Changing Demographics: Implications for Physicians, Nurses, and Other Health Workers

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EXECUTIVE SUMMARY

The size and characteristics of the future health workforce are determined by the complex interaction of the health care operating environment, economic factors, technology, regulatory and legislative actions, epidemiological factors, the health care education system and demographics. Efforts over the past several decades to model the supply of and demand for health workers show there is a lack of consensus on the relationship between the health workforce and its determinants, the future values of many of these determinants, and forecasters' assumptions.

The Workforce Analysis Branch of the Bureau of Health Professions (BHPr), Health Resources and Services Administration (HRSA), commissioned a report synthesizing the literature on one set of factors that will have a profound impact on the future health workforce—changing demographics—and discussing its implications for the health workforce. In addition, BHPr commissioned the update of two requirements forecasting models: the Physician Aggregate Requirements Model (PARM) and the Nursing Demand Model (NDM). The major findings of the literature and these two demand models are the following.

Population Aging

- If health care consumption patterns and physician productivity remained constant over time, the aging population would increase the demand for physicians per thousand population from 2.8 in 2000 to 3.1 in 2020. Demand for full-time-equivalent (FTE) registered nurses per thousand population would increase from 7 to 7.5 during this same period.

- In 2000, physicians spent an estimated 32 percent of patient care hours providing services to the age 65 and older population. If current consumption patterns continue, this percentage could increase to 39 percent by 2020.

- The aging of the health workforce raises concerns that many health professionals will retire about the same time that demand for their services is increasing. Furthermore, the declining proportion of the population age 18 to 30 raises concerns regarding the ability to attract a sufficient number of new health workers.

- The rise in health care expenditures associated with the rapid increase in the elderly population will likely place additional pressures on the Medicaid and Medicare programs, as well as private insurers, to control health care costs. Such measures would likely decrease the demand for and supply of health professionals.

- The aging population could result in rising average patient acuity, which could in turn require higher nurse and physician staffing levels. One countervailing trend is that tomorrow's elderly might have lower disability rates than today's elderly, controlling for age, because of improvements in economic resources, education levels, lifestyle, public health, and medical technology.

Increasing Racial and Ethnic Diversity

- The literature suggests that Hispanics and non-whites have different patterns of health care use compared to non-Hispanic whites. Disparities in access to care account for part of the difference in utilization.

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

- Minorities are underrepresented in the physician and nurse workforce relative to their proportion of the total population. As minorities constitute a larger portion of the population entering the workforce, their representation in the physician and nurse professions will increase. The U.S. will increasingly rely on minority caregivers.

- Minority physicians have a greater propensity than do non-minority physicians to practice in urban communities designated as physician shortage areas. An increase in minority representation in the physician workforce could improve access to care for the population in some underserved areas.

Geographic Location of the Population

- Geographic variation in population growth rates and in determinants of health worker demand and supply highlight the importance of developing forecasting models that can make State-level and sub-State level forecasts.

- Although an increasing proportion of the U.S. population resides in urban areas, a substantial proportion of the population will continue to reside in rural areas. Many of these rural areas are currently designated as physician shortage areas.

- Pockets of urban areas will continue to have a high concentration of minorities. Many of these areas are currently designated as physician shortage areas. Efforts to increase the supply of health professionals in these areas must deal with economic, cultural and language considerations.

Forecasting the Impact of Changing Demographics and Other Factors on Physician Requirements

The PARM forecasts requirements for allopathic (MD) and osteopathic (DO) physicians providing patient care in 19 specialties as well as physicians in non-patient-care activities. Requirements are demand-based and rely on current and forecasted patterns of health care use, physician staffing patterns, and medical insurance prevalence rates. We consider forecasts under five scenarios (***Exhibit ES.1***).

- Scenario 1, *Status Quo*, forecasts physician requirements under the assumption that patterns of health care use, medical insurance coverage, and physician productivity remain constant over time. Under this scenario, total requirements for physicians would increase from approximately 781,300 in 2000 to 1,038,200 in 2020 (a 33 percent increase).

- Scenario 2, *Baseline*, is our best estimate of demand for physicians based on changing demographics and projected trends in the other factors (e.g., insurance coverage and economic considerations). Under this scenario, physician requirements would increase to 996,400 in 2020 (a 28 percent increase).

- Scenario 3, *Universal Coverage*, assumes that the entire U.S. population has medical insurance. Under this scenario, the uninsured population is placed into the insured fee-for-service and health maintenance organization (HMO) settings based on the current proportion of the insured population in each of those two settings. Under this scenario, total demand for physicians would have been an estimated 817,600 in 2000, increasing to an estimated 1,092,400 (a 40 percent increase over the 2000 baseline level).

- Scenario 4 is *universal health care coverage with 100 percent of the population enrolled in a health maintenance organization.* Under this scenario, total requirements would have been an estimated 781,900 in 2000, increasing to an estimated 1,059,900 in 2020 (a 36 percent increase over the 2000 baseline level).

- Scenario 5, *Non-minority Rates*, assumes that minorities have rates of medical insurance coverage similar to non-Hispanic whites within each demographic group defined by age and sex. Under this scenario, demand for physicians would have been an estimated 802,400 in 2000, increasing to an estimated 1,072,000 in 2020 (a 37 percent increase over the 2000 baseline level).

Exhibit ES.1 Forecasted Physician Requirements

Scenario	2000	2020
1: Status Quo	781,282	1,038,234
2: Baseline	781,282	996,387
3: Universal Coverage	817,615	1,092,381
4: 100 percent HMO	781,889	1,059,907
5: Non-minority Rates	802,356	1,072,048

The PARM also forecasts requirements for three non-physician specialties: physical therapy, podiatry, and optometry. Based on available data and studies, the requirements for all three professions are projected to increase, between 2000 and 2020, at rates equal to or slightly greater than the growth in population.

Forecasting the Impact of Changing Demographics and Other Factors on Nurse Requirements

The NDM forecasts demand-based requirements for FTE registered nurses (RNs), licensed practical nurses (LPNs), nurse aides and home health aides (NAs). Although the NDM forecasts requirements at the State level, in this report we present only national-level forecasts (***Exhibit ES.2***). Under a baseline scenario, which represents the forecasts most likely to occur based on changing demographic and projected trends in other determinants of nurse demand, total requirements for FTE RNs would increase from approximately 2 million in 2000 to 2.8 million in 2020 (a 41 percent increase). Requirements for FTE LPNs would increase from 618,000 in 2000 to 905,000 in 2020 (a 46 percent increase). There would also be an increase in FTE nurse aide and home health aide requirements from 1.5 million in 2000 to 2.3 million in 2020 (a 50 percent increase).

Demand for nurses and nurse aides will continue to grow in hospitals during the next two decades, but at a slower rate than for the nursing professions as a whole. The exception results from strong growth in demand for RNs in hospital outpatient settings as technological innovations and managed care trends shift patients from inpatient to outpatient care. The fastest growth in demand will occur in nursing facilities and home health. Under a status quo scenario where patterns of per capita health care use and nurse staffing remain constant over time, the requirement for nurses and nurse aids increases at a slower rate than under the baseline scenario.

Exhibit ES.2 Forecasted FTE Nurse Requirements

	Baseline Scenario		Status Quo Scenario
	2000	2020	2020
Registered nurses	2,001,198	2,822,388	2,505,747
Licensed practical nurses	617,946	905,159	787,329
Nurse aides and home health aides	1,545,722	2,323,518	1,983,582

Findings from the PARM and NDM, as well as the literature review, provide important insights on the impact of changing demographics on the health workforce. This report also identifies

areas for additional research such as (a) factors changing the per capita use of health care services, (b) the paucity of information on the relationship between race/ethnicity and the supply of health workers, and (c) the need for models that can forecast demand for and supply of health workers at smaller geographic units of aggregation (e.g., at the sub-State level).

1 INTRODUCTION

The size and characteristics of the future health workforce are determined by the complex interaction of the health care operating environment, economic factors, technology, regulatory and legislative actions, epidemiological factors, the health care education system and demographics. Efforts over the past several decades to model the supply of and demand (or "requirements") for health workers show there is a lack of consensus on the relationship between the health workforce and its determinants, the future values of many of these determinants, and forecasters' assumptions.[1] Furthermore, past forecasts of impending surpluses and shortages of health professionals often failed to materialize, leading to the general consensus that a much better understanding is needed about the dynamics affecting the supply of and demand for health professionals.

The Workforce Analysis Branch of the Bureau of Health Professions (BHPr), Health Resources and Services Administration (HRSA), commissioned a report synthesizing the literature on one set of factors that will have a profound impact on the future health workforce—changing demographics. In addition, BHPr commissioned the updating of two requirements forecasting models: the Physician Aggregate Requirements Model (PARM) and the Nursing Demand Model (NDM).

This report discusses findings from the literature review of the implications of important demographic trends for the health workforce. In addition, this report presents findings from the NDM and PARM to quantify the impact of changing demographics on demand for allopathic (MD) and osteopathic (DO) physicians, registered nurses (RNs), licensed practical nurses (LPNs), nurse aides and home health aides (NAs), physical therapists, optometrists, and podiatrists. This report also presents forecasts from the PARM and NDM for several scenarios with different assumptions regarding the future health care operating environment, the productivity of doctors and nurses, and other factors.

[1] See, for example, recent articles by Snyderman, Sheldon and Bischoff (2002), Weiner (2002), Grumbach (2002) and Reinhardt (2002) commenting on recent physician workforce projections by Cooper et al. (2002). Prescott (2000) discusses the lack of consensus as it pertains to modeling the nurse workforce.

Although the demographic trends discussed here have implications for the entire health workforce, the discussion in this report is heavily tilted towards the physician and nursing professions. Reasons for this focus include the dominance of these professions in the health workforce literature, the focus on these professions by government commissions and policy makers, and the availability of the PARM and NDM for forecasting requirements for physicians and nurses.

Demographics are a major determinant of the size and characteristics of the future health workforce, and demographic trends can be extrapolated with reasonable accuracy one or two decades into the future. In addition to the growth in size of the U.S. population in future decades, three demographic trends have profound implications for the future health workforce:

- First, the population is aging and the size of the elderly population will increase substantially. An aging population will place greater demands on the health care system at the same time that many health professionals will be retiring. Also, as the population ages there will be a continuing shift in the type and setting of services provided.

- Second, the population is becoming more racially and ethnically diverse. Concerns that minorities are underrepresented in the health workforce have both equity implications for people who need health care services and efficiency implications for the health care system. As minorities constitute a larger proportion of persons entering the workforce, the U.S. population will increasingly rely on minority health workers for their care.

- Third, the population is shifting geographically and a significant portion of the U.S. population will continue to reside in areas with persistent shortages of health workers. These trends highlight the need for forecasting models that can make State-level and sub-State-level forecasts of health worker supply and demand.

Other demographic trends with implications for the future supply of and demand for health workers include changes in fertility patterns, family size and composition, longevity, immigration, and overall health of the population. These trends are discussed within the context of the three major trends discussed above.

In both the PARM and NDM, requirements are defined as the number of health professionals demanded based on the level of health care services that society is willing to purchase given population needs and economic considerations. Other authors have used "need" to define requirements, where need is based on the analyst's assessment of what constitutes an adequate supply of health workers, independent of society's willingness or ability to purchase services.

Using the PARM and NDM, we forecast future demand for health care services and the derived demand for 19 physician specialties, nurses, and the other health workers listed previously. We forecast a "status quo" scenario that assumes no change in per capita health care utilization patterns, health worker productivity, and health worker staffing patterns. Under such a scenario, between the years 2000 and 2020, changing demographics would cause an estimated 30 percent increase in inpatient days, a 20 percent increase in outpatient visits, and a 17 percent increase in emergency department visits at general, short-term hospitals. Inpatient days at non-general and long-term hospitals would increase by an estimated 33 percent; the number of nursing facility residents would increase by 40 percent; the number of home health visits would increase by 36 percent; and the number of visits to physicians' offices would increase by 23 percent.

The change in demand for health care services would increase requirements for physicians by approximately 33 percent, although the increase in requirements would vary by medical specialty. For example, requirements for cardiologists would increase by an estimated 52 percent while requirements for pediatricians would increase by an estimated 11 percent. Requirements would increase approximately 28 percent for RNs, 30 percent for LPNs, and 33 percent for nurse aides (including home health aides).

Although demographics are a dominant determinant of the demand for health workers, other important factors are the characteristics of the future health care system, economic considerations, technological advances, and population needs. A detailed discussion of these trends is outside the scope of this project; however, the extant literature in this area is relatively

large.[2] Using the PARM and NDM, we forecast future requirements for selected health care professions under alternative scenarios regarding the future health care operating environment.

The baseline scenario in both the PARM and NDM produce the forecasts that are most likely to occur based on changing demographics and projected trends in the factors listed above (e.g., trends in insurance coverage and economic considerations). The baseline forecasts for physician requirements are slightly lower than under the status quo scenario (28 percent growth between 2000 and 2020 instead of 33 percent growth), and the change in requirements for individual physician specialties is quite different in some cases. Under the NDM's baseline scenario, requirements for RNs grow faster than under the status quo scenario (41 percent growth between 2000 and 2020 instead of 28 percent growth), reflecting different assumptions about changes in average patient acuity levels and other factors. Under the baseline scenario, total requirements for LPNs, nurse aides, and home health aides rise faster than forecasts under the status quo scenario.

The remaining sections in this report discuss the implications for the health workforce of the aging population (***Section 2***), the changing racial and ethnic composition of the population (***Section 3***), and population geographic location (***Section 4***). Each of these sections presents information on the demographic trend, discusses the implications of the trend on demand for health care services and derived demand for health workers, and discusses the implications for the supply of health workers. ***Section 5*** describes the recently updated PARM and NDM and presents findings from these models. ***Section 6*** summarizes the main findings of this effort and discusses areas for additional research.

[2] The report: *The Impact of the Restructuring of the U.S. Health Care System on the Physician Workforce and Vulnerable Populations* (The Lewin Group, 1998), contains a literature review that discusses many of these trends.

2 AGING OF THE POPULATION

Increased longevity and the aging of the baby boom generation will contribute to a substantial increase in the size of the elderly population during the next few decades as well as the aging of the overall population. Four major implications of an aging population on the health workforce are the following.

Major Findings:

- *If health care consumption patterns and physician productivity remained constant over time, the aging population would increase the demand for physicians per thousand population from 2.8 in 2000 to 3.1 in 2020. Demand for full-time-equivalent RNs per thousand population would increase from 7 to 7.5 during this same period.*
- *In 2000, physicians spent an estimated 32 percent of patient care hours providing services to the age 65 and older population. If current consumption patterns continue, this percentage could increase to 39 percent by 2020.*
- *The aging of the health workforce raises concerns that many health professionals will retire about the same time that demand for their services is increasing. Also, the elderly population will grow at a faster rate than the working-age population.*
- *The rise in health care expenditures associated with the rapid increase in the elderly population will likely place pressures on the Medicaid and Medicare programs to control health care costs. Such measures would likely decrease the demand for and supply of health professionals.*

One, because the elderly have both greater and different health care needs than the non-elderly, the rapid growth in size of the elderly population could substantially increase overall demand for health care services and consequently the derived demand for health workers. Occupations and settings that disproportionately serve the elderly will experience the largest growth. If health care consumption patterns and physician productivity remained constant over time, the aging population would increase the demand for physicians per thousand population from 2.8 in 2000 to 3.1 in 2020. Demand for full-time-equivalent (FTE) RNs per thousand population would increase from 7 to 7.5 during this same period.

Two, physicians will spend an increasing proportion of their time treating the elderly. Our analysis of multiple health care use databases suggests that in 2000 physicians spent an estimated 32 percent of total patient care hours providing services to the age 65 and older population. If current patterns continue, this percentage could increase to 39 percent by 2020.

Three, the health workforce is aging along with the general population. As health professionals in the baby boom generation retire and as the pool of potential entrants to the health workforce (i.e., the population age 18 to 30) declines as a percentage of the total population, there is concern that the future supply of health professionals will be inadequate to meet demand.

Four, the expected increase in health care expenditures attributed to the growing elderly population will likely place pressures on the Medicaid and Medicare programs to control health care costs. The ratio of working-to-retired Americans will likely decrease, placing budget pressures on other government programs that compete with funding for Medicaid and Medicare. Economic pressures to curb the growth in health care costs could result in policies to reduce the demand for and supply of health workers.

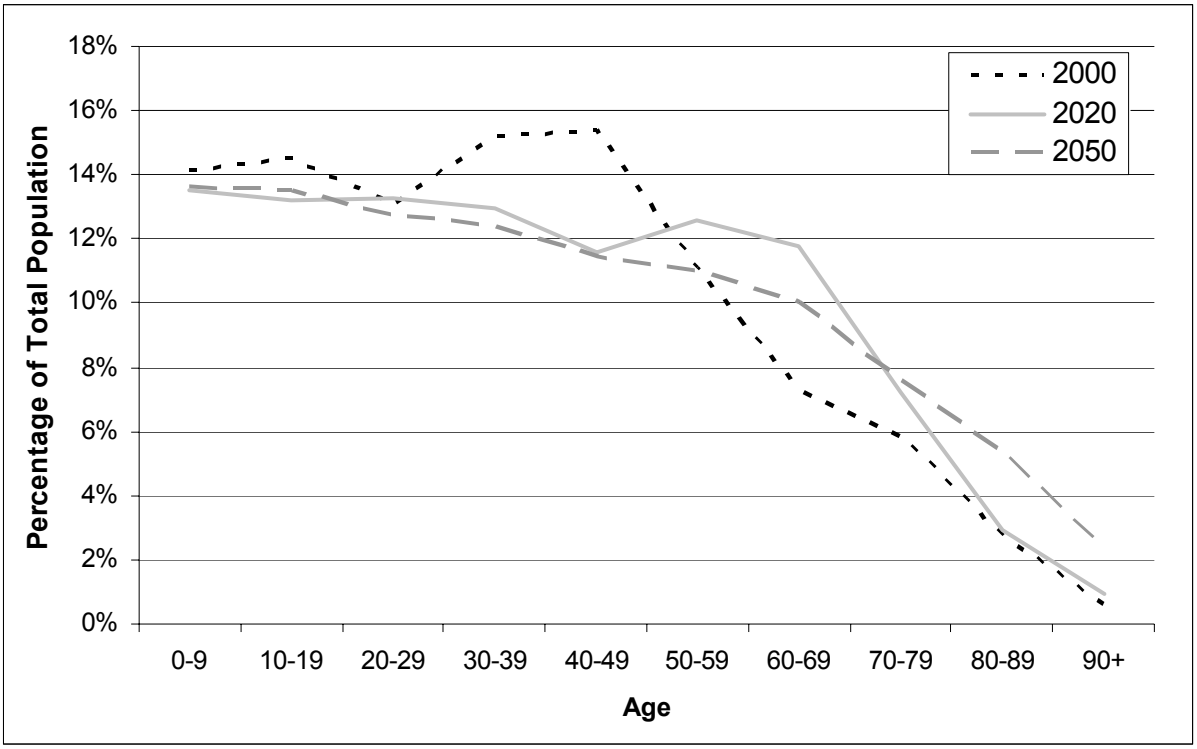
2.1 Population Forecasts

Census Bureau population projections show significant shifts in the age distribution (***Exhibit 2.1***) with the number of elderly increasing in absolute size and as a proportion of the total population (***Exhibit 2.2***). The number of elderly, defined as the "age 65 and over" population, will grow by over 50 percent between 2000 and 2020, and by an estimated 127 percent by 2050. Furthermore, the relative size of the elderly population is projected to increase from 12.6 percent of the population in 2000 to an estimated 16.5 percent in 2020. Between 2030 and 2050, one in five Americans will be elderly.

The most rapidly growing demographic group among age categories is the "oldest elderly." This group is sometimes defined differently by researchers, but the most common definitions are the population age 75 and over, age 80 and over, and age 85 and over.[3] In 2000, there were approximately 16.6 million people age 75 and over, 9.2 million people age 80 and over, and 4.2 million people age 85 and over. By 2020, the number of people in these age groups could reach 22 million, 13 million, and 7 million, respectively.

[3] Two factors that contribute to researchers using different age breaks to define the oldest elderly are (1) differences in use of health care services, and (2) small sample size among the oldest elderly when using survey data.

Exhibit 2.1. Age Distribution of U.S. Population



Source: U. S. Census Bureau middle series population projections (Day, 1996).

Exhibit 2.2. Projections of U.S. Elderly Population

Year	Mean Age	Population 65+ (in millions)	% of Population 65+	%increase from 2000 in 65+ population
2000	36.5	34.71	12.6	--
2005	37.2	36.17	12.6	4.2
2010	37.8	39.41	13.2	13.5
2020	39.0	53.22	16.5	53.3
2030	39.9	69.38	20.0	99.9
2040	40.3	75.23	20.3	116.8
2050	40.3	78.86	20.0	127.2

Source: U. S. Census Bureau middle series population projections (Day, 1996).

2.2 Implications of an Aging Population for the Demand for Health workers

2.2.1 Increasing Demand for Health Care Services

The greater medical needs of the elderly, combined with access to health care services through Medicare and Medicaid, have resulted in much higher per capita use of health care services for the elderly compared to the non-elderly. On a per capita basis, the elderly have more hospital inpatient

days, outpatient visits, and emergency department visits. Relative to the non-elderly, they also have more home health visits per capita and are more likely to be in a long-term care facility.

To illustrate these points, consider ***Exhibits 2.3*** through ***2.8*** that contain estimates of per capita health care use by age, sex, and urban or rural location for six health care settings modeled in the NDM. The most profound differences in per capita utilization exist across age groups; however, there are also important differences in per capita utilization by sex and by urban or rural location. Many of the following estimates are for 1996, the base year in the NDM, although more recent data are available for some settings.

An analysis of the 1996 Health Cost Utilization Project (HCUP) database finds that with the exception of the age 0-4 population, the number of inpatient days in general, short-term hospitals per 1,000 population increases substantially with age for both men and women, in both rural and urban areas (***Exhibit 2.3***). Analyses of other patient-level databases such as the National Hospital Ambulatory Medical Care Survey (NHAMCS), the National Home and Hospice Care Survey (NHHCS), and the National Nursing Home Survey (NNHS) produced estimates of per capita health care utilization in different settings for the eight age groups used in the NDM, by sex, and by urban or rural location. These are shown in Exhibits 2.4 through 2.8.

Exhibit 2.3. Inpatient Days in General, Short-term Hospitals (per 1,000 population)

	Rural		Urban	
Age Category	**Female**	**Male**	**Female**	**Male**
0-4 years	430	449	789	838
5-17 years	57	45	79	81
18-24 years	276	83	280	141
25-44 years	218	134	327	242
45-64 years	307	317	470	633
65-74 years	919	1,049	1,187	1,640
75-84 years	1,871	2,137	1,985	2,468
85 years and above	3,052	3,826	2,734	3,302

Source: Analysis of the 1996 HCUP database with an adjustment so that rates applied to the population in 1996 equaled total inpatient days reported by the American Hospital Association (AHA). See Dall and Hogan (2002).

Exhibit 2.4. Outpatient Visits in General, Short-term Hospitals (per 1,000 population)

	Rural		Urban	
Age Category	**Female**	**Male**	**Female**	**Male**
0-4 years	1,472	2,967	985	3,519
5-17 years	783	1,838	651	1,548
18-24 years	954	3,418	592	876
25-44 years	931	2,472	485	1,290
45-64 years	1,464	2,818	833	1,793
65-74 years	2,365	2,593	2,671	2,152
75-84 years	4,841	1,933	4,033	1,896
85 years and above	5,081	1,709	5,734	1,685

Source: Analysis of the 1996 NHAMCS database with an adjustment so that rates applied to the population in 1996 equaled total non-emergency, outpatient visits reported by the AHA. See Dall and Hogan (2002).

Exhibit 2.5. Emergency Department Visits in General, Short-term Hospitals (per 1,000 population)

	Rural		Urban	
Age Category	**Female**	**Male**	**Female**	**Male**
0-4 years	825	426	754	476
5-17 years	422	204	369	211
18-24 years	620	376	534	286
25-44 years	432	284	364	259
45-64 years	346	211	335	190
65-74 years	471	248	468	237
75-84 years	681	313	730	328
85 years and above	953	457	1,298	557

Source: Analysis of the 1996 NHAMCS database with an adjustment so that rates applied to the population in 1996 equaled total emergency visits reported by the AHA. See Dall and Hogan (2002).

Exhibit 2.6. Inpatient Days in Non-General and Long-term Hospitals (per 1,000 population)

	Rural		Urban	
Age Category	**Female**	**Male**	**Female**	**Male**
0-4 years	0	0	24	33
5-17 years	0	1	17	25
18-24 years	2	2	27	56
25-44 years	4	4	64	85
45-64 years	23	19	169	198
65-74 years	131	145	411	514
75-84 years	221	284	695	664
85 years and above	234	201	773	806

Source: Analysis of the 1996 HCUP database with an adjustment so that rates applied to the population in 1996 equaled total inpatient days reported by the AHA. See Dall and Hogan (2002).

Exhibit 2.7. Home Health Visits (per 1,000 population)

	Rural		Urban	
Age Category	**Female**	**Male**	**Female**	**Male**
0-17 years	420	400	427	406
18-44 years	232	169	403	190
45-64 years	1,497	1,367	1,180	702
65-74 years	8,032	5,230	5,332	3,570
75-84 years	22,211	13,327	12,607	9,485
85 years and above	33,507	29,117	17,534	13,429

Source: Analysis of the 1995 NHHCS database with an adjustment so that rates applied to the population in 1998 equaled estimates of total home health visits paid for by Medicare, Medicaid and other sources in 1998. See Dall and Hogan (2002).

Exhibit 2.8. Nursing Home Residents (Residents per 1,000 population)

	Urban & Rural	
Age Category	**Female**	**Male**
0-44 years	0.2	0.2
45-64 years	2.6	1.0
65-74 years	14.5	6.9
75-84 years	52.4	32.0
85 years and above	194.4	187.0

Source: Analysis of the 1997 National Nursing Home Survey (NNHS). See Dall and Hogan (2002).

Not only does per capita use of health care services within a delivery setting increase with age, but also the type of services used by the elderly (and the mix of health professionals who provide these services) differs from those of the non-elderly. To capture these differences in type of services received, the PARM uses physician-patient encounters in hospital inpatient and outpatient settings, in non-hospital office settings, and in other settings (e.g., nursing homes and home health) to forecast future demand for physician services by medical specialty.[4] Even within a specialty, the types of services demanded might differ by age. For example, eye diseases such as cataracts and glaucoma are much more prevalent in the older population (White et al., 2000). Consequently, as the population ages, optometrists will likely see a shift in the type of services provided.

An important question for modeling requirements for physicians and other health workers is whether these caregivers spend different amounts of time per encounter with the elderly relative to the non-elderly. Two databases used to update the PARM—the National Ambulatory Medical Care Survey (NAMCS) and the National Hospital Ambulatory Care Survey (NHAMCS) Outpatient File—contain information on the amount of time physicians spent with patients during each encounter. To increase sample size, we combined the 1997, 1998, and 1999 NAMCS, and we combined the 1997, 1998, and 1999 NHAMCS. We tested the hypothesis that patient demographic characteristics and insurance status are determinants of the amount of time physicians spend per visit with patients in doctors' offices and hospital outpatient settings. We tested this hypothesis by estimating a series of

[4] The nature of a physician-patient encounter, as well as the length of the encounter, can vary substantially by medical specialty and delivery setting. Physician surveys, reported in the annual AMA publication *Physician Socioeconomic Statistics*, reveal that physicians typically spend more time per encounter with patients in hospital-based visits versus office visits that are not hospital-based. Encounters that involve surgical procedures often last two to five times longer, on average, than visits that do not involve surgical procedures. Consequently, the PARM forecasts demand for each physician specialty by health care setting, and the hospital inpatient setting is subdivided by whether or not a surgical procedure was performed.

The PARM's use of physician-patient encounters differs from the workload measures used in other workforce models. For example, some models use physician per population ratios while other models use patient visits or hospital inpatient days. Estimates of total encounters can differ substantially from estimates of patient visits or inpatient days for the following reasons:

1) A patient might report one visit to a doctor's office or emergency room but might have zero, one, or multiple encounters with physicians during that visit. For example, a physician assistant or an advanced practice nurse might see the patient in which case no physician-patient encounter occurs. Or, a physician might see the patient and refer the patient to a colleague during the same visit in which case there are two or more physician-patient encounters that take place.

2) In hospital inpatient settings, a physician might visit with a patient one or more times while the physician makes his or her rounds. Furthermore, the patient might receive visits from multiple physicians during the day.

regressions, using the ordinary least squares (OLS) criterion, with length of time as the dependent variable and dummy variables that indicate patient characteristics and insurance status as the exogenous variables. The dummy variables take on the value of 1 if the patient has that characteristic, and take on the value of 0 if the patient does not have that characteristic. We estimated separate regressions for each medical specialty.

The regression results showed each of the exogenous variables (age, sex, race/ethnicity, and insurance status) to have a significant impact on the dependent variable (time per encounter) for some specialties but not for others. Even when statistically significant, the impact was in many cases quite small, less than two minutes per encounter. One caution when interpreting the regression results is that the R-squared statistic for every regression is extremely low, indicating that the exogenous variables in the model explain only a small proportion of the overall variation in length of time physicians spend with patients. The relatively large residual variance makes it more difficult to find a statistically significant relationship. Also, for some specialties the number of patients in a particular demographic group is small which reduces the precision of the estimates for those demographic groups.

Exhibit 2.9 contains the regression results for encounters in doctors' offices, and ***Exhibit 2.10*** contains the results for encounters in hospital outpatient settings. The column labeled AVG reports the average minutes per encounter for the reference group (non-Hispanic, white females age 55-64, insured in a fee-for-service arrangement). The other columns represent the marginal impact of the demographic characteristic or insurance status on minutes of physician time per encounter. Shaded boxes indicate marginal impacts, relative to the reference category, that are statistically different from zero at the 0.05 level of significance.

To illustrate, consider the first specialty: general and family practitioners. The average time spent with the reference group is 18.36 minutes per encounter in doctors' offices (***Exhibit 2.9***). Time spent with men is just 6 seconds shorter than time spent with women, on average, after controlling for age, race/ethnicity, and insurance status. General and family practitioners spend, on average, 2.43 fewer minutes per encounter with patients age 0-17 and 1.08 fewer minutes per encounter with patients age 18-34 compared to the reference group of patients age 55-64. Both of these differences in average minutes per encounter are statistically different from zero at the 0.05 level of significance. General

and family practitioners also spend 0.91 fewer minutes per encounter with African Americans and 0.53 fewer minutes per encounter with other minorities, relative to non-Hispanic whites, although only the estimate for African Americans is statistically different from zero. Time spent with patients in a health maintenance organization (HMO) is 0.81 minutes less than time spent with patients insured in a fee-for-service arrangement, while the time spent with uninsured patients is 0.74 minutes greater than that spent with patients covered under fee-for-service. Neither of these differences is large, however, and of the two, only the former is statistically different from zero.

With respect to the other specialties shown in Exhibit 2.9, major regression effects noted are as follows:

Sex. - Only orthopedic surgery and other surgical specialties show statistically significant differences for men and women. The time per encounter is in both cases greater for men than it is for women: an additional 0.66 minutes, on average, for orthopedic surgery, an additional 3.86 minutes for other surgical specialties.

Age. - Of the sixteen specialties shown, ten display significant age effects with respect to at least one age group. General and family practitioners, for example, spend significantly fewer minutes per encounter with patients under 35; internal medicine (IM) subspecialists spend significantly fewer minutes per encounter with patients over 74; etc. Most of these effects, however, although statistically significant, are no more than a minute or two, with the following exceptions: physicians in other medical specialties spend over three minutes more per encounter with children under 18 while physicians in other surgical specialties spend almost seven minutes less per encounter with patients in that age group.

Race/ethnicity. - Significant race/ethnicity effects are evident for ten of the specialties shown. African Americans spend significantly fewer minutes per encounter with physicians in four specialties (general and family practice, internal medicine subspecialties, cardiovascular disease, and other patient care) and significantly more minutes per encounter with ob/gyn's. Patients in the "other" minority category spend significantly fewer minutes per encounter with physicians in three specialties (general internal medicine, pediatrics, and psychiatry) and significantly more minutes per encounter with physicians in another three (other medical specialties, emergency medicine, and other patient care). The added 14.51 minutes per encounter for "other" minority patients seen by emergency medicine physicians is particularly noteworthy.

Insurance status. - A marked insurance effect is also evident. HMO patients spend significantly fewer minutes per encounter with physicians in four specialties (general and family practice, pediatrics, orthopedic surgery, and other patient care) and significantly more minutes per encounter with physicians in four other specialties (IM subspecialties, cardiovascular disease, other surgical specialties, and psychiatry). Of these differences, only those for other surgical specialties (plus 3.82 minutes) and other patient care (minus 2.61) exceed 2 minutes. Somewhat surprisingly, there are no specialties for which uninsured patients receive fewer minutes per encounter, on average, than the reference group, whereas there are six specialties for which they receive more minutes on average. Those six are pediatrics, other medical specialties, general surgery, ophthalmology, other surgical specialties, and psychiatry. The added time per encounter, on average, is particularly great for physicians in other surgical specialties (an additional 11.44 minutes) and psychiatry (an additional 7.95).

In addition to these observations, applicable to encounters in doctors' offices, observations of a similar nature are noted with respect to time spent in hospital outpatient clinics (Exhibit 2.10). General and family practitioners are seen to spend 24.06 minutes per encounter, on average, with members of the reference group. They spend slightly less time per encounter with men, less time with younger patients, more time with African Americans, less time with patients in the "other" minority category, more time with patients in HMOs, and less time with the uninsured. None of these differences, however, is statistically different from zero at the 0.05 level of significance.

Exhibit 2.9. Minutes of Physician Time Spent with Patients in Doctors' Offices (by Patient Characteristics and Insurance Status)

PARM Classification	Avg.	Marginal Impact (deviation from average minutes)													
		Sex		Age						Race/Ethnicity			Insurance		
		Male	Female	0-17	18-34	35-54	55-64	65-74	75+	White	AA	Other	FFS	HMO	None
General Primary Care			*Reference Category*				*Reference Category*			*Reference Category*			*Reference Category*		
General & family practice	18.36	-0.10		-2.43	-1.08	-0.43		-0.54	0.14		-0.91	-0.53		-0.81	0.74
General internal medicine	20.18	-0.29		-0.62	-0.02	0.31		0.16	0.55		-0.52	-1.48		-0.54	-0.34
Pediatrics	15.97	-0.23		a	a	a		a	a		0.25	-1.01		-0.66	3.31
Medical Specialties															
IM subspecialties	23.77	-0.81		-3.03	-1.24	1.43		-0.51	-2.13		-2.58	-1.61		1.89	-3.60
Cardiovascular diseases	19.86	-0.15		3.28	0.76	0.73		1.85	0.94		-1.69	-1.08		1.60	-0.22
Other medical specialties	15.68	-0.08		3.04	1.08	1.69		-0.71	-0.18		0.46	1.51		0.64	2.01
Surgery															
General surgery	18.05	0.17		-1.92	-1.35	-0.25		-0.71	-0.79		-0.00	1.17		-0.23	3.36
Obstetrics & gynecology	18.10	b		-0.57	-2.21	0.12		0.10	0.91		0.97	0.54		-0.26	0.79
Otolaryngology	17.21	-0.05		-1.76	0.03	-0.13		-0.08	1.15		0.73	-0.32		-0.49	-1.14
Orthopedic surgery	15.77	0.66		0.14	0.96	0.27		-0.26	0.34		0.86	0.38		-0.83	1.07
Urology	16.80	0.42		0.89	2.13	1.34		0.06	-0.32		-0.90	-0.13		-0.43	-1.20
Ophthalmology	17.11	0.33		1.56	0.08	0.11		0.10	-1.06		0.92	0.54		-0.03	2.77
Other surgical specialties	15.15	3.86		-6.54	-4.37	0.09		-3.73	-0.18		0.41	0.77		3.82	11.44
Other Patient Care															
Emergency medicine	7.15	2.83		-1.80	2.28	3.77		3.04	1.69		21.51	14.51		4.74	-2.61
Psychiatry	34.14	0.70		0.18	0.13	0.77		2.01	-3.17		-0.04	-2.70		1.72	7.95
Other specialties	25.31	-0.23		0.08	1.33	1.08		1.93	0.39		-3.38	2.51		-2.61	-0.52

Source: Analysis of the 1997, 1998, and 1999 NAMCS.

Note: Shaded boxes indicate marginal impacts, relative to the reference category, that are statistically different from zero at the 0.05 level of significance. [a] The large majority of patients seen by pediatricians are age 17 and younger, so the sample size of adults seen by pediatricians is insufficient to obtain reliable estimates by age group. [b] This physician specialty saw no patients with this characteristic.

Exhibit 2.10. Minutes of Physician Time Spent with Patients in Hospital Outpatient Clinics (by Patient Characteristics and Insurance Status)

PARM Classification	Avg.	Marginal Impact (deviation from average minutes)													
		Sex		Age						Race/Ethnicity			Insurance		
		Male	Female	0-17	18-34	35-54	55-64	65-74	75+	White	AA	Other	FFS	HMO	None
General Primary Care			*Reference Category*				*Reference Category*			*Reference Category*			*Reference Category*		
General & family practice	24.06	-0.33		a	-1.96	-0.54		0.80	1.21		1.01	-0.82		0.94	-0.98
General internal medicine	26.23	-1.25		a	-1.48	-1.98		-2.56	-0.53		-0.00	-2.64		4.43	-1.53
Pediatrics	25.83	-1.14		a	a	a		a	a		-0.89	-1.89		0.12	2.28
Medical Specialties															
IM subspecialties	26.85	-0.38		a	-0.34	-0.15		1.22	-0.43		-1.36	-2.90		1.32	-1.81
Cardiovascular diseases	25.88	0.66		-2.06	4.18	0.95		2.87	0.31		-1.16	-1.98		-2.82	-4.47
Other medical specialties	25.28	-1.36		-3.98	-3.25	-1.28		1.75	2.50		1.76	0.013		1.06	1.21
Surgery															
General surgery	22.97	0.59		-2.50	-1.46	0.65		0.64	-2.80		-1.10	1.34		-0.97	-1.27
Obstetrics & gynecology	21.76	b		-2.43	-3.04	-0.04		2.36	-1.24		0.98	-0.38		-0.11	0.81
Otolaryngology	17.10	1.00		-1.64	-1.12	1.64		1.89	4.23		2.38	0.20		0.69	-0.27
Orthopedic surgery	27.01	-2.36		b	-3.90	1.27		2.98	-1.56		0.31	-0.34		-2.17	-4.96
Urology	22.54	2.33		-3.73	-4.92	-4.26		-0.72	0.92		0.94	1.30		-1.04	1.01
Ophthalmology	24.21	0.48		-2.38	1.47	-0.70		4.48	7.05		2.25	-3.13		-4.15	-5.79
Other surgical specialties	24.67	-0.28		1.34	-2.51	-1.48		1.61	3.53		0.18	-1.58		3.49	1.51
Other Patient Care															
Psychiatry	27.06	-0.04		2.68	2.05	0.07		1.37	4.08		1.47	-2.04		2.77	-0.78
Other specialties	23.32	0.80		b	-2.44	-1.12		-3.12	-2.21		3.65	-6.32		-2.99	-7.19

Source: Analysis of the 1997, 1998, and 1999 NHAMCS.

Note: Shaded boxes indicate marginal impacts, relative to the reference category, that are statistically different from zero at the 0.05 level of significance. [a] The specialty imputation method identified the physician of patients age 0-17 with general primary care diagnoses or IM subspecialty diagnoses as pediatricians, and identified the physicians of adults with these diagnoses as general/family practitioners or internists in either general internal medicine or an IM subspecialty. [b] The imputation method identified no patients with this characteristic for this specialty.

Under a status quo scenario where per capita patterns of health care use within a defined demographic group are assumed to remain constant over time, future demand for health care services can be extrapolated by estimating the size of the population in each demographic group and applying the corresponding per capita utilization rates. Analyses to update the NDM found that under such a scenario the growth and aging of the population between 2000 and 2020 would contribute to a 30 percent increase in inpatient days at general, short-term hospitals; a 20 percent increase in non-emergency outpatient visits to hospitals; a 33 percent increase in inpatient days at non-general and long-term hospitals; a 17 percent increase in emergency department visits; a 36 percent increase in home health visits; and a 40 percent increase in nursing home residents. Estimates from the PARM suggest that visits to physician offices would increase by 23 percent under this status quo scenario.

Although recent history is often the best predictor of future health care utilization rates, many analysts argue that future rates might differ from current patterns because:

- The needs of the population are changing (even after controlling for demographics);
- The health care operating environment is constantly changing;
- Economic considerations may make current utilization trends unsustainable as the size of the elderly population increases;
- New diseases could emerge; and
- Technological advances will change how and where services are provided.

A detailed analysis of the impact on the future health workforce of changes to the health care operating environment and technological advances is beyond the scope of this effort; however, ***Section 5*** contains forecasts from the PARM and NDM for scenarios that rely on different assumptions regarding the future health care operating environment and other determinants of the demand for health care providers. A report entitled: *The Impact of the Restructuring of the U.S. Health Care System on the Physician Workforce and on Vulnerable Populations* (The Lewin Group, 1998) examines several emerging trends in the health care system and discusses their implications for the future physician workforce.

The impact of advances in science and medicine on demand for health care services and the productivity of health care providers will differ by medical specialty and delivery setting.

Advances could increase workforce demand in some settings or specialties while decreasing demand in other settings or specialties. For example, technological advances are making outpatient surgery a viable alternative to inpatient surgery, and this is contributing to the decrease in inpatient days and the increase in outpatient visits. Yashar (2000) reports that improvements in surgical instruments have transformed how ocular surgery is performed and that ambulatory surgery is becoming the norm for most ocular surgery.

Similarly, Balaban (1998) states that technological improvements and efforts to contain costs have contributed to the trend where bone marrow transplants are performed on an outpatient basis with following-up ambulatory visits. Gelijns and Fendrick (1993) provide other examples such as cholecystectomy and cardiac catheterization where minimally invasive surgical procedures have shifted many of these procedures from an inpatient to an outpatient setting.

This trend is occurring in many medical specialties and is likely to continue over the next few decades. Hospitalization will still occur when treating the more severe cases; consequently, while total inpatient days are expected to decline at acute care hospitals, average patient acuity is likely to rise and this could affect staffing patterns. In addition, the development of new medications could also reduce future demand for some health care services, and thus demand for some health professionals. Advances in science and medicine are contributing to higher life expectancy. Over the past 100 years, life expectancy has doubled. Increased longevity will contribute to greater demand for health care over the long run.

An important question for projecting future demand for health professionals as the population ages is whether current utilization rates for the elderly accurately represent future utilization rates for that group. Much of this debate centers on the oldest elderly, who have the highest per capita utilization of health care services. In addition to advances in science and medicine and improvements in public health, there are important differences between today's elderly and tomorrow's elderly that could lead to lower per capita utilization in the future. These differences include changes in lifestyle of the rising elderly cohort, such as improved diet and exercising, higher educational attainment, and greater economic resources.

The consensus is that higher education and greater economic resources, which are highly correlated, will contribute to improvements in the health status of the rising elderly cohort because both education and economic resources contribute to a healthier lifestyle.

Greater economic resources allow individuals to purchase the inputs to better health via more nutritious food, increased or better preventive care, improved information, and more effective pharmaceuticals. Freedman and Martin (1998) find that better educated elderly are more likely to comply with physicians' instructions, which leads to fewer complications. Manton, Corder, and Stallard (1997) find that people with higher levels of education are less likely to be disabled when controlling for age and other characteristics.

The extant literature finds that disability rates among the elderly have been declining slightly, resulting in a decline in use of some health care services.

- Bishop (1999) reports that per capita use of nursing home services has declined over the past decade. Possible explanations cited include lower disability rates among the elderly, the rise in alternative health care services such as home- or community-based care, economic considerations, changes in the health care operating system, changes in government programs such as Medicare and Medicaid, and other factors cited above.

- Manton et al. (1997) find that disability rates among older Americans are declining slightly. Using data from the National Long-term Care Surveys, these authors find that in 1994 an estimated 21.3 percent of the age 65 and older population were chronically disabled. If disability rates had remained at their 1982 levels, an estimated 24.9 percent of older Americans would have been chronically disabled in 1994, an imputed difference of 3.6 percentage points.

- Freedman and Martin (2000) used data from the Supplements on Aging to the 1984 and 1994 National Health Interview Surveys to examine trends in chronic conditions and functional limitations of Americans 70 years and older. They report that the percentage of older Americans with functional limitations relating to seeing, lifting, carrying, climbing, and walking declined between 1984 and 1994.

- Bonifazi (1998) analyzed the number and needs of nursing home residents in 1995 compared to 1977. He finds that a smaller percentage of older Americans are entering nursing homes—41 per thousand in 1995 compared to 47 per thousand in 1977—despite the aging of the elderly population. Part of this decline is attributed to the increase in alternative care settings such as outpatient care and home health care.

Declining disability rates among the elderly could help reduce the projected high growth in demand for nursing home care. In addition, the growth in community-based care could further reduce per capita demand for institutionalized care. As elderly with less severe health problems opt out of nursing homes for home- and community-based care, the health care needs of the average nursing home resident rises. Hence, future demand for nurses and other health workers in nursing homes could rise proportionately faster than the growth in nursing home residents as the population ages.

In community-based settings, the impact of declining disability rates is unclear. On the one hand, declining disability rates might decrease demand for services. On the other hand, declining disability rates could shift care from an institutional setting to a community- or home-based setting.

Alecxih (2001) finds that the increase in the size of the elderly population will likely overwhelm other factors that might influence the future demand for medical care from the elderly. Alecxih examined the potential impact of socioeconomic trends on demand for long-term care, including declining disability rates, increased availability of informal support networks, and a more highly educated elderly cohort. She estimates that demand for long-term care will more than double by 2050 because of the increasing size of the elderly population. Stuki and Mulvey (2000) estimate that by 2030, when the last of the baby boomers reach age 65, an estimated 6 million elderly could be at risk of institutionalization because of severe impairments.

Although the literature suggests numerous factors that could reduce per capita demand for health care services from tomorrow's elderly compared to today's elderly, Glied and Stabile (1999) provide an example of one factor that could cause health care utilization rates for the elderly to rise in coming years. These authors predict that private insurance coverage among the near-elderly (i.e., persons ages 61-64) will drop by 4.5 percent by 2005 because of trends relating to

the labor market behavior of the elderly and the reduced propensity of employers to offer medical insurance. Although the proportion of the population age 61 to 64 employed full time increased between 1989 and 1997, the authors report that older workers have been affected by the nationwide decline in private medical insurance coverage. The leading edge of the baby boom generation is just now entering the phase where they are not yet eligible for Medicare and are, for the most part, relying on their current or past employer (if retired) to obtain medical insurance. Declining rates of medical coverage among the near-elderly could result in a decline in preventive care with long-term implications for this group as they age.

2.2.2 Increasing Demand for Health Workers

Who will provide for the health care needs of the future elderly and where will they receive care? Currently, the elderly are cared for by services paid for by Medicare, Medicaid, private insurers, and out-of-pocket. In addition, many elderly rely on an informal network of unpaid workers—usually family members.

Several demographic trends could change the mix of people and institutions providing care to the elderly. As discussed above, declining disability rates among the elderly, controlling for age, might allow more elderly to remain in their homes or in other community-based settings. This would place fewer demands on providers of institutional care, but would increase demand for home-based services provided by home health aides, nurses, physical therapists, and other paid professionals. This could also increase demand for unpaid providers even while several trends suggest that in the future the elderly will have a smaller network to rely on for informal, long-term care. Consider the following factors that could reduce the future supply of unpaid health care providers.

- First, increased longevity means that the adult children of some elderly will themselves be elderly. In future years, it might be common for a 70-year old to care for his or her 90-year-old parent. The physical demands of caring for a disabled parent might be too great for many elderly children, which could increase demand for home- and community-based care as well as institutionalized care.

- Second, baby boomers had relatively small families compared to earlier generations, so they will have fewer children to provide unpaid care than today's elderly.

- Third, Stuki and Mulvey (2000) note that baby boomers had higher divorce rates than today's elderly, and research by Schone and Pezzin (1999) finds that divorced parents are less likely than widowed parents to receive long-term care from their adult children.

- Fourth, women traditionally have provided the bulk of unpaid care for elderly parents and the proportion of women in the workforce has increased during recent decades. Providing long-term care to an elderly parent or family member might require many of these women (or men) to leave the workforce or to reduce the number of hours worked. An estimated 40 percent of people who provide care to a severely-impaired, older parent or family member are employed, and a significant number of these caregivers are forced to adjust their work schedule or take a leave of absence (NAC and AARP, 1997). A higher proportion of women in the workforce makes it more expensive for family members to care for their disabled parents or relatives, but also makes it financially easier to purchase services from home health agencies and institutional care providers.

As the aging population demands more health care services, the demand for health workers will increase. Demand will grow faster for those specialties that disproportionately serve the elderly population. For example, Angus et al. (2000) discuss the implications of the growing elderly population on projected demand for physicians in adult critical care and pulmonary medicine. The authors report that two-thirds of all inpatient pulmonary days are incurred by patients age 65 and older. The projected growth in demand for services in these areas leads the authors to predict a growing shortage of physicians in adult critical care and pulmonary medicine during the next two decades.

Using the PARM, one can estimate the proportion of time physicians spend with patients in different age groups. In this model, as discussed previously, the average length of time that physicians spend per visit with patients in physicians' offices and hospital outpatient settings varies by patient demographic characteristics and insurance status. In the other settings modeled in the PARM, the assumption is made that physician time per encounter is independent of patient age, sex, race/ethnicity, and insurance status.

Currently, physicians spend an estimated 16 percent of patient-care hours providing services to children under age 17, 15 percent with the age 18-34 population, 26 percent with the age 34-54 population, 11 percent with the age 55-64 population, 14 percent with the age 65-74 population, and 18 percent with the age 75 and older population (***Exhibits 2.11 and 2.12***). These estimates combine differences in health care needs and size of the population in each age group, as well as differences in physician time per visit in settings where this information is available.

As expected, the proportion of time physicians spend with elderly patients will increase as the population ages and the elderly comprise a larger proportion of the population. Consider a scenario where physician productivity, staffing levels, and health care use patterns within a demographic group remain constant over time at their 1999 levels. In 2020, physicians would be spending an estimated 39 percent of total patient-care hours providing services to the age 65 and older population compared to an estimated 32 percent in 2000. Today, the 35-54 age group, which closely corresponds with the baby boom generation, consumes an estimated 26 percent of total patient-care hours. In 20 years, baby boomers will be in the 55-74 age group and will consume approximately 34 percent of total patient-care hours. The impact of the increasing age of the population on the percentage of total patient care hours spent with each age group is shown below for physicians in general primary care (***Exhibit 2.13***), other medical specialties (***Exhibit 2.14***), surgery (***Exhibit 2.15***) and other patient care (***Exhibit 2.16***).

Exhibit 2.11. Estimated Percentage of Physician's Time Spent Providing Care to Patients, by Age of Patient

Specialty	Age Category, 2000						Age Category, 2020					
	1-17	18-34	35-54	55-64	65-74	75 +	1-17	18-34	35-54	55-64	65-74	75 +
Total Patient Care Physicians (MDs and DOs)	**16**	**15**	**26**	**11**	**14**	**18**	**14**	**12**	**20**	**15**	**19**	**20**
General Primary Care	**29**	**11**	**22**	**10**	**12**	**16**	**25**	**9**	**17**	**14**	**16**	**19**
General & Family Practice	13	16	29	12	13	17	10	14	22	17	18	20
General Internal Medicine	3	11	28	14	18	25	2	9	20	19	23	27
Pediatrics	100	0	0	0	0	0	100	0	0	0	0	0
Medical Specialties	**6**	**10**	**26**	**15**	**20**	**23**	**5**	**8**	**19**	**19**	**25**	**24**
IM Subspecialties	2	9	28	16	21	23	2	7	20	20	26	24
Cardiovascular Diseases	2	3	18	17	27	33	1	2	12	20	33	32
Other Medical Specialties	17	16	29	12	12	15	14	13	23	16	16	18
Surgery	**7**	**23**	**27**	**11**	**15**	**17**	**6**	**20**	**20**	**16**	**20**	**19**
General Surgery	7	12	27	15	19	20	6	10	20	19	24	22
Obstetrics/Gynecology	4	56	31	5	3	2	4	55	27	7	5	2
Otolaryngology	22	15	27	10	11	14	19	14	21	15	16	16
Orthopedic Surgery	9	14	25	12	16	24	7	11	18	16	21	27
Urology	6	9	21	15	23	26	4	7	14	18	29	27
Ophthalmology	9	7	20	14	22	28	7	6	14	17	28	28
Other Surgical Specialties	4	9	29	16	21	21	3	7	20	21	27	22
Other Patient Care	**11**	**16**	**31**	**11**	**13**	**18**	**9**	**13**	**24**	**15**	**18**	**21**
Anesthesiology	10	18	43	10	8	11	9	16	35	15	11	14
Emergency Medicine	11	15	20	12	19	24	9	12	15	15	24	25
Radiology	24	27	26	7	7	8	22	25	22	11	10	10
Pathology	13	12	21	11	17	26	10	9	16	15	21	28
Psychiatry	1	10	42	12	16	18	1	8	33	16	21	20
Other Specialties	6	15	33	12	14	20	5	12	25	16	19	22
Non-Physician Specialties												
Physical Therapy	20	17	33	12	10	9	17	15	26	17	14	10
Optometry	16	19	31	12	11	10	14	17	24	17	16	11
Podiatry	9	13	29	14	16	20	7	11	22	19	21	21
Total U.S. Population (Thousands)	**26**	**24**	**29**	**9**	**7**	**6**	**24**	**22**	**25**	**13**	**10**	**7**

Source: These forecasts from the Physician Aggregate Requirements Model assume no change over time in per capita utilization, physician productivity or mix, or the health care operating environment. Note: percentages might not sum to 100 percent due to rounding.

Exhibit 2.12: Distribution of Total Patient Care Hours, by Patient Age: Total Active Physicians in Patient Care

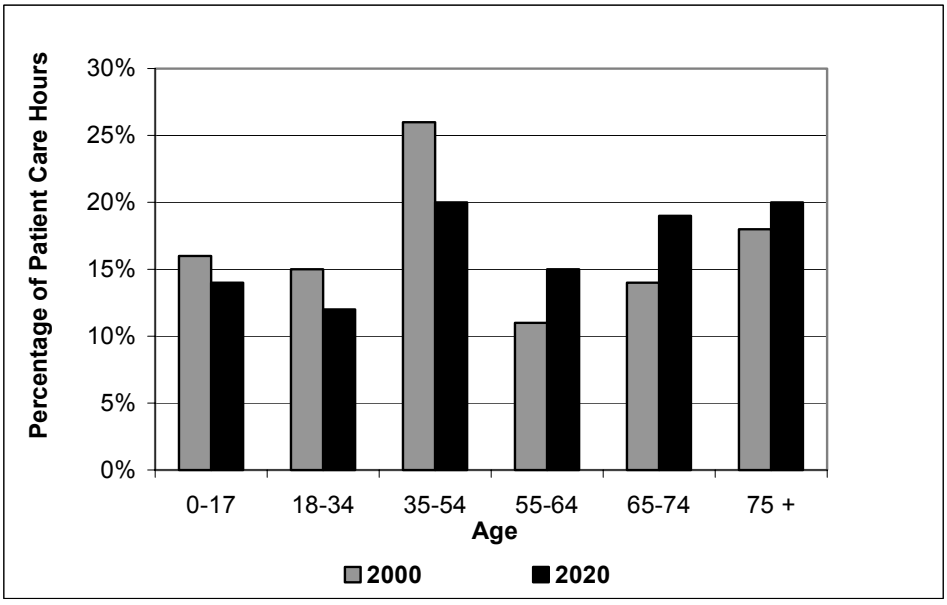


Exhibit 2.13: Distribution of Total Patient Care Hours, by Patient Age: General Primary Care Physicians

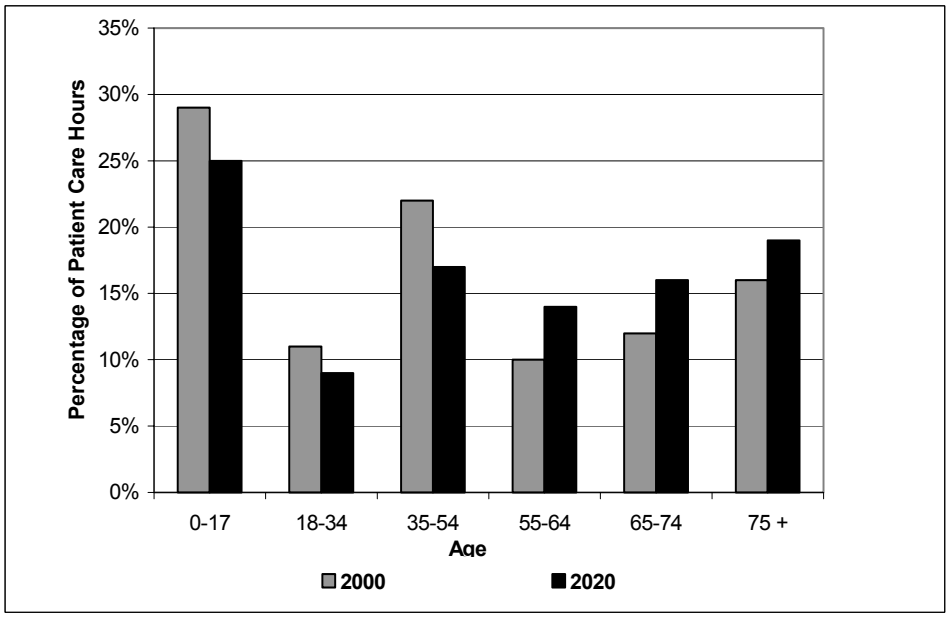


Exhibit 2.14: Distribution of Total Patient Care Hours, by Patient Age: Primary Care Subspecialty Physicians

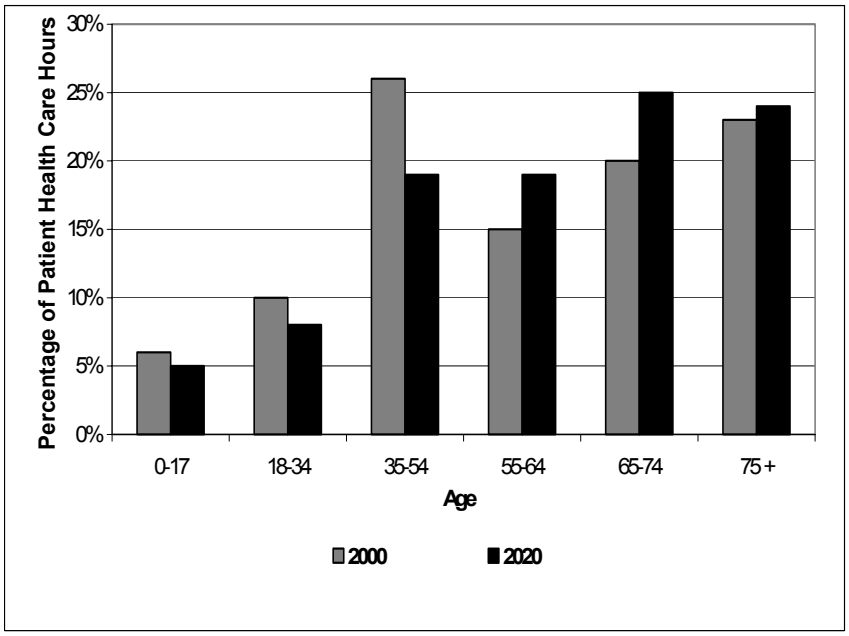


Exhibit 2.15: Distribution of Total Patient Care Hours, by Patient Age: Physicians in Surgical Specialties

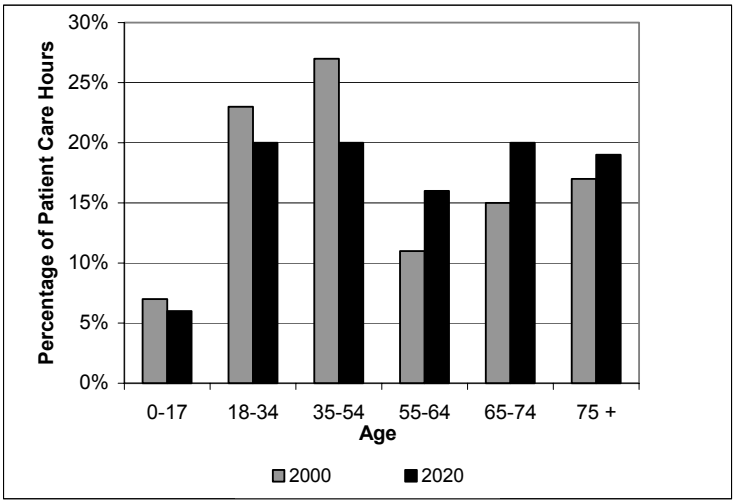
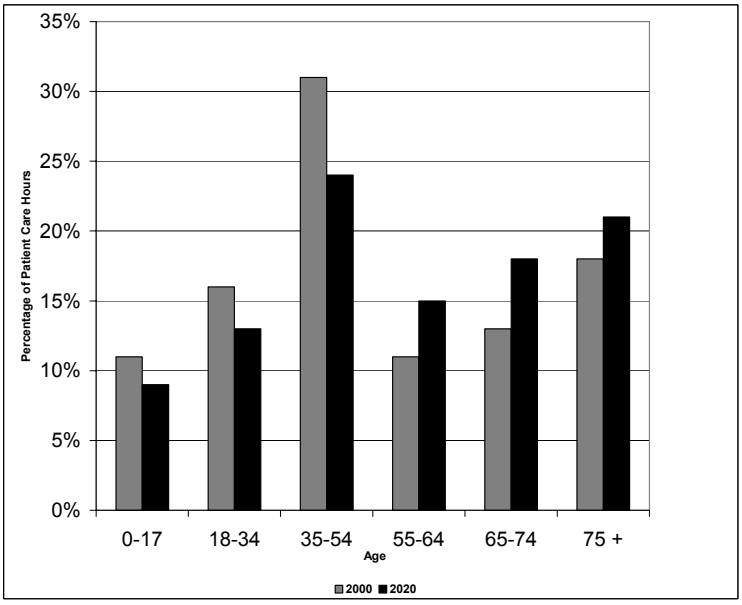


Exhibit 2.16: Distribution of Total Patient Care Hours, by Patient Age: Physicians in Other Patient Care Specialties



2.3 Implications of an Aging Population for the Supply of Health Workers

Demographic trends in the health workforce will mirror many of the trends in the overall population. In many health care occupations, there are a significant number of baby boomers that will retire just as demand for their services is increasing. This is especially true in nursing. An emerging nursing

shortage is likely to be exacerbated starting in approximately 2010 as a large portion of the nurse workforce nears retirement. In occupations where some analysts argue there is a current surplus—e.g., specialist physicians—the growth in demand for services and retirement from the physician workforce could eliminate any surplus and could even result in shortages. A large majority of the relevant workforce supply literature focuses on physicians and registered nurses, with much less published on other health workers.

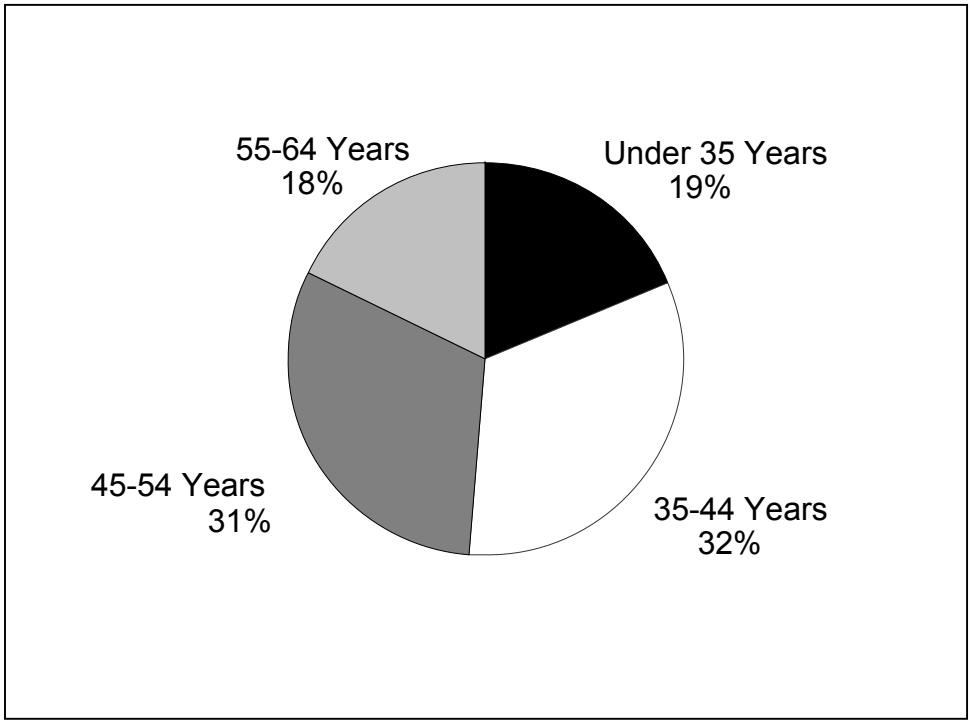
2.3.1 Physician Supply

Forecasting the future supply of physician services involves attempting to predict the future rate of entrance to and exit from the profession, and predicting the productivity of these physicians while they are in the workforce. The age distribution of both the U.S. population and the current physician workforce is an important determinant of the size and characteristics of the future workforce. The age distribution of the U.S. population affects the rate of new entrants to the profession, while the age distribution of the physician workforce affects rates of exit and average level of physician productivity. Productivity is defined here as the average number of patient hours per physician per year. Physicians, like many professionals who invest heavily in their training, remain active in their professions throughout a working career of 30 or more years. The literature suggests that the rate at which physicians exit the workforce or reduce their workload is highly related to age—especially as physicians approach retirement age.

American Medical Association (AMA) publications show the number of active physicians in different age groups. Of those physicians under 65 years of age in the AMA MasterFile in 1999, 18.9 percent were under age 35, 32.4 percent were age 35-44, 31 percent were age 45-54, and 17.8 percent were age 55-64 (***Exhibit 2.17***). The age distribution varies substantially by reported primary medical specialty, possibly reflecting when a specialty was officially founded (***Exhibit 2.18***). For example, 47.4 percent of general practitioners and 40.1 percent of radiologists were age 55-64, while only 10 percent of emergency physicians and 10.5 percent of family practitioners were in this age group. In thoracic surgery, approximately half the physicians are under age 35 and the other half are almost entirely age 35-44. There are very few physicians over age 44 who report thoracic surgery as their primary specialty. Some specialties, such as general surgery, have a relatively flat age distribution, with approximately 1/4th of physicians in each of the four age groups. Specialties with a high

percentage of physicians nearing retirement are especially vulnerable to a rapid decrease in number of active physicians. Not only is an adequate supply of new physicians important to consumers, but an adequate supply is important to retiring physicians who desire to see established practices continue to flourish.

Exhibit 2.17. Age Distribution of the Current Physician Workforce



Source: American Medical Association, Physician Characteristics and Distribution in the U.S., 2001-2002 Edition.

Exhibit 2.18. Percent Distribution of the Physician Workforce Under Age 65, by Age Group, in 1999

Specialty	Under 35 Years	35-44 Years	45-54 Years	55-64 Years
Total	**18.9**	**32.4**	**31.0**	**17.8**
Aerospace Medicine	2.9	28.5	41.5	27.1
Allergy & Immunology	5.8	31.4	38.0	24.8
Anesthesiology	13.2	42.4	29.2	15.2
Cardiovascular Disease	9.4	35.5	36.1	18.9
Child Psychiatry	8.4	34.5	36.3	20.8
Colon/Rectal Surgery	7.8	36.5	35.8	19.9
Dermatology	16.7	31.0	31.6	20.7
Diagnostic Radiology	18.7	34.2	30.9	16.2
Emergency Medicine	23.0	31.9	35.0	10.0
Family Practice	22.9	34.7	31.8	10.5
Forensic Pathology	6.6	32.3	35.7	25.4
Gastroenterology	9.6	37.3	35.8	17.3
General Practice	1.1	13.9	37.6	47.4
General Preventive Med.	7.2	31.0	37.4	24.3
General Surgery	24.1	26.9	26.9	22.1
Internal Medicine	24.8	33.0	29.5	12.7
Medical Genetics	13.2	31.9	34.0	20.8
Neurology	12.6	32.7	36.5	18.3
Neurological Surgery	18.6	28.7	27.6	25.1
Nuclear medicine	9.0	24.7	37.7	28.6
Obstetrics/Gynecology	19.2	30.1	30.6	20.1
Occupational Med.	0.6	27.7	45.2	26.5
Ophthalmology	12.6	31.5	31.2	24.7
Orthopedic Surgery	17.1	29.8	29.7	23.4
Otolaryngology	18.0	29.8	27.4	24.8
Pathology-Anat/Clin	12.2	31.7	32.6	23.6
Pediatrics	27.0	32.3	27.0	13.7
Pediatric Cardiology	13.9	42.2	26.6	17.3
Physical Med/Rehab	18.2	42.7	26.3	12.8
Plastic Surgery	7.5	32.2	35.1	25.1
Psychiatry	11.2	28.1	34.7	26.0
Pulmonary Diseases	11.3	36.5	37.3	14.9
Radiology	7.8	27.1	25.0	40.1
Radiation Oncology	13.6	37.8	29.5	19.0
Thoracic Surgery	50.4	49.2	0.4	0.0
Urological Surgery	13.5	27.6	29.9	29.0
Other	1.8	20.1	40.1	38.1

Source: American Medical Association, *Physician Characteristics and Distribution in the U.S., 2001-2002 Edition*

As health professionals age, they typically reduce their hours worked in patient care—especially professionals approaching retirement age who might view a reduced workload as an alternative to retirement. Although we identified no recent studies showing working patterns of physicians over their career, a survey of optometrists by Abt Associates (White, Doksum and White, 2000) finds that hours spent in patient care decline with age (***Exhibit 2.19***). The trend is especially evident among male optometrists. From age 30 to retirement, average hours spent in patient care drops slowly but steadily. Average hours worked by female optometrists declines slightly when these women are in their 30s and 40s, possibly resulting from a reduced workload to care for children, but then increases in their 50s until retirement. The spike in hours by female optometrists in the 65-69 age group could be an anomaly due to small sample size.

Exhibit 2.19. Average Number of Hours Optometrists Spend in Patient Care per Work Week

	Hours Spent in Patient Care	
Age Group	**Men**	**Women**
25 to 29	41.6	40.4
30 to 34	43.0	37.5
35 to 39	42.3	35.6
40 to 44	41.7	34.2
45 to 49	41.2	35.4
50 to 54	39.8	37.1
55 to 59	38.6	37.0
60 to 64	37.2	35.2
65 to 69	33.3	42.3
70+	28.5	27.1

Source: *Project Hope Census of Optometrists* (White, Doksum and White, 2000), *Table 2*.

2.3.2 Nurse Supply

The aging of the nurse workforce and the inability to attract new entrants are often cited as major contributors to an impending nurse shortage.[5] Factors contributing to the aging of the nurse population include the large number of baby boomers who entered the profession in the 1970s and 1980s, declining enrollment in nursing programs, retention difficulties, and a higher average age of new graduates from nursing programs.

Findings from the 2000 Sample Survey of Registered Nurses (HRSA, 2001) indicate that between 1980 and 2000 the percentage of RNs under the age of 40 fell from approximately 53 percent to 32 percent. Buerhaus, Staiger and Auerbach (2000) discuss this phenomenon and the implications of an aging RN workforce. The authors report that between 1983 and 1998 the average age of RNs in hospitals increased by 5.3 years. During the same period, the average age of the entire RN workforce increased 4.5 years, from 37.4 to 41.9. The General Accounting Office (GAO, 2001) estimates that by 2010, approximately 40 percent of the RN workforce will be age 50 or older.

The primary cause of an aging RN workforce is the failure to attract young workers (especially women) into the profession. The changing age distribution of the population will make it more difficult to attract young workers into nursing in future years. The American Association of Colleges of Nursing reports that enrollments in entry-level baccalaureate programs in nursing have declined every year between 1995 and 2000. Enrollees to these programs have declined by 21 percent between 1995 and 2000, while graduates have declined by 16.5 percent. The GAO estimates that the ratio of working-age women (age 18 to 64) to the age 85 and older population will decline over time from approximately 40:1 in 2000, to 22:1 in 2030, and to 15:1 in 2040. This finding has important implications for the future supply of all health professions.

Buerhaus, Staiger and Auerbach analyzed the relationship between age and RN workforce participation for a cohort (defined by birth year) of the population. RNs typically enter the profession in their early 20s to early 30s, and the number of full-time equivalent (FTE) RNs from a population cohort increases through age 45 as many RNs finish their schooling and pass out of their child rearing years. Between ages 45 and 55, the number of FTEs from a cohort remains fairly stable, but then begins to decline as RNs retire or reduce hours worked.

Although the demographics of the current nurse workforce will have a great impact on the nurse workforce of the future, the large proportion of nurses who will be retiring during the next 10 years will not necessarily result in a shortage. Economic theory suggests, and history has shown, that wages will adjust, making shortages and surpluses a short-term phenomenon. However, it does suggest that

[5] The extant literature on this topic is vast, but two recent publications include a study by the General Accounting Office (2001) and Nevidjon and Erickson (2001).

the real wages of nurses will increase. This in turn will attract new entrants, gradually reducing wages to "normal" levels.

There is less literature on the demographics of licensed practical nurses and nurse aides. LPNs and nurse aides tend to be younger than RNs. Indeed many LPNs and nurse aides see becoming RNs as a means to better oneself professionally. The duties performed by LPNs and nurse aides are often physically demanding which limits the ability of some older people to serve in this capacity. Because LPNs and nurse aides require less time to train than RNs, the supply of these nurses can react more quickly to market conditions.

As an aging population demands more services from an increasingly older nurse workforce, some employers of nurses might look outside the U.S. to countries with younger populations. Many of these countries that could potentially export nurses might themselves have nurse shortages, in which case an inadequate supply of nurses in the U.S. could reduce the availability of care in other countries. Cheryl Peterson, director of international nursing at the American Nurses Association, states: "I'm always telling people in developing countries, 'You don't want the U.S. shortage to worsen because we'll grab up all of the world's poor nurses.'"[6]

2.4 Implications of an Aging Population for the Economics of the Health Care System

Health care spending constitutes almost one-eighth of our Gross Domestic Product (Heffler, 2001). Because such a large portion of the Nation's resources is spent on health care, the economics of the health care system are closely intertwined with the national economy. Changing demographics will have a significant impact on both the U.S. economy and the economics of the health care system.

The Congressional Budget Office (1997) estimates that total national spending on health care could double between 1996 and 2008 to nearly $2 trillion. Ginzberg (1999) projects that annual expenditures for health care could top $4 trillion by 2025, and this, says Ginzberg, "could turn out to be a serious underestimate given the steep increase in the number of elderly, who make much greater use of health care services than the below-65 population (p. 58)."

[6] As reported in the Wall Street Journal article: *Shortage of Nurses Hits Hardest Where They Are Needed the Most: Nurse Shortage Shows How Labor Markets Go Global* (Zachary, 2001, p. A12).

Stucki and Mulvey (2000) report that by 2030, when the last of the baby boomers reaches age 65, the cost to provide personal care, adult day care, and assisted living to the elderly could quadruple to an estimated $193 billion. Nursing home expenditures paid by Medicaid could rise 360 percent to $134 billion (in 1996 dollars) between 2000 and 2030 (Mulvey and Stucki, 1998).

If retirement patterns remain unchanged, the ratio of working to retired Americans will continue to decline as the population ages. Pizer, Frakt and Kidder (2000) project that by 2005 the ratio of workers to retirees will be 5:1, and this ratio could fall to 2.75:1 by 2050. This means that a smaller proportion of the population will be supporting the needs of the elderly.

The Medicaid and Medicare programs will compete with other programs, such as Social Security, that serve the elderly. As the size of the elderly population grows, resulting in an increase in the number of Medicare and Medicaid eligibles, the resulting increase in government outlays for health care services could compel the government to reduce expenditures by

- reducing benefit levels,
- restricting eligibility,
- increasing out-of-pocket expenditures by increasing premiums or co-pays, and
- reducing reimbursements to health care providers.

On the other hand, the elderly will constitute a growing voting bloc that could attempt to retain current benefits or even expand benefits.

Tarlov (1995) states that the consensus outlook of future demand for health care services is that "service quantity and price will be set at economically absorbable levels determined by employer-employee willingness to pay and by politically acceptable government budgets for health care (p. 1560)." Ginzberg anticipates that cost pressures will result in radical changes in the health care system during the early part of the 21st century. Ginzberg anticipates that Medicare will provide beneficiaries access to "essential" health care services, but not to high-cost hospitals and expensive procedures.

Actions to reduce spending could reduce demand for health workers. The impact would vary substantially by medical specialty and delivery setting, with providers of expensive services likely to see the greatest impact on demand for their services. In addition, attempts to reduce health care

spending through lower reimbursement rates to health care providers could, in the long run, reduce the supply of health workers. Caro and Kaffenberger (2001) find that reductions in Medicare payments for nursing home care and home health services resulting from the Balanced Budget Act of 1997 pushed many long-term care providers out of business, thus reducing the demand for nurses and other health workers in those settings.

3 CHANGING RACIAL AND ETHNIC COMPOSITION OF THE POPULATION

Advocates for increased minority representation in the health workforce argue that increasing the number of minority physicians will improve access to care for minorities and vulnerable, underserved populations. These advocates argue that increased representation of minorities in the health workforce not only will increase equity, but will also improve the efficiency of the health care delivery system.

This section explores the changing racial and ethnic composition of the population and its implications for the future demand for and supply of health professionals. The four main findings are the following.

First, Hispanics and non-whites have different patterns of health care use compared to non-Hispanic whites. Some of the disparities in use can be attributed to differences in access to care. The literature suggests that cultural differences regarding appropriate use of health care services also help explain differences in health care use.

Second, as minorities increase as a percentage of the U.S. population, the percentage of total health care services provided to minority patients will also increase. In 2000, physicians spent an estimated 31 percent of patient-care hours providing services to minorities. By 2020, physicians will spend an estimated 40 percent of patient-care hours with minority patients.

Major Findings:

- *Minorities have different patterns of health care use compared to non-minorities. Disparities in access to care account for part of the difference in utilization.*
- *Demand for health care services by minorities is increasing as minorities grow as a percentage of the population. Between 2000 and 2020, the percentage of total patient care hours physicians spend with minority patients will rise from approximately 31percent to 40 percent.*
- *Minorities are underrepresented in the physician and nurse workforce relative to their proportion of the total population. As minorities constitute a larger portion of the population entering the workforce, their representation in the physician and nurse professions will increase. The U.S. will increasingly rely on minority caregivers.*
- *Minority physicians have a greater propensity than do non-minority physicians to practice in urban communities designated as physician shortage areas. An increase in minority representation in the physician workforce could improve access to care for the population in some underserved areas.*

Third, minorities are underrepresented in the physician and nurse workforces relative to their proportion of the total population, and are overrepresented in lower-paying health professions such as nurse aides and home health aides. As minorities constitute a growing percentage of the working-age population, their representation in the professional health workforce will naturally rise. The U.S. will increasingly rely on minority caregivers.

Fourth, the literature suggests that minority physicians have a greater propensity than do non-Hispanic white physicians to practice in urban communities designated as physician shortage areas. An increase in minority representation in the physician workforce could improve access to care for the population in some underserved areas.

3.1 Population Forecasts

The latest census figures highlight the fact that the United States is becoming increasingly racially and ethnically diverse. Furthermore, higher birth rates among racial and ethnic minority groups, relative to non-Hispanic whites, and immigration suggest that this trend will continue. ***Exhibit 3.1*** contains population forecasts used in the PARM that show the current and projected distribution of the population across the three race/ethnic groups modeled in the PARM. Whereas non-Hispanic whites constituted approximately 69 percent of the population in 2000, they will constitute an estimated 61 percent of the population in 2020. Between 2000 and 2020, African Americans (both Hispanic and non-Hispanic) will increase from approximately 12.3 percent to 13.1 percent of the population; all other minorities (including Hispanic whites) will increase from approximately 19 percent to 26 percent of the population. Growth in the Hispanic population is the major contributor to growth in the minority population.

Exhibit 3.1. Population Distribution by Race

Year	Non-Hispanic White	African American	All Other
2000	69.1%	12.3%	18.6%
2005	67.1%	12.5%	20.4%
2010	64.8%	12.7%	22.5%
2015	62.8%	12.9%	24.3%
2020	60.8%	13.1%	26.1%

Source: Modified version of Census Bureau middle series projections.

Racial and ethnic minority populations are unevenly distributed geographically. The proportion of a State's population that is minority varies substantially by State, and minorities are disproportionately located in inner cities.

3.2 Implications of the Changing Racial and Ethnic Composition of the Population for the Demand for Health Workers

The extant literature explores the degree to which and reasons why race and ethnicity may affect health care use. Differences between racial and ethnic groups in use of a wide range of health care services have been documented in the literature. Much of these utilization differences are attributed to differences in access to care and cultural differences regarding the use of health care services. A better understanding of differences in health care utilization by race and ethnicity, the causal factors of these differences, and whether these differences will persist in the future allows for better predictions of future demand for health workers.

> ***"Whether representing actual differences or a constellation of factors that affect health and health status, race and ethnicity are important determinants of health patterns in the United States."*** (Sondik et al., 2000)

Below is a sample of the literature that describes differences in health care utilization by race or ethnicity.

- Mueller, Patil and Boilesen (1998) analyzed data from the 1992 National Health Interview Survey (NHIS) and found racial disparities in use of physician services even after controlling for factors such as insurance status, geographic location and other patient characteristics. The disparity in use of physician services by race was not statistically different from zero for those patients living in urban areas, but the disparity was statistically different from zero for patients living in rural areas. Insurance status and location (urban versus rural) are greater determinants of use of physician services than is patient race.

- Hargraves, Cunningham and Hughes (2001) found small differences in access to care and health care use of non-Hispanic whites and minorities enrolled in managed care plans. Whereas approximately 78 percent of non-Hispanic whites have a regular provider, only 74 percent of Hispanics and African Americans have a regular provider. Whites have slightly higher use of

specialists. In their last physician visit, 28 percent of non-Hispanic whites saw a specialist compared to 26 percent for African Americans and 22 percent for Hispanics.

- Burns et al. (1996) use Medicare claims from ten States to examine differences in mammography use between elderly African American and white women. They find that African American women had lower use rates than white women across all levels of primary care. These authors cite additional research that finds that physicians are more likely to encourage elderly white women to obtain mammograms than elderly African American women, highlighting concerns about provider attitudes.

- Peterson et al. (1994) analyzed the use of cardiac procedures of men treated at Veterans Affairs Medical Centers. These authors find that African Americans are less likely than their white counterparts to undergo selected cardiac procedures. The authors suggest several reasons for the differences in treatment, including: (1) differences in severity, (2) consumer preferences, and (3) differences in how providers may weigh the risk and benefit of invasive procedures differently for African Americans than for whites.

- Todd et al. (1993) studied analgesic use in emergency departments and find that ethnicity was a strong predictor of the lack of use of analgesics.

- Mitchell et al. (2000) analyzed Medicare inpatient data to compare differences between African Americans and whites in the use of diagnostic and therapeutic services for cerebrovascular disease. These authors control for differences in factors such as health care needs and ability to pay. Still, they find that "black patients were significantly less likely to receive non-invasive cerebrovascular testing, cerebral angiography, or carotid endarterectomy compared to white patients (p. 1413)."

Not all studies find differences by race or ethnicity in use of health care services. For example, Horner et al. (1997) found no differences by race and ethnicity in the use of inpatient rehabilitation services for elderly stroke victims after adjusting for differences in patient risk.

Access to affordable medical insurance is often cited as a major determinant of access to care. People in racial and ethnic minority groups in 1999 were more than twice as likely as nonminorities to be uninsured. The Census Bureau estimates that, in 1999, 89 percent of non-

Hispanic whites had some form of medical insurance while only 79 percent of African Americans and 67 percent of Hispanics were insured.[7] These statistics are important because the literature has established a link between access to care and health status (e.g., Drake and Lowenstein, 1998). Specifically, people without medical insurance tend to receive less preventative care and have higher rates of hospitalization for potentially avoidable problems. Drake and Lowenstein note that in California during the year of their study (1993), approximately 14 percent of African Americans and 37 percent of Latinos were uninsured, compared to 12.5 percent of whites.

An analysis of the 1999 NHIS found that 9 percent of non-Hispanic whites, 16.4 percent of African Americans, and 26.3 percent of other minorities (including Hispanic whites) were without health insurance on the date surveyed in 1999. The PARM divides the population into three insurance categories: insured in a fee-for-service arrangement, insured in an HMO, and uninsured. ***Exhibit 3.2*** shows that the proportion of each racial/ethnic group in an HMO is relatively similar, controlling for age and sex, but the percentage insured in a fee-for-service arrangement and uninsured vary substantially by race/ethnicity.

Language and cultural differences also are cited as factors affecting health care utilization. With the growing population of Hispanics in the U.S. and immigration from non-English speaking countries, language is playing an increasingly important role in the provision of health care services. Consider the following findings in recent studies.

- Kravitz et al. (2000) found that Spanish-speaking patients who visited the General Medicine and Family Practice Clinics at the UC Davis Medical Center were less likely to follow up with recommended laboratory studies compared to English-speaking patients. In addition, patients needing a translator required more physician time per visit. The authors applied regression models to estimate the impact of language on physician time per visit. They found that Spanish- and Russian-speaking patients averaged 9.1 and 5.6 additional minutes of physician time, respectively, compared to English-speaking patients after controlling for other determinants of physician time per visit.

[7] US Census, http://www.census.gov/hhes/hlthins/hlthin99/hi99tc.html

Exhibit 3.2. Percent Distribution of the Population by Demographic Group Across Three Insurance Categories

Age	Insurance	Non-Hispanic White		African American		All Other	
		Male	Female	Male	Female	Male	Female
0-17	FFS	59	59	59	61	48	48
	HMO	34	34	30	27	29	29
	Uninsured	7	7	11	12	23	23
18-34	FFS	48	52	39	46	30	35
	HMO	32	33	29	33	28	31
	Uninsured	21	15	32	21	42	34
35-54	FFS	55	56	44	45	35	39
	HMO	35	35	37	36	36	36
	Uninsured	11	9	19	18	29	25
55-64	FFS	61	63	57	59	43	48
	HMO	32	30	28	25	37	31
	Uninsured	7	7	15	16	20	21
65-74	FFS	85	87	82	82	85	85
	HMO	15	13	18	18	15	15
	Uninsured	0	0	0	0	0	0
75+	FFS	89	89	87	93	88	93
	HMO	11	11	13	7	12	7
	Uninsured	0	0	0	0	0	0
All Ages	FFS	60	63	52	56	41	46
	HMO	30	29	30	29	30	30
	Uninsured	10	8	18	15	28	24
	FFS	61		54		44	
	HMO	30		30		30	
	Uninsured	9		16		26	

Source: Analysis of the 1999 NHIS.

- Derose and Baker (2000) analyzed survey data for 465 Spanish-speaking Latinos and 259 English speakers of various ethnicity who presented to a public hospital emergency department in Los Angeles. The survey asked participants to assess their English-speaking ability; indicate the number of visits to a physician during the prior three months; and provide information on the participants' health status, socioeconomic status, and demographic characteristics. The authors found that of participants who had at least one visit to a doctor during the previous three months, those with limited English proficiency had 22 percent fewer visits, on average, compared to participants with good-to-excellent English proficiency. The study controlled for patient characteristics that could be correlated with the use of physician services such as health conditions and insurance status. In practice, therefore, language and communication may be significant barriers to access to care.

In addition to differences across racial groups and English/non-English speakers in access to and use of health care services, there are significant differences in measures of health status that affect the type of care demanded. Keppel, Pearcy, and Wagener (2002) find that compared to non-Hispanic whites, many minority populations have higher infant mortality rates, higher rates of infants with low birth weight, higher age-adjusted rates of heart disease death, higher rates of tuberculosis, and disparities in many other measures of health care.

Freiman (1998) argues that the relationship between race or ethnicity and demand for health care services is a complex function of cultural, socioeconomic, and other considerations. Consequently, Freiman concludes that separate demand equations should be estimated for people in different racial or ethnic groups. To support his conclusions, Freiman presents findings from a multiple regression analysis of the 1987 National Medical Expenditure Survey where statistical tests performed indicate significant differences in the estimated coefficients of demand equations—estimated separately for non-Hispanic whites, African Americans, and Hispanics—that control for important determinants of health care use.

The PARM provides insight on the proportion of patient care hours that physicians spend providing care to patients in three race/ethnic groups. These estimates, like those described for people in different age categories in the preceding section, are based on patterns of health care use, the size of the population in each demographic group, and the average amount of time physicians spend with patients per encounter. In physicians' offices and in hospital outpatient settings, the average time spent per visit can differ by patient depending on the patient's demographic characteristics and insurance status. In the other settings, however, there are insufficient data to test the hypothesis that physician time per visit is independent of patient demographics and insurance status. Note that differences in the age and sex distribution of the population, by race, contribute to differences in the proportion of patient care hours spent with patients of different races.

In 2000, physicians spent approximately 69 percent of patient care hours with non-Hispanic whites, 13 percent with African Americans, and 18 percent with other minorities (***Exhibits 3.3 and 3.4***). Although the proportion of total patient care hours approximated the proportion of the population in each racial group, the distribution of hours varied by physician specialty. African Americans, who constituted approximately 12 percent of the U.S. population in 2000, used a

disproportionately higher percentage of total patient care hours of emergency medicine physicians (38 percent), obstetrician/ gynecologists (17 percent), and pediatricians (16 percent). They received proportionately fewer hours from "other" surgical specialties (8 percent) and general surgeons (9 percent). The population in the "other" race/ethnicity category, which constituted approximately 19 percent of the total population in 2000, received a relatively larger proportion of radiology (31 percent) and pathology (29 percent) services, but a relatively smaller proportion of patient care hours from urologists (11 percent), ophthalmologists (11 percent), and general and family practitioners (13 percent).

If the distribution of insurance status for non-Hispanic whites were applied to other racial minorities, the total demand for physicians in 2000 would have risen significantly (see ***Section 5, Scenario 5***) but the percentage of patient care hours by racial group would have remained relatively unchanged. The percentage of total physician patient care hours spent with non-Hispanic whites would decline by two percentage points while the percentage spent with African Americans and other minorities would rise by one percentage point for each group. For most specialties, the change in percent of time spent with patients in each race/ethnicity group changes by less than two percentage points. The largest change is for obstetrics/gynecology services. Under this scenario, the percentage of hours spent with non-Hispanic white patients would fall by three percentage points while the percentage of hours spent with patients in the "other" category (which includes Hispanics) would rise by three percentage points.

If health care utilization patterns and physician productivity patterns remain constant over time, in 2020 physicians will be spending approximately 14 percent of patient care hours with African Americans and 26 percent of hours with patients of other minority groups, again percentages roughly comparable to each group's share of the total population.

Physical therapists, optometrists, and podiatrists are seen to spend a disproportionate amount of time with non-Hispanic whites relative to their share of the population (***Exhibit 3.4***). While the gap for African Americans is small (and non-existent in the case of podiatrists), the gap for other minority groups was large in 2000 and projected to remain so in 2020.

Exhibit 3.3: Distribution of Total Patient Care Hours, by Patient Race: Total Active Physicians in Patient Care

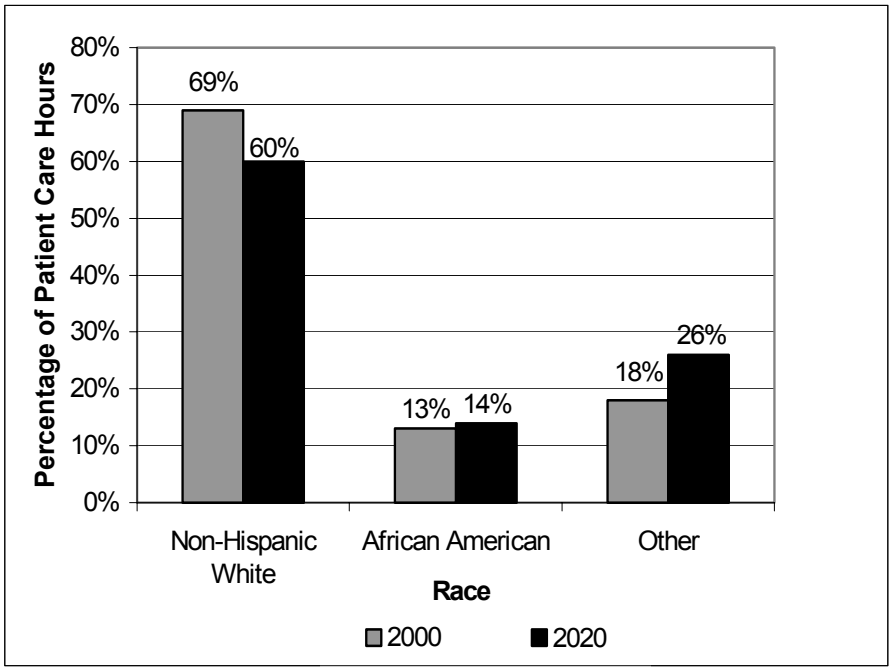


Exhibit 3.4. Estimated Percentage of Patient Care Hours, by Race of Patient

Specialty	2000[a]			2020[a]		
	Non-Hispanic White	African American	All Other	Non-Hispanic White	African American	All Other
Total Patient Care Physicians (MDs and DOs)	**69**	**13**	**18**	**60**	**14**	**26**
General Primary Care	**72**	**13**	**15**	**63**	**14**	**24**
GP & FP	78	10	13	69	11	20
General Internal Med.	72	14	14	63	15	23
Pediatrics	61	16	23	51	17	32
Medical Specialties	**71**	**13**	**16**	**62**	**13**	**25**
IM Subspecialties	71	13	16	62	13	25
Cardiovascular Diseases	73	11	15	64	12	24
Other Medical Specialties	70	13	17	60	13	26
Surgery	**71**	**12**	**17**	**62**	**12**	**26**
General Surgery	70	9	22	59	9	32
Obstetrics/Gynecology	66	17	17	57	18	25
Otolaryngology	75	11	14	67	12	21
Orthopedic Surgery	72	11	17	62	11	27
Urology	78	11	11	71	12	17
Ophthalmology	78	10	11	71	11	18
Other Surgical Specialties	73	8	19	62	8	30
Other Patient Care	**64**	**15**	**21**	**53**	**15**	**32**
Psychiatry	73	11	16	62	11	26
Anesthesiology	66	14	21	56	13	31
Emergency Medicine	47	38	16	39	39	22
Radiology	56	14	31	45	12	43
Pathology	60	11	29	48	10	42
Other Specialties	67	13	20	57	13	30
Non-Physician Specialties						
Physical Therapy	80	10	10	74	12	15
Optometry	80	10	11	73	11	16
Podiatry	78	12	10	71	14	15
Total U.S. Population	**69**	**12**	**19**	**61**	**13**	**26**

[a] These forecasts from the Physician Aggregate Requirements Model assume no change over time in per capita utilization, physician productivity or mix, or the health care operating environment.

Note: percentages might not sum to 100 percent due to rounding.

3.3 Implications of the Changing Racial and Ethnic Composition of the Population for the Supply of Health Workers

One of the five major recommendations of the Pew Health Professions Commission is to "ensure that the health profession workforce reflects the diversity of the nation's population." (O'Neil et al., 1998, p. iv). Currently, minorities are underrepresented in the physician and registered nurse workforce. The Pew Commission and numerous others argue that increasing minority representation in the health workforce is not only a commitment to diversity, but will also improve the health care delivery system. The two main arguments that diversity improves health care delivery are (1) minority health professionals express a greater propensity than do non-minority professionals to practice in underserved areas, and (2) health professionals who share the same culture and language with the patients they serve can provide more effective care (see, for example, Trevino, 1994). Much of the literature on willingness to practice in underserved areas pertains to physicians.

Supply models generally do not have a race/ethnicity component. Possible reasons include data limitations and the lack of priority this topic has received. Consequently, our understanding of the relationship between supply of health workers and race/ethnicity consists of snapshots of the racial and ethnic distribution through surveys and periodic efforts to survey health workers regarding the relationship between race/ethnicity and workforce issues (e.g., workforce participation, retention, and productivity). The following are important factors and questions to consider regarding the relationship between race/ethnicity and the supply of health workers:

1. Minorities have historically been underrepresented in higher-paying health care occupations and overrepresented in lower-paying health care occupations relative to their percentage of the U.S. population. As minorities constitute an increasing proportion of the population entering the workforce for the first time, minority representation in higher-paying health care occupations will naturally increase. As a result, the U.S. will increasingly rely on minority health workers.

2. One area where additional research is needed is whether lifetime labor force participation patterns of health workers differ by race or ethnicity. For example, minorities have historically had a shorter life span than non-minorities, although in recent years longevity of minorities has

increased to more closely resemble longevity of whites. Do differences in longevity affect retirement rates?

3. Does race or ethnicity affect the health worker's choice of profession or medical specialty?

4. Does race or ethnicity affect the education and training opportunities of persons desiring to enter a health care profession?

5. Empirical research suggests that physician race and ethnicity are significant determinants of where the physician will practice, and minority physicians have a greater propensity than do non-minority physicians to practice in underserved locations.

6. Does physician race or ethnicity affect the quality of care that patients receive? A large body of literature explores the issue of "cultural competence," which is that health professionals can provide more effective and efficient services if they are sensitive to their patients' cultural background.[8] A recent literature review analyzed over 120 works in the field of cultural competence in health care to develop a measurement profile for cultural competence in health care delivery settings (The Lewin Group, 2001). Several articles reviewed discuss the need to emphasize the value of diversity and the importance of involving people from diverse backgrounds in the decision-making process of what care to provide to underrepresented groups. Much of the literature discusses the importance of educating health workers to be sensitive to differences in the needs of their patients resulting from differences in culture.

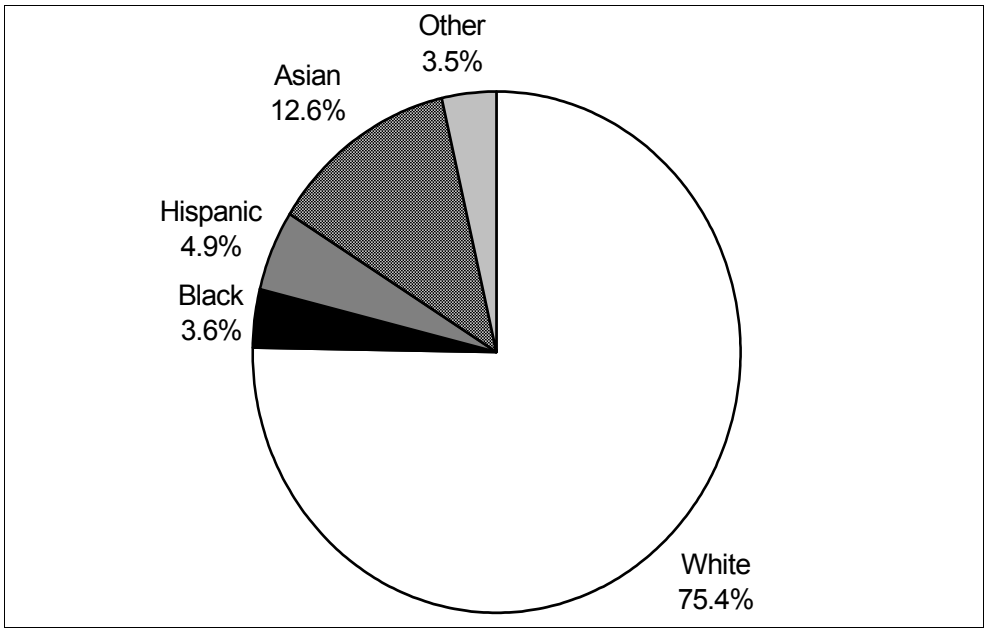
[8] Cross et al. (1999) define cultural competence as "a set of congruent behaviors, attitudes, and policies that come together in a system, agency, or among professionals and enable that system, agency, or those professionals to work effectively in cross-cultural situations." It should be noted that culture is defined by more than race and ethnicity, it also encompasses economic and social factors. Often, race and ethnicity are correlated with these economic and social factors, which can obscure the relationship between health care and race or ethnicity. For example, Kington and Smith (1997) analyzed the relationship between socioeconomic status and racial and ethnic differences in the prevalence of diabetes, heart conditions, hypertension, and arthritis. They find that socioeconomic status plays a greater role in explaining racial and ethnic differences in individuals' ability to function once someone is ill, rather than explaining the differences in the probability of becoming ill.

Brown and Nichols-English (1999) discuss the implications of patient diversity for pharmacists. People of different cultures—which they broadly defined by race and ethnicity, language, socioeconomic group, family structure, and geographic location—have different perceptions, on average, of health care issues. Their perceptions might differ in the following: "(1) [the constitution of] disease and its causation; (2) appropriate health-care-seeking behavior; (3) the quality and usefulness of medical encounters; (4) effective approaches to healing, including both conventional and alternative practices; and (5) the role of family in health care (p. 61)." Brown and Nichols-English discuss the importance of educating pharmacists on providing culturally competent care to reduce drug-related problems—e.g., noncompliance, adverse effects, and sub-optimal dosing.

3.3.1 Physician Supply

Relative to the overall population, minorities are underrepresented in the physician workforce for all races and Hispanic ethnicity with the exception of the population of Asian descent. ***Exhibit 3.5*** shows the distribution of the physician workforce by race and ethnicity in 1999. For those physicians whose race and ethnicity is recorded in the AMA master file, 75.4 percent are non-Hispanic white, 3.6 percent are African American, 4.9 percent are Hispanic, 12.6 percent are Asian, 0.1 percent are American Indian or Alaskan Native, and the remaining 3.5 percent are of various other races.

Exhibit 3.5. Race Distribution of the Physician Workforce, 1999



Source: American Medical Association, Physician Characteristics and Distribution in the U.S., 2001-2002 Edition.

The racial and ethnic composition of the physician workforce, however, varies substantially by specialty (***Exhibit 3.6***). The percent non-Hispanic white ranges from a high of 91.1 percent in aerospace medicine to a low of 65.2 percent in physical medicine and rehabilitation. Specialties with the highest representation of physicians of Asian descent are physical medicine and rehabilitation (20.6 percent), internal medicine (17.9 percent) and radiation oncology (17.4 percent). African Americans have the highest representation in general preventive medicine (6.3 percent), obstetrics/gynecology (6.2 percent) and pediatrics (4.8 percent). Hispanics have the highest representation in general practice (7.9 percent), child psychiatry (7.0 percent) and pediatrics (6.7 percent).

A visual inspection of the specialties where physicians spend relatively more (less) time with African American and other minority patients (***Exhibit 3.4***) finds that these specialties tend to have higher (lower) minority representation in the physician workforce. The three specialties, for example, shown in Exhibit 3.4 to have spent the greatest percentage of time with African American patients in the year 2000 were emergency medicine, obstetrics/gynecology, and pediatrics; from Exhibit 3.6, we see that each of these specialties had in 1999 an above-average

representation of African American physicians compared to the workforce at large (4.1, 6.2, and 4.8 percent respectively, compared to an overall average of 3.6 percent for all specialties combined). The two specialties shown in Exhibit 3.4 to have spent the *lowest* percentage of time with African American patients in the year 2000 were general surgery and other surgical specialties, groups characterized in Exhibit 3.6 by a *below*-average representation of African Americans. Similar observations apply, with some exceptions, to Hispanics and other minorities. The exceptions are as follows: (a) radiologists spent a large percentage of time with "other minority" patients (31 percent) despite the fact that other minorities constituted a distinctly below-average percentage of the radiologist workforce (12.7 percent as against an overall average of 21 percent), and (b) cardiologists spent a *low* percentage of time with other minority patients (15 percent) despite the fact that other minorities constituted an *above*-average percentage of the cardiologist workforce (26.3 percent compared to 21 percent for all specialties combined).

Advocates for increased representation of minorities in the physician workforce cite both equity and efficiency reasons. One equity issue cited is providing greater access to care for minority populations who are disproportionately in designated physician shortage areas. Defining a "physician shortage area" as an area with fewer than 30 office-based primary care physicians per 100,000 population, Komaromy et al. (1996) found that 57 percent of poor areas with a high percentage of African American and Latino residents could be classified as physician shortage areas. In comparison, Komaromy et al. found that only 13 percent of poor areas with a high percentage of non-Hispanic white residents could be classified as physician shortage areas. Intuitively, one might expect that poorer urban neighborhoods might naturally have fewer physicians per population. Komaromy et al. found, however, a stronger correlation between the physician supply and the proportion of residents in the community who are African American or Hispanic residents than the correlation between physician supply and an area's average income level.

Exhibit 3.6. Percent Distribution of Physicians by Race and Ethnicity, in 1999

Specialty	Non-Hispanic White	African American	Hispanic	Asian	Other	American Indian/ Alaskan Native
Total MDs	**75.4**	**3.6**	**4.9**	**12.6**	**3.5**	**0.1**
Aerospace Medicine	91.1	2.1	3.4	2.1	1.3	0.0
Allergy & Immunology	79.0	1.4	3.7	12.2	3.6	0.1
Anesthesiology	71.5	3.4	4.2	16.9	4.1	0.1
Cardiovascular Disease	71.1	2.4	4.9	15.2	6.2	0.1
Child Psychiatry	73.5	4.8	7.0	10.2	4.3	0.2
Colon/Rectal Surgery	81.6	1.8	5.1	9.8	1.7	0.0
Dermatology	87.4	2.5	2.7	5.9	1.4	0.0
Diagnostic Radiology	80.2	2.0	3.5	11.5	2.7	0.1
Emergency Medicine	82.4	4.1	4.2	7.3	1.8	0.1
Family Practice	79.2	4.1	5.4	8.8	2.3	0.2
Forensic Pathology	82.2	3.7	4.7	8.3	0.7	0.3
Gastroenterology	71.5	3.1	4.8	14.8	5.8	0.0
General Practice	75.5	2.2	7.9	13.6	0.7	0.0
General Preventive Med.	82.1	6.3	3.5	6.6	1.4	0.1
General Surgery	78.3	3.4	4.6	10.9	2.7	0.1
Internal Medicine	67.0	4.1	5.1	17.9	5.8	0.1
Medical Genetics	84.6	1.9	3.4	8.0	2.2	0.0
Neurology	72.8	1.9	5.2	14.1	5.9	0.0
Neurological Surgery	82.7	2.5	3.9	7.8	3.1	0.1
Nuclear medicine	71.0	2.0	5.7	16.8	4.4	0.0
Obstetrics/Gynecology	77.2	6.2	5.3	9.3	2.0	0.1
Occupational Med.	88.6	2.9	3.0	4.6	0.9	0.1
Ophthalmology	84.6	2.2	2.9	7.9	2.4	0.1
Orthopedic Surgery	88.7	2.4	2.4	4.7	1.7	0.1
Otolaryngology	84.3	2.0	3.2	8.7	1.7	0.0
Pathology-Anat/Clin	74.5	1.9	4.9	15.5	3.3	0.0
Pediatrics	68.6	4.8	6.7	15.7	4.0	0.1
Pediatric Cardiology	75.7	2.0	5.6	11.5	5.0	0.1
Physical Med/Rehab	65.2	4.4	6.2	20.6	3.7	0.1
Plastic Surgery	84.8	1.8	3.6	7.5	2.3	0.0
Psychiatry	75.0	3.2	5.6	12.7	3.4	0.1
Pulmonary Diseases	75.7	2.6	5.2	12.3	4.2	0.1
Radiology	85.7	1.4	2.2	8.8	1.7	0.0
Radiation Oncology	73.5	2.7	3.2	17.4	3.2	0.0
Thoracic Surgery	67.2	4.2	5.6	10.5	12.2	0.3
Urological Surgery	82.7	2.8	3.5	8.7	2.2	0.1
Other	88.2	2.0	3.4	5.5	0.9	0.0

Source: American Medical Association, *Physician Characteristics and Distribution in the U.S., 2001-2002 Edition.*

The Komaromy et al. study found that of many possible characteristics of a physician, the best predictor for whether the physician cared for a high percentage of African American patients was whether the physician was African American. After controlling for the proportion of African American residents in the community, this analysis indicated that the proportion of African American patients cared for by African American physicians was 25 percentage points higher than the average proportion of African American patients cared for by physicians of other races. Other

variables, such as the ranking of the physician's medical school, experience, and type of hospital had insignificant effects. The authors suggest that the personal choice of the physician is the most likely explanation for the phenomenon that African American physicians are more likely than non-Hispanic white physicians to treat African American patients. Given that the ranking of the physician's medical school is not significant in predicting the race of the physician's patients, the authors conclude that top African American medical school graduates are themselves choosing to practice in poorer, predominantly minority areas.

A study by Moy and Bartman (1995) found that minority patients were more than 4 times as likely as non-Hispanic white patients to receive care from minority physicians. Moy and Bartman note that any solution that attempts to increase the proportion of minority physicians must also take into account the financial hardships they face. On average, minority physicians tend to treat lower-paying uninsured and Medicaid patients. Moy and Bartman estimate Medicaid fees for physician services as averaging only 47 percent of private insurance fees. Because up to 29 percent of low-income patients are receiving care from minority physicians, these physicians must bear a disproportionately higher share of the financial burden associated with poorer patients. Medicaid insured 45 percent of the patients seen by African American physicians and only 18 percent of patients seen by non-Hispanic white physicians. Hispanic physicians cared for more uninsured patients than physicians of other ethnic groups. On average, 9 percent of their patients were uninsured compared to 6 percent for non-Hispanic white physicians.

Physicians whose clientele is composed of a high percentage of Medicaid and uninsured patients may also have a more difficult time securing managed care contracts. Bindman et al. (1998) studied the frequency of denials or terminations of managed care contracts experienced by primary care physicians. They found that physicians with higher proportions of uninsured patients were 4 times more likely to have a contract terminated or denied. There was also a significant positive correlation between the number of uninsured patients a physician saw and the frequency of denials from managed care contracts for these physicians. Latino physicians had significantly lower odds of having more than 10 percent of their patients enrolled in a managed care plan: 23 percent of Latino physicians in group practice are in no way affiliated with an HMO.

One reason for the imbalance, noted by Mackenzie et al. (1999), might be that solo practices are associated with lower levels of participation in managed care, and minority physicians tend to have solo practice settings. MacKenzie et al., through a survey of physicians who tended to treat managed care patients, found that 56 percent claimed they had difficulty referring patients of varied ethnic backgrounds to specialists who met those patients' cultural needs. The author expresses guarded optimism that as the idea of cultural competency within managed care gains momentum, managed care organizations will become increasingly aware of the importance of 'ethnic matching'. As a result, they may attempt to recruit ethnic minority physicians as a way to attract and retain ethnic minority members.

In 2000, minorities constituted 27 percent of the population age 18-34—the age group that reflects the population entering the workforce. By 2020, minorities will constitute approximately 45 percent of the age 18-34 population. An estimated 15 percent of the population in this age group will be African American, and 30 percent will be Hispanic or a non-African American minority. As minorities constitute a larger portion of the population from which new health workers are drawn, minority representation in the physician workforce will naturally rise. Also, as noted by Libby, Zhou, and Kindig (1997), organizations such as the Bureau of Health Professions, the Institute of Medicine, the Association of American Medical Colleges, and others have made racial/ethnic equity in the physician workforce a high priority.

As shown by Libby et al., however, racial parity in the physician workforce will likely not occur in the next few decades, although some gains in parity will be made. For five race/ethnicity groups, these authors forecast the number of physicians per 100,000 population of the same race or ethnicity as the physician. Their projection model constrains the race-specific physician-to-population ratios to converge over time to an equilibrium of 218 physicians per 100,000 population by adjusting the racial composition of first-year graduate medical education cohorts. The soonest that racial parity is reached, given projected demographics, is around 2040.

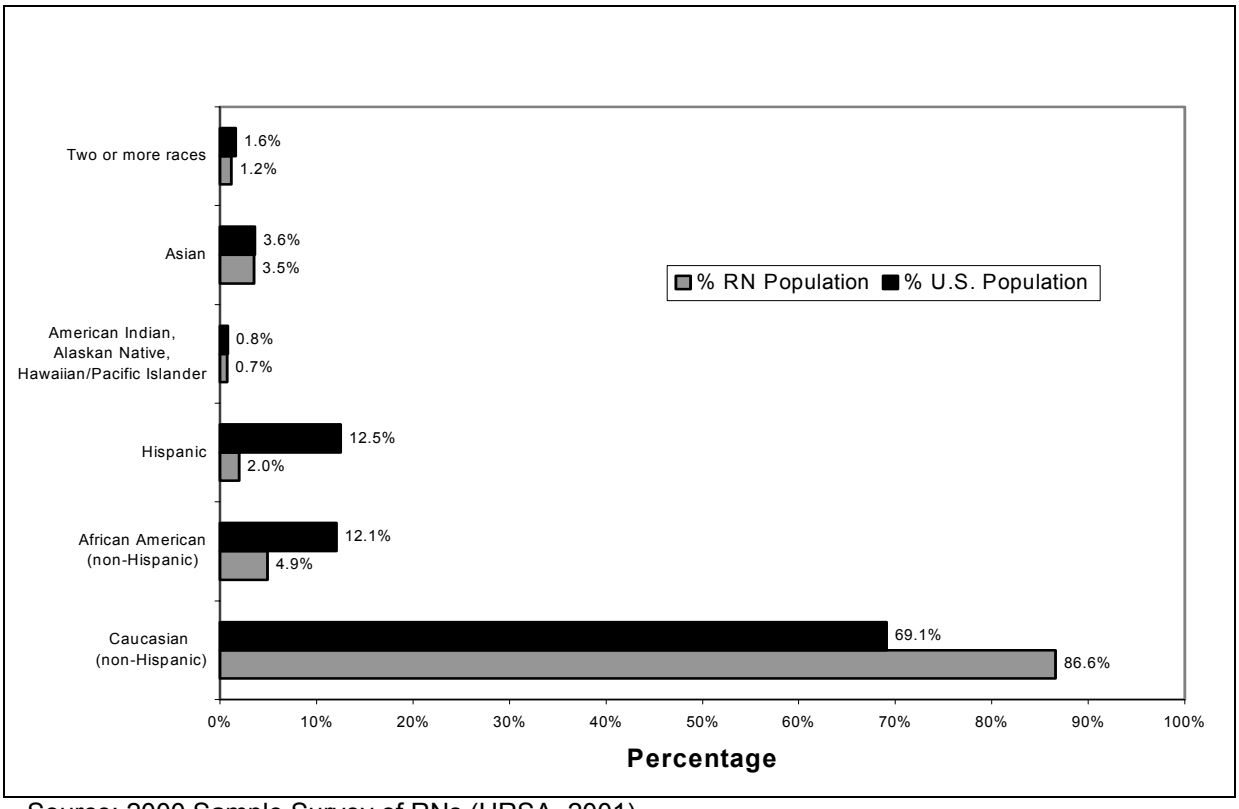
In summary, the literature and changing demographics suggests that increasing minority representation in the physician workforce will improve access to care for minority and vulnerable populations. Minorities face financial obstacles to become physicians, and once they become physicians may face greater financial obstacles than non-minority physicians because of practice

location or other factors. Increased racial/ethnic diversity of the U.S. population over the next few decades will naturally increase minority representation in the physician workforce.

3.3.2 Nurse Supply

Estimates from the 2000 Sample Survey of Registered Nurses (HRSA, 2001) indicate that approximately 86.6 percent of RNs are non-Hispanic white, 4.9 percent are non-Hispanic African American, 3.5 percent are Asian; 2 percent are Hispanic; 0.5 percent are American Indian or Alaskan Native, 0.2 percent are Native Hawaiian or Pacific Islander, and 1.2 percent are of two or more racial backgrounds (see ***Exhibit 3.7***). Among minorities, Hispanics and African Americans are underrepresented in the registered nurse workforce relative to their proportion in the overall population.

Exhibit 3.7 Racial/Ethnic Distribution of the Registered Nurse Workforce in 2000



Source: 2000 Sample Survey of RNs (HRSA, 2001).

The literature on the relationship between race or ethnicity and the supply of nurses is substantially smaller than the corresponding literature for physicians.

Sechrist, Lewis, and Rutledge (1999) report that the nurse workforce in California is becoming more ethnically diverse. Although minorities are underrepresented in the current nurse workforce in California, the racial and ethnic mix of nursing school entrants more closely parallels the diversity of California's population. The authors report that minority students, however, are less likely to graduate from nursing programs than their non-Hispanic white counterparts. The authors make several recommendations to improve ethnic diversity of the nurse workforce including outreach efforts to increase the number of minorities in nursing programs. They cite an unpublished study by Martin-Holland et al. that looks at strategies to improve ethnic diversity in the nurse workforce. Specifically, the study looks at (1) strategies that have been successful in recruiting and retaining ethnically diverse students in nursing programs, (2) barriers to nursing program success for ethnically diverse students, and (3) activities incorporated into nursing programs to improve cultural sensitivity of nursing school graduates.

In 2000, approximately 61 percent of the female population age 18-34—the main source of new nurses—was non-Hispanic white. By 2020, the percentage will have decreased. Only half of all women age 18-34 will be non-Hispanic white; African Americans and all other minorities (including white Hispanics) will constitute 16 percent and 33 percent, respectively, of the female population age 18-34. As minorities constitute a growing proportion of the female population in this group, minority representation in the nurse workforce will naturally rise.

Furthermore, the growing nurse shortage in the U.S. has encouraged some employers to recruit foreign nurses. Recruiting foreign nurses will increase the diversity of the nurse workforce; however, many of the countries exporting nurses to the U.S. may themselves in turn face an inadequate supply of nurses.[9]

[9] See, for example, the Wall Street Journal article: *Shortage of Nurses Hits Hardest Where They Are Needed the Most: Nurse Shortage Shows How Labor Markets Go Global* (Zachary, 2001).

4 GEOGRAPHIC LOCATION OF THE POPULATION

Discussion of the adequacy of the health care workforce is often framed in the context of a maldistribution of workers. An inadequate supply of health workers is often a local or regional phenomenon, frequently accompanied by surpluses elsewhere. Consequently, national forecasts of supply and demand can mask inadequacies of supply at the local level.

Major Findings:

- *Geographic variation in population growth rates and determinants of health worker demand and supply highlight the importance of developing forecasting models that can make State-level and sub-State level forecasts.*
- *Although an increasing proportion of the U.S. population resides in urban areas, a substantial proportion of the population will continue to reside in rural areas. Many of these rural areas are currently designated as physician shortage areas.*
- *Pockets of urban areas will continue to have a high concentration of minorities. Many of these areas are currently designated as physician shortage areas.*

Trends in geographic location of the population that have important implications for the future health care workforce include the following. First, there is substantial variation in population growth and other factors that affect the supply of and demand for health professionals. This phenomenon highlights the importance of models that can forecast at the State and local level.

Second, a significant proportion of the population will continue to reside in rural areas and have less access to health care services than the population residing in urban areas.

Third, some urban areas will continue to have a high concentration of minorities. These areas are often characterized as having fewer economic resources per capita, greater health care needs, and less access to health care services than surrounding areas.

4.1 Population Projections and Regional Growth Patterns

According to the U.S. Census Bureau (Campbell, 1997), all regions of the country will grow over the next 25 years, with the West and the South growing at the fastest rate (***Exhibit 4.1***). As the population continues to rapidly grow in these regions, the demands for health care will also increase.

Exhibit 4.1 Population Projections by Region

Region	Projections by Year (thousands of resident population)						
	1995	2000	2005	2010	2015	2020	2025
Northeast	51,466	52,107	52,767	53,692	54,836	56,103	57,392
Midwest	61,804	63,502	64,825	65,915	67,024	68,114	69,109
South	91,890	97,613	102,788	107,597	112,384	117,060	121,448
West	57,596	61,413	65,603	70,512	75,889	81,465	87,101
Total	262,755	274,634	285,981	297,716	310,133	322,742	335,050

Source: United States Census Bureau (Campbell, 1997).

The uneven regional growth of the population has both short-term and long-term ramifications for the health workforce. Regions of the country that experience rapid growth in population could experience temporary shortages of some health professionals, such as physicians, who might be less mobile than the population at large. Efforts by some localities to recruit specific growth industries—e.g., high-tech industries—without a balanced approach to recruit health professionals could cause a short-term strain on the local health care infrastructure. Areas of the United States that are already experiencing physician shortages and that are high-growth areas might see more severe short-term inadequacies in the health workforce. For example, the Census Bureau estimates that Texas will be one of the fastest growing States over the next 20 years. However, according to the Bureau of Primary Health Care, Texas currently has one of the highest number of physician shortage areas in the country, understandable in view of its size. Not only does this trend appear in Texas, but many smaller southern States also face a combination of high growth and a large number of shortage areas.

Regional differences in physicians per population and nurses per population do not necessarily reflect inadequacies in the health care workforce. As discussed previously, demand for health care services is highly correlated with the age distribution of the population, and there is substantial geographic variation in the age distribution of the population. For example, the proportion of the population age 65 and older is much greater in Florida (18), West Virginia (17) and North Dakota (15) than it is in Alaska (5), Utah (8) and Colorado (9).

In addition, there exists substantial variation in other determinants of demand for health care services such as the characteristics of the health care operating environment, economic conditions, and lifestyle. Douglass (1995) projected the future supply of family physicians on a State-by-State basis and found substantial regional variation in physician supply and needs. One implication of the uneven population growth and geographic variation in the determinants of

supply and demand is the need to develop forecasting models that can forecast at the State or sub-State level.

The NDM forecasts demand for nurses at the State level. Preliminary demand forecasts compared to current and future supply forecasts show substantial variation across States in the adequacy of the nurse workforce—both now and in the future (Dall and Hogan, 2002).

4.2 Evolving Trends in Urbanization

Although the proportion of the U.S. population living in metropolitan areas will continue to grow, a large proportion of the population will continue to live in rural areas. A substantial body of literature describes the inadequacies of the physician workforce in rural areas, and over 65 of the Health Professional Shortage Areas (HPSAs) are in rural areas.

Between 1990 and 2000, the population in metropolitan areas increased by nearly 14 percent, whereas the population in non-metropolitan areas grew by only 10 percent (***Exhibit 4.2***). One reason for this phenomenon is a matter of classifications: geographic regions formerly designated as rural areas are becoming more metropolitan and were re-designated as metropolitan areas. Another reason is immigration: immigrants disproportionately settle in metropolitan areas. A third reason is migration from rural to urban areas, although this effect has been small. The Census Bureau (March 2001) reports that net migration out of rural areas totaled only 137,000 between 1998 and 2000.

The "metropolitanization" of the country could help alleviate the problems of an inadequate supply of physicians in some rural locations as the population in these areas increases above the threshold required to support a more comprehensive health workforce.

Exhibit 4.2 Population Growth by Metropolitan Status and Size

Population Size	Population		Percent Change 1990-2000	2000 share of total
	April 1, 1990	April 1, 2000		
United States	248,709,873	281,421,906	13.2	100.0
Total Metropolitan	198,402,980	225,981,676	13.9	80.3
5 million or greater	75,874,152	84,064,274	10.8	29.9
2 – 5 million	33,717,876	40,398,283	19.8	14.4
1- 2 million	31,483,749	37,055,342	17.7	13.2
250,000 – 1 million	39,871,391	45,076,105	13.1	16.0
250,000 or fewer	17,455,812	19,387,675	11.1	6.9
Non-Metropolitan	50,306,893	55,440,227	10.2	19.7

Source: United States Census Bureau.

A substantial proportion of the population will continue to reside in rural areas during the foreseeable future. When modeling the supply of health professionals in rural and underserved areas, analysts might consider the following obstacles to increasing physician supply in these shortage areas, as reported in the literature.

- Connor, Hillson and Krawelski (1995) suggest that physicians locate in areas with other physicians in order to benefit from the professional synergism that develops when there is an established population of physicians. Similarly, Brasure et al. (1999) found a general aversion to rural practice may exist among urban professionals, but there is less resistance to enter an underserved market once at least one health provider has settled there. Efforts to model the supply of physicians in underserved areas might identify "forerunner" specialties and analyze patterns of physician location.

- Olchanski et al. (1998) found that the average age of physicians in rural areas of Virginia is increasing, raising concerns that physician shortages in these areas will be exacerbated when these physicians retire. Furthermore, he speculates that this phenomenon could be applicable to other parts of rural America.

- Rabinowitz et al. (1999), in a study of rural physicians in Pennsylvania, found that one of the most critical factors in determining whether a physician will practice in a rural environment is the extent of the physician's rural background. Models of physician supply might incorporate an urban/rural dimension that takes into account the propensity of physicians to practice in physician shortage areas based on the background and demographic characteristics of medical students and the existing physician workforce.

A disincentive to physicians choosing to practice in rural settings is lower earnings potential. For heavily-indebted physicians exiting medical school, practicing in suburban areas where there is greater economic activity can be more enticing than practicing in a rural area.

Government and private organizations have implemented various programs and grants to encourage physicians to practice in underserved, rural areas. For example, the State of Illinois, along with the University of Illinois College of Medicine at Rockford, has implemented a program designed to improve the supply of physicians to these areas. According to Stearns et al. (2000), this program has been reasonably successful, with 69 percent of the graduates choosing to enter rural practices. Efforts to model physician supply might incorporate estimates of the impact of programs that try to influence where physicians will practice. Similarly, some States are offering grants to people in nursing programs who agree to work in rural or underserved areas for a specific length of time following graduation.

Some researchers have argued that international medical graduates (IMGs) can be used to augment the physician workforce in underserved areas. Mick et al. (2000, 1999) have shown that the IMGs are more likely than U.S. medical graduates to locate in rural areas with high rates of infant mortality, fewer per capita economic resources, a high proportion of minorities, a disproportionate number of elderly, and low physician-to-population ratios. Baer et al. (1999) found that IMGs were also fulfilling an important role in community health centers. These centers tend to be located in physician shortage areas, so these researchers suggest that the role of IMGs is indispensable in the rural setting. As hospitals in rural areas close, the authors assert that community health center clinics are the most effective way for underserved populations to receive the health care they require and that IMGs help fill a 'safety net' role.

Not all researchers agree that IMGs help alleviate physician shortages in underserved areas. A study conducted by Politzer, Cultice, and Meltzer (1998) found that the geographic distribution of physicians has become less even. The study also argued that IMGs, rather than helping to mitigate this trend, had in fact contributed to its severity. The authors state that the *majority* of IMGs choose not to work in areas with a physician shortage, and that the contributions others note are overstated.

4.3 Urban Demography and the Effects on Physician Locations

Pockets of the population will continue to contain high concentrations of minorities. These pockets, generally located in urban areas, are often characterized by lower average levels of economic resources, greater average health care needs, and less access to health care services. COGME (1998) reports that although there appears to be an oversupply of physicians, most of the oversupply is located in affluent urban and suburban areas. Additionally, specialists are especially prone to locating in more affluent areas. The traditionally poor areas of the city exhibit a unique need, as they are often demographically independent from the more affluent areas in the same region.

One of the most sensitive populations is the immigrant population, especially those with little or no English proficiency. Members of this population tend to locate in areas that traditionally consist of low-income households and are more likely to live in cities than non-metro areas. According to the 2000 census, 5.1 percent of foreigners live in rural areas, compared to 20.7 percent of native-born people. This means that as immigration increases, there may be greater pressure placed on urban community hospitals, which typically serve more non-English speaking people (Gaskin and Hadley, 1999). According to Gaskin and Hadley, these hospitals face a higher level of physician and health care professional shortages, thus degrading the level of care provided to the underserved population. As immigration increases in the near future, this strain placed on the community hospitals may increase.

In addition to the use of IMGs in rural areas, Mick has suggested that they may help relieve shortages in the urban areas as well. According to his study, IMGs tend to locate in less affluent areas within a city and are willing to work for a lower salary. Additionally, as discussed previously, some policy makers advocate increasing the efforts made towards recruiting minorities into the health care professions. They claim that these individuals may be willing to work in shortage areas, as well as being able to overcome some of the language barriers that exist in some of these areas (Trevino 1994, Komarmony et al., 1996).

5 MODELING THE IMPACT OF CHANGING DEMOGRAPHICS ON THE FUTURE DEMAND FOR HEALTH PROFESSIONALS

Efforts to model the impact of changing demographics on the demand for and supply of health professionals incorporate many of the demographics trends discussed above as well as trends in economics, technology, the education system, regulation and legislative activities, the health care operating environment, and the ability to substitute between health professionals. Recent modeling efforts differ in level of sophistication, factors used to forecast future supply and demand, and assumptions made by analysts.

A consensus exists that the supply of physicians and nurses can be predicted with an adequate degree of accuracy even 10 or 20 years into the future (see, for example, Tarlov [1995] and Prescott [2000]). Previous efforts to model the requirements for health workers, on the other hand, have met with mixed success and often with controversy. As discussed above, efforts over the past two decades to model requirements show there is little consensus on how best to define requirements, the relationship between requirements and its determinants, the future values of many of these determinants, and forecasters' assumptions.

There is often disagreement regarding how requirements should be defined. For example, should requirements be defined by an assessment of the population's needs? Should requirements be based on demand and, if so, are current levels of employment accurate measures of demand? Should requirements be defined by benchmarking? For example, one could compare physician staffing levels to a level determined to be "efficient" (e.g., HMO staffing patterns). Alternatively, one could compare physician-per-population levels in the U.S. to levels in other countries. Or, should requirements be defined as some combination of demand, needs, and benchmarking? Despite these concerns and disagreements, supply and demand models are important tools to help analysts and policy makers understand the implications of trends and policies.

This section contains a brief description of two requirements forecasting models recently updated by BHPr—the Physician Aggregate Requirements Model (PARM) and the Nursing Demand Model (NDM)—and presents preliminary forecasts of the impact of changing demographics and other user-defined scenarios on requirements for the health professions in these two models.

Both models define requirements as the number of health workers that the U.S. is likely to demand based on population needs and economic considerations.

Demographics, especially the growth in size of the elderly population, are the driving force behind most projections of future workforce requirements. Future demographics can be extrapolated with some degree of accuracy based on historical patterns of fertility rates, mortality rates and migration. The Census Bureau publishes its middle series projections that extrapolates future population levels based on expected fertility, mortality, and migration patterns. The Census Bureau last updated the series in 1996, and the middle series under-predicted the size of the 2000 population by approximately 6.8 million individuals (or 2.4 percent of the total population). The population projections used in the PARM and NDM are based on the Census Bureau's middle series projections, but incorporate adjustments based on recently released 2000 census data.

5.1 Physician Aggregate Requirements Model

The PARM combines projections of the future demand for health care services, by medical specialty and setting, with estimates of physician productivity to forecast future requirements. ***Exhibit 5.1*** provides an overview of this process. For a more thorough description of the model and its capabilities see *PARM User Guide and Technical Report* (Dall, 2002). To calculate future demand for health care services, the PARM first combines population projections (***Exhibit 5.2***) by six age groups, three race/ethnicity groups, and sex (Box 1 of ***Exhibit 5.1***) with estimates of the proportion of the population in each of three insurance categories (Box 2) to divide the population into 108 categories (Box 3). The six age categories are 0-17, 18-34, 35-54, 55-64, 65-74, and 75 years and older. The three race categories are non-Hispanic white, African American (Hispanic and non-Hispanic), and other (including white Hispanic). The three insurance categories are (1) the insured who receive services in a fee-for-service arrangement, (2) people enrolled in a health maintenance organization (HMO), and (3) the uninsured.

The PARM contains 22 categories of health professionals providing patient care. These categories consist of 19 physician specialties and three non-physician specialties (i.e., physical therapy, podiatry, and optometry). The process to forecast requirements is similar for both physicians and these three non-physician specialties, although the data sources differ.

The workload measures used in the PARM are physician-patient encounters in each of five settings: (1) doctors' offices, (2) hospital outpatient clinics and emergency departments, (3) hospital inpatient (hospital rounds), (4) hospital inpatient (surgery), and (5) other settings (e.g., nursing homes and home health). The PARM multiplies the number of people in each population category by its corresponding estimate of per capita physician-patient encounters (Box 4) to estimate total demand for physician services as measured by physician-patient encounters (Box 5). Estimates of total encounters in each setting (Box 5), multiplied by the average minutes physicians spend per encounter (Box 6), creates an estimate of total physician minutes required to provide patient care (Box 7). Note that the minutes per encounter include an adjustment for indirect patient care to capture time spent on tasks such as completing paperwork and reviewing patient histories.

Total required minutes (Box 7), divided by estimates of total annual patient care minutes per physician in each specialty (Box 8), creates forecasts of total physician requirements for patient care activities (Box 9). The data on physician-patient encounters and physician productivity come from the AMA annual survey and thus only include MDs. Consequently, an adjustment is made to the physician requirement counts to include DOs (Box 10). Data on the number of DOs in 1999, by specialty, come from the American Osteopathic Association. These numbers are inflated, using recent growth rates by DO specialty, to update the numbers to the base year of 2000. In addition, requirements for physicians in non-patient care activities (e.g., administration, teaching, and research) are calculated as a fixed percentage of physicians in patient care. Calibration adjustments are made to equate base year forecasts of actual physician supply with base year estimates of total requirements (Box 11), and this produces the refined forecasts of requirements for the 22 original specialties plus a category for physicians in nonpatient care activities. The base year for total MD counts is 2000.[10] The shaded boxes (i.e., boxes 2, 4, and 6) indicate areas of the PARM where the user can easily change the forecasting assumptions.

[10] The base year counts of MDs come from the AMA's *Physician Characteristics and Distribution in the US: 2002-2003 Edition*. Active MDs whose specialty is unknown are distributed across the other specialties based on those specialties' proportion of total active physicians.

Exhibit 5.1 PARM Structure

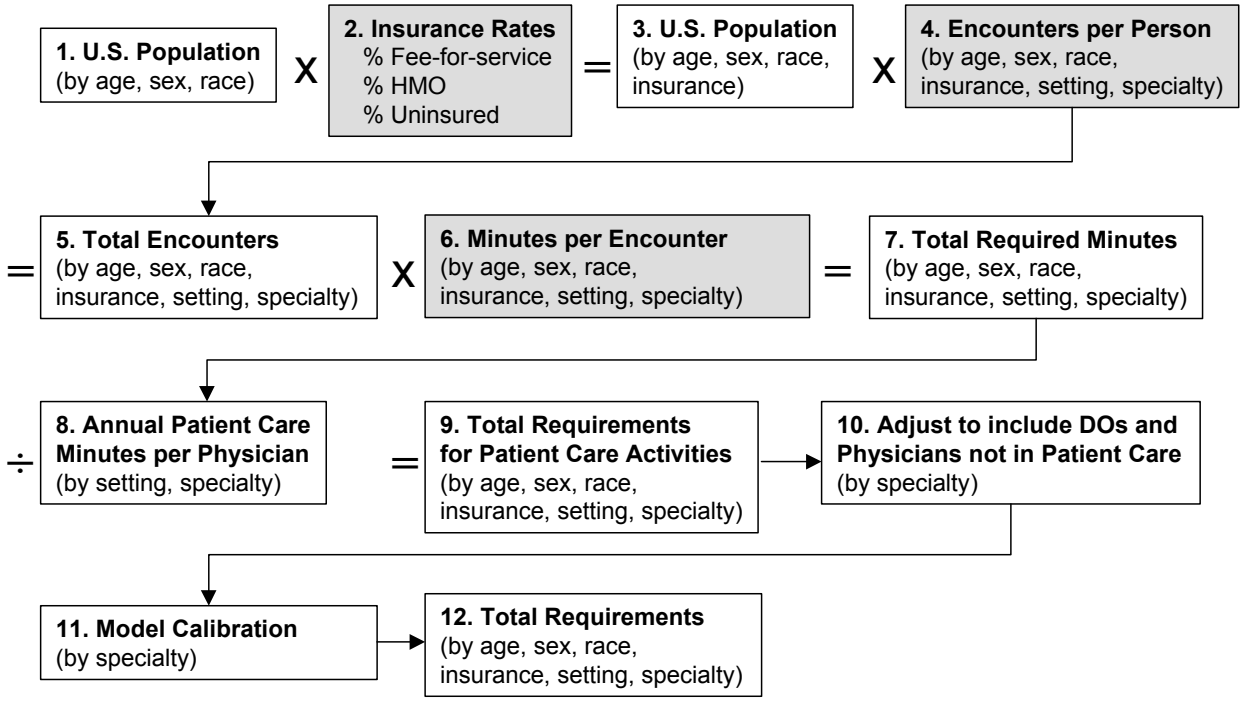


Exhibit 5.2 U.S. Population Forecasts (in thousands)

Race	Sex	Age	Year					
			1999	2000	2005	2010	2015	2020
Non-Hispanic White	Men	0-17	22,737	22,628	22,042	21,315	21,067	21,143
		18-34	21,373	21,223	21,069	21,375	21,641	21,174
		35-54	29,670	29,974	29,654	27,994	25,887	24,596
		55-64	9,027	9,231	11,341	13,104	14,371	14,675
		65-74	6,871	6,846	6,894	7,854	9,817	11,599
		75+	5,141	5,255	5,686	6,019	6,367	7,341
	Men Total		94,818	95,158	96,685	97,661	99,150	100,528
	Women	0-17	21,501	21,399	20,851	20,152	19,902	19,965
		18-34	21,003	20,842	20,597	20,842	21,116	20,672
		35-54	29,896	30,214	29,996	28,385	26,258	24,909
		55-64	9,594	9,796	11,931	13,730	14,967	15,241
		65-74	8,233	8,132	7,919	8,789	10,750	12,485
		75+	8,887	9,011	9,352	9,318	9,395	10,184
	Women Total		99,113	99,395	100,646	101,216	102,389	103,456
Non-Hispanic White Total			193,931	194,553	197,332	198,877	201,539	203,984
African American	Men	0-17	5,483	5,532	5,799	5,987	6,282	6,619
		18-34	4,305	4,319	4,474	4,765	5,052	5,276
		35-54	4,374	4,483	4,768	4,747	4,697	4,722
		55-64	1,029	1,057	1,317	1,637	1,969	2,149
		65-74	660	666	707	864	1,096	1,404
		75+	400	408	450	473	517	594
	Men Total		16,252	16,465	17,515	18,472	19,613	20,763
	Women	0-17	5,310	5,354	5,593	5,754	6,017	6,322
		18-34	4,643	4,653	4,800	5,053	5,338	5,566
		35-54	4,999	5,125	5,477	5,626	5,582	5,602
		55-64	1,277	1,313	1,634	2,102	2,512	2,735
		65-74	937	947	1,009	1,136	1,423	1,802
		75+	791	802	864	876	949	1,071
	Women Total		17,957	18,193	19,376	20,547	21,821	23,096
African American Total			34,209	34,658	36,892	39,020	41,434	43,859
Other (including Hispanic White)	Men	0-17	8,676	8,899	10,050	11,092	12,317	13,752
		18-34	8,340	8,453	9,160	9,063	10,324	11,398
		35-54	6,221	6,488	7,627	10,078	10,741	11,450
		55-64	1,298	1,357	1,786	2,408	3,051	3,710
		65-74	761	791	945	1,224	1,608	2,111
		75+	418	443	585	764	963	1,226
	Men Total		25,713	26,431	30,153	34,630	39,004	43,647
	Women	0-17	8,269	8,482	9,577	10,570	11,739	13,100
		18-34	7,390	7,546	8,439	9,077	10,303	11,348
		35-54	6,288	6,543	7,618	9,524	10,354	11,259
		55-64	1,452	1,520	2,015	2,709	3,339	3,943
		65-74	976	1,009	1,176	1,486	1,941	2,495
		75+	642	681	901	1,182	1,455	1,810
	Women Total		25,017	25,780	29,725	34,549	39,130	43,955
Other Total			50,730	52,211	59,877	69,179	78,134	87,602
Total U.S. Population			**278,870**	**281,422**	**294,100**	**307,075**	**321,107**	**335,444**

Source: Modified version of Census Bureau middle series projections.

The base year for the PARM is 2000; however, data from 1996 to 2000 are pooled from some health care use databases to increase sample size. Data from the 1999 National Health Interview Survey (NHIS) are used to estimate the proportion of people in each demographic category among three possible insurance status groups.

5.1.1 Modeling Physician Requirements

To estimate per capita demand for physician services from each of the 108 population groups in the PARM, we first estimated the total amount of care that physicians in each specialty provide in each setting. We estimated these totals using AMA estimates for 1999 of the total number of MDs in each medical specialty primarily engaged in patient care, and data from the 1998 and 1999 AMA physician surveys that asked respondents the average number of weeks worked per year and average encounters (i.e., visits or surgical procedures) per week with patients. These data come from the 1999-2000 and 2000-2002 editions of the *Physician Socioeconomic Statistics*. Published statistics from the 1998 and 1999 surveys were averaged because sample sizes for some specialties are relatively small.

We used the following databases to determine the distribution of total patient-physician encounters across the 108 population subgroups:

- The 1997, 1998, and 1999 National Ambulatory Medical Care Survey (NAMCS) databases were pooled to analyze patient-physician encounters in physicians' offices.
- The 1997, 1998 and 1999 National Hospital Ambulatory Care Survey (NHAMCS) databases were pooled to analyze patient-physician encounters in hospital outpatient and emergency department settings.
- The 1997 and 1998 Health Care Cost and Utilization Project (HCUP) databases were pooled to analyze patient-physician encounters in hospital inpatient settings.
- The 1996 and 1998 National Home and Hospice Care Survey (NHHCS) databases were pooled to analyze patient-physician encounters in patients' homes.

As illustrated in ***Exhibit 5.1***, we combine information on per capita demand for physician services obtained from an analysis of these databases with population forecasts and estimates of annual physician time spent in patient care to forecast future requirements for physicians.

Below we present forecasts of physical requirements under five scenarios. We selected these scenarios based on policies being advocated in the political arena and scenarios looked at in previous modeling efforts. In all of these scenarios, changing demographics—and in particular the aging of the population—are a major determinant of the projected increase in physician requirements between 2000 and 2020. Comparing the forecasts from a particular scenario to the forecasts from scenario 1 (which represents the status quo) indicates the impact upon physician requirements attributed to changing demographics and/or changes in forecasting assumptions.

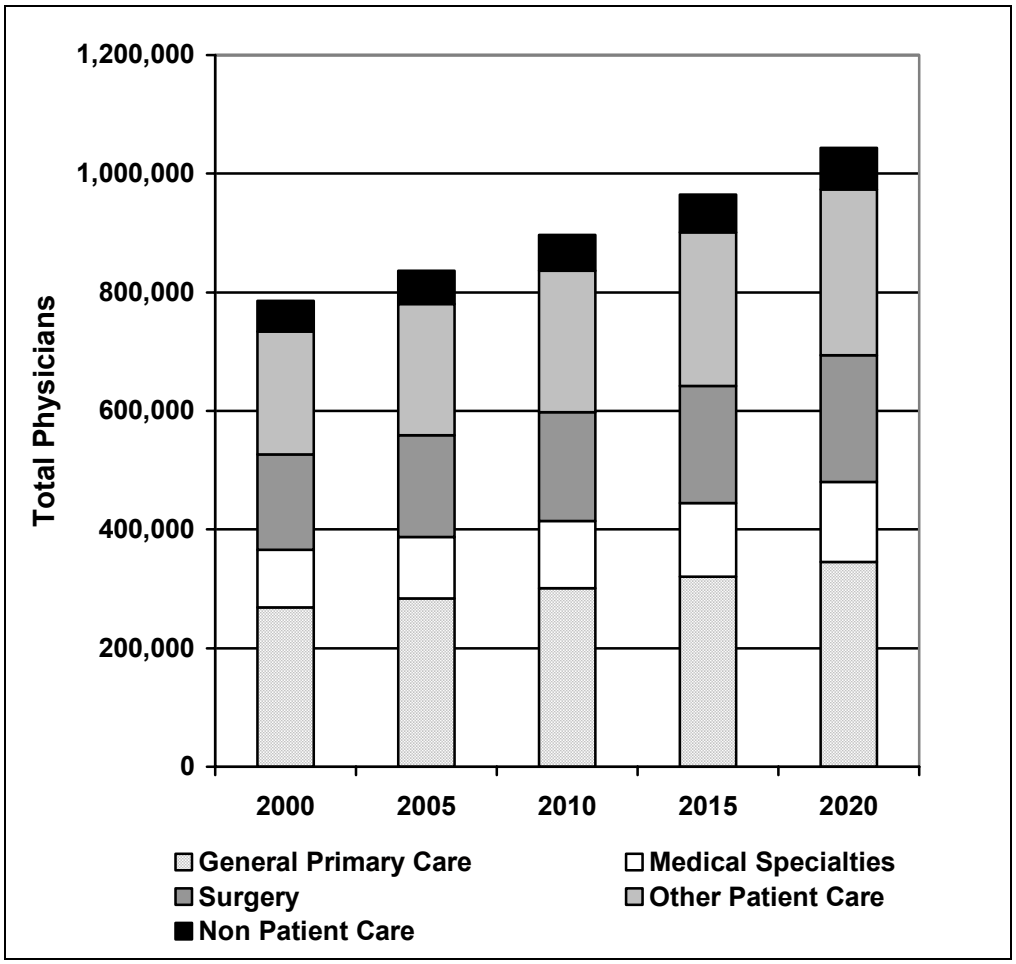
- Scenario 1, the s*tatus quo*, assumes that patterns of health care use, insurance distribution, physician staffing, and physician productivity remain constant over time similar to the patterns that existed in the late 1990s.[11] Under this scenario, the number of physicians would increase from approximately 781,300 in 2000 to 1,038,200 in 2020, a 33 percent increase (***Exhibits 5.3*** and ***5.4***). At the same time, the U.S. population would increase by 19 percent, so that the ratio of physician per population would rise from 2.8 per thousand population in 2000 to 3.1 per thousand population in 2020. Medical specialties experiencing the largest percentage increases in demand between 2000 and 2020 are cardiovascular diseases (52 percent), radiology (51 percent), pathology (44 percent) and various surgical specialties (44 percent). Medical specialties experiencing the smallest percentage increases in demand are pediatrics (11 percent), obstetrics/gynecology (14 percent) and psychiatry (22 percent).

[11] As discussed above, the PARM assumes that an adequate supply of physicians existed in the base year (i.e., 2000). An over (or under) supply of physicians in the base year will result in an over (or under) estimate of requirements in future years. Patterns of health care use cover the period 1996 to 1999.

Exhibit 5.3 Impact of Changing Demographics on Requirements for Physicians: Status Quo Scenario

Medical Specialty	2000	2005	2010	2015	2020	% Change 2000 to 2020
Total Physicians (MDs and DOs)	**781,282**	**831,447**	**891,687**	**959,996**	**1,038,234**	**33**
Total Patient Care Physicians	**733,342**	**780,266**	**836,594**	**900,574**	**973,840**	**33**
General Primary Care	**268,710**	**283,632**	**300,651**	**320,992**	**344,907**	**28**
GP & FP	109,571	115,583	122,512	130,358	139,252	27
General Internal Med.	106,411	114,197	123,645	134,406	146,885	38
Pediatrics	52,728	53,852	54,494	56,228	58,770	11
Medical Specialties	**96,926**	**104,145**	**113,200**	**123,560**	**135,331**	**40**
IM Subspecialties	40,205	43,336	47,301	51,841	56,955	42
Cardiovascular Diseases	20,828	22,675	25,143	28,172	31,690	52
Other Medical Specialties	35,893	38,133	40,756	43,548	46,687	30
Surgery	**161,160**	**171,133**	**183,519**	**197,706**	**213,196**	**32**
General Surgery	37,604	40,605	44,473	48,805	53,641	43
Obstetrics/Gynecology	43,068	44,547	46,168	47,802	48,962	14
Otolaryngology	9,839	10,326	10,877	11,520	12,248	24
Orthopedic Surgery	23,225	24,804	26,736	28,965	31,596	36
Urology	10,690	11,455	12,448	13,696	15,122	41
Ophthalmology	18,876	20,099	21,650	23,643	25,972	38
Other Surgical Specialties	17,858	19,296	21,167	23,276	25,655	44
Other Patient Care	**206,545**	**221,355**	**239,224**	**258,315**	**280,405**	**36**
Psychiatry	44,495	46,877	49,340	51,537	54,116	22
Anesthesiology	36,762	39,547	43,188	47,499	52,493	43
Emergency Medicine	23,494	24,813	26,206	27,802	29,505	26
Radiology	30,354	33,218	36,919	41,005	45,855	51
Pathology	16,757	18,229	20,174	22,019	24,167	44
Other Specialties	54,683	58,672	63,398	68,453	74,270	36
Non Patient Care	**47,940**	**51,182**	**55,093**	**59,422**	**64,394**	**34**
Total U.S. Population (Thousands)	**281,422**	**294,100**	**307,075**	**321,107**	**335,444**	**19**

Exhibit 5.4 Forecasts of Physician Requirements Under the *Status Quo* Scenario



- Scenario 2, *baseline*, produces the requirements forecasts that are most likely to occur based on projected trends in managed care growth and the shifting of care from higher cost to lower cost settings. This scenario is comparable to the baseline scenario in the NDM, described later in Section 5.2, which assumes that HMO enrollment rates will increase by half a percentage point per year between 2000 and 2020 (with the gains in HMO enrollment coming from the population insured under a fee-for-service arrangement). In addition, this scenario assumes that each year, 2 of inpatient-based surgeries will shift to an outpatient setting. Regression analyses conducted to update the NDM find that for each 1 increase in the proportion of hospital-based surgeries performed on an outpatient basis, demand for inpatient days at acute care hospitals will decline by 0.47, outpatient visits will increase by 0.66, and home health visits will increase by 0.86. Using this information, the baseline scenario assumes a gradual decrease in per capita demand for inpatient days and surgery performed on

an inpatient basis, and a gradual increase in outpatient visits and "other" visits. ***Exhibit 5.5*** presents the forecasts for this scenario. Under this scenario, total requirements for physicians would increase by 28 percent between 2000 and 2020 to 996,400. Compared to the status quo scenario, there would be the same level of growth in general primary care specialties (28 percent), but slower growth in medical specialties (33 percent versus 40 percent), surgical specialties (17 percent versus 32 percent), and "other" patient care specialties (32 percent versus 36 percent).

Exhibit 5.5 Impact of Changing Demographics on Requirements for Physicians: Baseline Scenario

Specialty	2000	2005	2010	2015	2020	% Change 2000 to 2020
Total Physicians (MDs and DOs)	**781,282**	**823,465**	**874,019**	**931,208**	**996,387**	**28**
Total Patient Care Physicians	**733,342**	**772,936**	**820,389**	**874,069**	**935,248**	**28**
General Primary Care	**268,710**	**284,113**	**301,283**	**321,556**	**345,039**	**28**
GP & FP	109,571	115,576	122,428	130,168	138,846	27
General Internal Med.	106,411	114,438	123,929	134,583	146,730	38
Pediatrics	52,728	54,099	54,926	56,806	59,463	13
Medical Specialties	**96,926**	**102,850**	**110,381**	**119,005**	**128,730**	**33**
IM Subspecialties	40,205	42,759	46,041	49,799	53,993	34
Cardiovascular Diseases	20,828	22,235	24,192	26,629	29,440	41
Other Medical Specialties	35,893	37,856	40,149	42,577	45,297	26
Surgery	**161,160**	**165,957**	**172,525**	**180,173**	**188,291**	**17**
General Surgery	37,604	38,974	40,943	43,086	45,378	21
Obstetrics/Gynecology	43,068	43,721	44,495	45,260	45,567	6
Otolaryngology	9,839	10,003	10,214	10,498	10,847	10
Orthopedic Surgery	23,225	23,995	25,001	26,169	27,547	19
Urology	10,690	11,115	11,737	12,567	13,511	26
Ophthalmology	18,876	19,746	20,915	22,491	24,378	29
Other Surgical Specialties	17,858	18,402	19,219	20,102	21,064	18
Other Patient Care	**206,545**	**220,016**	**236,199**	**253,334**	**273,187**	**32**
Psychiatry	44,495	46,925	49,329	51,398	53,782	21
Anesthesiology	36,762	39,547	43,188	47,499	52,493	43
Emergency Medicine	23,494	24,285	25,103	26,079	27,122	15
Radiology	30,354	33,218	36,919	41,005	45,855	51
Pathology	16,757	18,229	20,174	22,019	24,167	44
Other Specialties	54,683	57,812	61,487	65,333	69,768	28
Non Patient Care	47,940	50,528	53,630	57,140	61,139	28
Total U.S. Population (Thousands)	**281,422**	**294,100**	**307,075**	**321,107**	**335,444**	**19**

- Scenario 3, *universal health care coverage*, assumes that the entire U.S. population has medical insurance. Under this scenario, the PARM moves a portion of the uninsured population into the insured fee-for-service and HMO settings based on the current proportion of the insured population in each of those two settings. The primary motivation for this scenario is that some advocates for the uninsured would like to see the Government sponsor more initiatives to cover the uninsured. Under this scenario, total demand for physicians would have been an estimated 817,615 in 2000, and would increase to an estimated 1,092,400 in 2020—a 40 percent increase from current (2000) baseline and/or status quo levels (***Exhibits 5.6, 5.7,*** and ***5.8***). (It should be noted that under the status quo scenario, although substantially short of universal coverage, the percentage of population with medical insurance will rise over time as the population ages and a larger proportion of the population becomes Medicare-eligible.)

- Scenario 4 is *universal health care coverage with 100 of the population enrolled in a health maintenance organization.* The motivation for this scenario is work performed by Weiner (1994) and others on requirements for physicians under a managed care environment. Under this scenario, total physician requirements would have been an estimated 781,900 in 2000 and would increase to 1,059,900 in 2020—a 36 percent increase from current levels (***Exhibits 5.6, 5.7,*** and ***5.8***).

- Scenario 5, n*on-minority rates*, assumes that minorities have similar rates of medical insurance coverage as non-Hispanic whites within each demographic group defined by age and sex. Under this scenario the percentage of the population uninsured, insured under a fee-for-service arrangement, and in an HMO applicable to non-Hispanic whites is applied to the other two race/ethnicity groups. The motivation for this scenario is equality across racial and ethnic groups in access to medical coverage. Under this scenario, demand for physicians would have been an estimated 802,400 in 2000, increasing to 1,072,000 in 2020—a 37 percent increase from current levels (***Exhibits 5.6, 5.7,*** and ***5.8***).

Exhibit 5.6 Forecasted Physician Requirements Under Five Scenarios

Specialty	Scenario 1: Status Quo		Scenario 2: Baseline		Scenario 3: Universal Coverage		Scenario 4: 100HMO		Scenario 5: Non-minority Rates	
	2000	2020	2000	2020	2000	2020	2000	2020	2000	2020
Total Physicians (MDs and DOs)	**781,282**	**1,038,234**	**781,282**	**996,387**	**817,615**	**1,092,381**	**781,889**	**1,059,907**	**802,356**	**1,072,048**
Total Patient Care Physicians	**733,342**	**973,840**	**733,342**	**935,248**	**767,420**	**1,024,551**	**735,131**	**995,794**	**753,007**	**1,005,383**
General Primary Care	**268,710**	**344,907**	**268,710**	**345,039**	**281,421**	**362,692**	**294,546**	**384,349**	**275,137**	**355,105**
GP & FP	109,571	139,252	109,571	138,846	112,652	143,979	107,348	139,754	111,543	142,514
General Internal Med.	106,411	146,885	106,411	146,730	112,347	154,794	121,979	170,451	108,661	150,594
Pediatrics	52,728	58,770	52,728	59,463	56,422	63,919	65,219	74,145	54,933	61,997
Medical Specialties	**96,926**	**135,331**	**96,926**	**128,730**	**101,452**	**141,911**	**101,499**	**144,317**	**99,016**	**138,814**
IM Subspecialties	40,205	56,955	40,205	53,993	42,540	60,263	41,819	59,922	41,176	58,572
Cardiovascular Diseases	20,828	31,690	20,828	29,440	21,549	32,742	21,130	32,944	21,110	32,183
Other Medical Specialties	35,893	46,687	35,893	45,297	37,364	48,906	38,550	51,450	36,729	48,058
Surgery	**161,160**	**213,196**	**161,160**	**188,291**	**170,919**	**226,585**	**161,462**	**218,836**	**165,223**	**219,711**
General Surgery	37,604	53,641	37,604	45,378	39,463	56,421	37,187	54,102	38,479	55,185
Obstetrics/Gynecology	43,068	48,962	43,068	45,567	48,880	56,185	44,818	51,627	44,939	51,730
Otolaryngology	9,839	12,248	9,839	10,847	10,294	12,856	7,985	10,281	10,035	12,557
Orthopedic Surgery	23,225	31,596	23,225	27,547	24,741	33,604	22,066	30,884	23,803	32,534
Urology	10,690	15,122	10,690	13,511	11,175	15,755	11,236	16,260	10,824	15,341
Ophthalmology	18,876	25,972	18,876	24,378	18,704	25,915	20,194	28,701	19,034	26,254
Other Surgical Specialties	17,858	25,655	17,858	21,064	17,663	25,850	17,977	26,980	18,110	26,110
Other Patient Care	**206,545**	**280,405**	**206,545**	**273,187**	**213,627**	**293,363**	**177,624**	**248,293**	**213,631**	**291,753**
Psychiatry	44,495	54,116	44,495	53,782	42,133	52,752	31,961	38,129	45,871	56,328
Anesthesiology	36,762	52,493	36,762	52,493	38,804	55,424	38,804	55,423	37,528	53,781
Emergency Medicine	23,494	29,505	23,494	27,122	23,606	30,114	13,086	17,918	24,378	30,766
Radiology	30,354	45,855	30,354	45,855	32,865	49,649	32,865	49,649	31,543	47,822
Pathology	16,757	24,167	16,757	24,167	17,989	26,011	17,989	26,011	17,290	25,087
Other Specialties	54,683	74,270	54,683	69,768	58,230	79,413	42,918	61,163	57,021	77,970
Non Patient Care	**47,940**	**64,394**	**47,940**	**61,139**	**50,195**	**67,830**	**46,759**	**64,113**	**49,349**	**66,665**

Exhibit 5.7 Forecasts of Physician Requirements in 2000 Under Alternative Scenarios

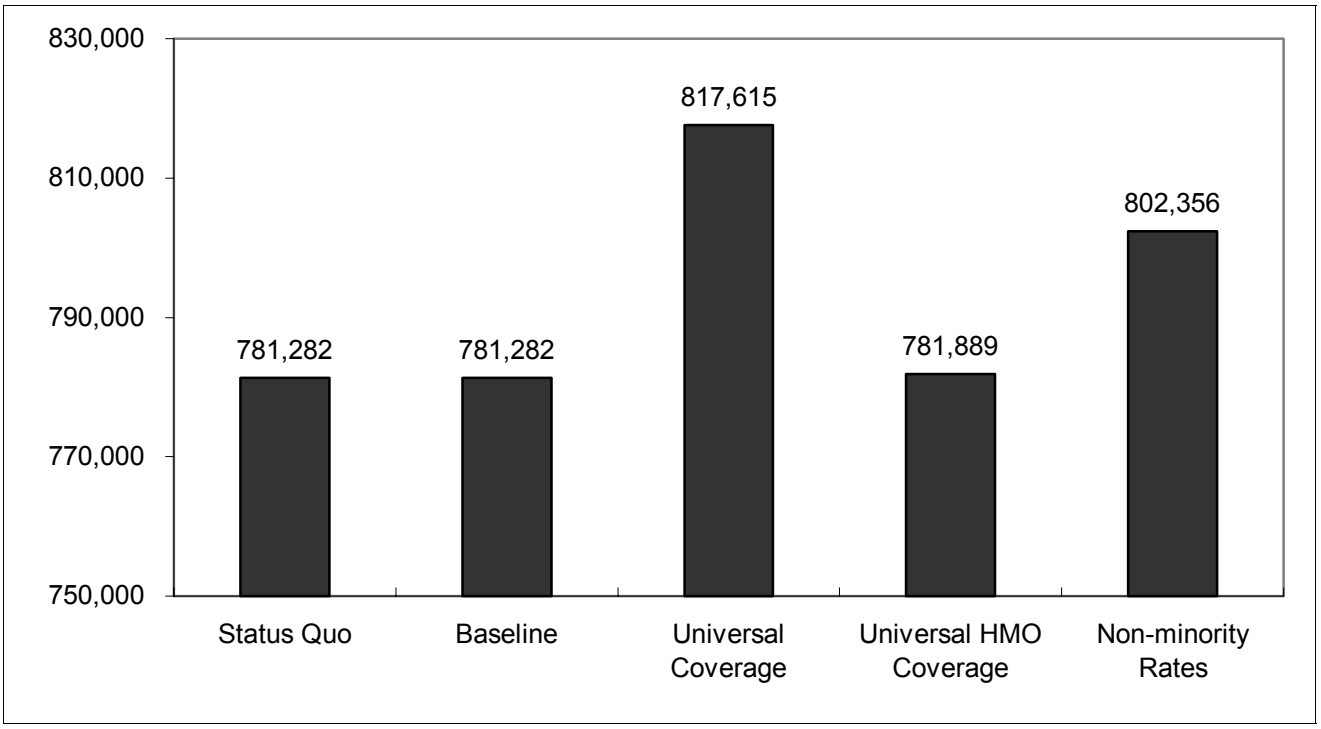
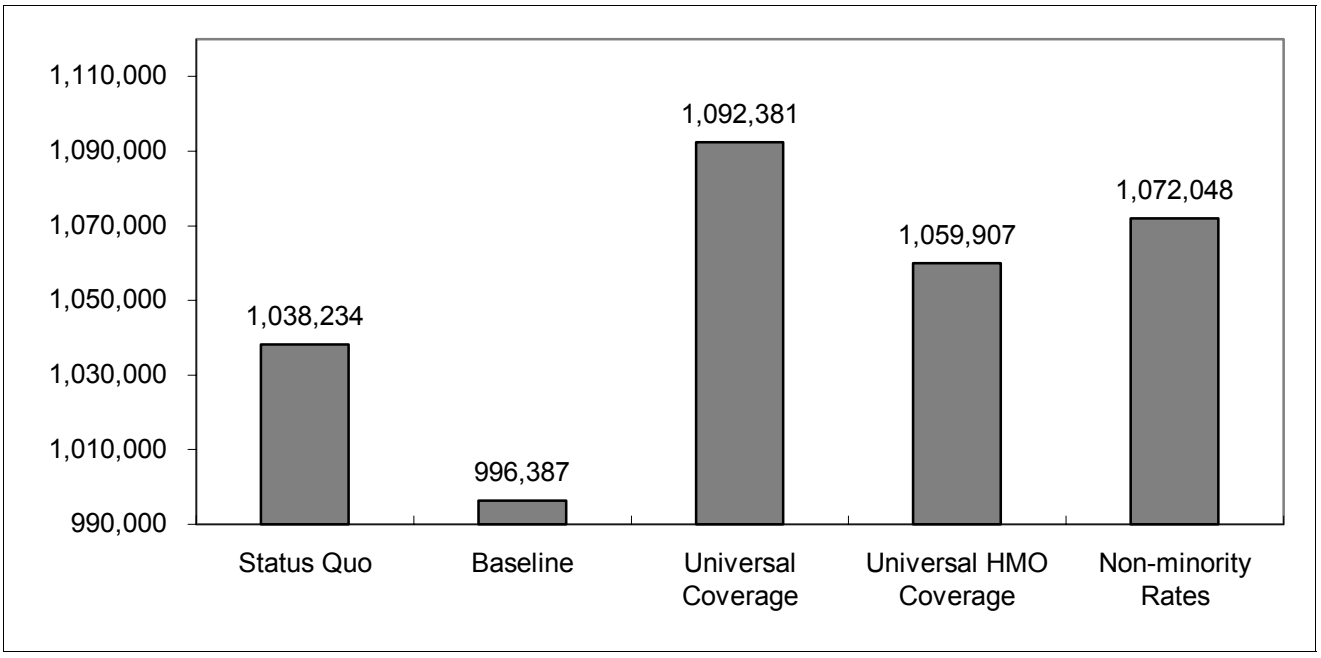


Exhibit 5.8 Forecasts of Total Physician Requirements in 2020 Under Alternative Scenarios



5.1.2 Modeling Requirements for Physical Therapists, Optometrists, and Podiatrists

The PARM also models requirements for physical therapists, optometrists, and podiatrists. These three specialties are modeled using the same approach as physicians, but rely on different data sources. The following data sources are used to model demand for physical therapists:

- Data from the 2000 Occupational Employment Statistics (OES), which are published by the Bureau of Labor Statistics (BLS), provide information on the total number of physical therapists in 2000. In addition, the BLS reports the total hours per week worked, and weeks per year worked, on average, for physical therapists:

- The American Physical Therapy Association estimates that physical therapists spend approximately 13.9 percent of their time in inpatient settings (Vector Research Inc., 1997). Multiplying this percentage by the estimate of the total number of physical therapists as published by the BLS produced an estimate of the number of FTE physician therapists working in inpatient settings.

- An analysis of the 1996 Medical Expenditure Panel Survey (MEPS) provided additional information on the distribution of visits with physical therapists by delivery setting, but the sample sizes were insufficient to estimate the distribution of visits across the 108 population groups in the PARM. Consequently, we pooled data from the 1998, 1999, and 2000 NHIS on people who reported a visit with a physical therapist to distribute our estimate of total physical therapist visits across the 108 population groups.[12]

The following data sources and steps describe the approach used to forecast requirements for optometrists:

- A major source of data on optometrists is a paper by White, Doksum and White (2000) entitled "Workforce Projections for Optometry." These authors analyzed survey data and report

[12] To estimate the distribution of visits to physical therapists, we analyzed the demographics and insurance status of NHIS survey participants who responded in the affirmative to the question of whether during the past 12 months they had seen or talked to any one of the following health workers: physical therapists, speech therapists, respiratory therapists, audiologists, or occupational therapists.

information on the current size of the optometrist workforce, patient encounters and associated time requirements, and demographic characteristics of patients. In addition, these analysts provide estimates of the total hours per week worked in patient and non-patient care.

- One important data item not included in the White et al. paper was a breakdown of the hours spent by optometrists in different patient care settings. An examination of the 1998 BMAD (Part-B Medicare Annual Data) beneficiary file, which provides information on Medicare Part-B carriers, provided some information on the distribution of patients by practice setting. Although Medicare patients make up only a small percentage of total visits to optometrists, we used the distribution of practice setting from optometrists who saw Medicare patients to approximate the overall distribution of optometrists' time by delivery setting. This was a less than perfect remedy, but it does not alter the accuracy of the forecasts except with regard to practice setting. This is because the data on the actual productivity of the optometrists, which is based on minutes per visit and total patient care hours worked, comes directly from the White et al. survey. Productivity is assumed equal among all practice settings.

- Although the White et al. paper provides information on patient demographics, the information is insufficient to distribute total visits across the 108 population groups in the PARM. Like the analysis for physical therapists, we pooled data from the 1998, 1999, and 2000 NHIS on people who reported a visit to an eye doctor (including optometrists and ophthalmologists) to distribute our estimate of total optometrist visits across the 108 population groups.

We used a similar approach to estimate base year visits to podiatrists and then extrapolate future requirements for podiatrists.

- The American Podiatric Medical Association (APMA) provides data on total visits to podiatrists per year, as well as the total number of FTE podiatrists in the current workforce.[13] APMA also publishes data indicating the hours per week, weeks per year, and visits per week of the typical podiatrist.

[13] American Podiatric Medical Association, http://www.apma.org/faqgeneral.html.

- To distribute total visits across the 108 population groups in the PARM, we pooled data from the 1998, 1999, and 2000 NHIS on people who reported a visit to a foot doctor.

- Finally, to create a distribution of visits over practice settings, BMAD Medicare data were analyzed in a similar fashion to that used for optometrists. The totality of these data sources proved sufficient to create baseline estimates for podiatrist visits by demographic group, and the order of the procedures undertaken was analogous to that used for optometrists.

Exhibit 5.9 shows the requirements projected for these three professions. In 2000, there were an estimated 120,410 physical therapists, 30,468 optometrists, and 13,320 podiatrists. Under the *status quo* scenario, the number of physical therapists, optometrists, and podiatrists will increase by 18 percent, 20 percent, and 28 percent, respectively, between 2000 and 2020. ***Exhibit 5.10*** shows the projected requirements under the five scenarios described previously.

Exhibit 5.9 Impact of Changing Demographics on Requirements for Physical Therapists, Optometrists, and Podiatrists

Profession	2000	2005	2010	2015	2020	% Change 2000 to 2020
Physical Therapy	120,410	125,476	130,636	136,235	142,065	18
Optometry	30,468	31,825	33,270	34,900	36,576	20
Podiatry	13,320	14,066	14,916	15,910	17,030	28
Total U.S. Population (Thousands)	**281,422**	**294,100**	**307,075**	**321,107**	**335,444**	**19**

Exhibit 5.10 Forecasted Requirements for Physical Therapists, Optometrists, and Podiatrists Under Alternative Scenarios

Scenario	Physical Therapy		Optometry		Podiatry	
	2000	2020	2000	2020	2000	2020
1: Status Quo	120,410	142,065	30,468	36,576	13,320	17,030
2: Baseline	120,410	165,360	30,468	39,326	13,320	18,410
3: Universal Coverage	126,163	149,291	32,233	38,735	14,034	17,935
4: 100HMO	137,111	171,790	36,793	46,781	17,258	23,297
5: Non-minority Rates	122,301	145,128	30,925	37,286	13,536	17,391

5.2 Nursing Demand Model

The Nursing Demand Model forecasts demand for RNs, LPNs and nurse aides by delivery setting and State through 2020 based on projected changes in demographics and other factors that affect patterns of health care use and nurse staffing. Below is a brief description of the recently revised NDM and preliminary forecasts that show the impact of changing demographics and other determinants on nurse demand. For a more detailed description of the NDM, the data used in the NDM, the assumptions that go into the model and the forecasts, see *The Nursing Demand Model: Development and Baseline Forecasts* (Dall and Hogan, 2002).

The NDM uses an eclectic approach to forecast demand that combines empirical analysis with input from health care experts regarding how the health care system operates and the role of nurses in the delivery of care. The purpose of the model is to forecast future demand for health care services in different delivery settings, and then to forecast the number of FTE RNs, LPNs, and nurse aides in each setting to meet the projected demand for nursing services. The NDM forecasts demand for nurses at the State level and then aggregates these numbers to obtain a national estimate. The NDM seeks to answer four questions:

1. What will be the future health care demands of the population?
2. Where will patients receive health care services?
3. What level of nursing services will patients require?
4. Who will provide these nursing services?

Exhibit 5.11 visually depicts how the NDM combines input databases and forecasting equations to answer these four questions. The NDM contains two major components: (1) the data and equations to forecast future demand for health care services, and (2) the data and equations to forecast future nurse staffing patterns.

Modeling Demand for Health Care

The following steps produce forecasts for inpatient days in short-term (ST) and long-term (LT) hospitals, outpatient and emergency department visits in ST hospitals, nursing facility residents, and home health visits:

- Step 1, combine State-level population forecasts with national estimates of per capita health care utilization to extrapolate expected demand for health care services. For each of the six health care delivery settings modeled, there are 32 per capita utilization rates applied to 32 population strata divided into eight age categories, by sex, and by urban or rural location. The eight age categories are ages 0-4, 5-17, 18-24, 25-44, 45-64, 65-74, 75-84, and 85 and older. Then, apply per capita utilization rates from the base year (1996) to extrapolate demand for health care services. Demand is measured in terms of inpatient days, outpatient visits, and emergency department visits in hospitals; home health visits; and nursing facility residents. This first step controls for variation across States and over time in demographics.

- Step 2, adjust up or down these initial extrapolations of health care demand in each State and year based on projected changes in the health care operating environment, economic conditions, and the overall health of the population. This step creates a more refined forecast of future demand for health care services. The relationship between demand for health care and its determinants (e.g., HMO enrollment rates, changes in technology), after controlling for demographics, was estimated using multiple regression analysis.

- Step 3, calibrate the model by calculating multiplicative adjustment factors that equate base-year forecasts of health care demand with the base-year estimates of actual demand, and then apply these State-level adjustment factors to the forecasts.

Modeling Nurse Staffing Intensity

The following steps produce forecasts of staffing intensity measured in terms of FTE nurses per inpatient day, per visit, per nursing facility resident, or per population depending on the nurse type and setting modeled.

- Step 1, apply the projections of future health care market conditions and other determinants of staffing intensity (e.g., relative wages of RNs, LPNs, and nurse aides, patient acuity levels, and reimbursement rates for health care services) to the 22 forecasting equations—one for each nurse-type-by-setting combination—to create preliminary estimates of staffing intensity. These forecasting equations were estimated by regressing nurse staffing intensity on various determinants.

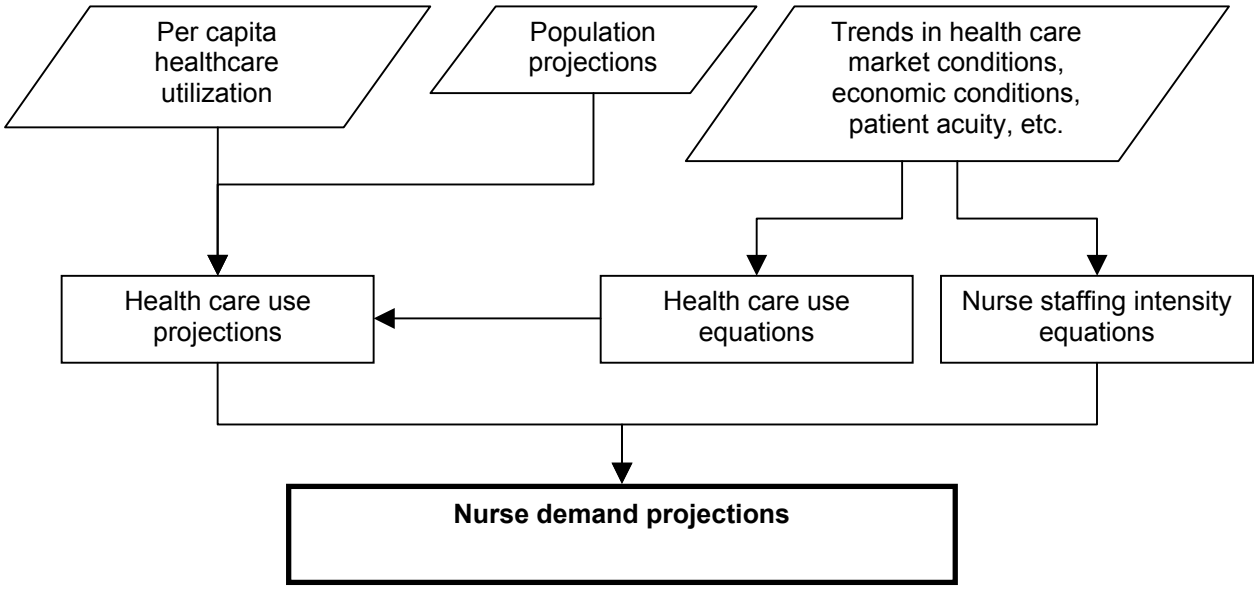
- Step 2, calibrate the model by calculating multiplicative adjustment factors that equate base-year forecasts of staffing intensity with the base-year estimates of actual staffing intensity, and then apply these State-level adjustment factors to the forecasts.

Combining estimates of future demand for health care services (e.g., demand for inpatient care in ST hospitals as measured in total inpatient days) with forecasts of future staffing intensity (e.g., FTE nurses per 1,000 inpatient days) creates the demand forecasts.

The majority of the forecasting equations were estimated using multiple regression analysis with State-level data from 1996 through 2000 (although most regression equations were estimated using a subset of these years based on data availability). Both theory and empirical analysis helped determine which exogenous variables to use in the forecasting equations. Three criteria considered in selecting variables are (1) a logical relationship between the exogenous variable and the dependent variable, (2) the impact of the exogenous variable on the dependent variable is statistically significant, and (3) forecasts of the exogenous variables are readily available or can be reliably extrapolated into the future.

The revised NDM runs as a stand-alone program to be run on a personal computer in a Windows environment. The model, like the PARM, allows the user to change assumptions regarding the future determinants of nurse demand.

Exhibit 5.11 Overview of the Nursing Demand Model



Data on nurse staffing levels during the base year come from multiple sources. The estimates of FTE RNs come from the 1996 Sample Survey of RNs. Estimates of LPNs and nurse aides come from the Bureau of Labor Statistics (BLS) Occupational Employment Statistics (OES), the American Hospital Association (AHA) annual survey, and the American Health Care Association (AHCA). Data that describe the current and future trends in the health care operating environment, patient acuity levels, economic conditions, etc., and that are used to forecast future health care utilization patterns and nurse staffing patterns come from publications from various government agencies and private organizations. The NDM assumes that the labor market for nurses was in equilibrium in 1996 (the base year) with the exception of hospitals. The NDM uses employment levels in 1996 as a demand-based measure of nurse requirements, but increases requirements for RNs in hospitals by 7 percent above employment levels. The reason for this adjustment is based on analyses of the 1992, 1996, and 2000 Sample Surveys of RNs that show a significant decrease in the proportion of RNs in hospitals between 1992 and 1996—possibly as a result of extensive cost-cutting measures and hospital mergers that occurred during the early 1990s (Dall and Hogan, 2002). Hospitals in many parts of the U.S. have been unable to fill vacant RN positions reopened after these turbulent times for RNs in hospitals.

The forecasts presented below show the increase in projected demand for nurses under a *status quo* scenario where there is no change in per capita health care utilization rates (within the 32 demographic groups) and no change in nurse staffing ratios (***Exhibit 5.12***). This scenario is comparable to the status quo scenario used to forecast physician requirements using the PARM. These projections simply show the impact of changing demographics on the demand for health care services.[14] Under this scenario, changing demographics will result in a projected 28 percent increase in demand for RNs between 2000 and 2020, a 32 percent increase in demand for LPNs, and a 37 percent increase for nurse aides. The areas with the largest percentage growth are those that predominantly serve the elderly: home health and nursing facilities (***Exhibit 5.13***).

Note that these forecasts of total nurse requirements under the status quo scenario are lower than The NDM baseline scenario forecasts which incorporate trends in factors other than changing

[14] Projections under this scenario assume no change in average patient acuity for hospital inpatient days, visits, and nursing facility residents.

demographics that affect future demand for nurses (***Exhibits 5.14 and 5-15***). The NDM's baseline forecast predicts an increase in total FTE RN requirements from 2 million in 2000 to 2.8 million in 2020 (a 41 percent increase), an increase in total FTE LPN requirements from 618,000 in 2000 to 905,000 in 2020 (a 46 percent increase), and an increase in FTE nurse aide and home health aide requirements from 1.5 million in 2000 to 2.3 million in 2020 (a 50 percent increase). Demand for nurses and nurse aides will continue to grow in hospitals during the next two decades, but at a slower rate than for the nursing professions as a whole. The exception is the strong growth in demand for RNs in hospital outpatient settings as technological innovations and managed care trends shift patients from inpatient to outpatient care.

Under the baseline scenario, the aging of the population and resulting increase in demand for geriatric care suggests large increases in demand for nurses and nurse aides in home health and nursing facilities. Demand for RNs, LPNs and NAs in home health is projected to increase by 109 percent, 137 percent, and 67 percent, respectively, between 2000 and 2020. Demand for RNs, LPNs and NAs in nursing facilities is projected to increase by 66 percent, 66 percent, and 61 percent, respectively, between 2000 and 2020.

Exhibit 5.12. Forecasts of FTE Nurse Demand: *Status Quo* Scenario

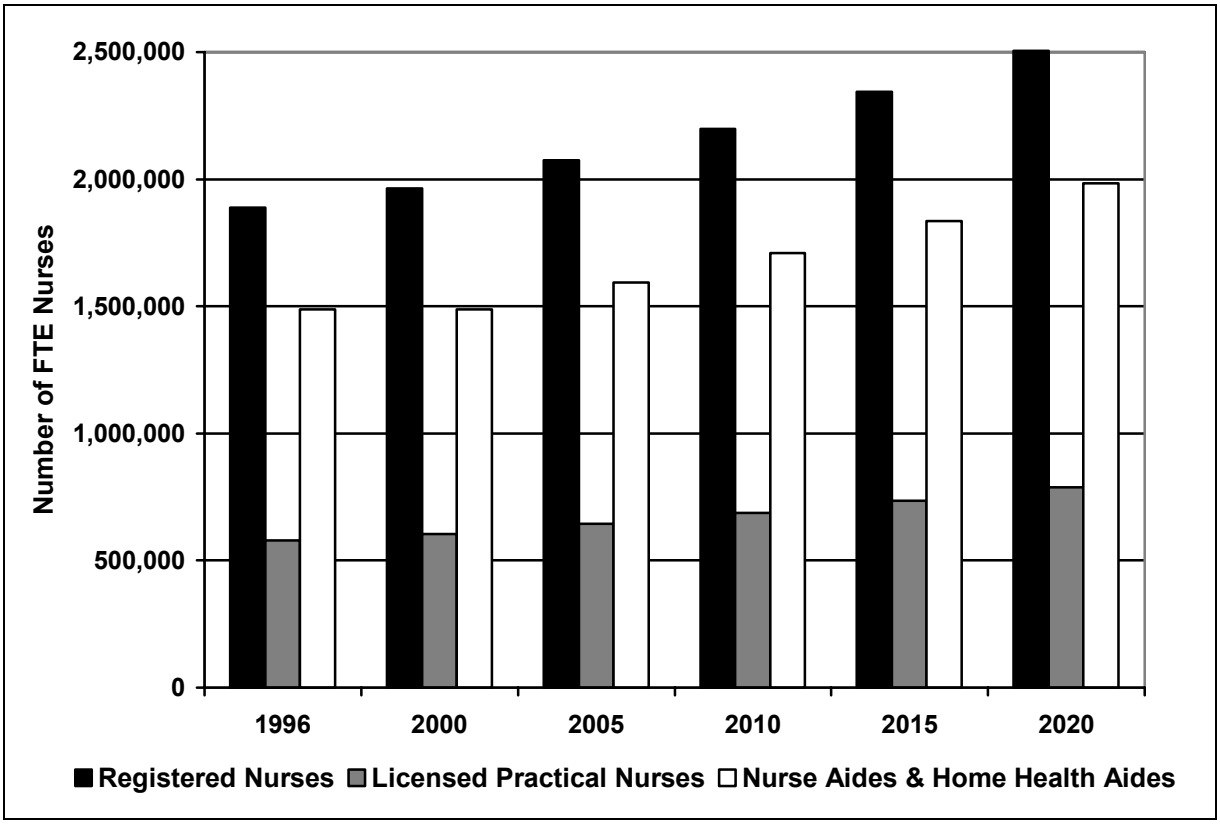


Exhibit 5.13 Forecasts of FTE Nurse Demand: *Status Quo* Scenario

	Base Year	Forecasts					
Setting	**1996**	**2000**	**2005**	**2010**	**2015**	**2020**	**% Increase 2000-2020**
Registered Nurses							
Total	**1,889,326**	**1,964,920**	**2,075,690**	**2,198,904**	**2,342,782**	**2,505,747**	**28**
Hospitals	1,165,688	1,233,403	1,303,924	1,386,817	1,486,728	1,599,109	30
ST, inpatient	828,316	875,173	925,824	986,312	1,059,597	1,142,113	31
ST, outpatient	69,281	73,068	75,981	79,209	83,036	87,170	19
ST, emergency	88,699	92,989	96,265	99,918	104,133	108,633	17
LT hospitals	179,392	192,173	205,854	221,377	239,962	261,193	36
Nursing facilities	147,722	160,442	174,860	189,857	204,611	221,091	38
Doctors' offices	145,941	154,727	160,804	166,904	173,528	180,386	17
Home health	145,754	115,393	122,744	130,594	141,294	155,675	35
Occupational health	19,180	20,040	20,984	21,826	22,241	22,390	12
School health	53,628	57,638	59,657	60,419	61,060	62,244	8
Public health	94,194	99,758	103,520	107,337	111,491	115,785	16
Nurse education	43,322	44,982	47,520	50,279	53,477	57,101	27
Other health care	73,898	78,537	81,678	84,872	88,354	91,966	17
Licensed Practical Nurses							
Total	**578,444**	**604,151**	**644,026**	**687,281**	**734,242**	**787,329**	**30**
Hospitals	145,405	154,105	163,768	175,206	188,937	204,385	33
ST hospitals	128,269	135,817	144,262	154,288	166,317	179,821	32
LT hospitals	17,135	18,288	19,506	20,919	22,620	24,564	34
Nursing facilities	194,670	211,863	231,831	253,290	274,568	298,689	41
Home health	53,633	42,405	45,178	48,151	52,150	57,491	36
Other health care	184,736	195,778	203,250	210,633	218,588	226,764	16
Nurse Aides/Auxiliaries							
Total	**1,487,915**	**1,487,792**	**1,593,810**	**1,708,561**	**1,835,164**	**1,983,582**	**33**
Hospitals	274,029	289,662	306,621	326,545	350,653	377,971	30
ST hospitals	218,640	230,699	243,898	259,508	278,396	299,731	30
LT hospitals	55,389	58,963	62,723	67,037	72,257	78,239	33
Nursing facilities	607,127	660,490	721,720	787,314	852,441	926,112	40
Home health	391,798	309,643	329,242	350,336	378,876	417,177	35
Other health care	214,961	227,997	236,228	244,366	253,193	262,322	15

Source: *The Nursing Demand Model: Development and Baseline Forecasts* (Dall and Hogan, 2002).

Exhibit 5.14. Forecasts of FTE Nurse Demand: *Baseline* Scenario

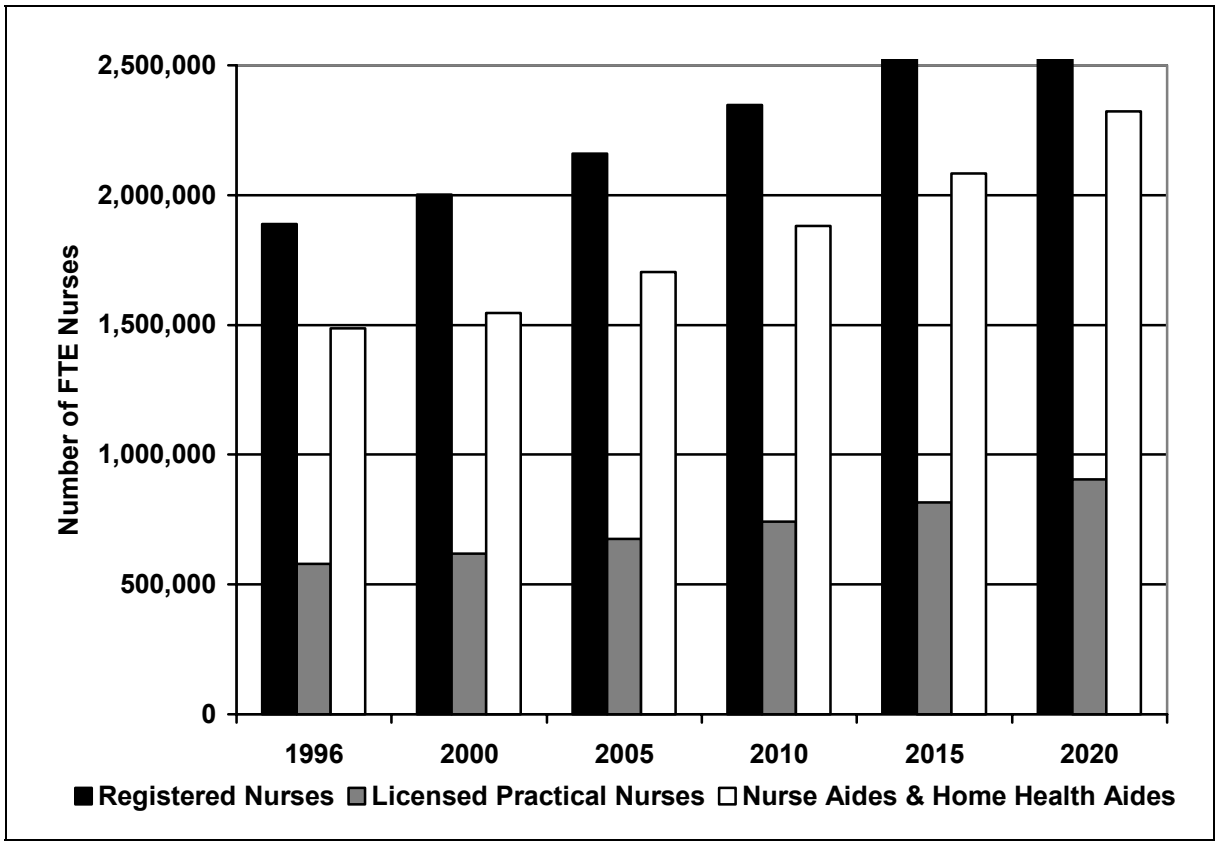


Exhibit 5.15 Forecasts of FTE Nurse Demand: *Baseline* Scenario

	Base Year	Forecasts					
Setting	**1996**	**2000**	**2005**	**2010**	**2015**	**2020**	**% Increase 2000-2020**
Registered Nurses							
Total	**1,889,326**	**2,001,198**	**2,160,980**	**2,346,388**	**2,568,253**	**2,822,388**	**41**
Hospitals	1,165,688	1,239,539	1,324,818	1,427,876	1,555,591	1,698,873	37
ST, inpatient	828,316	874,747	930,249	999,094	1,086,838	1,187,002	36
ST, outpatient	69,281	83,451	95,861	110,395	126,381	142,024	70
ST, emergency	88,699	90,335	92,217	94,487	97,317	100,399	11
LT hospitals	179,392	191,007	206,491	223,900	245,054	269,448	41
Nursing facilities	147,722	172,750	197,005	224,006	252,922	286,355	66
Doctors' offices	145,941	155,001	166,394	178,789	191,585	204,674	32
Home health	145,754	132,016	157,334	187,482	226,241	275,633	109
Occupational health	19,180	20,040	20,984	21,826	22,241	22,390	12
School health	53,628	57,638	59,657	60,419	61,060	62,244	8
Public health	94,194	99,758	103,520	107,337	111,491	115,785	16
Nurse education	43,322	45,918	49,590	53,781	58,769	64,468	40
Other health care	73,898	78,537	81,678	84,872	88,354	91,966	17
Licensed Practical Nurses							
Total	**578,444**	**617,946**	**675,190**	**740,928**	**816,291**	**905,159**	**46**
Hospitals	145,405	150,608	158,326	167,709	179,544	193,135	28
ST hospitals	128,269	131,885	138,116	145,745	155,373	166,383	26
LT hospitals	17,135	18,723	20,210	21,964	24,171	26,752	43
Nursing facilities	194,670	223,334	254,114	289,038	326,761	371,020	66
Home health	53,633	48,226	59,501	73,548	91,398	114,240	137
Other health care	184,736	195,778	203,250	210,633	218,588	226,764	16
Nurse Aides/Auxiliaries							
Total	**1,487,915**	**1,545,722**	**1,702,803**	**1,880,368**	**2,083,860**	**2,323,518**	**50**
Hospitals	274,029	284,514	300,794	320,992	347,215	377,580	33
ST hospitals	218,640	222,834	232,918	245,653	262,564	282,325	27
LT hospitals	55,389	61,680	67,877	75,339	84,652	95,255	54
Nursing facilities	607,127	692,415	781,447	881,493	988,620	1,113,474	61
Home health	391,798	340,796	384,333	433,517	494,831	570,142	67
Other health care	214,961	227,997	236,228	244,366	253,193	262,322	15

Source: *The Nursing Demand Model: Development and Baseline Forecasts* (Dall and Hogan, 2002).

6 SUMMARY AND CONCLUSIONS

Current and future demographics play an important role in determining the demand for and supply of health workers. This report discusses three major demographic trends and discusses their implications for the future demand for and supply of health professionals. Both a literature review and forecasts from two recently updated requirements forecasting models provide insight on the impact of changing demographics on the future health workforce. The major findings are as follows:

Aging of the Population

The aging of the population and the subsequent increase in the size of the elderly population is perhaps the most important demographic trend that will affect the future health workforce. The aging of the population will increase the total amount of health care services demanded, will change the mix of services demanded, and will have profound economic implications that could affect future coverage policies and the provider reimbursement system. Key findings and implications from this literature review and analysis of the PARM and NDM include the following:

- If health care consumption patterns and physician productivity remained constant over time, the aging population would increase the demand for physicians per thousand population from 2.8 in 2000 to 3.1 in 2020. Demand for full-time-equivalent RNs per thousand population would increase from 7 to 7.5 during this same period.

- In 2000, physicians spent an estimated 32 percent of patient care hours providing services to the age 65 and older population. If current consumption patterns continue, this percentage could increase to 39 percent by 2020.

- The aging of the health workforce raises concerns that many health professionals will retire about the same time that demand for their services is increasing. Furthermore, the declining proportion of the population age 18 to 30 raises concerns regarding the ability to attract a sufficient number of new health workers.

- The rise in health care expenditures associated with the rapid increase in the elderly population will likely place additional pressures on the Medicaid and Medicare programs, as well as private insurers, to control health care costs. Such measures would likely decrease the demand for and supply of health professionals.

- The aging population could result in rising average patient acuity, which could in turn require higher nurse and physician staffing levels. One countervailing trend is that tomorrow's elderly might have lower disability rates than today's elderly, controlling for age, because of improvements in economic resources, education levels, lifestyle, public health, and medical technology.

Changing Racial and Ethnic Composition of the Population

The changing racial and ethnic distribution of the population has important demand and supply implications for the future health workforce. Key findings and implications from this literature review and analysis of the PARM include the following:

- The literature suggests that Hispanics and non-whites have different patterns of health care use compared to non-Hispanic whites. Disparities in access to care account for part of the difference in utilization.

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

- Minorities are underrepresented in the physician and nurse workforce relative to their proportion of the total population. As minorities constitute a larger portion of the population entering the workforce, their representation in the physician and nurse professions will increase. The U.S. will increasingly rely on minority caregivers.

- Minority physicians have a greater propensity than do non-minority physicians to practice in urban communities designated as physician shortage areas. An increase in minority

representation in the physician workforce could improve access to care for the population in some underserved areas.

Geographic Location of the Population

The geographic location of the population determines where the health care needs of the population lie. Key demographic trends and their implications for the health workforce include the following:

- Geographic variation in population growth rates and in determinants of health worker demand and supply highlight the importance of developing forecasting models that can make State-level and sub-State level forecasts.

- Although an increasing proportion of the U.S. population resides in urban areas, a substantial proportion of the population will continue to reside in rural areas. Many of these rural areas are currently designated as physician shortage areas.

- Pockets of urban areas will continue to have a high concentration of minorities. Many of these areas are currently designated as physician shortage areas.

- Pockets of urban areas will continue to have a high concentration of minorities. Many of these areas are currently designated as physician shortage areas. Efforts to increase the supply of health professionals in these areas must deal with economic, cultural and language considerations.

Modeling

One way to better understand the potential implications of demographic and other trends on the demand for health professionals is through modeling of specific scenarios. Using forecasting models such as the PARM and NDM, one can determine the relationship between demographics and demand for health care services and, based on projections of future demographics, extrapolate future demand for health professionals. While there is general agreement that demographics can be extrapolated with sufficient accuracy for policy purposes, there is often disagreement on the future characteristics of other determinants of demand for health

professionals. Even modest changes in assumptions regarding the characteristics of the future health care operating system can result in large changes in projected demand for health professionals such as doctors and nurses.

The literature review identified the following items to consider when modeling the impact of changing demographics on the demand for and supply of health professionals:

- Current utilization patterns among the elderly might not be sustainable in the future given the expected explosion in Medicare and Medicaid spending. Ginzberg (1999) anticipates that within the next couple of decades Medicare will provide beneficiaries access to "essential" health care services, but not to high-cost hospitals and expensive procedures. Consequently, modeling efforts should consider scenarios where the Medicare and Medicaid programs place greater restrictions on access to expensive medical procedures and delivery settings, or where these programs reduce reimbursement rates to providers.

- Numerous authors have found declining disability rates among the elderly over time which could lead to declining utilization rates for nursing home and other health care services (see, for example, Manton et al., 1997; Bonifazi, 1998; Bishop, 1999; and Freedman and Martin, 1998 & 2000).

- Freiman (1998) argues that the relationship between race or ethnicity and demand for health care services is a complex function of cultural, socioeconomic, and other considerations. Consequently, Freiman concludes that separate demand equations should be estimated for people in different racial or ethnic groups.

- Several studies suggest that physicians locate in areas with other physicians in order to benefit from the professional synergism that develops when there is already an established population of physicians (e.g., Connor, Hillson and Krawelski, 1995; Brasure et al., 1998). Efforts to model the supply of physicians in underserved areas might identify "forerunner" specialties and analyze patterns of physician location.

- Efforts to model physician supply might consider adding an urban/suburban/rural dimension to the model for the following reasons. One, there could be a systematic difference in the age distribution of physicians in these geographic locations. Two, the relationship between

supply and its determinants could be different in these geographic locations. Three, there is substantial policy interest in forecasting supply in underserved urban and rural areas.

- Modeling the primary impact of changing demographics on the future health workforce is straightforward. What are less obvious are the secondary and tertiary impacts. For example, as the population ages and places greater demands on the health care system, how might the system react in terms of changing utilization or provider staffing patterns? Additional research in this area could improve supply and requirements forecasting models.

Information on how demographic trends will affect the future demand for health care services, and consequently the derived demand for health workers, is important to the public debate. Forecasting models provide a tool for analysts to understand the likely impact of changing demographics and other factors on the future demand for health professionals, and on the adequacy of the supply of professionals to meet this demand.

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