130
Otolaryngology	1073	57,405	29,227
Psychiatry	3058	20,140	6300
Pediatrics	4480	13,746	7900
Pediatric Allergy	14	4,398,425	271,000
Pediatric Cardiology	33	1,860,361	212,000
Pediatric Endocrinology	21	2,932,284	304,000
Pediatric Hem-Onc	32	1,942,522	148,000
Physical Medicine & Rehab	437	141,056	76,000
Pediatric Nephrology	9	6,585,877	696,000
Plastic Surgery	279	220,354	90,000
Pathology	1444	42,631	20,000
Pulmonary Disease	517	119,106	67,640
Radiology	783	78,609	13,844
Rheumatology	238	258,189	143,000
Thoracic Surgery	275	223,595	118,800
Urology	1285	47,922	31,625

Data Source: Medicus Partners[24]; Analysis by The Robert Graham Center, 2004.

Emergency medicine is the only other specialty close to distributing its members throughout rural America consistent with the population there to support its presence. Family physicians and emergency medicine physicians are filling a critical role, probably due to the implausibility of other specialties serving rural populations because of insufficient numbers of people to support them due to the low density and dispersion of the populations in non-MSA counties.

The rural population has grown, but remained relatively stable as a proportion of the U.S. population in recent national censuses. Most of the rural population, however, does not live in counties on the verge of being designated an MSA in the near term (31.3% in counties with at least one town with 20,000+ population) or in counties so sparsely settled that a family physician's practice would not be economically viable (11.9% in counties without a town with as many as 2500 people). It is notable that primary care physicians in the 1995-1999 NAMCS accommodated 49.5% of urban, but 61.4% of rural office visits. In the non-MSA counties, family physicians accounted for 68.6% of primary care physician office visits.

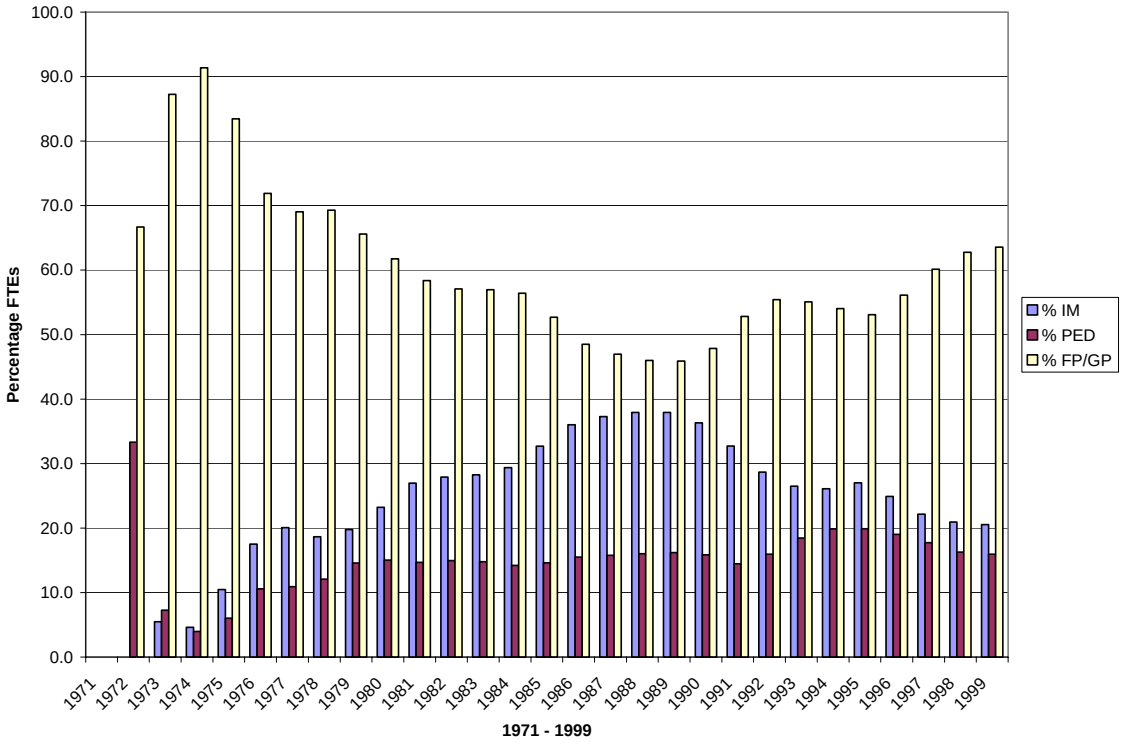
Special Case of Health Centers and the National Health Service Corps

It is important to consider the role of family physicians in staffing Health Centers and the National Health Service Corps (NHSC) as both of these programs provide essential access to care for very underserved populations and are dependent on family physicians. For nearly 40 years, the national network of Community, Migrant, and Homeless Health Centers has been delivering high-quality and cost-effective primary

and preventive health care to low income and otherwise medically underserved communities.[75] Health Centers serve 3,600 rural and urban communities in every US state and territory. In 2003, Health Centers provided nearly 40 million visits for 15 million people who would have otherwise had great difficulty accessing care. Health Centers depend on primary care physicians for 96% of their staffing, nearly half of whom are family physicians or general practitioners (FP/GPs) (1,992 of 4,400 in 1999).[76]

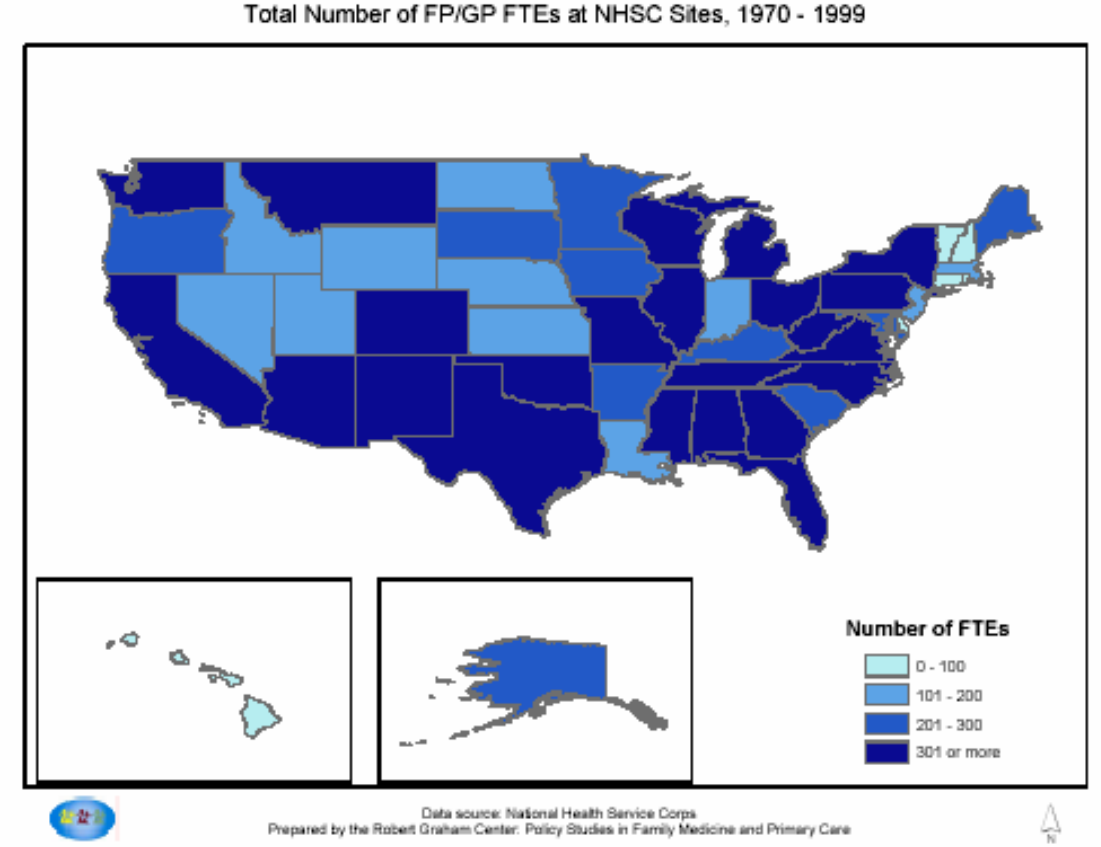
The NHSC addresses the most extreme physician distribution problems by placing physicians and other clinicians in locations that have extraordinary difficulty attracting health care resources. The Corps from its inception in 1971 through 1999 placed over 18,000 health care providers in medically underserved areas. Forty-seven percent of the doctors were FP/GPs who contributed a total of nearly 16,000 FTEs (one FTE equals one physician giving one full-time equivalent year of service), as seen in figure 22. In accordance, in 1999 nearly 78% of the NHSC primary care physician FTEs, and nearly 70% of non-federal physicians, were FP/GPs in full-county Health Professional Shortage Areas (HPSAs), as seen in figure 23.

Figure 22: NHSC Percent Total FTEs per Year per Primary Care Specialty, 1971 - 1999



Data source: NHSC historical workforce data; Analysis by The Robert Graham Center, 2004.

Figure 23: Total Number of FP/GP FTEs at NHSC Sites, 1970 - 1999



Both of these health care safety net programs are dependent on family physicians to provide medical homes to millions of underserved people in America. Workforce planning must consider how any changes in the production and training of family physicians would affect these programs.

Summary Comments

Indeed, the methods and the assumptions determine the results of modeling projections of the physician workforce. The projections from the unconstrained supply and demand models responding to market forces yielded the highest projections, 58% higher in 2020 than the need model projection for 2020, showing why some predict a physician shortage in the U.S. and others claim sufficiency. The planning model projections, reflecting the constraints of medical school enrollment and residency positions, were intermediate, between the other two sets of projections. The current supply of family physicians and general practitioners already exceeds what the needs model projected would be “needed” in new model practices for the current, estimated market share of family physicians, a situation typical of most other specialties using GMENAC projections of need.

The analysis of need must be interpreted cautiously because it is not based on extensive experience. Its projections should be adjusted upward or downward as more is learned about how many more or fewer people than 1200 persons per panel and how many more or fewer than 100,000,000 persons are served by family physicians. The special case of rural populations requires particular attention from family medicine, and the number of family physicians needed in rural areas is a floor beneath which the family physician workforce cannot be permitted to fall because of rural America’s continuing reliance on family physicians. The continued operations of community health centers and the National Health Service Corps depends on an adequate supply of family physicians.

While there is no apparent agreement now about the right balance between primary care physicians and other specialties, there is agreement that there must be one. The unilateral practice of birth control by one specialty, with a steady or reduced supply of new trainees, would almost automatically lead to increases, possibly not needed, in other specialties and promote un-useful competition that could thwart the integrated care people deserve.

These analyses suggest that family medicine has entered a new era in which a steadily increasing “head count” is not necessarily the primary objective. Perhaps a period has arrived when further attention can turn to enhancing practice performance and the work-life of family physicians and improving the interfaces between primary care and the rest of the health care enterprise.

Selected Findings

1. In 2004 there is a family physician/general practitioner for every 3200 persons in the United States. There is a primary care physician actively taking care of patients for every 1321 persons in the United States. Combined with approximately 92,000 primary care nurse practitioners and more than 22,000 primary care physician assistants, there are now approximately 336,000 primary care clinicians. These primary care clinicians are probably the largest and best-trained primary care workforce that has ever existed in the United States. Given the salutary effects of primary care, they are a precious national resource.

2. In 2004, of 936,178 physicians in the United States and its possessions, only 629,039 (67.2%) report patient care as their major professional activity. Five and two tenths percent of these practicing physicians are osteopathic physicians (DOs), 41.3% of whom are family physicians or general practitioners, while only 13.5% of allopathic physicians (MDs) are family physicians or general practitioners.

3. In 2004, there are 75.7 primary care physicians per 100,000 people in the U.S., compared to 135.9 specialists per 100,000. There are 26.1 family physicians/100,000 and 5.1 general practitioners/100,000.

4. If medical residents are incorporated as 0.35 physicians and all active physicians are included in calculations as was done by GMENAC, in 2004 there are 36.2 family physicians/GPs per 100,000 people and 91.6 primary care physicians/100,000. This contrasts with 174.2 other medical specialists/100,000 people.

5. In 2004 there are 34 direct patient care family physicians/general practitioners/100,000 people in non metropolitan areas, a higher ratio than in the country in general.

6. Since 1981 the primary care physician workforce in direct patient care has increased 79% (vs 77% for other specialties) with family physicians increasing 172% while general practitioners declined 39%.

7. Prior predictions by GMENAC, the AMA, and COGME concerning the physician workforce in 2000 were closer to correct than is often assumed, all underestimating the actual number of physicians by approximately 3-5%.

8. In 2004 there are approximately 10,342 family medicine residents in the United States (MD + DO). As of July 2004, family medicine offered 3501 resident positions and filled 3275, a 93.5% final fill rate, the lowest in years.

9. The growth rate of the FM workforce is, even with recent declines in student interest and residency fill rates, still greater than a decade ago.

10. International Medical Graduates (IMGs) currently comprise nearly one-third of family medicine residents, twice the proportion of IMGs in the existing family physician/general practice workforce.

11. Medical students from rural backgrounds are twice as likely to choose family medicine as those of non-rural backgrounds yet the percentage of rural students in medical schools has fallen 47% since 1976. This decline occurred without any

change in the percentage of rural applicants. The 47 schools with a stated preference for rural applicants have a similar decline in rural students.

12. The steep and well-recognized decline in student interest in family medicine since 1998 holds for both MD and DO students, even though DO students are matching a larger number of family medicine postgraduate year one (PGY-1) positions. A persistent decline in the number of U.S. seniors filling FM PGY-1 positions has been accompanied by a steady increase to 25.6% of PGY-1 positions filled by IMGs, an unprecedented high for family medicine.

13. Only 8.8% of allopathic medical residents are in family medicine, while 21.4% of osteopathic medical residents are in family medicine. However, in 2003, 31% of DOs filled PGY-1 family medicine positions, a decline from 37% in 1996-7.

14. An increasing number of family medicine residency positions are being filled outside the National Resident Matching Program or Military Match—now about one in six.

15. Because of unfilled positions, under current Medicare rules and regulations, family medicine resident positions may be lost, and funding will be difficult or impossible to regain once lost.

16. Reductions in hours worked and early retirements by family physicians about which there has been conjecture, do not appear to be happening as of 2004.

17. The current exit rate for direct patient care family physicians was 5.7% between 2000 and 2004, slightly less than the 6.4% rate for all direct care physicians. The exit rate for general practitioners was 18.9%.

18. The number of physician assistants (PAs) and the number of PA training programs have grown explosively (118% and 131% respectively) between 1993 and 2003, with 41% of 2003 PA graduates reporting primary care as their area of interest.

19. The number of nurse practitioners grew 87% to 103,000 between 1996 and 2000.

20. Nurse practitioners and physician assistants, because of the nature and shorter lengths of their training programs, represent an elastic and flexible workforce that can adapt to changing needs more rapidly than physicians.

21. Since 1980, the population of the United States has increased steadily by 27% to approximately 290 million. The United States is becoming older, more diverse, and more urban and will require a physician workforce capable of serving an older and diverse population.

22. The supply of physicians is increasing faster than the growth of the population, with a persistent one-third to two-thirds primary care to subspecialty distribution.

23. While there is steady growth in both metro and non-metro populations, the proportion of the population living in non-metropolitan areas has decreased. Suburbs, not central cities, account for most of the metropolitan growth.

24. Almost half of the net increase in the population of the United States has been from net in-migration, with almost half of these in-migrants 25-44 years of age with about one-third of Hispanic origin from Mexico or South America. It is likely that the health resource demands of the baby boom population cohort will be extended indefinitely based on in-migration of a large 25-44 year old cohort.

25. During the last decade, the highest health service utilization rates have been for the population 65-74 years of age and 75 years and over, including office-based physician services, hospital, emergency, and outpatient department services.

26. Prior to 1996, the public and private aggregate expenditures on physician and clinical services grew steadily even though it was doing so at a decreasing rate. Since 1996 however, it has been growing at an increasing rate.

27. About one-third of the population of the United States consults with a family physician each year.

28. From a visit perspective, the market share of family physicians is declining with the decline in proportion of visits persisting steadily for about 25 years, coinciding with the decline of general practice and the increase in other primary care physicians.

29. Even without growth of United States medical school enrollment or increases in residency positions, as recently recommended by the Council on Graduate Medical Education, the growth rate of the physician workforce will probably continue to outpace the growth of the population of the United States.

30. For each of the primary care specialties the main supply adjustment factor is the current size of the population. An increase of 4,000 persons in the U.S. population is associated with an increase of about two family physicians, two pediatricians and about three general internists.

31. Economic expansion is positively related to the size and composition of the physician workforce. A one billion dollar increase in real GDP is associated with a corresponding increase of six family physicians, eight general internists, and four pediatricians, three years later.

32. Despite some literature on the expected role of the physician work effort in determining the supply of the physician workforce, there seems to be little actual evidence on the influence of physician work effort. We found that the work-life balance variable accounted for very little of the variation in the physician workforce. Thus the effect of work-life balance changes on the number of physicians seems to be currently negligible, but it may be more important in the future.

33. In a status quo projection based on supply and demand as existed in the early 2000s, the workforce of family physicians increases from 93,837 in 2004 to about 151,000 in 2020, increasing by about 60% over the period or 3% per year.

34. In a status quo projection based on supply and demand as existed in the early 2000s, the primary care physician workforce increases from 276,022 in 2004 to about 413,000 in 2020.

35. In a status quo projection based on supply and demand as existed in the early 2000s, the number of family physicians and general internists equilibrates by 2010, after which the number of general internists exceeds the number of family physicians.

36. A theoretical projection of the effects of increased demand based on the increase in population size as projected by the U.S. Census Bureau with no change in adjustment factors results in demand exceeding the status quo supply for all three primary care specialties at 2010, 2015, and 2020.

37. A theoretical projection of the effects of increased gross domestic product as projected by the Congressional Budget Office with no change in other factors also results in demand exceeding the status quo supply for all three primary care specialties at 2010, 2015, and 2020.

38. If family physicians can provide family medicine's basket of services in new model practice to their current patients (about 100,000,000 people) with two hours of time per patient per year, on average, for a population reflecting the U.S. population, 83,300 family physicians are needed in 2004, fewer than the current supply.

39. More than 35 million people now reside in rural counties with a community of at least 2,500 but no town as large as 20,000, presently served mostly by family physicians. If these people are to have a personal physician responsible for 1200 patients, more than 29,000 family physicians would be required. With projected population growth the number of family physicians required for this population increases in 2010 to 30,824, in 2015 to 32, 824, and in 2020 to 37,503.

40. Based on (1) recent experience and trends in health care and the health care workforce in the United States and (2) the declared future direction for family medicine (FFM), there is not a single compelling answer to how many family physicians are required to meet the needs and the demands of the U.S. population. Projections using different methods result in different estimates:

    a. The supply and demand model projects approximately 112,000, 130,000, and 151,000 family physicians in 2010, 2015, and 2020, respectively;

    b. The planning model projects approximately 106,000, 117,000, and 129,000 family physicians in 2010, 2015, and 2020, respectively; and

    c. The need model projects for the current market share of family physicians a need of approximately 88,000, 92,000, and 96,000 family physicians in 2010, 2015, and 2020, respectively.

National Advisory Committee Commentary

Tuesday, September 21, 2004

The following comments reflect a rich and stimulating conversation among the national advisory committee convened in Washington to reflect on the study, draw possible conclusions, and propose recommendations concerning the family physician workforce. They are presented as heard by staff of the Robert Graham Center in no particular order and may not fully capture what members of the committee expressed. Each member of the committee was invited to send any written commentary they wanted to be incorporated into the report, and this additional commentary as received in September 2004 is incorporated in Appendix G.

1. The current model of care in the United States, with a payment system that undervalues primary care, is unsustainable. We are at the beginning of a new chapter in the workforce story.

2. This analysis reveals that 1) we have a growing per capita supply of family physicians, fueled increasingly by international medical graduates, that 2) it will continue to grow in a 1-15 year time frame, and 3) it presents decision-makers with a potential break-through idea that could focus future workforce development, namely “1 family physician per 1200 people.” These ideas are novel and possibly sufficiently profound to get us out of family medicine’s old ways of thinking, while presenting an opportunity to enhance services and correct disparities in health care.

3. How many family physicians are needed depends on what type of health care system we’ll have, other components of the workforce, disruptive technologies

and who does what, where. It also will depend heavily on consumer choice. All of these factors are in flux and much less certain than they were a decade ago.

4. The relevant disruptive technology is not a nurse practitioner in independent practice; it is a collaborative practice model.

5. The U.S. is producing only three-fourths of its physician workforce, is accused of "poaching" from poor nations, and should be self-sufficient.

6. The lack of empirical evidence to support the impact of productivity and lifestyle on hours worked and retirement rates is important new information.

7. Work underway is showing an approximate one-third drop in entry into general internal medicine from 2001 to 2004, and this has powerful implications for what may be expected of family physicians and other primary care providers. Combined with declines in family medicine's match rates, this may also herald a serious workforce deficiency, especially for older people.

8. The supply side is knowable in a 5-10 year time frame; it is the demand side and determination of adequacy of that supply that is hard.

9. Switch the focus from production of physicians to provision of services and how PAs, NPs, and physicians will work together to care for all the people.

10. The overlap between NPs and PAs merits more attention, and complementarity among the primary care clinicians is much more important than substitution. An important question is, "what can be the particular production function of PAs, NPs, and primary care physicians?"

11. The numbers showing a drop off in NPs are correct, and the 80% of NPs in primary care is probably too high with the FTE count even lower, with likely

increased retirements because of the age distribution of nurse-practitioners. There is no evidence now that production of or demand for PAs is decreasing.

12. The NP and PA workforces are not only elastic and adaptive in relatively short time frames; they are also volatile.

13. PAs and NPs are well positioned to help family physicians actually be integrators of care as proposed in the future of family medicine report. They are, however, increasingly working with specialist physicians and so may not continue to fill as big a role in primary care.

14. While many in primary care object to pure economic model-based projections and forecasts, comments or innuendo that either denigrate or aggrandize different types of workforce models are not particularly useful.

15. There is a tension between larger numbers of patients served in a collaborative model and what primary care physicians enjoy and want to do. Just because it could exist, doesn't mean it will exist.

16. The supply estimates for family physicians overestimate the future supply compared to the Bureau of Health Professions workforce models.

17. The range of the yields of the three models is obviously large; one consequence is that the supply/demand model should not be over-emphasized. Even if the models get the number right, it may be for the wrong reasons.

18. There are at least three new medical schools on-line and deans are talking about expanding class size. There is a need for a clear statement about whether we need more, fewer, or the same production of family physicians, possibly that we have about the right number of family physicians now and in the foreseeable

future and could use some more U.S. medical students inclined to enter family practice.

19. It matters who gets into medical school and current trends don't auger well for an increasingly diverse society and rural populations.

20. The story about international medical graduates increasingly populating family medicine residencies needs emphasis and raises concerns regarding cultural competence and distribution of family physicians.

21. It is important to ask what are family physicians going to do, with whom, where? Also, what are the particular functions of other primary care providers and how might that affect family physicians?

22. Push hard on caring for rural populations as one role of FPs, elaborating family medicine's new model of practice and basket of services into reality in various settings, and inspiring students into executing the family physician's role.

23. The clarity of two hours per patient per year with 1200 patients per family physician is refreshing, and it should be modeled further with sensitivity analyses and measurements of its effects.

24. Unless or until the existing supply of physicians is used well, don't increase the physician workforce. More physicians may be worse than wasted. There is such a thing as too many physicians.

25. Stop being preoccupied with getting the number right, and ask what are we doing and what do we need to do to enhance deployment, distribution and efficiency of what we already have while reducing duplication and waste.

26. Support the current number of GME slots, while working to reduce family medicine's dependency on IMGs. An increase in medical school class size without increasing the GME positions would be reasonable.

27. Restricting the flow of doctors internationally seems to fly in the face of the trends of globalization and outsourcing.

28. Overall, preserve the stock and supply of family physicians and focus on improving performance and quality in family medicine and primary care. Any increases in supply should be accompanied by a guarantee to address an important problem.

29. We're still asking the wrong questions. We need to push up the questions from how many of this or that profession to what it is we want to produce: a better doctor or better medical services?

30. It is imperative to not neglect the demography and the implications for older people requiring more resources. When this is added to the increasing pursuit of subspecialty fellowships by internists, there may be a large demand placed on other health care providers, particularly primary care clinicians such as family physicians who may need to increase their emphasis on geriatrics.

31. Family physicians, general internists, general pediatricians, nurse practitioners, and physician assistants are all part of a team pursuing a moving target.

32. Models that don't break out the population into smaller segments (not just MSA vs non-MSA) miss important geographic differences in care, practice models and workforce distribution.

33. Primary care's value is established and there must be enough of it for everyone: urban and rural, men and women, adults and children, rich and poor.

34. New models of care that optimize the contribution of the existing primary care workforce are important and very promising.

35. Since the work of family physicians depends on what goes into and remains outside of their basket of services, they must be drivers of policies that support their basket of services and manage how the basket changes.

36. The results of the future of family medicine project are on the mark. Family physicians should stick with what they have learned and proposed and get it done.

37. The dialogue among family physicians and NPs and PAs may be insufficient, but has opened up more now than dialogue with general pediatrics and general internal medicine.

38. COGME's latest report is assailable and is not necessarily "way off", not necessarily pertinent to family medicine's most important issues, and need not provoke over-reaction by anyone. The medical school recommendation and increase in GME positions are probably not necessary. While a looming physician shortage is arguable, ongoing population growth is likely and will be a powerful driver of need for physician services.

39. A lot of people want a lot of stuff from health care, and there may be some irrational exuberance being expressed by providers and consumers. Just because someone can pay for it, doesn't mean it should happen.

Workforce National Advisory Committee

Nominations for Recommendations, Not Ranked

1. Recruit a diverse medical student population that reflects what is known about who is inclined to enter primary care and serve where needed.
2. Support medical school class expansion with an objective to fill more FM positions with U.S. graduates, under-represented minorities, and students from rural backgrounds.
3. Sustain approximately the current level of production of family physicians, avoiding large increases or decreases.
4. The current number of family medicine residency positions is satisfactory, but there is a need to fill more of them with students inclined to serve an increasingly diverse society.
5. Use any apparent excess of family physicians to address maldistribution of physicians and relatively neglected roles e.g. as researchers and system leaders.
6. Advocate for a national institution devoted to research in family medicine and primary care.
7. Sustain about 3200 family medicine residents per year and re-assess in about five years, also monitoring developments in general internal medicine, general pediatrics, nurse practitioners, and physician assistants.
8. Reassess family medicine's relationships with other types of health care providers, including medical subspecialists.
9. Focus on quality more than numbers and on provision of services more than production of doctors.
10. Stick with the directions in the future of family medicine report, toward new model practice and a reliable basket of services.
11. Seriously examine alternative models of delivering primary care to patients that are responsive to patients' needs and demands, and prepare the family physician workforce to work in these models.

12. Figure out how to deliver and finance “new model” practice and its full basket of services and how it will need to be modified, e.g., to meet the needs of rural or older populations.
13. Be an active driver of what goes in and out of family medicine’s basket of services, managing any changes.
14. Focus family physicians’ efforts on actually integrating care for individuals.
15. Pay more attention to geriatrics and chronic illness care.
16. Watch carefully the impact of genetics, market share, age/sex of people seen, actual numbers entering family medicine residencies, and the number of underserved areas.
17. Convert NPs and PAs into partners in delivering the basket of services and alter training to reflect this.
18. Re-write and re-authorize Title VII to support the elaboration of new model practice and education and training for it.
19. Experiment with new curricula designed to promote the teamwork necessary in new model practice to deliver integrated care.
20. Advocate for further workforce research and for a national health care workforce commission reporting to Congress similar to Medpac.

Graham Center Conclusions and Recommendations

Conclusions:

1. Family physicians are in the enviable position of having accomplished to a large extent their prior workforce goals.

2. The population of the United States is growing, becoming more diverse, and will include a larger cohort of older people, not only as the baby-boomers age, but continuing past the baby-boomers with a new cohort of in-migrants. A large need for medical care by an older population probably will continue for at least half a century.

3. Millions of people rely on family physicians as a usual source of care across the entire nation, and the versatility of family physicians positions them well to serve any segment of the population. Family physicians are critically important physicians for people in rural areas, those receiving care in community health centers, and an older and more diverse population.

4. *Projections* of the numbers of family physicians that might be in practice in the near future vary substantially according to the methods and assumptions used.

    - Based on recent experience, a supply and demand model projects the number of family physicians in 2010, 2015, and 2020 to be 112,160; 130,134; and 150,989, respectively.
    - A planning model based on recent levels of supply projects the number of family physicians to be 105,757; 116,838; and 129,081, in the same years, respectively.
    - A need model based on the directions proposed in the future of family medicine report projects the number of family physicians needed to be 88,000; 91,700; and 95,600 for the same years, respectively, assuming that family physicians sustained the same market share they now have.

    The precise numbers of family physicians in future years cannot be confidently *predicted* because of unknowable factors that will influence their future practice.

5. Targeting a specific number of people for whom family physicians can provide their full basket of services, on average, is a readily understandable way to estimate the need for family physicians. A reasonable ratio that can be tested is 1,200 patients per 1 family physician.

6. The current stock and expected supply of family physicians is reasonable, given the current context that includes 1 primary care physician whose main professional activity is patient care for every 1,321 persons in the United States.

In addition to general internists and general pediatricians, there is a large and growing number of physician assistants, and a large number of primary care-oriented nurse practitioners with whom family physicians can work effectively to the benefit of people.

7. Sustaining 3,200 family medicine residency positions is sufficient to maintain the current family physician workforce.

8. A large increase of international medical graduates filling family medicine residency positions is a significant change, and its impact on the U.S. and other nations is not completely positive. An increase in the number of U.S. medical school graduates might increase the number of U.S. seniors entering family medicine. There is already a sufficient number of GME positions to absorb an increase in U.S. medical graduates.

9. The basic workforce requirement of family medicine has shifted from production of more family physicians to their effective deployment. The key task of family physicians now is to implement new models of practice and effectively provide a basket of important, necessary services in collaboration with each of their patients and other members of the health care team.

Recommendations:

Disclaimer

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

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Appendices

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Appendix B: Technical Report on Data Used

AMA Physician Masterfile data

For the cohort-flow modeling we used data from the American Medical Association (AMA) Physician Masterfiles, and the reports of the National Resident Match Program (NMRP). To estimate the magnitudes of the adjustment variables or their rates, we used data from the Physician Survey of the Community Tracking Survey (CTS), the National Ambulatory Medical Care Survey (NAMCS), the Medical Expenditure Panel Survey (MEPS), statistical trends data from the U.S. Statistical Abstract published by the U.S. Department of Commerce, Bureau of Economic Analysis, and Census data published by the U.S. Bureau of Census.

The Physician Masterfile is a database created and maintained by the AMA, the nation’s largest association representing doctors. The association collects the data through a periodic survey of physicians, collecting data on each physician's professional activity, practice specialty, type of practice, present employment, hospital affiliation, and group practice affiliation, among other things. The AMA also collects data from more than 20,000 medical groups using a telephone verification method every six to nine months. The association also sends an annual electronic survey (on computer disk) to 7,900 Accreditation Council for Graduate Medical Education (ACGME)-accredited residency programs, and 200 programs that offer medical specialty board-approved "combined specialty" programs. Data are also collected through an annual survey of 900 institutions sponsoring ACGME-accredited residency programs and 700 institutions that

participate in GME training by making facilities available to one or more residency programs.

The AMA also collects primary source data from ACGME-accredited residency programs, GME teaching institutions, and the American Board of Medical Specialties (ABMS) on board certification and subcertification status. They also collect U.S. medical school matriculation data from the Liaison Committee on Medical Education, and data on medical students and physicians completing all parts of the United States Medical Licensing Examination from the National Board of Medical Examiners. They obtain information on medical residents matched to ACGME-accredited programs from the National Residency Matching Program (NMRP), and they also obtain physicians' initial and active licensure status from the State licensing boards and data on physicians in government service from the United States Surgeon General’s office.

The AMA assigns each medical student a medical education number when they begin their medical training, and uses that number to track them from then on ad infinitum in the Masterfile database. The database contains data on all U.S. allopathic (M.D. degree) and osteopathic (D.O. degree) physicians, AMA members and nonmembers, and graduates of foreign medical schools who reside in the United States and who have met the educational and credentialing requirements necessary for recognition as physicians. Data on international medical graduates (IMGs) (graduates of foreign medical schools residing in the United States) are included in the Masterfile when IMGs enter residency programs accredited by the Accreditation Council on Graduate Medical Education (ACGME). The database also contains data on IMGs who are licensed to

practice medicine but who have not entered ACGME-accredited programs and on physicians licensed to practice medicine in the United States but who are temporarily located abroad.

Each Physician Masterfile data record includes the physician's name, medical school and year of graduation, gender, birthplace, and birth date. Additional data (residency training, state licensure, board certification, geographical location and address, type of practice, present employment, and practice specialty) are added from primary data sources or from surveying the physicians directly as the physicians' training and career develop.

Physician data records are never removed from the Masterfile database, even in the case of a physician's death. The AMA maintains information on more than 130,000 deceased physicians which they share with other organizations and agencies that credential physicians. The “death” records are used to identify individuals who attempt to fraudulently assume the credentials of deceased physicians. On the other hand, in the Masterfile database, physicians self-designate or self-identify their practice specialties. In some cases these self-designated practice specialties have no relation to training history or certification of the physician. In some cases physicians opt-out of providing information on their activities and they are then coded in the database as having “unclassified” activity.

Despite these issues, the AMA has maintained this large database for about 100 years, and has licensed it to other companies for more than 50. It seems obvious that the

Physician Masterfile has historical, current, and comprehensive data on all physicians licensed in the United States.

Assessment of AMA Physician Masterfile data

Prior to processing the Masterfile data for our cohort-flow modeling we checked it to ensure that the information provided is accurate, coherent, complete, and consistent. We performed edit checks on the following ten fields that we selected to be used in our modeling exercise: ‘Medical education number’, ‘Last Name’, ‘First Name’, ‘Birth Date’, ‘Birth Town’, 'Medical School Year of Graduation', 'GME Ending Date', 'Primary Practice Type', 'Primary Specialty', and 'Whether Physician was Presumed Dead'. The edit checks included:

- **Validity edit checks** to ensure there are no invalid characters and values, and that essential database fields have valid values.
- **Duplication edit checks** for duplicated records, making certain that each physician or resident has only one data record in the database. We created a check variable from the first four letters of a physician’s first name, the first seven letters of their last name, their birth date and town or city of birth, and their ‘Medical education number’. Potential duplicates have identical check variables. We printed all data fields for the potential duplicates and manually checked the data.
- **Consistency edit checks** made up of (a) inter-field edit checks within each copy of the database, comparing different answers from the same record to ensure that they are coherent with one another. We also performed (b) historical edit checks comparing field entries in current copy of the database to copies from previous data dates for consistency. For example we checked that physicians “presumed dead” in the 2000 copy of the database are not “residents” or providing patient care in the 2002 copy of the database.

Appendix table 1 below summarizes the results of our checks on our ten selected fields for the five copies of the AMA Physician Masterfile database.

Appendix Table 1: Results of Edit Checks on AMA Physician Masterfile Data

Data Date	Number of Records in Raw AMA Masterfile	Records Old or Marked for Deletion	Duplicate Records	Number of Records in Masterfile used
Jun 2000	885,437	15,416	13	870,008
May 2001	892,978	19,214	22	873,742
May 2002	920,656	24,528	16	896,112
Dec 2002	917,391	-	*NA	917,391
Mar 2004	936,178	-	15	936,163

Note: * We obtained a December 2002 copy of the AMA Physician Masterfile database that contained only six fields. This was adequate for us to undertake processing for our cohort-flow modeling but not adequate to allow us to check for duplicates.

Our checks revealed the following:

- For the ten essential fields that we selected, there are no invalid characters and values, and all ten fields have valid values.
- We also found copies of the AMA Masterfile database prior to 2004 included a few records that are either marked as “old” or marked for deletion by the AMA data management staff. We excluded such records (see Appendix table 1 above) from our modeling and processing.
- There are a small number of records that are duplicated entries in the AMA Physician Masterfile database. We excluded the duplicate records from our modeling and processing (see Appendix table 1 above).

For cohort-flow modeling in this study, we used the AMA Physician Masterfile data for the 50 U.S. states, District of Columbia, and the U.S. possessions, but excluded physicians whose primary practice type was coded as “Unclassified.” For all other data analysis we used Masterfile data for the 50 U.S. states, District of Columbia, and

excluded physicians in the U.S. possessions, but included physicians whose primary practice type was coded as “Unclassified.”

Selected NRMP Data Tables 2004

The National Residency Matching Program (NRMP) is a program for electronically matching U.S. medical residency applicants to the available medical residency programs according to the preferences expressed by both parties on their individualized rank order lists. The NRMP is **not** an application service nor does it advise applicants in selecting specialties or medical residency programs.

The program was established in 1952 to provide an orderly and fair mechanism to match the preferences of applicants for medical residency positions with medical residency program choices. The program provides a common time for the announcement of the appointments, as well as an agreement for medical residency programs and applicants to honor the commitment to offer and accept an appointment if a match results. The program is sponsored by the American Board of Medical Specialties, the American Hospital Association, the American Medical Association, the Association of American Medical Colleges, and the Council of Medical Specialty Societies.

The data we used came from the NRMP Selected Data tables, 2004 published, at the following web link: http://www.nrmp.org/res_match/data_tables.html

The CTS Physician Survey data

The Community Tracking Study (CTS) is conducted by the Center for Studying Health System Change (HSC) and funded by the Robert Wood Johnson Foundation. The Physician Survey is a component of the CTS surveys, and a nationally representative telephone survey of non-federal, patient care physicians. The first three Physician Surveys were conducted in 1996-97, 1998-99 and 2000-01. Data collection for the fourth survey is planned for spring 2004 to spring 2005.

Each round of the Physician Survey contains observations from more than 12,000 physicians who spend at least 20 hours a week in direct patient care. The survey is conducted by The Gallup Organization using the AMA Physician Masterfile data as the sample frame. Data were mostly collected from physicians practicing in 60 randomly selected communities (51 metropolitan areas and 9 non-metropolitan areas), allowing analyses to be conducted at both the national and community level. Primary care physicians are over-sampled. Survey questions cover a range of topics, including financial incentives, care management, acceptance of new patients, provision of charity care, practice characteristics, income, and career satisfaction

For this study we used public use data from the Physician Surveys conducted in 1996-97, 1998-99 and 2000-01. Distribution of the number of data records in the surveys are presented in Appendix table 2 below.

Appendix Table 2: Distribution of Data Records in CTS Physician Survey Files Used

Survey Period	Data Records in Survey Sample
1996-97	12,528
1998-99	12,304
2000-01	12,406

NAMCS data

The National Ambulatory Medical Care Survey (NAMCS) is a national survey designed to collect reliable information on the provision and use of ambulatory medical care services in the U.S. Data are collected on a sample of patient visits to non-federally employed office-based physicians who are primarily engaged in direct patient care. Physicians in the specialties of anesthesiology, pathology, and radiology are excluded from the survey. The survey was conducted annually from 1973 to 1981, in 1985, and annually since 1989.

Specially trained interviewers visit the physicians prior to their participation in the survey in order to provide them with survey materials and instruct them on how to complete the forms. Data collection from the physician, rather than from the patient, provides an analytic base that expands information on ambulatory care collected through other National Center for Health Statistics (NCHS) surveys. Each physician is randomly assigned to a one-week reporting period. During this period, data for a systematic random sample of visits are recorded by the physician or office staff on an encounter

form provided for that purpose. Data are obtained on patients' symptoms, physicians' diagnoses, and medications ordered or provided. The survey also provides statistics on the demographic characteristics of patients and services provided, including information on diagnostic procedures, patient management, and planned future treatment.

For survey years 1973-91, there are two data files--one for patient visit data and a second for drug mention data. The second file is limited to those visits with mention of medication therapy. For the 1991 data, it is possible to link information on the drug file with information on the patient visit file. Beginning with the 1992 survey year, only one data file is produced annually that contains both patient visit and drug information.

For this study we used NAMCS survey data from the 1993 to 2003 surveys. Distribution of the number of data records in the surveys are presented in Appendix table 3 below.

Appendix Table 3: Distribution of Data Records in NAMCS Survey Files Used

Survey Period	Data Records in Survey Sample
1993	35,987
1994	33,598
1995	36,875
1996	29,805
1997	24,715
1998	23,339
1999	20,760
2000	27,369
2001	24,281
2002	28,738

MEPS data

The Medical Expenditure Panel Surveys (MEPS) are a series of medical expenditure surveys conducted by the Agency for Healthcare Research and Quality (AHRQ). Each is a nationally representative survey that collects detailed information on the health status, access to care, health care use and expenses, and health insurance coverage of the U.S. civilian non-institutionalized population.

The MEPS consist of three component surveys: the Household Component, the Medical Provider Component, and the Insurance Component. The Household Component is the core survey and is conducted each year using an overlapping panel design to collect data for two calendar years from each sampled household.

MEPS is unique in its ability to link data on individuals and households (including demographics, health status, employment, and income) to information on their use of health care. This information includes expenses and sources of payment for specific medical services, health insurance status, and the details of individual/household health plans, including what individuals/households pay for health insurance coverage. No other survey contains such a wide range of data essential for analyzing the correlates of health spending and insurance coverage. The MEPS panel design makes it possible to examine how health care use, expenses, sources of payment, and insurance coverage change over time.

For this study we used MEPS data from the 1996 through 2001 surveys. Distribution of the number of data records in the surveys are presented in Appendix table 4 below.

Appendix Table 4: Distribution of Data Records in MEPS Survey Files Used

Survey Period	Data Records in Survey Sample
1996	22,601
1997	34,551
1998	24,072
1999	24,618
2000	25,096
2001	33,556

U.S. Economic Indicators Trend Data

Available from April 1995 forward, trend data on U.S. economic indicators are compiled monthly for the Joint Economic Committee, by the Council of Economic Advisors. The data are published in reports called “Economic Indicators.” They provide quarterly and annual information about the U.S. economy including data on prices, wages, production, business activity, purchasing power, credit, money, and federal finance.

For this study we obtained annual trend data from the “Economic Indicators” on the real Gross Domestic Product (GDP), and Real Personal Consumption Expenditures.

U.S. Statistical Abstract data

The U.S. Statistical Abstract’s National Data Book contains U.S. national and regional data tables and statistics on social and economic conditions in the United States. The data have been compiled by the U.S. Census Bureau every year since 1878.

A complete count of the U.S. population has been conducted every ten years since 1790. Data are obtained on number and characteristics of people in the U.S. In 1980, 1990, and 2000 there was a complete census for the following items: age, sex, race, and relationship to householder. In 1980, approximately 19% of the housing units were sampled for other variables ; in 1990 and 2000, approximately 17%. In 1980, 1990, and 2000, mail questionnaires were used extensively with personal interviews in a few

cases. Extensive telephone and personal follow-up for non-respondents was done in the Censuses. Imputations were made for missing values.

Data presented in the Statistical Abstract come from many sources. The sources include not only federal statistical bureaus and other organizations that collect and issue statistics as their principal activity, but also governmental administrative and regulatory agencies, private research bodies, trade associations, insurance companies, health associations, and private organizations such as the National Education Association and philanthropic foundations. Consequently, the data vary considerably as to reference periods, definitions of terms and, for ongoing series, the number and frequency of time periods for which data are available. The statistics presented were obtained and tabulated by various methods. Some statistics are based on complete enumerations or Censuses, while others are based on selected samples out of the total universe. Some information is extracted from records kept for administrative or regulatory purposes (school enrollment, hospital records, securities registration, financial accounts, social security records, income tax returns, etc.), while other information is obtained explicitly for statistical purposes through interviews or by mail. The estimation procedures used vary from highly sophisticated scientific techniques to crude ‘‘informed guesses.’’

For this study we obtained data on the total U.S. resident population and the population by age and gender from Section 1 of the National Data Book. We obtained data on national health expenditures on physician and clinical services, and counts of physicians involved in office-based practice from Section 3 of the National Data Book.

Appendix C: Technical Report on Modeling

The major methods for statistical modeling to forecast or produce future projections of data or information include:

- time series analysis;
- regression analysis;
- multiple-equation modeling; and
- simulation modeling.

In this study, we employed three of these four major methods. We used time series analysis, some regression analysis and simulation modeling. So in this section of the appendix we discuss the employment of these methods in broad terms, their limitations, and the technical results from our analyses.

In general, the statistical method of modeling assumes that (1) historical data can be characterized or symbolized by one or more mathematical equations; (2) such equations can be used to replicate historical patterns; (3) all information needed to forecast future data is contained in the selected historical data being analyzed; (4) the structure of the resultant model replicates accurately the real life structure of the system that gave rise to the historical data; and (5) the ongoing structure of the system that gave rise to the historical data will be unchanging throughout the period of the projection or forecast.

Time-series analysis refers to the mathematical methods used to fit trend data. The time-series methods can be simple or complex. The simpler ones involve using statistical processes to plot a line through historical data in a way that minimizes any divergence or discrepancy between the line and the data. The plot can be a straight line or a curved line. The data being predicted (dependent variable) depends on time only. Time is the only independent variable. If the statistical fit is assessed to be good, the plot can be extended into the future as a projection or forecast. Assessment of the statistical fit is usually done using the highest correlation coefficient or "least-squares" criterion.

In regression analysis, the objective is still fitting historical data. The difference is that the value of the data being predicted (the dependent variable) is not dependent on time only. It may depend on factors other than time or in addition to time. Population size, for example, may be dependent on numerous variables, such as the number of young women in the population a year ago, their education, or personal income. Regression equations can be linear (straight line) and involve a few independent variables, nonlinear (curved line) or polynomial and involve many variables, or a mixture.

Sometimes the dependent variable of one equation is used as an independent variable in another equation. In this way, "simultaneous" equations are built to describe the operation of complex systems (such as national economies) in econometrics. This is multiple-equation or simultaneous-equation modeling.

In time-series analysis, regression analysis, and simultaneous-equation modeling, the equations are determined by statistical relationships that existed in past times. By contrast, in simulation modeling, the equations are constructed to duplicate, to a greater or lesser degree, the actual functioning of the system under study. For example, a simulation model that attempts to duplicate the historical size of population might involve the following logic: population today is simply the number of people who existed last year, plus the number of people born and minus the number of people who died during the year. Such an equation can be used as a forecasting model. Our cohort flow modeling methods in this study are good examples of micro-level simulation modeling.

In simulation modeling, an attempt is made to duplicate the system being modeled in the form of equations, not solely by drawing on statistical relationships among variables, but rather by logic and inference about how the system works. Simulation modeling could be complicated but it has the advantage of forcing attention on how things really work.

Although time-series modeling is quick and easy, it provides little fundamental understanding of future behavior. Since the future is predicated solely on the past without an underlying feel for causal factors, time series is a naive forecasting method. While various forms of explanatory or causal forecasting strive to explain a fundamental causal relationship, they are also predicated on past behavior and therefore also present naive forecasts.

The major strength of regression modeling as a projection method is that it capitalizes on historical relations between the predicted (dependent) and predictor (independent) variable. It uses all the information in the historical data pairs to determine the future values of the predicted variables. The method of least squares, as commonly used, implies that the predicted values of the independent variable are devoid of error or uncertainty; that is, the only possible error or uncertainty is in values of the predictor variable. Often this assumption is questionable.

When the past-history data are subject to error, the effect of the error makes the predicted values of the predicted variables vary less than they should. Values of the predicted variable that should fall below the mean will generally be forecast as such, but less so than they should be, similarly for values that should be above the mean. It has been shown that the greater the possible error in the past history data, the greater this effect. There is no way to distinguish a weak relationship between the predictor and predicted variables from a strong relationship that is obscured by error of measurement (often referred to as “noise”). All the above modeling methods, as commonly applied, assume that all past-history data pairs are equally important. While "weighted" data pairs can be used to generalize, that method of correction is not common.

The results of the best-fit regression estimates deriving the adjustment factors for the supply/demand model are presented in Appendix table 5.

Appendix Table 5: Results of Regression Analysis

		Family Medicine	Internal Medicine	Pediatrics
Supply adjustment variables				
Economy three years ago ($billions GDP using dollars from 2000)	**Parameter**	5.04	13.30	6.78
	T value	23.24	32.77	38.98
	Prob > |T|	<0.0001	<0.0001	<0.0001
	Adjusted R^2	0.97	0.98	0.99
Demand adjustment variables				
Population growth (size of resident mid-year U.S. population)	**Parameter**	0.0004	0.0010	0.0005
	T value	14.92	28.18	59.44
	Prob > |T|	<0.0001	<0.0001	<0.0001
	Adjusted R^2	0.95	0.99	0.99
Proportion of population uninsured (size of resident mid-year U.S. population)	**Parameter**	-1,642	-1,163	-686
	T value	-3.46	-1.94	-4.36
	Prob > |T|	0.0030	0.0701	0.0005
	Adjusted R^2	0.95	0.99	0.99
Market share of specialty (proportion of patient visits to physicians of that specialty)	**Parameter**	n/a	-93,433	43,089
	T value	n/a	-3.34	6.78
	Prob > |T|	n/a	0.0040	<0.0001
	Adjusted R^2	n/a	0.99	0.99

Appendix D: Using the Physician Workforce Projection Tool

Purpose of the Projection Tool

As part of this study, a physician workforce projection tool was developed. This tool makes available the “engine” of our supply/demand physician workforce model for anyone who wants to use it to project the primary care physician workforce into the future under their own assumptions.

Description of the Projection Tool

The projection tool was created using the Microsoft EXCEL software. It contains the two main parts of the “engine” of our primary care physician workforce model. These are:

1. The major physician workforce flow rates derived from the cohort flow simulation part of this study, and
2. The formulas developed that relate the various components of the physician workforce system to each other.

As stated in the main section of the report, there are two main mechanisms for tuning the model and using it to make projections. It can be done by:

1. Keeping the physician workforce flow rates unchanged but changing the magnitude of the various factors (or variables) in the model.

2. Changing the formulas that represent the relationships underlying the model. That is the same as changing any of the rates, with no changes in the various factors (or variables) in the model.

Of course one can anticipate circumstances in which the nature of the relations (the rates), and the magnitude of the variables (GDP, population, physician retirement, etc.) both change simultaneously in various directions. Making projections with this model is straightforward.

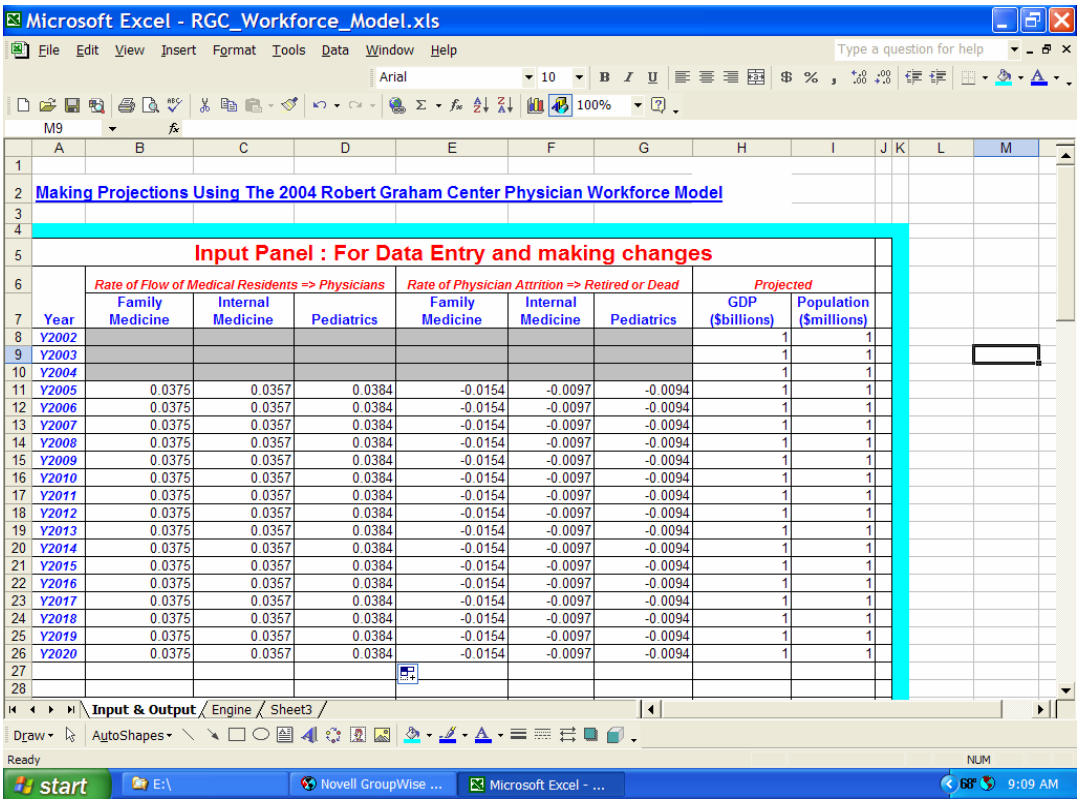
The projection tool has two worksheets. One of these worksheets (called the “engine” sheet) has the physician workforce cohort flow rates and the formulas that connect the various relationships in our model. That worksheet is protected and is not open for data input. The top part of the other worksheet (called the “Input & Output” sheet) has the input panel that allows one to change the physician workforce flow rates, the magnitude of the various variables (e.g.: GDP, population, physician retirement) or the projected future magnitudes of those variables. The bottom portion of the second worksheet is the output panel that displays a table and a graph showing the results from using the projection model – the projected future physician workforce numbers.

Using the Projection Tool

In the Input Panel of the spreadsheet you may do any of the following:

- Replace the physician cohort flow rates by entering your own assumptions or forecasts of the rates in decimal numbers in columns B through G. For example, we derived from our physician cohort flow simulations that medical residents become active Family Physicians at the rate of 3.75 percent (or 0.0375 in

decimal numbers). That is the number in the Input Panel at the start as part of our “Status Quo” model.



Microsoft Excel - RGC_Workforce_Model.xls

Making Projections Using The 2004 Robert Graham Center Physician Workforce Model

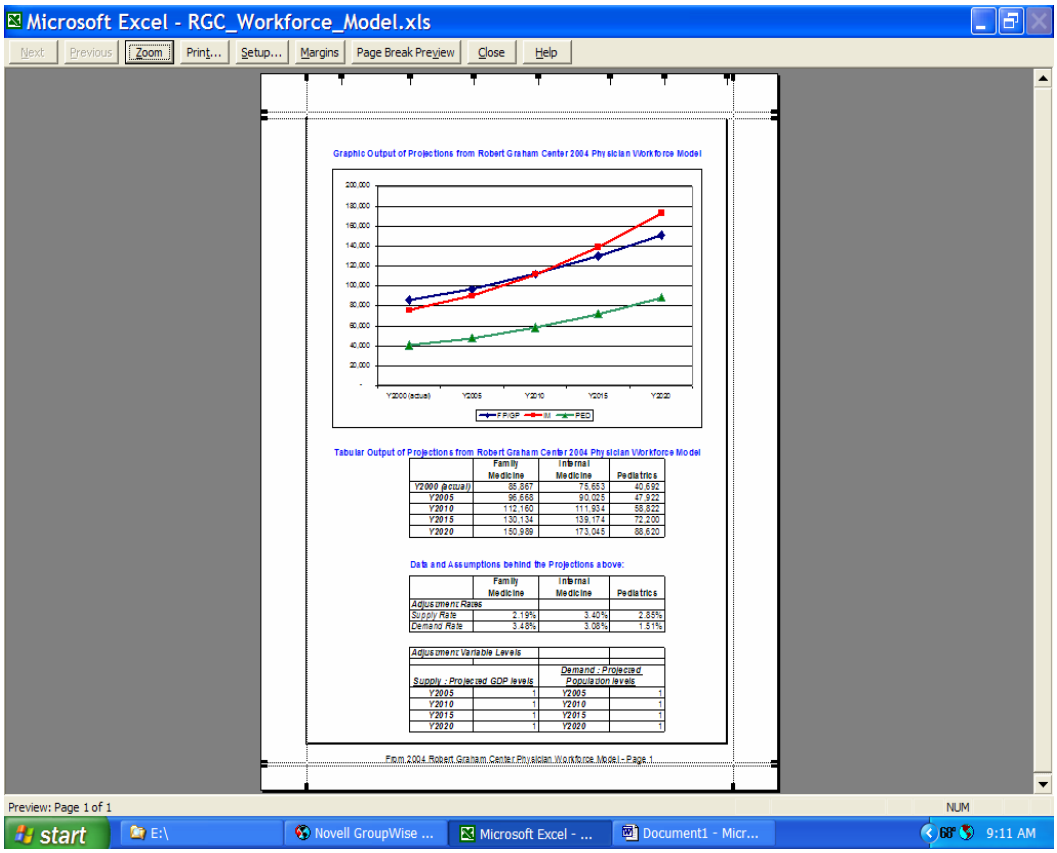
Input Panel : For Data Entry and making changes

	Rate of Flow of Medical Residents => Physicians			Rate of Physician Attrition => Retired or Dead			Projected	
Year	Family Medicine	Internal Medicine	Pediatrics	Family Medicine	Internal Medicine	Pediatrics	GDP ($billions)	Population ($millions)
Y2002							1	1
Y2003							1	1
Y2004							1	1
Y2005	0.0375	0.0357	0.0384	-0.0154	-0.0097	-0.0094	1	1
Y2006	0.0375	0.0357	0.0384	-0.0154	-0.0097	-0.0094	1	1
Y2007	0.0375	0.0357	0.0384	-0.0154	-0.0097	-0.0094	1	1
Y2008	0.0375	0.0357	0.0384	-0.0154	-0.0097	-0.0094	1	1
Y2009	0.0375	0.0357	0.0384	-0.0154	-0.0097	-0.0094	1	1
Y2010	0.0375	0.0357	0.0384	-0.0154	-0.0097	-0.0094	1	1
Y2011	0.0375	0.0357	0.0384	-0.0154	-0.0097	-0.0094	1	1
Y2012	0.0375	0.0357	0.0384	-0.0154	-0.0097	-0.0094	1	1
Y2013	0.0375	0.0357	0.0384	-0.0154	-0.0097	-0.0094	1	1
Y2014	0.0375	0.0357	0.0384	-0.0154	-0.0097	-0.0094	1	1
Y2015	0.0375	0.0357	0.0384	-0.0154	-0.0097	-0.0094	1	1
Y2016	0.0375	0.0357	0.0384	-0.0154	-0.0097	-0.0094	1	1
Y2017	0.0375	0.0357	0.0384	-0.0154	-0.0097	-0.0094	1	1
Y2018	0.0375	0.0357	0.0384	-0.0154	-0.0097	-0.0094	1	1
Y2019	0.0375	0.0357	0.0384	-0.0154	-0.0097	-0.0094	1	1
Y2020	0.0375	0.0357	0.0384	-0.0154	-0.0097	-0.0094	1	1

Since the “Status Quo” model assumes that these flow rates do not change into the future, 0.0375 appears for each of the years from 2005 through 2020. If you forecast or assume that the rate increases to 5 percent in any range of years, you would need to change the number 0.0375 by entering the number 0.0500 in its place for those years in Column B of the panel.

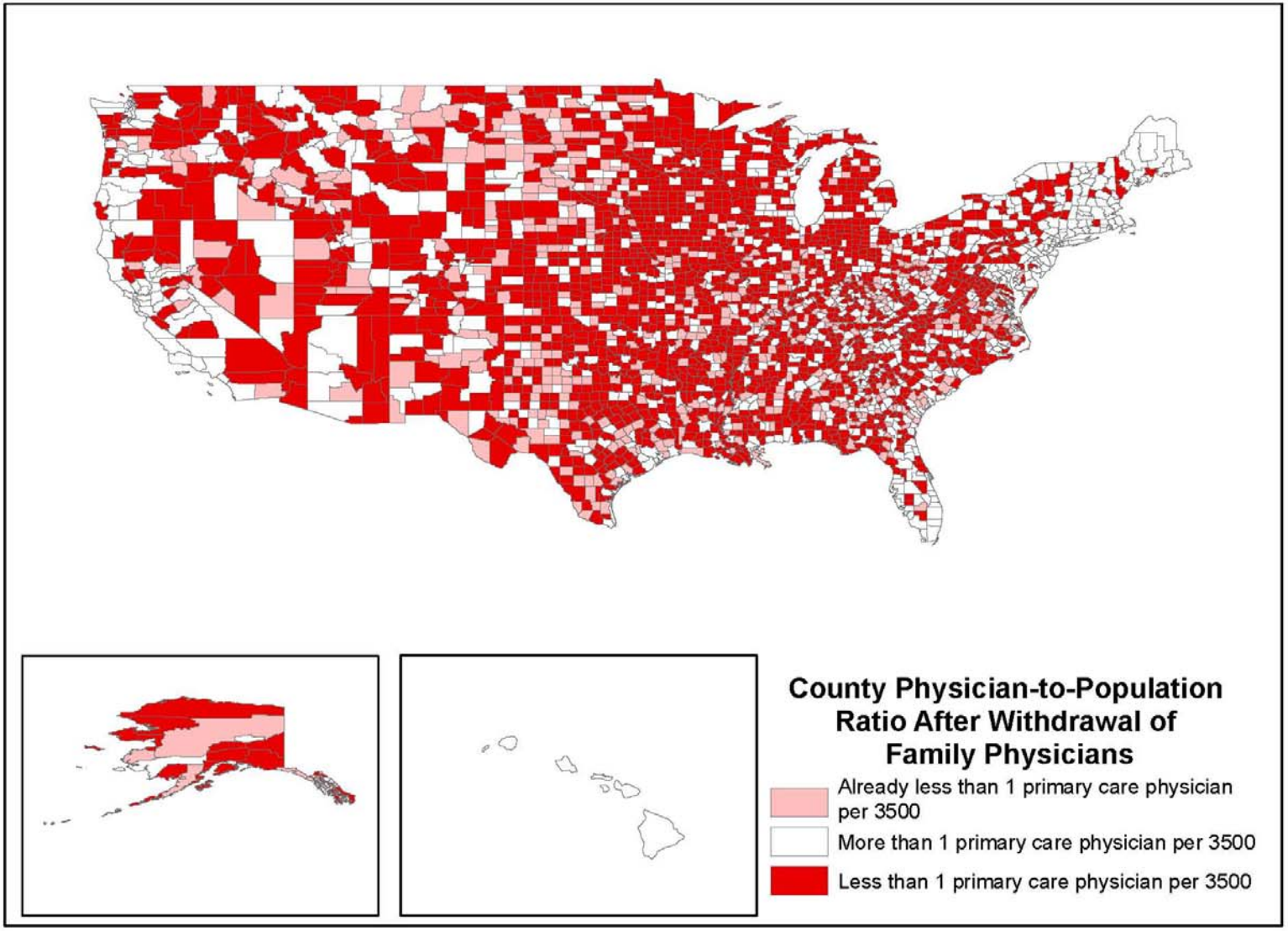
- Enter your forecasted or assumed GDP and/or population numbers in the appropriate columns (Columns H and I) of the worksheet. Those columns currently may have the number “1” in place of these forecasts. That is because in our “Status Quo” model, the GDP and Population are assumed to stay at 2004 levels. The “1s” are thus only place holders for any GDP or Population forecast numbers. You must replace the “1s” with your forecasts or assumptions of future GDP and/or population.

Each of your input numbers is automatically carried from the Input Panel of the spreadsheet to the “engine” of the model on the protected worksheet. The results of the modeling are then presented on the Output Panel below the Input Panel. The results include a graph and table of the projected Family Medicine, Internal Medicine, and Pediatric Physician workforce numbers from 2005 to 2020. These results page, presented below in a “screen-shot” may be printed using the regular Microsoft Windows print commands.



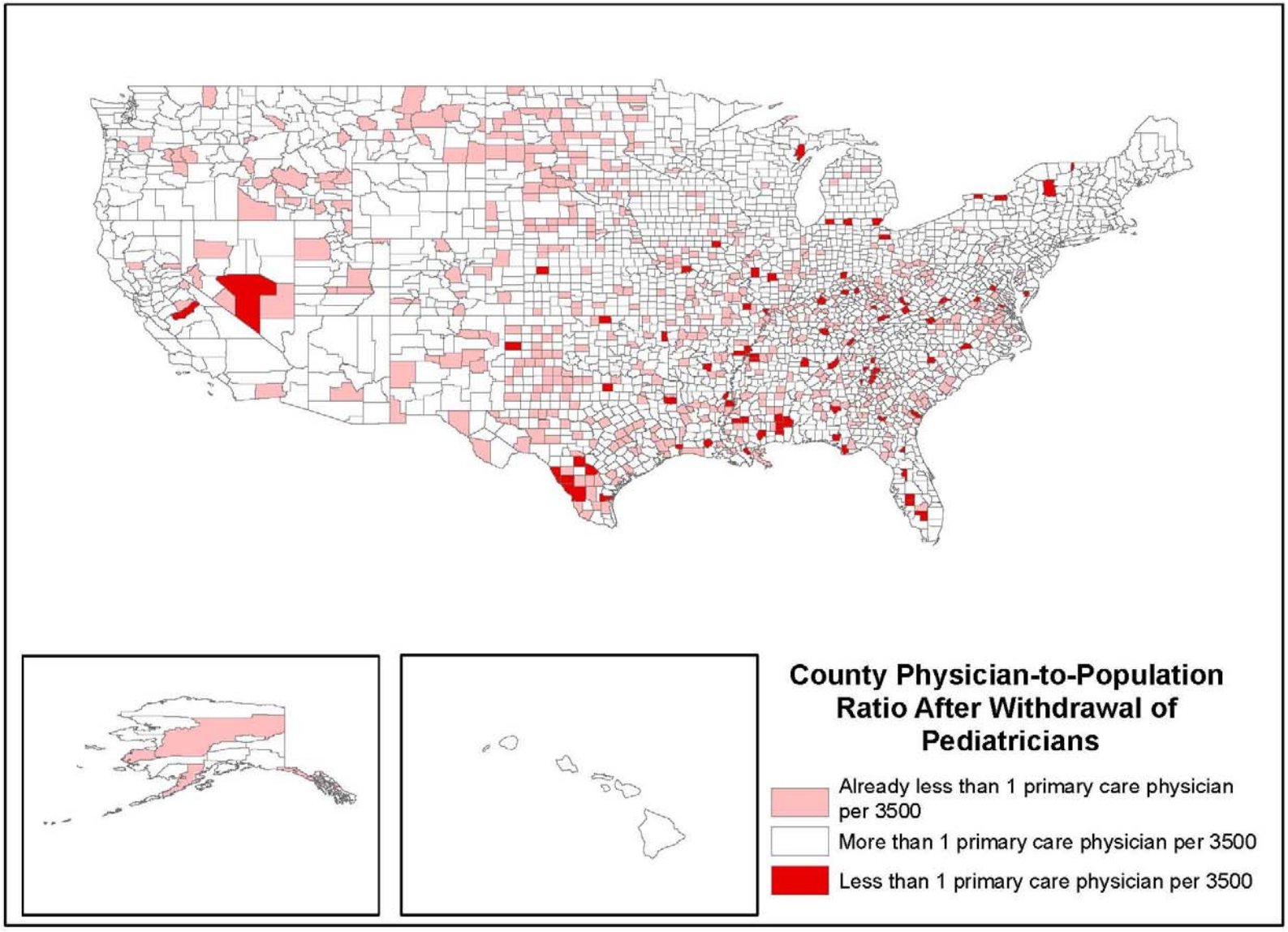
Appendix E: Physician Workforce Maps

Appendix Figure 1: 2004 County Primary Care Physician-to-Population Ratios After Withdrawal of Family Physicians



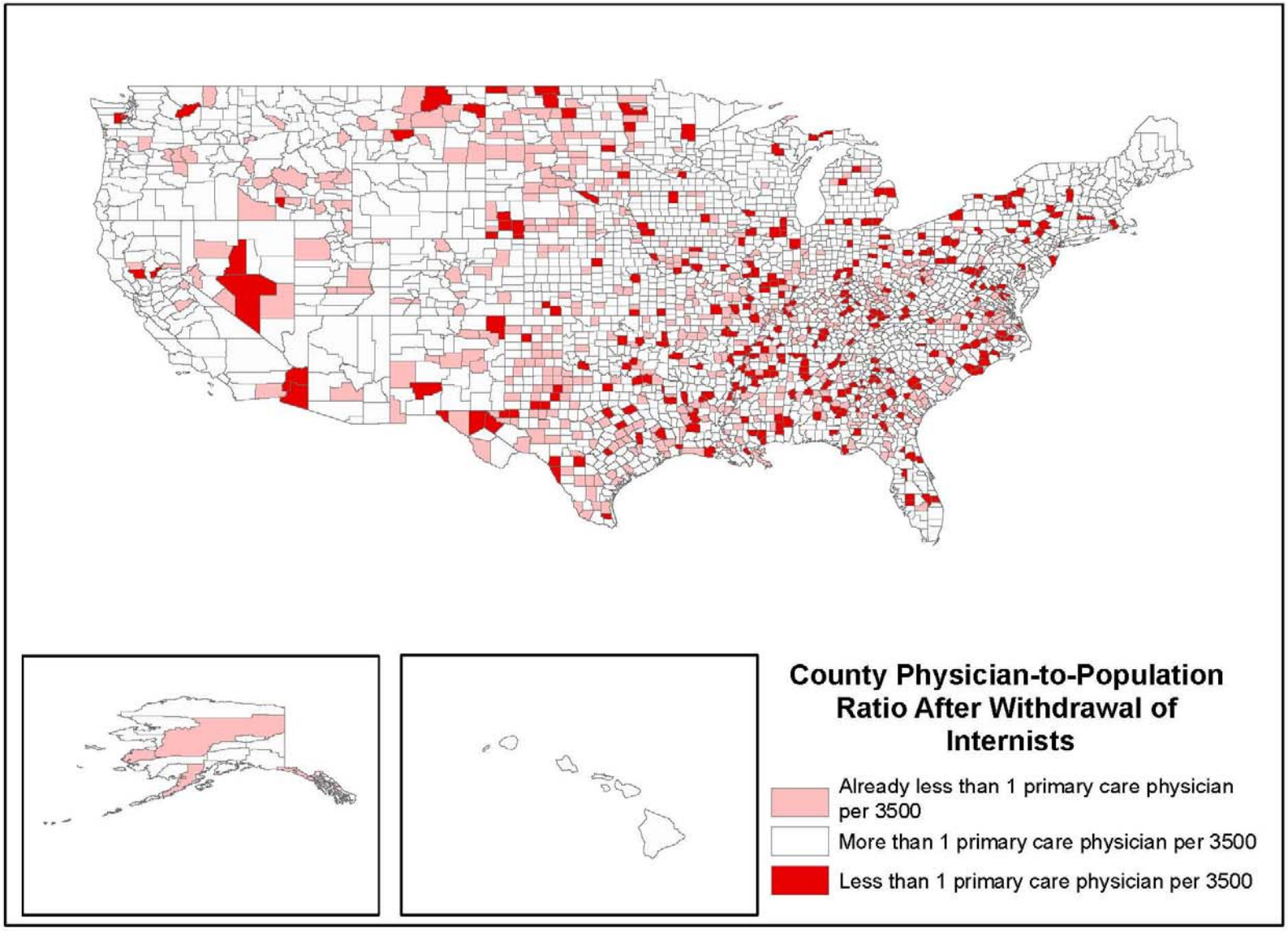
Sources: 2004 AMA Physician Masterfile, 2003 U.S. Census population estimates; Analysis by The Robert Graham Center, 2004.
Note: Less than 1 primary care physician per 3500 persons is a criterion used to designate federal Primary Care Health Professional Shortage Areas.

Appendix Figure 2: 2004 County Primary Care Physician-to-Population Ratios After Withdrawal of Pediatricians



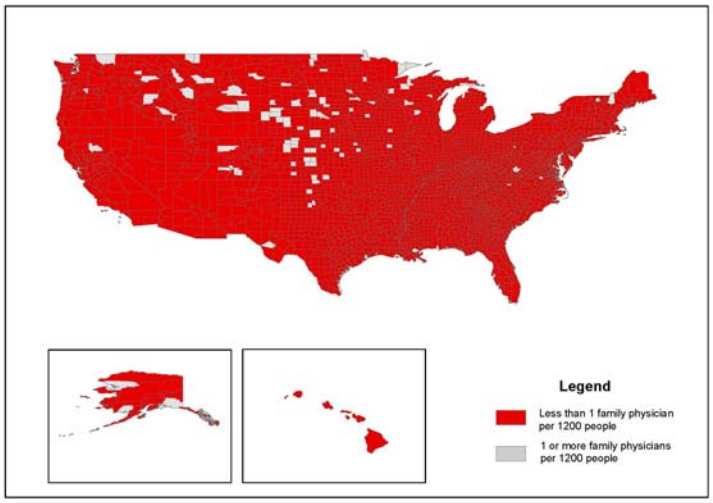
Sources: 2004 AMA Physician Masterfile, 2003 U.S. Census population estimates; Analysis by The Robert Graham Center, 2004.
Note: Less than 1 primary care physician per 3500 persons is a criterion used to designate federal Primary Care Health Professional Shortage Areas.

Appendix Figure 3: 2004 County Primary Care Physician-to-Population Ratios After Withdrawal of Internists



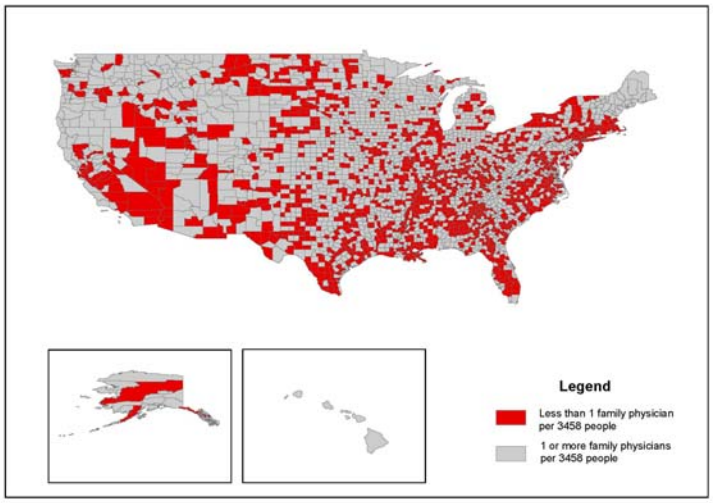
Sources: 2004 AMA Physician Masterfile, 2003 U.S. Census population estimates; Analysis by The Robert Graham Center, 2004.
Note: Less than 1 primary care physician per 3500 persons is a criterion used to designate federal Primary Care Health Professional Shortage Areas.

Appendix Figure 4: 2004 Counties with Less than One Family Physician per 1200 People



Sources: 2004 AMA Physician Masterfile, 2003 U.S. Census population estimates; Analysis by The Robert Graham Center, 2004.

Appendix Figure 5: 2004 Counties with Less than One Family Physician per 3458 People



Sources: 2004 AMA Physician Masterfile, 2003 U.S. Census population estimates; Analysis by The Robert Graham Center, 2004.

Appendix F: Canadian Population per Physician

Table 2.1

Population per Physician, by Specialty and Province/Territory, Canada, 2003

	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T.	N.W.T.	Nun.	Canada
1.0 Family Medicine	845	1,141	903	1,016	957	1,181	1,085	1,046	1,007	900	616	1,459	2,950	1,036
2.0 Medical Specialists	2,023	2,818	1,407	2,467	1,332	1,464	1,576	2,564	1,577	1,537	15,704	5,290	0	1,500
2.1 Clinical Specialists														
- Internal Medicine	6,932	9,207	4,638	8,334	4,205	4,848	5,552	7,959	5,108	5,963	0	21,161	0	4,992
- Medical Genetics	519,897	0	936,892	0	469,371	878,119	291,486	497,423	352,458	595,446	0	0	0	588,016
- Dermatology	103,979	138,102	58,556	107,157	40,815	70,250	105,995	165,808	81,336	66,161	0	0	0	62,629
- Neurology	74,271	138,102	39,037	93,762	34,768	50,178	72,872	82,904	45,316	42,970	0	0	0	45,622
- Pediatrics	15,754	15,345	13,983	25,003	14,143	14,082	10,999	24,871	14,419	18,044	31,408	14,107	0	14,810
- Physical Medicine and Rehab.	259,949	0	85,172	83,344	100,132	83,630	89,688	124,356	99,129	92,625	0	0	0	92,845
- Psychiatry	14,854	23,017	7,873	23,441	7,624	7,045	8,328	22,610	11,289	7,497	0	21,161	0	8,049
- Community Medicine	259,949	0	156,149	0	41,955	101,601	68,585	142,121	126,885	115,781	0	42,321	0	80,591
- Emergency Medicine	519,897	138,102	78,074	375,048	77,422	78,806	77,730	0	49,564	50,218	0	0	0	73,672
- Occupational Medicine	0	0	0	750,096	1,501,986	585,413	1,165,944	994,845	317,212	694,687	0	0	0	705,619
- Anesthesia	16,247	19,729	10,769	15,308	13,531	13,406	11,897	16,309	13,054	11,675	31,408	0	0	13,192
- Nuclear Medicine	259,949	0	156,149	250,032	89,404	168,406	166,563	331,615	211,475	208,406	0	0	0	149,074
- Diagnostic Radiology	16,247	27,620	13,384	18,295	15,453	16,933	20,820	24,265	14,823	17,737	0	0	0	16,659
- Radiation Oncology	129,974	0	104,099	93,762	139,073	83,630	233,189	248,711	102,326	81,728	0	0	0	101,447
Total—Clinical Specialists	2,251	3,069	1,487	2,679	1,430	1,557	1,668	2,810	1,693	1,677	15,704	5,290	0	1,607
2.2 Laboratory Specialists														
- Medical Biochemistry	0	0	468,446	0	153,264	647,035	0	331,615	3,172,121	320,625	0	0	0	364,975
- Medical Microbiology	173,299	138,102	468,446	250,032	52,152	279,402	388,648	331,615	396,515	198,482	0	0	0	136,866
- Pathology	22,604	46,034	29,278	35,719	38,912	28,196	30,683	35,530	24,782	21,823	0	0	0	29,051
Total—Laboratory Specialists	19,996	34,526	26,025	31,254	19,456	24,637	28,438	29,260	23,154	18,525	0	0	0	22,488
3.0 Surgical Specialists	5,048	5,524	3,689	4,121	3,709	4,217	4,720	5,349	4,988	4,156	15,704	7,054	0	4,187
- General Surgery	19,996	15,345	15,615	17,048	15,295	19,001	17,146	21,627	21,727	20,432	31,408	0	0	18,228
- Cardio and Thoracic Surgery	103,979	0	78,074	150,019	98,815	110,754	129,549	110,538	132,172	112,652	0	0	0	110,253
- Neurosurgery	173,299	0	117,112	150,019	134,106	175,624	145,743	124,356	144,187	134,456	0	0	0	150,487
- Obstetrics and Gynecology	22,604	23,017	20,367	24,197	19,355	18,599	22,422	24,265	24,401	22,653	31,408	21,161	0	20,289
- Ophthalmology	47,263	46,034	19,519	34,095	26,917	31,522	43,183	41,452	37,319	25,261	0	42,321	0	30,097
- Otolaryngology	57,766	138,102	42,586	50,006	41,955	56,653	64,775	99,485	88,114	52,102	0	21,161	0	53,910
- Orthopedic Surgery	34,660	46,034	34,700	24,197	25,117	29,481	32,387	43,254	27,826	25,109	0	42,321	0	28,050
- Plastic Surgery	129,974	138,102	85,172	57,700	69,536	70,653	97,162	71,060	77,369	66,161	0	0	0	72,002
- Urology	74,271	69,051	46,845	46,881	50,402	53,920	68,585	90,440	83,477	57,098	0	0	0	56,600
4.0 Medical Scientists	0	0	0	0	750,993	682,982	1,165,944	994,845	1,057,374	833,625	0	0	0	835,601
Total—All Specialists	1,444	1,866	1,018	1,543	979	1,085	1,180	1,730	1,197	1,121	7,852	3,023	0	1,103
Total—All Physicians	533	708	478	613	484	566	565	652	547	499	571	984	2,950	534

Source: SMDB, CIHI

Notes: Excludes residents and physicians with "no publication" status (see Methodological Notes for details).
Includes physicians who provide both clinical and/or non-clinical services.
Specialty allocation based on latest acquired certified specialty. "Internal medicine" includes sub-specialties.
"Family medicine" includes certificants of the College of Family Physicians of Canada (CFPC), non-CFPC general practitioners, foreign-certified specialists and other non-certified specialists. "Specialists" includes certificants of the Royal College of Physicians and Surgeons of Canada or the Collège des médecins du Québec (see Methodological Notes for details).
The population per physician ratio is calculated annually using the most recent Statistics Canada Population Estimates. See Appendix A for Statistics Canada Population Estimates.
Data as of December 31, 2003.

Source: Canadian Institute for Health Information

Appendix G: Written Commentary from Workforce Advisory Committee

From: Gary Hart 9/23/04

I much enjoyed the advisory meeting. I am on a plane headed for Seattle and I know you need any comments and suggestions that I did not make at the meeting very quickly. Thus, I am listing them below in no special order and I am doing so as fast as I can – otherwise you will not get them. I thought most of the important comments were already made at the meeting and will not repeat them.

1) Do not say NPs are 80% generalist – number is much smaller. We have some work on this and it is closer to 50%.
2) NP headcounts are misleading as by the time primary care is extracted and FTEs are calculated the numbers of FTEs land up being something like 70% less.
3) Our Health Affairs article from about 8 years ago per staff model HMOs did come up with a number of population per FP of about 1200 – very detailed study in response to errors by Wiener.
4) There is very little in text about the gender change in medicine – how it specifically is related to generalist specialties and how this changes productivity (not per hour but hours per week)
5) Your model, like all the rest, basically ignores geography – it is not the numbers for nation but the maldistribution of providers that is the bigger issue – along with disparities of access
6) There should be more emphasis in the report on the relative lack of minorities in medicine
7) There are lots of specialists in large rural places – therefore they are not totally dependent on FPs
8) The rural places that are too small to support an FP still need care and will have to drive to get it – and will usually land up getting it from an FP in another rural place.
9) I thought the introduction was too stilted in its language – it just needed to be simpler and more user friendly
10) The “team sport” example on page 2 seems inappropriate.
11) Page 44 – our FP residency study give detailed information on rural training – 7.5% of training and how over 60% of it is done by only 35 of the 453 residencies and how what they say their emphasis per rural is has little to do with their doing rural training. The letter in JAMA tells some of this that Roger Rosenblatt is the lead author of.
12) Per demographics – growth of non metro (rural) could have been broken out by type – this makes a difference – esp. when looking at docs per pop. When non metro population grow is shown – it is not clear about the definition being used – e.g., is it the definition in 93 showing the population change for the same counties between 90 and 2000? etc. etc. or does it not hold the counties per

definition constant? Remember that over 250 counties were reclassified from non metro to metro per the 2000 Census.

Appendix H: Abbreviations

AAFP	American Academy of Family Physicians
AANP	American Academy of Nurse Practitioners
AAPA	American Academy of Physician Assistants
AHEC	Area Health Education Center
AHRQ	Agency for Healthcare Research and Quality
AMA	American Medical Association
BHPr	Bureau of Health Professions
COGME	The Council on Graduate Medical Education
CTS	Community Tracking Study
DHHS	Department of Health and Human Services
DO	Doctor of Osteopathy
FM	Family Medicine
FMM	Future of Family Medicine Project
FNIMG	Foreign National International Medical Graduate
FP	Family Physician
FPGP	Family Physician or General Practitioner
GAO	United States General Accounting Office
GDP	Gross Domestic Product
GHAA	Group Health Association of America
GME	Graduate Medical Education
GMENAC	The Graduate Medical Education National Advisory Committee
GP	General Practice or General Practitioner
GPEDS	General Pediatrics or General Pediatrician
HRSA	Health Resources and Services Administration
IM	General Internal Medicine
IMG	International Medical Graduate
MD	Medical Doctor
MEPS	Medical Expenditure Panel Survey
NAMCS	National Ambulatory Medical Care Survey
NHIS	National Health Interview Survey
NP	Nurse Practitioner
PA	Physician Assistant
PCP	Primary Care Physician
PD/PEDS	Pediatrics or General Pediatrician
U.S.	United States
USFMG	United States Foreign Medical Graduate
USMG	United States Medical Graduate
WAMI	Washington, Alaska, Montana, Idaho Training Program