Forecasts of Physician Supply and Requirements

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Foreword

Undertaken at the request of the Senate Committee on Labor and Human Resources, this report evaluates the assumptions, methods, and results of the two current models used to forecast the number and kinds of physicians the country is likely to need and have. Congress must rely heavily on such forecasts in shaping Federal policy and programs for aiding education in the health professions and for providing health resources and services.

This report examines the two most important physician forecasting efforts— those of the Bureau of Health Manpower of the Department of Health and Human Services (DHHS) and those of the DHHS-chartered Graduate Medical Education National Advisory Committee. These two efforts together are generally representative of the kinds of techniques that are used to forecast physician and other health personnel supplies and requirements.

The report points out that projections of physician supply and requirements depend on historical data to predict future events, but even recent historical data reflect past policies, not current ones. The limits of forecasts must be fully understood if they are to serve as effective tools in the shaping of Federal medical policy. Those limits could be made clearer by explicitly describing the assumptions behind any forecasts, by making alternative forecasts based on different sets of assumptions, and by expanding the forecasting process to include policy makers as well as technicians.

This analysis was prepared by OTA staff. Drafts of the report were reviewed by an advisory panel convened for the study, by the Health Program Advisory Committee, and by various individuals associated with the forecasting activities analyzed.

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Forecasts of Physician Supply and Requirements

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List of Acronyms

AMA — American Medical Association
AOA — American Osteopathic Association
BCHS — Bureau of Community Health Services
BHM — Bureau of Health Manpower
BLS — Bureau of Labor Statistics
CMG — Canadian medical graduate
CPI — Consumer Price Index
DHHS — Department of Health and Human Services
DO – doctor of osteopathy
FMG — foreign medical graduate
FTE — full-time equivalent
GMENAC — Graduate Medical Education National Advisory Committee
GNP — gross national product
GP — general practitioner
HIS — Health Interview Survey
HMOS — health maintenance organizations
HMSA — Health Manpower Shortage Area
HSA — Health Service Area
MD — doctor of medicine
MUA — Medically Underserved Area
NHI – national health insurance
NHSC — National Health Service Corps

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INTRODUCTION

Reauthorization of the Health Professions Educational Assistance Act (Public Law 94-484) is scheduled for 1980. Essentially, the Act reflects Congress' policies toward medical and other health professions educational support and toward identifying and addressing the problems of medically underserved areas and populations.

The request for this assessment originated with the Senate Committee on Labor and Human Resources, supported by the House Committee on Interstate and Foreign Commerce. The Senate Committee's letter pointed out that there have been wide variations in the numbers and types of physicians "required," and that as Congress begins to deal with the more difficult issues of specialty and geographic maldistribution, legislative policy will have to rely on such forecasting results and related forecasting technologies for estimating the adequacy of specialty and geographic distribution. It would therefore be helpful to Congress that an analysis be undertaken of the assumptions underlying the different forecasts, as well as the methods and conclusions of the forecasts themselves, in order to determine which forecasting technologies are most reasonable.

Projections of physician supply and requirements have influenced Federal policy toward and legislation on health professions education and the problem of medically underserved areas, and play an important role in existing Federal programs whose purposes are to build up area medical resources or to provide medical services directly.

Until the 1976 Act, Federal policy was to increase the supply of physicians and other health professionals, because the perception was that of acute shortages. Although the expiring legislation contains incentives to continue to accelerate the supply of physicians, the general consensus now is that the aggregate supply of physicians is at least adequate and perhaps even in excess. Hence, attention has turned toward the problems of specialty and geographical, or locational, maldistribution.

Efforts at correcting specialty maldistribution have concentrated on the primary care specialties, which are usually identifed as general practitioners, family practitioners, general internists, and general pediatricians. All osteopathic physicians are also included, although this profession is becoming more specialized (about 40 percent are now specialists). Psychiatrists, obstetrician-gynecologists, and general surgeons have sometimes been included.

Definitional problems are obvious, and they are important in determining the requirements for primary care physicians. For example, primary care physicians may include only those categories identified as primary care; i.e., different combinations of the categories identified above. The underlying rationale is that the way in which medical care is provided is crucial. This approach sees primary care as requiring a change in attitude toward patient care, a holistic approach to patients and their families, and as providing the appropriate entry point into the medical care system. Others may concentrate on office-based ambulatory care regardless of the specialty designation of the physician providing such services and estimate requirements on that basis.

In addition to definitional problems, approaches toward primary care have been reminiscent of past approaches to aggregate physician supply; the emphasis has been on simply increasing the supply rather than simultaneously being concerned over what is an appropriate supply. Usually, this has meant that primary care objectives have been phrased in terms of the percent of the aggregate physician supply that should be in primary care. Such objectives would be inappropriate if aggregate supply were excessive.

Geographical or locational maldistribution is generally a problem where health personnel and services are found inadequate, by some defined standard, to meet the health needs of the population of the identified communities, areas, or institutional settings. Locational maldistribution is by definition a relative concept, where some of our people are determined to be at a disadvantage relative to the rest of the United States. Once these are identified, then the gap between health personnel and services and that population's needs for them is quantified to determine: 1) how many personnel are needed to bridge the gap, and 2) of the identified deficiency, how much of it will be addressed through a specific program.

Quantifying locational maldistribution serves two purposes. First, it is used as part of the eligibility criteria for the Health Manpower Shortage Area (HMSA) designation for: 1) National Health Service Corps (NHSC) sites; 2) designation as service areas in which students who borrow money under health professions student loan programs can practice in lieu of repaying the loans in money; 3) grants for various health manpower training programs; 4) eligibility or preference for grant funds for several Bureau of Community Health Services programs, such as the urban and rural health initiatives; and 5) certification of rural health clinics for nurse practitioner's and physicians' assistant's services reimbursement through Medicare and Medicaid.

Second, these methods to quantify locational maldistribution are used to plan for the future size of NHSC. That is, given the estimated universe of existing and future HMSAS, plans must be made for determining how many of those medical manpower shortage areas will be staffed by NHSC physicians. Currently, the major source for those future NHSC positions are students who will be obligated to NHSC in exchange for scholarship support.

CURRENT ACTIVITIES

Under the Health Professions Educational Assistance Act of 1976, the Department of Health and Human Services (DHHS) is required to provide annual reports to the President and Congress on the status of health personnel in the United States. Estimating the present and future supply of and requirements for physicians and other health professions is the responsibility of the Health Resources Administration through its Manpower Analysis Branch of the Bureau of Health Manpower (BHM). DHHS has produced its first report (dated August 1978 and reprinted in March 1979) and is in the final stages of review for its next report.

In addition, DHHS chartered a Graduate Medical Education National Advisory Committee (GMENAC) on April 20, 1976, to make recommendations in 3 years to the Secretary on the present and future supply of and requirements for physicians, their specialty and geographic distribution, and methods for financing graduate medical education. Its most immediate impact will come from its recommendations on how graduate medical education (residency programs) should (could) be changed to meet these stated goals. GMENAC was given a l-year requested extension of its charter to April 20, 1980, at which time its final report must be submitted. An interim report was published in April 1979.

Finally, the Bureau of Labor Statistics of the U.S. Department of Labor includes physicians and other health occupations in its projections of occupational requirements and training needs. These projections relate manpower to projected economic demand (expenditures) as provided by the Bureau's model of the future economy, which projects the future gross national product (GNP) and its components—consumer expenditures, business investment, governmental expenditures, and net exports; industrial output and productivity; the labor force; average weekly hours of work; and employment for detailed industry groups and occupations.

The Bureau of Labor Statistics considers the BHM's modeling efforts to be a more sophisticated effort than its own, and in its forthcoming revision of its estimates, will adopt the midpoint of the range of projections from the BHM model for its physician demand projections. Thus, there are essentially two major efforts currently underway, which will have immediate impacts on Federal health manpower policy; the sustained modeling activities of BHM and the nearly completed deliberations of DHHS'S GMENAC. These two activities also illustrate well the different approaches through which physician supply and requirements projections can be made.

FINDINGS AND CONCLUSIONS

supply

Forecasts of the future supply of physicians consist of:

- current Supply, adjusted for attrition from deaths and retirements, and
- additions to supply from:
  - —graduates of U.S. medical and osteopathic schools and
  - —immigration of physicians educated in other countries plus U.S. citizens educated in foreign medical schools.

The supply of active physicians is projected to be approximately 450,000 in 1980, 525,000 in 1985, and 600,000 in 1990. Compared to a 1975 supply of 378,000, the net increase will average 75,000 every 5 years.

BHM estimates of additions to supply from graduates of U.S. medical and osteopathic schools take first-year enrollment projections, adjusted for attrition, to arrive at the number of graduates per year. Estimates of first-year enrollments are based on trends in: 1) Federal cavitation support, 2) Federal construction grants activity, 3) new schools already planned, and 4) potential State and local support of new schools.

Estimates of additions to supply from immigration of physicians educated in other countries are currently based on the presumed impact of the Health Professions Educational Assistance Act of 1976, which was designed to sharply curtail the immigration of physicians into the United States.

GMENAC'S approach to estimating supply (not yet completed) uses a different way of disaggregating the U.S. medical school graduate source. They will project graduates for each school, based on information provided by the Association of American Medical Colleges.

Although predictions of the future supply have been consistent in the aggregate over the past 5 years, the additions—domestic and foreign graduates—have changed considerably. Current projections may overestimate the number of future domestic graduates because of the assumption of full cavitation funding. In contrast, the addition to supply from foreign medical graduates, projected to be 1,000 to 2,000 in the 1980's, could be unrealistically low. U.S. students studying abroad (currently under study by the General Accounting Office) may not be adequately accounted for and could double the 1,000 to 2,000 additions per year from foreign medical schools in the 1980's.

The net effect of overestimating domestic sources and underestimating foreign sources could "wash" each other out.

Supply projections leave the impression that 600,000 physicians in 1990 is a fixed number. But the assumptions currently in use explicitly recognize the influence of policy on supply. Estimates based on different sets of assumptions could provide better indications of the variability of the projected supply and of the influence of deliberate policy decisions on the ultimate numbers.

For foreign graduates, the presumed full impact of Public Law 94-484 is deliberately factored into the model. For domestic sources, full cavitation and continued development of new medical schools in the 1980's are also assumed. The latter also reflects a presumed full impact of existing Federal law, but past experience and current consensus would deny the real possibility of ever gaining authorized cavitation levels, although private medical schools continue to be developed. And the impact of Public Law 94-484 on dampening foreign medical graduate sources may be circumvented by the increasing number of U.S. citizens studying medicine abroad and eventually returning to the United States to practice.

The specialty distribution of the projected supply is estimated by taking the number of active practitioners by (self-designated) specialty, adjusted for death and retirement, and distributing graduates among the specialties through projections of first-year residency trends.

Trends in first-year residency positions are used to predict future specialty distribution because of lack of data on final-year residency positions. However, first-year residency positions are often used for general clinical experience prior to concentration in a particular subspecialty or in another specialty and therefore do not necessarily represent final specialty choices; i.e., first-year residency counts are duplicative for particular specialties in that a proportion move on to subspecialization or to another specialty altogether. BHM's current projections assume that the first-year residency distribution trends for 1968, 1970-74, and 1976, also apply through 1980-81. After 1980-81, the residency distribution is held constant for the statistical reason that the base years chosen to establish the trend cover 6 years, so BHM has chosen not to extend the extrapolation beyond 6 years. Downward adjustments are made to minimize double-counting; the greatest adjustments occur in general surgery (62 percent) and internal medicine (32 percent).

As a percent of the total projected supply, physicians in general practice, family practice, internal medicine, and pediatrics (those usually counted as primary care specialties) are projected to comprise 39 percent in 1980,41 percent in 1985, and 42 percent in 1990. The largest specialty among these, as well as among all the specialties, will be internal medicine, which will have more than twice "as many physicians than any one of the other specialties.

The locational distribution of the projected supply, by specialty, is estimated by similar methods as for aggregate and specialty supply; i.e., current supply plus additions. These locational projections can be disaggregate in a variety of ways; e.g., by geographic criteria such as by States, counties, Census-Defined State Economic Areas, or Health Service Areas, or by special populations such as institutional care (mental hospitals, prisons), the indigent, and Native Americans.

Locational projections are used to identify those locations with the least number of physicians for programs which intend to place physicians (e.g., NHSC) or for which shortage designation is necessary to qualify for Government funds.

The process of designating and staffing HMSAS presently includes estimating the future supply of physicians for: 1) rural counties; 2) urban areas; 3) Federal, State, and local prisons; 4) State mental hospitals and community mental health centers; and s) the Indian Health Service.

Projections of specialty and locational supply depend on the standard method of relying on historical data to predict future events, and in particular, on most recent experience to predict the most immediate future. This can be seen in the use of mid- to late 1960's to mid-1970's data to predict 1980-90 patterns. Aside from the inevitable finding of "inadequate data" which, for one of the most important marker specialties (internal medicine), contains an error factor of at least 32 and perhaps as high as 62 percent in the first-year residency count, the use of historical data has two other limitations in these projections of specialty and locational distribution. The late 1960's and 1970's have witnessed: 1) Medicare and Medicaid and greater third-party private insurance coverage, 2) unprecedented increases in medical school enrollments and a large influx of foreign medical graduates, and 3) major changes in graduate medical education, including abolition of the free-standing internship and its selective replacement by the first year of some residency programs. Second, legislation in this area has purposely tried to affect physician specialty and location choices, and, given the lag time between physician education and eventual practice, late 1960's and early to mid-1970's data reflect past policies, not current ones.

Requirements

Estimates of the numbers of physicians required in the future are derived by dividing the amount of services that it is anticipated physicians will or should provide a given population in a given year, by physician productivity. Estimates of a population's economic demand for services measure the capacity of the population to use physician services and are not limited to physician care that is essential to the patient's health. In general, physician productivity is assumed to remain constant. Thus, the difference between forecasting models is essentially one of differences in the estimates of use.

Although productivity is generally assumed constant, the particular measure chosen will directly influence the estimates of physician requirements. For example, GMENAC'S workbook for estimating general surgeon requirements lists alternative estimates of average weekly office visits that could be used as productivity measures as 77.2,58,51, and 43.

BHM's estimates of economic demand for physician services in 1990 are derived first from current per capita use rates projected onto the 1990 population. These figures are then adjusted for what the Bureau identifies as a long-term trend toward rising use of services, based on analysis of historical changes in per capita utilization during the period 1968-76. Thus, projections of future use can be separated into: 1) effects due simply to population growth and changes in the population's age, sex, and income distribution; and 2) effects due to a projected long-term trend toward increased per capita use apart from demographic considerations.

The BHM model projects the U.S. population by age, sex, and income subgroups, and use rates for each of these (40) subgroups are estimated for 20 types of health services settings. The historical trend in per capita use is separated into price- and non-price-related components. The price-related component interprets the effects of trends in out-of-pocket costs to consumers on changes in use. Projections of increased demand for physician services in 1990 calculated on the basis of a presumed trend toward rising per capita use of services are, however, highly sensitive to the particular start date chosen for the trend analysis. Stated another way, the assumption that there is a currently ongoing strong historical trend toward rising per capita use that can be projected to continue to 1990 is highly dependent on using the particular historical period 1968-76 as the basis for calculating the trend factor. If a more recent period were used to calculate the trend, the projected growth rate in per capita use would be considerably more moderate.

The BHM model assumes that supply and demand were in balance in 1975. This is a mathematical convenience to provide a constant base against which the relative magnitude of projected future changes can be referenced. However, prior estimates on aggregate demand have generally reached this conclusion (see table below). Using current use rates, demographic

Comparisons of Aggregate Physician (MD) Supply With Requirements Using Different Models

	Rate/100,000	Target year	Total	supply
HMO.	153.6	1972	321,000	333,000
Need-based.	167.8	1974	355,600	351,000
Professional judgment. .	187.3	1975	400,000	366,000
Demand/productivity . . .	182.8	1980	407,000	430,000 (projected)

SOURCE: See text.

changes (population increases plus changes in age, sex, and income distribution) are projected to lead to a lo-percent increase by 1990 over 1975 demand, or 415,000 physicians in 1990 versus 378,000 in 1975.

Using a trend factor of increasing use based on 1968-76 data, an additional increase of 185,000 in physician demand is projected.

Thus, the total projected demand for physicians in 1990 is 600,000 (415,000 pIus 185,000).a

Increases in demand attributable to a historical trend toward increased per capita use are overestimated, particularly for office services. The period 1968-76 is used to establish the trend, but whereas a start date of 1968 yields a distinctly upward trend for physician office services, a start date of 1971 yields a downward trend (see figure on p. 9).

Based on the BHM model, an alternative ap proximation of the demand for physician services in 1990, adjusting only for demographic changes, and assuming no long-term trend toward increases in per capita use, would be 415,00 physicians, an increase of 37,000 from 378,000 in 1975. But use could change, as could productivity. To some extent, these are policy choices to be made. If it is considered desirable for use to rise, for physicians to spend a few extra minutes with each patient, or for physicians to have shorter workweeks, much of the projected supply of 600,000 physicians in 1990 could be appropriate.

As supply is estimated to be 600,000 in 1990, there is a difference of 185,000 physicians between predicted supply and estimated demand in a static situation.

Some flexibility in the model is necessary, for several reasons. The enactment of national health insurance should lead to some increase in the demand for physician services. Second, physicians currently average longer workweeks than most of the rest of the labor force. Current projections are based on the assumption that physician productivity will remain constant to 1990, which, in specific terms, means that it is assumed that general surgeons will continue to average 52-hour patient care workweeks, pediatricians so hours, etc. If physicians continued to see patients at the same rate but shortened their workweek, this would have the effect of raising the number of physicians required to meet a specific level of demand for physician services. Alternatively, physicians might work the same number of hours, but see fewer patients and spend more time with each one. This would also raise the number of physicians required to meet a specific level of demand for services. According to the National Center for Health Statistics, almost half of all office visits to physicians in 1973 and 1977 lasted 10 minutes or less. With smaller patient loads, physicians might be able to use the additional time to provide patients with more information, education, and counseling and lead to greater patient satisfaction with the quality of medical care.

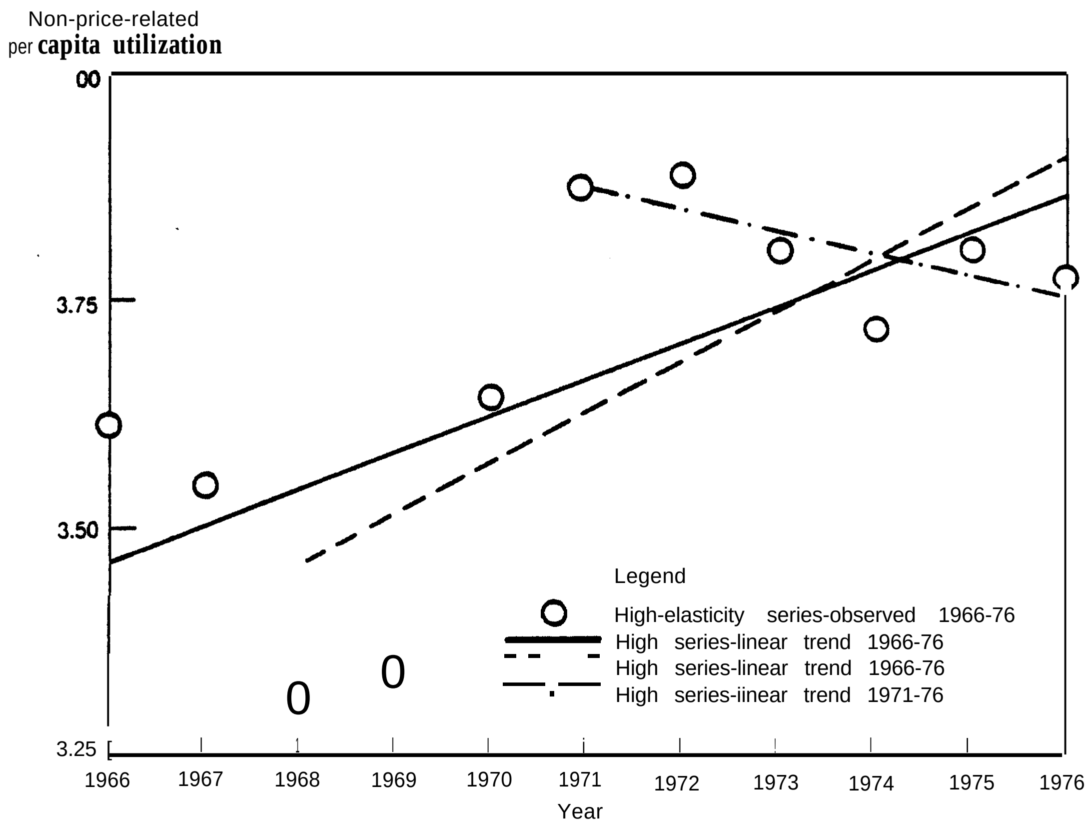
It is therefore necessary to decide how much of these changes are desirable at the cost that will be borne by the society.

The GMENAC normative, medical opinion model estimates all diseases and conditions (on demographic bases such as age and sex) that should be treated by physicians and the amount of physician services, on a disease-by-disease or condition-by-condition basis, that should be provided.

The theoretical level of use is usually adjusted downwards to real-world estimates through consensus formation techniques. Instead of quantifying use by health care setting, these estimates quantify use on a specialty-by-specialty basis.

Unlike the BHM model, which can project demand year to year (projections now exist up to zoo(I), GMENAC'S current future target is 1990, although its model is capable of providing year-to-year projections. GMENAC'S modeling effort, because its ultimate aim is to provide recommendations on graduate medical education, professes to be less concerned with aggregate requirements. When addressed, aggregate requirements will be more of a byproduct of the parent GMENAC panel's consolidating the work of the individual specialty panels.

Non-Price-Related per Capita Utilization Trens, Physician Office Services, 1968-76



SOURCE: JWK International, Inc., *Evaluation of Project SOAR* (Supply, *Output, and Requirements),* draft report, DHEW contract No. HRA-232-78-0140, 1979.

On the other hand, the BHM model, as presently constructed, can only provide aggregate, and not specialty-specific physician requirements, because demand is grouped by health care setting, not by specialty care.

The normative, medical opinion model is thus, better capable of estimating specialty-by-specialty requirements but could overestimate aggregate physician requirements because of the difficulty of reconciling overlapping patient care responsibilities. This task is to be undertaken by the GMENAC panel after the work of its specialty panels is completed.

An unresolved issue, however, is the requirements for the primary care specialties. There are basic differences on what is primary care, disagreement over what specialties constitute the primary care ones, and the pragmatic problem that other specialists will continue to provide similar services even if there were agreement on what primary care is. The models cannot be expected to resolve these issues. Resolution of these issues is a precondition to projecting the requirements for primary care specialties.

The BHM trend projection model and GMENAC'S medical opinion, goal-driven model are complementary, and not competing, models of estimating future physician requirements. As such, each model's results can aid in the interpretation of the other. Comparison of the models can shed some light on the relationship between medical need for physician services and trends in the actual use of those services. Ideally, the medical opinion model could be used to estimate the distribution of physicians by specialty within the aggregate requirements estimates provided by the BHM model.

The GMENAC model focuses on translating a normative definition of medical need into appropriate rates of use of medical services, while the BHM model looks on medical care as a "consumer good" and treats empirical trends in the use of medical services as a proxy for economic demand. If the BHM demand estimates should prove significantly greater than the GMENAC estimates, this would suggest that there are powerful factors at work that are pushing the use of medical services beyond the level medically necessary and appropriate for "good" care. This would then raise the policy question of what percentage of the projected future economic demand for medical services over and above the professional judgment-based estimates of medical need should be considered legitimate. Conversely, if the BHM demand estimates should prove significantly less than the GMENAC estimates, this would suggest that there remains and will remain in the near future significant barriers to obtaining medically necessary care for large segments of the American population rather than for a few discrete areas and populations. Presumably, these barriers could be financial, geographic, cultural, or involve ignorance about when to seek care—most likely some mixture of these variables that would need to be investigated. Finally, if the BHM and GMENAC estimates prove to be in rough parity-what could be viewed as the most desirable outcome—this would suggest that the economic demand for services is more or less in line with professional estimates of the medical need for physician services.

As the GMENAC model has yet to generate any numbers, we cannot say which of these three alternatives will prove to be the case. We can say, however, that the most likely occurrence would appear to be rough parity or a BHM demand estimate that is significantly greater than the GMENAC aggregate estimate. The major reason for anticipating that the BHM estimate will most likely prove greater than or at least equal to the GMENAC estimate is that one of the major variables in the BHM model is a projected trend toward rising per capita use of medical services, independent of demographic changes and projected changes in price. In contrast, the GMENAC model assumes no major changes in medical need apart from changes in medical need induced by demographic shifts (e.g., an aging population) between now and 1990; hence, no medical rationale for large *per capita* increases in the use of physician services.

Estimates of locational requirements are used to address different problems than aggregate and specialty estimates. Such estimates are used in operating programs designed to provide physicians and other medical care resources to targeted populations. Thus, locational requirements are based not only on assumptions about what are appropriate types and quantities of medical services, but also on: 1) how medical services should be redistributed, and 2) the amount of care that the Federal Government should provide or finance compared to other public and private sources.

These additional assumptions are clearly reflected in the designation and staffing ratios that were used to estimate the numbers of additional primary care physicians "needed" in shortage areas, and which, with additional criteria, provide the basis by which specific areas qualify as HMSAS.

- *Designation* ratio. —The actual minimum ratio of active, non-Federal, patient care physicians engaged in primary care to the civilian population of an area below which an area is considered to have a shortage of health manpower sufficient to justify its being counted as a shortage area.
- *Staffing ratio.* —The theoretical maximum ratio if active non-Federal, patient care physicians engaged in primary care to the civilian population of an area used as a standard above which an area is considered to have adequate health manpower so that additional Federal intervention with NHSC staffing is no longer necessary.

The designation ratio reflects that quarter of the United States having the least number of primary care physicians. It has been set at 1:3,500. The staffing ratio establishes a limitation on the extent of Federal involvement by specifying an "appropriate" relationship between the service demands of the population and the primary care physicians available to provide these services. It has been set at 1:2,000.

Estimates of shortage areas in 1990 must be considered weak for a number of reasons. First, data on patterns of distribution of physicians aged 32 to 40 in 1974 are used as the base from which projections are made. These data are currently the most recent available. They reflect, however, the conditions and policies of the 1960's. To assume that physicians will continue to follow the same distributional patterns in 1990 is to discount the large increases in aggregate physician supply and deliberate policy efforts to *increase* the physician supply in shortage areas that have occurred since the 1960's. Second, future estimates are based almost entirely on county physician-to-population ratios, again due to limitations in available national data. Actual HMSA designation, however, often involves smaller areas that have lower physician-to-population ratios than the county as a whole. Thus, methods for estimating future urban shortages are especially weak.

In such estimates, potential use divided by expected productivity (ultimately expressed in physician-to-population ratios) is an inadequate indicator of the targeted population's use of physician services, because average use and productivity calculated on a national basis can be expected to deviate from a specific population's use of specific physician services, and access problems (physical, financial, social) also determine whether use and productivity estimates are realized.

Thus, physician-to-population ratios comprise only part of the eligibility criteria that must be met to be designated an HMSA. Additional criteria include meeting specific definitions of "a rational area for the delivery of primary care services, " and when "primary medical care manpower in contiguous areas are overutilized, excessively distant, or inaccessible to the population of the area under consideration."

Consequently, even if national aggregate and specialty requirements were satisfied, it would be unlikely that physicians would be evenly distributed in all geographic areas or equally accessible to all population groups. Thus, some areas would always be underserved as measured against the average national physician-to-population ratio.

Projections of supply and requirements depend on historical data to predict future events, but legislation in this area has purposely tried to affect physician specialty and location choices. Given the lag time between medical education and eventual practice, even recent historical data reflect past policies, not current ones.

As currently published, the projections of aggregate requirements from BHM give no indication of the very different results that could be obtained by simply shifting the first years of the historical period used to establish the trend in per capita use from 1968 to 1971. Assumptions such as these are now hidden in the methodology, yet it is clear that they are crucial to the results.

Second, these estimates may be given in basic, high, and low projections or encompass a range of numbers, but they all revolve around the same set of assumptions. They are techniques that represent the degree of statistical confidence the methodologists have in their calculations, which is an entirely different question from projecting alternate estimates based on fundamentally different sets of assumptions about the factors that influence future supply and requirements.

The final and most important observation is that the forecasting process has remained too technical a process, where statistical techniques, economic knowledge, and medical expertise greatly influence the process. Yet, more often than not, the basic assumptions adopted in the methodologies are policy ones. This is particularly true for projections of the future supply of physicians and decisions on specialty distribution requirements. Further, policies that have been made and are under consideration directly impact on the projections, yet the reliance on historical data can systematically underestimate the effects of such policies. Methodologists themselves, in the absence of specific policy direction, are having to make decisions on which policies will most directly influence their projections. The result is that current forecasting techniques may influence policy decisions to a greater extent than called for.

Greater awareness of the limits of forecasting and less preoccupation with a particular set of numbers would be possible if the assumptions underlying the projections are made more explicit; alternative forecasts are projected, based on different sets of assumptions; and participation in the forecasting process is expanded to include policymakers as well as technicians.

2 m

supply

2
Supply

This chapter summarizes supply projections for physicians—doctors of medicine (MD) and doctors of osteopathy (DO)-in the aggregate, by specialty, and by location. The elements to be covered are: 1) assumptions, 2) data sources, and 3) projections.

AGGREGATE SUPPLY

The future aggregate supply of physicians is based on assumptions of the following factors (USDHEW, 1979a):

- physicians currently active in practice,
- new graduates of U.S. medical and osteopathic schools, and
- immigration of physicians (including U.S. citizens studying abroad) educated in other countries.

The estimates based on these production factors assume that supply will not be affected by the demand for physicians; i.e., there is an inelastic relationship between physician production and demand.

Data on currently active physicians are obtained from the American Medical Association (AMA) and the American Osteopathic Association (AOA). Both AMA and AOA data rely on the physician's self-designation of specialty, so the published data are based on this self-identification of primary specialty and activity and provide no information on activities in other specialty areas nor on the proportion of time spent in actual patient care.

An additional factor is that the "not classified" category in the AMA data, introduced in 1971, has grown from 300 in 1971 to over 30,000 in 1976, plus approximately 8,800 physicians whose addresses were unknown. Seventy percent of this "not classified" category is below age 35 and most likely in active practice. In the trend analysis for estimating specialty distribution, this "not classified" category is not included. However, "not classified" is included in the aggregate projections, with the assumption that its specialty distribution is identical to physicians in residency programs.

For physicians currently active in practice, the starting point (base year) is 1974. Data for MDs include age, specialty, and country of medical education. DO data for 1974 start with 1971 AOA data and add new DOS and subtract retirements and deaths between 1971 and 1974.

Mortality and retirement rates for MDs are computed by age and sex as derived from studies on the physician population, not the general population. 1967 data on retirement rates are used, and mortality rates use an article published in 1975. These rates are also applied to osteopathic physicians. Both retirement and mortality data, therefore, do not reflect trends that might be occurring. Table 1 summarizes these estimates.

Trends in new graduates of U.S. medical and osteopathic schools start with estimates of first-year enrollments to arrive at the number of graduates per year after adjustments for attrition. 1974 data were the original starting point, but data from the latest academic year, 1977-78, are now used.

Estimates of first-year enrollments are based on trends in: 1) Federal cavitation support, 2) Federal construction grants activity, 3) new schools already planned, and 4) potential State and local support of new schools. Separate computations are made for first-year enrollments in

Table 1.—Derivation of Male and Female MD Retirement Rates and Death Rates by 5-Year Age Cohort

Age	Total MDs	Number inactive	Percent inactive	Retirement rate	Death rate	Separation rate
			Male MDs			
Less than 30	31,047	64	.0020	—	.0007	.0007
31-34	39,470	64	.0016	.0000	.0007	.0007
35-39	38,562	88	.0023	.0001	.0014	.0015
40-44	37,501	107	.0029	.0001	.0022	.0023
45-49	32,989	156	.0047	.0004	.0043	.0047
50-54	27,319	188	.0069	.0004	.0066	.0070
55-59	25,100	370	.0147	.0016	.0111	.0127
60-64	19,452	708	.0410	.0053	.0188	.0241
65-69	13,368	1,483	.1109	.0140	.0294	.0434
70-74	8,941	2,034	.2275	.0233	.0465	.0698
75 and over	11,817	5,186	.4389	.0423	.1243	.1665
			Female MDs			
Less than 30	3,568	70	.0196	—	.0005	.0005
31-34	2,929	157	.0536	.0007	.0008	.0015
35-39	2,617	166	.0634	.0020	.0013	.0033
40-44	2,894	226	.0781	.0029	.0023	.0052
45-49	2,313	163	.0705	.0015	.0028	.0013
50-54	1,832	151	.0824	.0024	.0043	.0067
55-59	1,410	126	.0894	.0014	.0064	.0078
60-64	1,105	139	.1258	.0073	.0098	.0171
65-69	993	242	.2437	.0236	.0152	.0388
70-74	779	290	.3723	.0257	.0250	.0507
75 and over	964	630	.6535	.0562	.0916	.1478

Based on:1)Amerlcan Medical Association, Department of Survey Research, Selected *Characteristics of the Physician population,* 1963 and 1967 (Chicago, 1978), table 21, p.182; and2)R. Hendrickson, ''Specialists Outlive Generalists:' Prism, December 1975.

SOURCE: *Interim Report of the Graduate Medical Education National Advisory Committee to the Secretary, Department of Health, Education, and Welfare,* Washington, D. C.: Health Resources Administration, DHEW publication No. (HRA) 79-833, p. 119.

3-year programs because of different attrition rates. Transferees into U.S. medical schools are also estimated.

High, low, and basic projections are calculated for these first-year enrollments. Basic projections assume that full funding of cavitation grants and moderate funding of construction grants will be achieved by 1981, that seven new medical and osteopathic schools will be established after the 1977-78 school year, and that there will be some limited further State, local, and private support for additional enrollment growth. The low-level projections assume full funding of cavitation grants, but minimum funding of construction grants by 1981, the establishment of four new schools after 1977-78, and no additional growth in enrollments arising from State, local, or other support beyond 1977-78. The high-level projections assume full funding of both cavitation and construction grants by 1981, the establishment of 10 new schools after 1977-78, and additional growth in enrollments arising from State, local, or other support beyond 1977-78 at half the annual rate exhibited by the years 1953-54 through 1964-65 (before Federal programs had an impact). Tables 2, 3, and 4 summarize these estimates for MD and DO first-year students.

Attrition rates are based on historical trends for 3- and 4-year MD programs, for osteopathic programs, and for foreign-trained U.S. medical students who transfer to U.S. medical schools. Tables summarizes actual and projected graduates for 1978-79 to 1989-90, based on the foregoing assumptions. Table 6 summarizes similar projections made at about the same time for the Department of Health, Education, and Welfare's (HEW) (now the Department of Health **and** Human Services (DHHS)) annual report to the President and Congress (USDHEW, 1979b). The two tables show different projections for 1980 and 1990; for 1980, 16,375 v. 17,155; for 1990, 19,289 v. 19,987. The lower estimates are based on the foregoing assumptions.

There are also discrepancies between the first-year enrollment assumptions and the projected

Table 2.—MD First"Year Enrollment Projections Using 1977 First-Year Enrollment as Base, to 1987

	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86.	1986-87	1987-88
Low series											
Total	16,136	16,486	16,908	16,921	16,931	16,936	16,938	16,940	16,942	16,944	16,944
Base year	16,136	16,136	16,136	16,136	16,136	16,136	16,136	16,136	16,136	16,136	16,136
Construction commitments	—	300	700	700	700	700	700	700	700	700	700
New schools.	—	50	72	85	95	100	102	104	106	108	108
Basic series											
Total	16,136	16,725	17,350	17,525	17,612	17,690	17,765	17,838	17,909	17,980	18,047
Base year	16,136	16,136	16,136	16,136	16,136	16,136	16,136	16,136	16,136	16,136	16,136
Construction commitments	—	450	950	1,025	1,025	1,025	1,025	1,025	1,025	1,025	1,025
New schools	—	74	134	169	191	204	214	222	228	234	236
Other	—	65	130	195	260	325	390	455	520	585	650
High series											
Total	16,136	17,013	17,748	18,019	18,188	18,340	18,485	18,628	18,769	18,906	19,037
Base year	16,136	16,136	16,136	16,136	16,136	16,136	16,136	16,136	16,136	16.136	16.136
Construction commitments	—	650	1,150	1,225	1,225	1,225	1,225	1,225	1,225	1,225	1,225
New schools	—	98	204	271	311	334	350	364	376	384	386
Other	—	129	258	387	516	645	774	903	1,032	1,161	1,290

SOURCE: *Interim Report of the Graduate Medical Education National Advisory Committee to the Secretary, Department of Health, Education, and welfare, Washington, D. C.: Health Resources Administration,* **DHEW publication No. (HRA) 19-633, P.135.**

Table 3.—First-Year Enrollment Projections Using 1976 First-Year Enrollment as Base, to 1987

	1976-1977	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88
Low series												
Total	1,068	1,218	1,309	1,354	1,411	1,429	1,447	1,464	1,481	1,498	1,515	1,532
Base year	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068
Construction commitments	—	90	154	184	214	214	214	214	214	214	214	214
New schools.	—	60	87	102	129	147	165	182	199	216	233	250
Basic series												
Total	1,068	1,258	1,364	1,437	1,522	1,562	1,603	1,643	1,682	1,722	1,762	1,801
Base Year	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068
Construction commitments	—	95	164	199	234	234	234	234	234	234	234	234
New schools.	—	84	111	138	177	207	237	266	295	324	353	382
Other.	—	11	21	32	43	53	64	75	85	96	107	117
High series												
Total	1,068	1,273	1,432	1,534	1,658	1,721	1,782	1,843	1,903	1,963	2,024	2,084
Base year	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068
Construction commitments	—	100	214	264	264	264	264	264	264	264	264	264
New schools.	—	84	188	241	282	322	361	361	400	439	478	517
Other.	—	21	64	85	107	128	10	150	171	192	214	235

SOURCE: *Interim Report of* **the** *Graduate Medical Education National Advisory Committee to the Secretary, Department of Health, .Education and* **Welfare, Washington D. C.. Health Resources Administration, DHEW publication No. (HRA) 19-633, P.136**

Table 4.—First.Year Enrollments in Medical and Osteopathic Schools Projected Under the Basic Assumption; 1978-79 Through 1987-88

Academic year	Total MD and DO first-year enrollments	MD first-year enrollments	DO first-year enrollments
1978-79	18,089	16,725	1,364
1979-80	18,787	17,350	1,437
1980-81	19,047	17,525	1,522
1981 -82	19,174	17,612	1,562
1982-83	19,293	17,690	1,603
1983-84	19,408	17,765	1,643
1984-85	19,520	17,838	1,682
1985-86	19,631	17,909	1,722
1986-87	19,742	17,890	1,762
1987-88	19,848	18,047	1,801

SOURCE: *Interim Report o! the Graduate Medical Education National Advisory Committee to the Secretary, Department of Health, Education, and We/fare,* **Washington, D. C.: Health Resources Administration, DHEW publication No. (HRA) 19-633, p.146.**

Table 5.—U.S.-Trained Physicians, Graduates (MD and DO); Projected 1978-79 Through 1989.90

Academic year	Total graduates	MD graduates	DO graduates
1978-79	16,044	15,048	996
1979-80	16,375	15,346	1,029
1980-81	16,997	15,789	1,208
1981 -82	17,662	16,354	1,308
1982-83	18,333	16,956	1,377
1983-84	18,699	17,241	1,458
1984-85	18,818	17,322	1,496
1985-86	18,928	17,394	1,534
1986-87	19,036	17,464	1,572
1987-88	19,142	17,532	1,610
1988-89	19,201	17,554	1,647
1989-90	19,289	17,604	1,685

SOURCE: *Interim Report of the Graduate Medical Education National Advisory Committee to the Secretary, Department of Health, Education, and We/fare,* **Washington, D. C.: Health Resources Administration, DHEW publication No, (HRA) 19-633, p.147.**

Table 6.—U.S.-Trained Physicians, Graduates (MD and DO); Projected for 1980 and 1990

Year	MD		DO		Total graduates
	Schools	Graduates	Schools	Graduates	
1960	86	7,081	6	427	
1970	103	8,367		432	
1975	114	12,714	9	698	1 3,412
1980 (projected)	121	16,086	13	1,069	17,155
1990 (projected)	121	18,318	13	1,069	19,987

SOURCE: A *Report to the President and Congress on the Status of Health Professions Personnel in the United States,* **Washington, D. C.: Bureau of Health Manpower, Health Resources Administration, DHEW publication No. (HRA) 79-93, p,II-29,**

numbers of graduates. The AMA's annual report, *Medical Education in the United States* (AMA, 1978), lists 122 medical schools accredi ted or provisionally accredited and 16,134 first-year students in 1977-78, plus 2 schools accredited or provisionally accredited for the first 2 years of the MD program whose first-year enrollments apparently were not included in the 1977-78 total of 16,134. And the Association of American Medical Colleges identified 2 additional medical schools in 1979, for a total of 126 (American Medical News, 1979). The projections of first-year enrollments for 1977-78 match the AMA's estimates of the number of first-year enrollees in medical school (16,136 v. 16,134). But the projections to 1980 and 1990 (table 6) state that there will be 121 medical schools and 13 osteopathic schools, compared to 114 medical schools and 9 osteopathic schools in 1975. Thus, it is not clear whether the alternative estimates of 7, 4, or 10 new medical and osteopathic schools include some of the 122 medical schools already in existence, or whether they represent additional schools, as the explanation of the methodology seems to say.

In addition, the assumption of full cavitation funding by 1981 also is unrealistic, and the projections also seem to indicate that full cavitation is expected to be *maintained* after 1981, Currently, the issue with cavitation is whether it will continue at all, not whether fully authorized levels will be appropriated.

Immigration of graduates of foreign medical schools are calculated separately for Canadian medical graduates (CMGS) and other foreign medical graduates (FMGs). The Canadian addition is currently estimated to equal losses from death, retirement, and emigration because the recent historical growth has leveled off.

Additions from the rest of FMGs are particularly uncertain at this time because of the curtailing legislation in the Health Professions Educational Assistance Act of 1976 (Public Law 94-484). Since historical trends will not be predictive of future additions to supply by FMGs, the 1974-76 period has been used, with major adjustments that essentially try to guess at the impact of the legislative changes. Temporary-visa FMGs are assumed to equal the number of graduate medical positions available to them through regulations that implement Public Law 94-484, which require a stepwise reduction in positions until available positions to FMGs reach zero by 1990. The addition of permanent-visa FMGs to the supply is based on estimates of the number of FMGs passing the National Board of Medical Examiners' Visa Qualifying Examination. This exam was begun in September 1977, so only 1 or 2 years of data are available.

Permanent-visa FMGs and the proportion of temporary-visa FMGs estimated to establish permanent status through marriage (based on actual trends) are assumed to have the same death and retirement rates as U.S.-educated physicians.

Of crucial importance is the apparent lack of analysis of the contribution from U.S. citizens studying medicine abroad, a situation currently under study by the General Accounting Office. The projections do account for students returning to the United States to *complete* their medical education in the United States, but they comprise only a small part of the pool of U.S. citizens studying medicine abroad.

Basic, high, and low projections are calculated for the FMG addition to supply. The basic projection is summarized in table 7, with the results of the alternative estimates of the active FMG supply from the basic, high, and low estimates summarized in table 8.

These supply projections are prepared in two matrices. The first matrix projects year-by-year future MD graduates and attrition from the active work force by country of medical education. The second matrix distributes these future graduates and attrition of active practitioners by specialty, each by country of medical education. The first matrix projects graduates and foreign additions utilizing estimates of first-year enrollments, student attrition, other medical-school-related trends, and the model of FMG (including Canadians) immigration. The second matrix distributes the graduates among medical specialties through projections of first-year residency trends, and computes deaths and retirements of active practitioners among the specialties, using the mortality and retirement rates described earlier. Comparable disaggregation of the data on DOS has not been developed, although estimates of total DO supply have been made.

The method is summarized in figure 1. Table 9 summarizes the projected supply of *physicians* through 1990. For comparative purposes, table 10 summarizes estimates made in early 1978 (USDHEW, 1979b). The estimates are approximately equal. It should be noted that the

Table 7.–Supply of Active Foreign”Trained Physicians, Using Basic Methodology, Projected 1975-90

	New entry supply			Losses			Active supply	
Year	Total	Permanent	Temporary	Total	Death and retirement	J-visa emigrants	FMG	CMG
1974	—	—	—	—	—	—	70,940	5,510
1975	7,316	3,898	3,418	2,166	764	1,402	76,090	5,510
1976	6,609	3,399	3,210	2,569	815	1,754	80,130	5,510
1977	6,596	3,399	3,197	2,626	872	1,754	84,100	5,510
1978	4,150	1,152	2,042	2,680	917	1,763	85,570	5,510
1979	4,857	2,521	2,336	2,737	983	1,754	87,690	5,510
1980	3,847	2,521	1,326	2,107	1,047	1,060	89,430	5,510
1981	4,591	2,521	2,070	2,371	1,109	1,262	91,650	5,510
1982	3,581	2,521	1,060	1,751	1,184	567	93,480	5,510
1983	4,325	2,521	1,804	2,355	1,276	1,076	95,450	5,510
1984	3,315	2,521	794	1,735	1,351	384	97,030	5,510
1985	4,059	2,521	1,538	2,349	1,453	896	98,740	5,510
1986	3,049	2,521	528	1,739	1,538	201	100,500	5,510
1987	3,793	2,251	1,272	2,353	1,640	713	101,490	5,510
1988	3,023	2,521	502	1,923	1,740	183	102,590	5,510
1989	3,287	2,521	766	2,227	1,862	365	103,650	5,510
1990	3,023	2,521	502	2,153	1,971	182	104,520	5,510

SOURCE. Interim *Report of the Graduate Medical Education National Advisory Committee to the Secretary, Department of Health Education, and We/fare,* **Washington, D.C.: Health Resources Administration, DHEW publication No. (HRA)19-633, p,140.**

Table8.–Basic, High,and Low Projections of the FMG Active Supply

	Basic		High		Low	
Year	FMG	Canadian	FMG	Canadian	FMG	Canadian
1975	76,090	5,510	76,090	5,510	76,090	5,510
1980	89,430	5,510	92,340	5,510	86,270	5,510
1985	98,740	5,510	104,340	5,510	92,910	5,510
1990	104,520	5,510	112,580	5,510	96,320	5,510

SOURCE: Interim *Report of the Graduate Medical Education National Advisory Committee to the Secretary, Department of Health, Education,* **and We/fare, Washington, D.C; Health Resources Administration, DHEW pubiication No. (HRA) 19-633, PP. 140-142.**

estimates in table 9 have lower projections of the graduate supply and higher projections of the FMG supply than the estimates in table lo. This is despite the optimistic projections of cavitation funding and even further curtailment of the FMG supply that underlie the table 9 projections.

Interestingly enough, projections from the Bureau of Health Manpower (BHM) made in 1974 (USDHEW, 1974) were similar to those made in its report to the President and Congress (USDHEW, 1979b) but the contribution from the graduate supply was lower and that from FMGs higher. In other words, the Bureau's previous estimates, made before the 1976 law curtailing FMG immigration, are more internally consistent with the estimates taking into consideration the effect of the 1976 law. So even though the aggregate projections of supply are similar for these different sets of assumptions, the contribution of the components of the aggregate estimates has differed significantly.

Figure 1.— Diagram of Projection of Supply of Active Physicians Through 1990

Projected active supply	=	Base year active supply 1974	+	U.S. medical graduates (USMGS)	+	Canadian medical graduates (CMGS)	+	Foreign medical graduates (FMGs)	-	Deaths and retirement	-	Emigration of temporary FMGs

USMG = FYE[a] – Attrition

FMG = Permanent visa + Temporary visa

Total separations = Deaths and retirements + Emigration of temporary FMGs

Derived from estimates of percent inactive (retirees) and percent mortality of MDs by age and sex cohort

aFy E = first.year enrollment

SOURCE *Interim Report of the Graduate Medical Education* **National** *Advisory Committee to the Secretary, Department of Health, Education, and Welfare,* **Washington, D C Health Resources Administration, DHEW publication No (HRA) 79.633, p, 112.**

Table 9.—Supply of Active Physicians (MD and DO) by Country of Medical Education Using Basic Methodology: 1974 and Projected 1975-90

Category	1974	1975a	1980	1985	1990
	Number of active physicians				
All active physicians	362,500	377,400	447,800c	523,600	596,800
U.S.-trained	286,000	295,800	352,800	419,300	486,900
MD.	272,400	281,700	335,100	396,100	457,000
DO.	13,600	14,100	17,700	23,200	29,900
Canadian-trained MDs	5,600	5,500	5,600	5,600	5,600
Foreign-trained MDs.	70,900	76,100	89,400	98,700	104,500
	Rate per 100,000 population				
All active physicians.	171.1	176.8	201.5	224.8	245.1
U.S.-trained	135.0	138.5	158.8	180.0	200.0
MD.	128.6	131.9	150.8	170.1	187.7
DO.	6.4	6.6	8.0	10.0	12.3
Canadian-trained MDs	2.6	2.6	2.5	2.4	2.3
Foreign-trained MDs.	33.5	35.6	40.2	42.4	42,9
	Percent distribution				
All active physicians.	100.0	100.0	100.0	100.0	100.0
U.S.-trained	78.9	78.4	78.8	80.1	81.6
MD.	75.1	74.6	74.8	75.6	76.6
DO.	3.8	3.7	4.0	4.4	5.0
Canadian-trained MDs	1.5	1.5	1.3	1.2	0.9
Foreign-trained MDs, ...	19.6	20.2	20.0	18.9	17.5

available estimates for 1975 and 1976 for active U. S,-trained MDs are 282,800 and 290,900 respectively; active FMGs are estimated at 76,200 and 79,700 resPOctivOIY. Ac. tive Canadian-trained MDs are estimated at 5,500 for both years.
bAssumes that the percent active of the AMA "not classified" MDs is the same as the percent "professionally active" Of the classified MDs includlng those with address unknown.
corigInal table added this column incorrectly to total 477,800.
Population figures used (in millions): 1960: 185.4; 1970: 206.1; 1974: 21 1.9; 1975: 213.5; 1980: 222.2; 1985 232.9; 1990: 243,5.

SOURCE: */nferirn Report of tfre Graduate Med/ca/ .Educat/on rValiona/ Adwsory Cornrn/ttee to the Secretary, Deparfrnent of* **Health,** *Educat/err, and We/tare,* **Washington, D. C.: Health Resources Administration, DHEW publication No, (HRA) 19-633, p,144.**

Table 10.—Supply of Active Physicians (MD and DO) by Country of Medical Education Using Basic Methodology: Actual 1974, 1975; Projected 1980.90

Category	1974	1975	1980	1985	1990
	Number of active physicians				
All active physicians.	362,500	378,600	444,000	519,-joo	594,000
U.S.-trained	286,000	296,700	353,600	42,$,400	495,700
MD.	272,400	282,600	335,900	40"t ,100	465,900
DO.	13,600	14,011	17,700	23,300	29,800
Canadian-trained MDs	5,600	5,700	6,000	6,100	6,200
Foreign-trained MDs.	70,900	76,200	89,400	86,500	92,100
	Rate per 100,000 population				
All active physicians.	171.1	177.3	199.3	2;)1 .7	242.4
U.S.-trained	135.0	138.9	158.7	181.3	202.3
MD.	128.6	132.3	150.8	171.4	190.1
DO.	6.4	6.6	7.9	10.0	12.2
Canadian-trained MDs	2.6	2.7	2.7	2.6	2,5
Foreign-trained MDs.	33.5	35.7	37.9	37.8	37.6

SOURCE: *A Report to the Pres/derrt and Congress on the Srafus of Hea/th ProfessIons Personnel m the Ur?/ted States,* **Washington, D. C.: Bureau of Health Manpower, Health Resources AdminIstratlon, DHEW publication No. (HRA) 79-93, p A-25.**

SPECIALTY SUPPLY

Recall that aggregate supply was prepared in two matrices. The first matrix projects graduates and foreign additions utilizing estimates of first-year enrollments, student attrition, other medical-school-related trends, and the model of FMG immigration. The second matrix distributes the graduates among medical specialties through projections of first-year residency trends, and computes deaths and retirements of active practitioners among the specialties.

Comparable disaggregation of the data on DOS has not been developed, although estimates of total DO supply have been made. The DO distribution between primary care specialties is difficult to predict because of the lack of basic data on graduate training positions and because the graduate osteopathic training system is changing. In addition, MD residency programs accept DOS, which could lead to increasing specialization by younger DOS.

Presently, about 58 percent of DOS are in primary care. If DO graduates enter first-year residency programs in the same proportion as projected for MDs, by 1990 only 52 percent would be in primary care. If DOS continue current trends in graduate osteopathic training, 64 percent would be in primary care in 1990 (USDHEW, 1979b). Although these are significant percentage differences, the absolute differences are not large. Out of a total DO supply of 30,000 in 1990, the 52-percent figure corresponds to about Is, SOO primary care DOS, and the 64-percent figure corresponds to 19,000. This is in contrast to 1990 estimates of total MD and DO supply of 600,000 and a primary care MD supply of 240,000.

The projections for MD specialty distribution of the aggregate supply depend principally on first-year residency trends and on the attrition rates of the various specialties and subspecialties.

The data sources for current specialty supply are summarized in table 11. Specialty designations are obtained from the AMA master file, Board certification data, and specialty society memberships. The AMA file contains self-designation of specialty, tending to overestimate specialty supply and underestimate general practice supply. And, as only the primary activity/specialty is identified, nothing is known about patient care time spent in the identified specialty or in activities usually associated with other specialties. About half of the physicians identified in the AMA files are not identified in the Board certification data. Also, Board certification data and especially society membership data result in duplicate counting, as physicians can belong to more than one specialty board or society. There are 22 medical and surgical boards and over 130 specialty societies.

BHM uses the AMA master file as its basic source, with the 1974 active supply as the starting point.

First-year residency trends, which are used to project additions of MD graduates (foreign and domestic) to the specialties, contain three assumptions: 1) that the first-year residency distributions for 1968, 1970-74, and 1976, can be used to predict future first-year residency trends; 2) that first-year residency counts for particular specialties are duplicative in the sense that a proportion of these residents do not go on to complete that specialty training, but move on to subspecialization or to another specialty altogether; and 3) that some residency positions are shared by different institutions, which also leads to duplicative counting. Considering the kinds of interpretation problems that accompany trying to project specialty distribution among active practitioners from first-year residency positions, the better method would be to analyze final-year residency counts, but the AMA does not keep year-by-year accounts of medical graduates, and first-year residency data represent the best available data.

Residency data sources and comments on their strengths and limitations are summarized in table 12. The principal data source is the *Directory of Accredited Residencies.*

The particular years chosen to establish trends, 1968, 1970-74, and 1976, are the most recent years on which to base such calculations,

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Table 11.–Data Sources on Physician Specialty Supply

Data sources	Strengths	Limitations
1. *The American Medical Association Master File,* —Contains data on all known MDs in the United States, obtained by surveys performed every 3 to 4 years, and updated annually by selected mailings to specific physicians for whom a change in status has been indicated.[a] Physicians are listed by self-designation as to their specialty, activity, and location according to how they spend the majority of their time. Sixty-eight specialities are included within which eight activity categories are included.	Most complete source of data on allopathic physicians. Published and updated annually providing trend data.	Self-designation of specialty gives no indication of specific training in the area and also tends to overestimate specialty manpower, and underestimate general practice manpower. Published data provide no information on the time devoted to other specialty areas and activities making it difficult to determine full-time equivalent manpower.[b] Accuracy of data on FMGs is debatable as is the accuracy of specialty distributions because increasing numbers of physicians are being relegated to the "non-classified" category.[cd] Can be difficult and/or expensive to obtain unpublished tabulations. Published data usually 2 years out of date.
2. *The American Osteopathic Association MAster* File.—Contains information on both member and nonmember osteopathic physicians as to location and updated annually. Augmented by surveys performed in 1956, 1967, 1971, and 1976 which yielded additional data on specialty, age, and activity status.[e]	Most complete sources of data on Osteopathic Physicians. Updated annually, and thus, only sources of trend data on osteopathic physicians. In some cases the data are comparable to AMA data.	The problems associated with self-designation relating to AMA data also apply to AOA data. Specialty data only available for survey years, and when published contains information up to 3 years out of date. Accuracy of specialty data questionable because large numbers of physicians are relegated to the non-classified category.[f] Not always comparable to AMA data.
3. *Licensure* data.—Provides data on numbers of physicians Licensed by State. Disaggregate by whether or not physician attended a U.S. or foreign medical school.	Contains data on physicians who have received licenses; therefore, one can be sure all uncredentialled physicians are excluded.[g] Published and updated annually, so trend data are available.	Underestimates true physician supply since it excludes all physicians who are not licensed, such as some of those in teaching and administration and research, and some FMGs who are providing important service despite their unlicensed status. No information on specialty and practice activity of licensed physicians. Duplication often occurs between various State licensure boards.
4. *Board certification data.—Gives* information the numbers of MDs certified by the 22 medical and surgical boards and the numbers of DOS certified by the 14 Osteopathic specialtv boards.[h]	Most objective criteria of physicians postgraduate training in specific specialty areas. Published and updated annually so trend data are available.	Excludes almost half of MD supply as reported by AMA and 4/5 of the DO supply as reported by AOA. Duplicate counting occurs due to certification by more than one specialty board. Does not necessarily represent physician's present specialty activities.
5. *Specialty society memberships,*—Includes numbers and distributions of MDs in over 130 specialty societies.[i]	Gives some indication of physician's interests in specific areas of medicine not revealed in other AMA specialty classifications. Published and updated anually.	Gives no indication of physician's training or background in a specific specialty area represented by the society. Duplicate memberships often occur. Does not necessarily represent the present activities of the physician.

[a] American Medical Association Physician Master Fde, American Medical Association, Chicago, Ill., 1977.

[b] For example, a physician may report his or her professional activities in a typical workweek consisting of 30 hours of patient care and 20 *hours* of teaching and research, and In addition specialty activity is reported as 25 hours of internal medicine and 25 hours of dermatology. This precludes determination of number of FTE physicians in direct patient care

[c] According to cohort study of physicians immigrating to the United States between 1961 and 1971 an estimated 33 percent of 27,710 Immigrants in the cohort ware not on the AMA master file J C Kleinman, Physician Manpower Data: "The Cese of the Missing Foreign Medical Graduates," *Medical Care,* 12 906, 1974. Others believe that the AMA does account for all FMGs I Butler and M. Schaffner, "Foreign Medical Graduates and Equal Access to Medical Care," *Medical Care,* 9(2) 136-43, March. April 1974

[d] From 258 in 197o to 30,129 in 1976 for MDs, Louis J Goodman, *Physician Distribution and Medical Licensure in the US,* 1976 Chicago, American Medical Association, 1977

[e] *1976 Directory,* American Osteopathic Association, Chicago, 1976

[f] From 901 in 1971 to 653 in 1976. M E Altenderfer, *Osteopathic Physic/arrs in the* U S A *Report of* a *1971* Survey, BHRD, DHEW publication No (HRA) 75-60, 1975 and American Osteopathic Association, 1974 Master File, Liaison Committee on Osteopathic Information, *Osteopathic Manpower Information Project*, final report, May 20, 1977

[g] At present it is estimated that there are about 36,500 physicians in the country who do not hold a regular State license. Louis J Goodman, *Distribution of Physicians,* 1976, p 577

[h] For MDs the American Medical Association, Pro/da *of Medical Practice 1977,* Chicago, 1977, p 101 For DOS sea, Liaison Committee on Osteopathic Information, *Osteopathic Manpower Information Project,* Final Report, May 20, 1977

[i] In 1974, over 130 such societies existed, in which there were 342,090 members representing 104 percent of all active physicians during that year. American Medical Association, *Profile of Medical Practice 1975-76* Chicago, 1976.

SOURCE: *Interim Report of the Graduate Medical Education* National *Advisory Committee to the Secretary, Department of Health, Education, and We/fare,* Washington, D. C,: Health Resources Administration, DHEW publication No. (HRA) 79-633, pp. 101-103.

Table 12.—Internship and Residency Data Sources

Data sources	Strengths	Limitations
1. *Directory of Accredited Residencies* and previous editions of the *Directory of Approved Internships and Residencies.* — Contains data on distributions off first-year and total residents by specialty (30 listed), country of education, and affiliation status of hospital. Also lists numbers of positions offered and filled by specialty and affiliation and numbers of positions offered for the forthcoming year.[a]	Most complete source of data available on MDs in training. Published and updated annually.	Usually it is 2 years out of date. Does not provide distributions of residents by institutions. Physicians listed as first-year residents in some specialties may in fact be the second or third year of training. includes only first-year and total counts—intervening years not given. No data on fellowships.
2. *American Osteopathic Association Almanac.*—Contains data on residents in osteopathic hospitals by specialty and institution.[b]	Most complete source of data on DOS in training. Published and updated annually. Provides distributions of residents by institution.	Does not provide disaggregated data on residents by years in t raining. No information provided on DOS training in non-AOA-approved programs such as AMA-approved hospitals.
3. *Council of Teaching Hospitals.* — Provides data on interns and residents by institution.[c]	Provides distributions of interns and residents by institution. Published and updated annually. Timely, 1976 data available in 1976.	Does not provide distributions of resident specialty or years in training.
4. *National Intern and Resident Matching Program.*— Provides information on specialty distributions of first-year and other residents in AMA-approved hospitals who participate in the program.[d]	Provides indications of student specialty and institutional preferences. Timely, 1976 data available in 1976.	Does not provide trend information on unmatched graduates and foreign medical graduates variously estimated at 10 to 30 percent of the total first-year resident supply.[e,f,g]

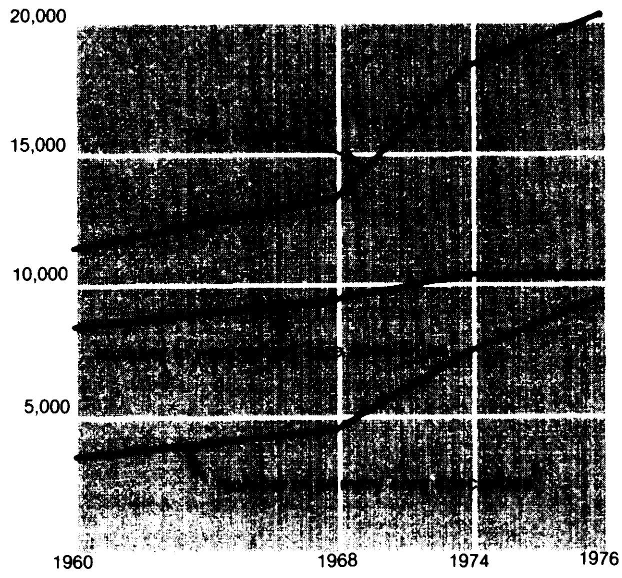
[a] American Medical Association, *Directory of Approved Internships and Residents 1975-1976,* Chicago, 1976.
[b] American Osteopathic Association, "Almanac, Supplement to Volume 76," 1975 *Journal of the American Osteopathic Association,* April 1977.
[c] Council of Teaching Hospitals, *Directory, 1976,* Association Of American Medical Colleges, January 1976.
[d] American Medical Association, *D/rectory of Approved InternShips and Residencies.*
[e] J. S. Graettinger, "Graduate Medical Education Viewed From the National Intern and Resident Matching Program," *J. Med. Educ., 51,* September 1976,
[f] B. Biles, communication to staff of the Senate Committee on Labor and Public Welfare, June 6, 1976.
[g] NIRMP does provide data for 1977 and 1978 on unmatched U.S. graduates. The program plans to collect such information periodically on all U.S. graduates, both those who use as well as those not using NIRMP.

SOURCE: *Interim Report of the Graduate Medical Education National Advisory Committee to the Secretary, Department of Health, Education, and Welfare,* Washington, D. C.: Health Resources Administration, DHEW publication No, (HRA) 79-633, pp. 105-108,

but they also are unfortunate choices in the sense that major changes were occurring in addition to the general drive to increase the aggregate supply of physicians and particularly those in primary care. In 1971, the AMA decided to terminate the free-standing internship after July 1, 1975, and instead to integrate the first year of graduate medical education into specific residency programs. During this time, the number of first-year residency positions increased dramatically. Most of this increase occurred in the primary care specialties, especially internal medicine (see figures 2 and 3). It would be reasonable to presume that much of this growth was not related to interest in primary care as a career. Instead, the first year of primary care residency training most likely substituted for the internship of previous years.

This overcounting of specialists through the use of first-year residency data is not a phenomenon solely related to the discontinuation

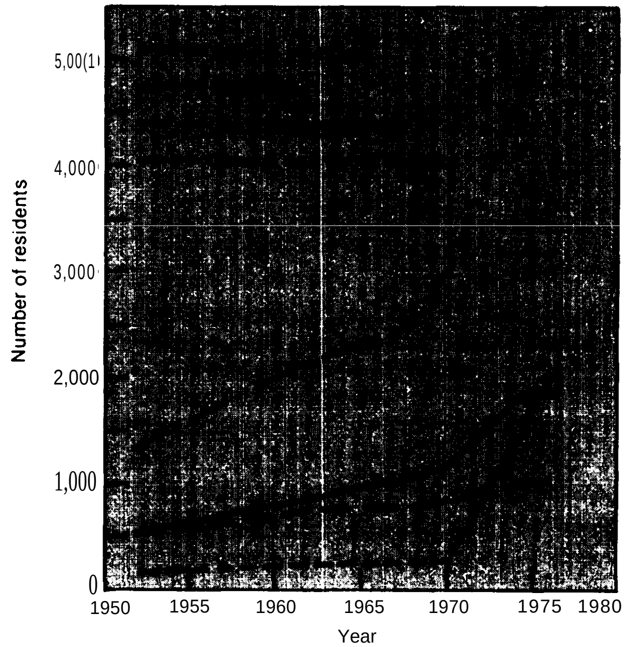
Figure 2.—Trend Data on Number of First-Year Residents: Total, Primary, Nonprimary Care Specialties; 1960, 1968, 1974, and 1976



[a]Nonprimary specialties are total less primary care specialties.
[b]Primary care specialties include general and family practice, internal medicine, and pediatrics.

SOURCE: *interim Report of the Graduate Medical Education National Advisory Committee to the Secretary, Department of Health, Education, and We//are,* Washington, D. C.: Health Resources Administration, DHEW publication No. (HRA) 79-633, p. 51.

Figure 3.—Trend in Number of First-Year Allopathic Residents in Four Selected Specialties



SOURCE: *Interim Report of the Graduate Medma/ Education Nat/ona/ Advisory Committee to the Secretary, Department of Hea/th, Educat/on, and We/fare,* Washington, D. C.: Health Resources Administration, DHEW publication No. (HRA) 79-633, ɪ.ɪ. 50,

of the free-standing internship. It has been known for some time, although hard to quantify, that some graduate trainees take a second first-year residency in a more specialized area of the same specialty or move on to more advanced training in another specialty altogether. For example, there is an observed 22-percent increase between the first and second year in the surgical specialties (USDHEW, 1979a).

The way in which the overcounting is minimized is to adjust the first-year residency data in the *Directory of Accredited Residencies* by subtracting the appropriate subspecialties from the general residencies 1 year later. These adjustments are performed for internal medicine, pediatrics, general surgery, psychiatry, and pathology (USDHEW, 1979a).

For internal medicine, 9 percent of first-year residents are subtracted first, this percent is assumed to take another first-year residency in a medical subspecialty or in another specialty. Of the remainder, 25 percent is assumed to go on to subspecialty training. Thus, a total of about 32 percent (25 percent of the remainder of first-year residents after subtracting 9 percent, plus the original 9 percent of the total) of all internal medicine first-year residents are subtracted and "lost" to medical subspecialties or other specialties.

More recent data estimates that only 38 percent of first-year internal medicine residents end up in general internal medicine, as compared to the 68 percent summarized above (USDHEW, 1979a). However, these percentages are not directly comparable because of the way in which internal medicine subspecialties are counted or not counted as primary care. The 68 percent remaining in primary care internal medicine excludes gastroenterology, pulmonary disease, cardiovascular disease, and allergy, but includes allergy and immunology, diabetes, endocrinology, geriatrics, hematology, immunology, infectious diseases, neoplastic diseases, nephrology, nutrition, oncology, and rheumatology (table 13). Whether a subspecialty of medicine is included in the internal-medicine primary care count is of crucial importance, as the first-year residency distribution of primary care specialties is heavily weighted toward internal medicine. Internal medicine comprises more than so percent of all first-year primary care residency positions (table 13).

The adjustment to pediatric first-year residency positions is 9 percent, representing losses to pediatric allergy and pediatric cardiology. The surgical figures are adjusted downwards by 62 percent, representing all surgical specialties except obstetrics-gynecology and ophthalmology. Pathology is adjusted downwards by 2.7 percent, representing forensic pathology. And psychiatry is adjusted downwards by 20 percent, representing child psychiatry. The “miscellaneous” category is assumed to remain proportionate to the overall numbers of MDs throughout the projection period. The adjusted and unadjusted first-year residency distribution for 1974 is summarized in table 13.

The same adjustments made for the 1974 year are made for all historical years, 1968, 1970-74, 1976, that are used to establish the trend. For 1968, the use of these specific adjustment percentages may not be very relevant, since it was several years before announcement by AMA of its intention to discontinue the internship.

A more technically oriented summary is provided in the following excerpt (with table numbers changed to match the sequence of this report) from the Graduate Medical Education National Advisory Committee (GMENAC) interim report (USDHEW, 1979a). Note that the trend in distribution of residents among the various specialty training programs assumes a similar trend for 1974 to 1980-81 as the base years of 1968-74 (which were also modified to include 1976 data). After 1980-81, the residency distribution is held constant. BHM’s justification for the constant distribution after 1980-81 is primarily that the base years which have been chosen to establish the trend covered 6 years, so the trend extrapolation is limited to 6 years.

The total projection method is summarized in figure 4. Tables 16 and 17 summarize specialty projections for MDs to 1980, 1985, and 1990.

> Projections of filled first-year residencies were made by extrapolating the results of simple linear regression applied to the trend in filled first-year residency percent distributions for the years 1968, 1970-74, and 1976. The procedure was applied for each specialty individually except for the category “miscellaneous,” which was assumed to remain constant at 6.7 percent (see tables 14 and 15). Also, rates were developed separately for U. S., Canadian, and other medical school graduates.
>
> In these regression analyses, the slope of the regression line was computed from historical trends, and the constant term (base year) was taken from the first-year residency distribution of 1974, adjusted for the duplication caused by physicians first taking a residency in a general area and then in a specialty (table 13). Where this adjusted value differed significantly from the original vaIue, as in general surgery, the yearly rate of change (slope) was decreased by the ratio of the unadjusted to the adjusted value. The degree to which simple linear regression represents historical trends in individual specialties is reflected in the F and R2 values displayed in tables 14 and 15. Most specialty trends are adequately “explained” using this statistical method. However, recent cultural, political, and fiscal interventions have affected certain specialties so that they behave erratically, and therefore have statistically nonsignificant F and R2 values for a linear fit. In two cases, U. S./CMG general practice and radiology, the linear trend produced actual negative percent values. These values were set and held at zero for these two specialties. This is a reasonable assumption since general practice is being replaced by family practice, and general radiology is being replaced by the diagnostic and therapeutic training programs.
>
> The effects of recent legislation (Public Law 94-484) have not been evaluated and incorporated into the projections. However, the percent of U.S. /CMG filled first-year residencies in primary care for 1980 are projected to meet the legislative mandates.

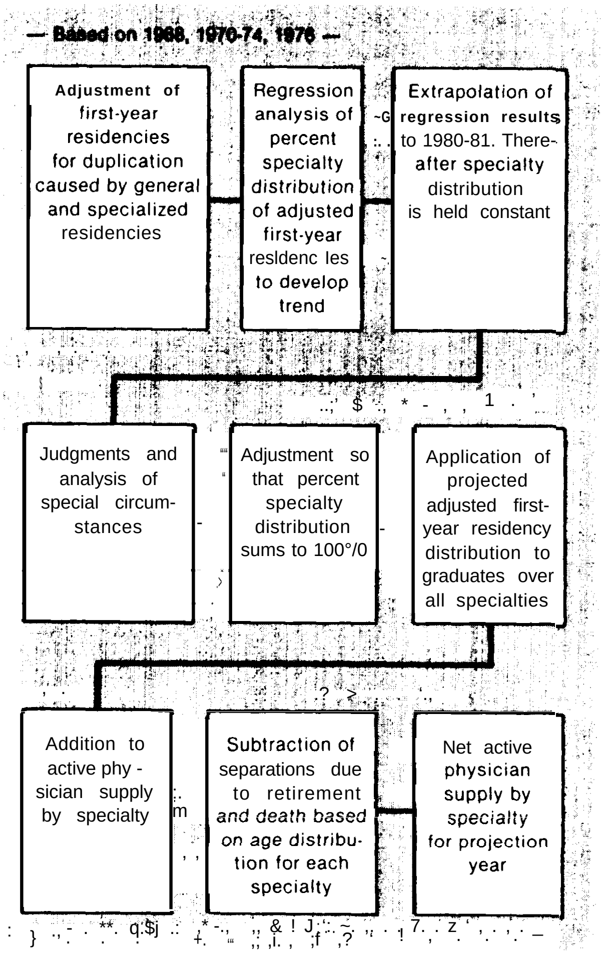
Table 13.–First.Year Residency Distribution With Subspecialty Adjustment: Sept. 1,1974

Specialty	AMAa				Adjustments		Adjusted AMA			
	US/CMGs		FMGs		US/CMGs	FMGs	US/CMGs		FMGs	
	Number (1)	Percent (2)	Number (3)	Percent (4)	Number (5)	Percent (6)	Number (7)	Percent (8)	Number (9)	Percent (lo)
Total active physicians	13,519	100.0	5,216	100.0			12,626	100.0	4,755	100.0
Primary care	5,978	44.2	1,746	33.5			4,735	37.5	1,394	29.3
General practice	23	0.2	139	2.7			23	0.2	139	2.9
Family practice	1,131	8.4	68	1.3			1,131	9.0	68	1.4
Internal medicineb	3,591	26.6	962	18.4	– 1,144	–306C	2,447	19.4	656	13.8
Pediatrics	1,233	8.4	577	11.1	– 99	– sad	1,134	9.0	531	11.2
Other medical specialties	335	2.5	46	0.8			1,155	9.1	266	5.6
Dermatology	248	1.8	16	0.3			248	2.0	16	0.3
Pediatric allergy	46	0.3	13	0.2			46	0.4	13	0.3
Pediatric cardiology	41	0.3	17	0.3				0.3	17	0.4
Internal medicine subspecialtiese	—	—			+ 820	+ 220f	8;;	6.5	220	4.6
Surgical specialties	4,395	32.5	1,454	2;.9			3,280	26.0	936	19.7
General surgery	1,803	13.4	836	16.0	– 1,118	– 5189	685	5.4	318	6.7
Neurological surgery	114	0.8	15	0.3			114	0.9	15	0.3
Obstetrics and gynecology	742	5.5	288	5.5			742	5.9	288	6.1
Ophthalmology	468	3.5	36	8.7			468	3.7	36	0.8
Orthopedic surgery	547	4.0	62	1.2			547	4.3	62	1.3
Otoiaryngology	227	1.7	43	0.8			227	1.8	43	0.9
Plastic surgery	148	1.1	36	0.7			148	1.2	36	0.8
Colon andrectalsurgery		0.1	10	0.2			20	0.2	10	0.2
Thoracicsurgery	%	0.7	50	1.0			97	0.8	50	1.1
Urology	232	1.7	78				232	1.8	78	1.6
Otherspecialties	2,808	20.8	1,970	3;::			3,456	27.4	2,159	45.4
Anesthesiology	367	2.7	348	6.7			367	2.9	348	7.3
Neurology	252	1.9	109	2.1			252	2.0	109	2.3
Pathology	397	2.9	410	7.9	– 11	– I I h	386	3.1	399	8.4
Forensic pathology	17	0.1	7	0.1			17	0.1	7	0.1
Psychiatry	952	7.0	612	11.7	– 180	– I I G i	771	6.1	496	10.4
Child psychiatry	189			1.9			189	1.5	98	2.1
Physical medicineand rehabilitaticm	29	::;	!%	1.8			29	0.2	93	2.0
Radiology	88	0.7	137	2.6			88	0.7	137	2.9
Diagnostic radiology	452	3.3	101	1.9			452	3.6	101	2.1
Therapeutic radiology	65	0.5	55	1.1				0.5	55	1.2
Miscelianeousj	—	—	—	—	+ 840	+316k	8:;	6.7	316	6.7

aDirectO~OfACCredited Residencies, AMA,Chicago, 1977.
bIncludesa~ergy and immunology, diabetes, endocrinology, geriatrics, hematology, immunology, infectiousdiseases, neoplasticdiseases, nephrology, nutrition, oncology, and rhematology.
cForexplanationofganed 2$percent adjustments, seetext.
d1974FyR9inpediatfica~ergy and pediatric cardiology(l17) divided by 1973 FYRsin pediatrics (l,899)is 8.9 percent, theproportion excluded from the 1974 FYRsin pediatrics.
eInclude.g gastroenterology, pulmonary disease, cardiovascular disease, andallergy.
fl,~figure from footnotec.
g1974 FYRs (1,679) in surgical Subspecialties (excluding obstetrics/gynecology, and ophthalmology) divided by 1973 FYRs(2,6g8) in general surge~ is 62percent, the proportion subtracted out of the 1974 FYRsin general surgery.
hlg74FyRs(24) in forensic pathology divided by 1973 FYRs(896) in pathology is2.7 percent, theproportionexcluded from the1974FYRsin pathology.
i1974FYR9(287) inchildpsyhiatdiidd by the 1973 FYRs(l,472) in psychiatvis20 percent, the proportion subtractedout of the 1974 FYRsin psychiatry.
jIncludes aerospace medicine, public health, general preventive medicine, occupational medicine, "other,"a ndunspecified.
'For explanation, see text.

SOIJRCE: *Interim Report of the Graduate* Medical ~duc~~io~ ~S'tkVM/ *AdvisoW Committee to the Secretary, Deparfrnerrt of Health, Educatiorr, and We/fare,* **Washington, D. C.: Health Resources Administration, DHEW publication No. (HRA) 79-833, pp. 124-125.**

Figure 4. -Projection of Active Physicians by Specialty



SOURCE: *Interim Report of the Graduate A.fed/ca/ Education Naf/ona/ Advisory Cornrn/tree to fhe Secretary, Depar?nrenf of* **Health,** *Educaf/on, “and We/fare,* **Washington, D. C.. Health Resources Admlnistratlon, DHEW publication No (HRA) 79-633, p 122,**

As mentioned, judgment was used in specific instances where straightforward extrapolation appeared to produce intuitively unreasonable results. Such was the case with specialties showing a curvilinear trend. This trend was terminated in 1977 for these specialties, not only because the projected numbers appeared unreasonable, but also because the historical data in no instance showed a strong curvilinear trend in one direction that lasted more than 3 years. The USMG radiology trend was allowed to fall to zero by 1980 because of the reported phasing out of general radiology as a prerequisite for entry into one of the radiology subspecialties.

It is readily acknowledged that such use of regression in this analysis implied an assumption that the conditions underlying and responsible for past trends will also be in force in the future. Even though the situation is rapidly changing in the GME environment, it is nonetheless believed that such projections, when interpreted in a cautious manner, can be of value as “baseline” estimates, indicating what the specialty configuration might be if residency developments continue as they have in the past.

Using this approach, extrapolations of each distinctive residency trend were developed. Because each residency category was projected separately, however, a few minor changes had to be made to adjust the overall distribution to the control total for all residencies. In other words, when the projected percentage distribution of residencies did not add to 100 percent because of unusually strong trends in one specialty, the specialties which remained constant (10 out of *29* in the case of USMGS) in the historical trend period were adjusted slightly to make up the difference.

For several reasons, this methodology was employed for the period of 1980-81. Thereafter, the 1980-81 residency distribution was held constant. One reason for this is that extrapolation is not statistically justified for longer periods in the future than are represented by the historical data on which it is based, in this case 6 years. Another reason is that most trends of the type observed have a tendency to level off after their initial spurt. (Additional research and trend analysis is continuing on this aspect of the projections.)

These assumptions are the working assumptions of the Division of Manpower Analysis, BHM, for specific purposes. They have not been endorsed by GMENAC, which will develop its own assumptions concerning requirements rates, foreign medical graduates projections, specialization rates, cavitation grants to medical schools and other issues. It is GMENAC’S intent to investigate and, as needed, modify these assumptions (USDHEW, 1979a).

Table 14.—Percent Distribution of U.S/CMG First-Year Residency Projections Using Simple Linear Regressions (1976 actual, 1977-81 projections)

Specialty	1976[a]	1977	1978	1979	1980	1981	F[b]	R^2[b]
Total[c]	100.0	100.0	100.0	100.0	100.0	100.0		
Primary care	43.2	43.8	46.0	48.1	50.2	— 52.2		
General practice	0.1	0.0	0.0	0.0	0.0	– 0.0	18.2	.78
Family practice	12.0	13.5	15.1	16.6	18.1	19.5	385.9	.99
Internal medicine	22.6	21.2	21.7	22.2	22.7	23.2	10.1	.67
Pediatrics	8.5	9.1	9.2	9.3	9.4	9.5	9.6	.66
Other medical specialties	9.8	9.6	9.5	9.7	9.8	9.9	–	–
Dermatology	1.6	1.7	1.6	1.6	1.5	1.5	2.7	.36
Pediatric allergy	0.4	0.4	0.4		0.4	0.4	0.1	.02
Pediatric cardiology	0.2	0.3	0.2	0.4	0.2	0.2	2.6	.34
Internal medicine subspecialties[d]	7.6	7.2	7.3	7.5	7.7	7.8	16.1	.76
Surgical specialties	22.5	21.8	20.7	19.4	18.0	16.9	–	–
General surgery	4.8	4.2	3.8	3.4	3.0	2.6	60.3	.92
Neurological surgery	0.6	0.6	0.5	0.5	0.4	0.3	24.9	.83
Obstetrics and gynecology	5.9	5.8	5.8	5.7		5.6	0.4	.07
Ophthalmology	3.1	2.8	2.6	2.3	5.6	1.8	500.0	.99
Orthopedic surgery	3.4	3.6	3.4	3.2	3.0	2.8		.61
Otolaryngology	1.4	1.4	1.3	1.1	1.0	0.9	3:::	.88
Plastic surgery	1.0		1.1	1.1	1.1	1.1	8.8	.40
Colon and rectal surgery	0.1	1.1	0.2		0.2	0.2	22.7	.82
Thoracic surgery	0.7	0.6	0.6	0.2	0.5	0.5	5.4	.52
Urology	1.4		1.4	1.3	1.2	1.1	5.3	.51
Other specialties	24.6	24.6	23.8	22.9	22.1	21.2	–	–
Anesthesiology	2.2	2.0	1.7	1.4	1.1	0.9	113.9	.96
Neurology	1.8	1.8	1.6	1.5		1.3	6.1	.55
Pathology	3.2	2.9	2.8	2.7	1.4	2.5	11.7	.70
Forensic pathology	0.1	0.1	0.1	0.2	0.2	0.2	0.5	.11
Psychiatry	4.8	4.5	3.9	3.3	2.7	2.2	26.0	.84
Child psychiatry	1.3	1.5	1.5	1.5	1.5	1.4	0.01	.002
Physical medicine and rehabilitation	0.4	0.2	0.2		0.1	0.0	5.1	.50
Radiology	0.2	0.0	0.0	0.1	0.0	0.0	57.1	.92
Diagnostic radiology	3.5		4.8	5.0	5.3	5.5		.28
Therapeutic radiology	0.4	4.6	0.5	0.5	0.5	0.5	0.07	.02
Miscellaneous	6.7	6.7	6.7	6.7	6.7	6.7	–	–

[a]Actual figures.
[b]The degree to which simple linear regression represents actual historical trends in the individual specialties is reflected in the F and R^2 values.
[c]Figures may not total due to independent rounding.
[d]Includes gastroenterology, pulmonary disease, cardiovascular disease, and allergy.
[e]Includes aerospace medicine, public health, general preventive medicine, occupational medicine, '*other," and unspecified.

The "F Test," as applied to the regression on historical residency data, measures the statistical significance of the linear trend as an estimate of the past changes in the number of first-year residents by specialty 1968-76. Values of F greater than 6.6 are statistically significant at the 95-percent confidence level.

R^2, the square of the Pearson product-moment correlation coefficient, is frequently referred to as "The Correlation Index." On a scale from zero to one, it measures the degree to which the linear trend estimates the actual changes in the number of first-year residents, by specialty, 1968-76.

SOURCE: Interim Report of *the Graduate Medical Education National Advisory Committee to the Secretary, Department of Health, Education, and Welfare,* Washington, D. C.: Health Resources Administration, DHEW publication No. (HRA) 79-633, pp. 127-128.

LOCATIONAL DISTRIBUTION

Where **physicians reside and practice** medicine is generally obtained from the same data sources as for aggregate and specialty supply. Distribution is usually described at the State, county, or Health Service Area (HSA), and, for comparative purposes, quantified as a physician-to-population ratio.

The limitations of the data sources in simply describing where physicians live and practice are similar to the data limitations in describing aggregate and specialty supply. In addition, describing locational distribution by States, by counties, by metropolitan versus nonmetropolitan areas, and even by HSAS may be most con-

Table 15.—Percent Distribution of FMG First-Year Residency Projections Using Simple Linear Regressions
(1976 actual, 1977.81 projections)

Specialty	1976a	1977	1978	1979	1980	1981	Fb	RZb
Total:	100.0	100.0	100.0	100.0	100.0	100.0		
Primary care	33.2	31.6	32.1	32.6	33.1	33.6		
General practice	4.4	3.5	3.6	3.7	3.8	3.9	0.7	.12
Family practice	3.1	3.1	3.5	3.9	4.3	4.7	27.2	.87
Internal medicine	13.2	13.3	13.1	12.9	12.7	12.5	2.0	.28
Pediatrics	12.5	11.7	11.9	12.1	12.3	12.5	1.3	.21
Other medical specialties	5.4	5.2	5.2	5.1	4.9	4.7	—	—
Dermatology	0.3	0.2	0.2	0.2	0.2	0.1	6.7	.57
Pediatric allergy	0.3	0.3	0.3	0.3	0.3	0.3	0.1	.02
Pediatric cardiology	0.4	0.3	0.3	0.3	0.3	0.2	10.4	.68
Internal medicine subspecialties[d]	4.4	4.4	4.4	4.3	4.2	4.1	2.2	.31
Surgical specialties	20.5	19.0	18.2	17.6	17.0	16.2	—	—
General surgery	7.0	6.6	6.4	6.1	5.9	5.7	16.4	.77
Neurological surgery	0.8	0.5	0.5	0.5	0.5	0.5	0.1	.02
Obstectrics and gynecology	5.4	5.0	4.6	4.1	3.7	3.3	138.7	.97
Ophthalmology	0.5	0.6	0.5	0.5	0.5	0.4	3.6	.42
Orthopedic surgery	2.0	1.7	1.7	1.8	1.9	1.9	2.3	.31
Otolaryngology	0.9	0.9	0.9	0.9	0.9	0.9	0.7	.13
Plastic surgery	0.8	0.9	0.9	1.0	1.0	1.0	41.3	.89
Colon and rectal surgery	0.3	0.3	0.3	0.4	0.4	0.4	9.5	.65
Thoracic surgery	0.9	0.8	0.7	0.6	0.5	0.4	14.9	.75
Urology	1.8	1.7	1.7	1.7	1.7	1.7	.00005	.00001
Other specialties	40.9	44.3	44.5	44.8	45.1	45.5	—	—
Anesthesiology	6.2	6.6	6.2	5.9	5.5	5.2	6.5	.56
Neurology	1.9	2.3	2.3	2.4	2.4	2.5	2.7	.35
Pathology	7.1	7.5	7.2	6.8	6.5	6.2	6.7	.57
Forensic pathology	0.2	0.2	0.2	0.2	0.2	0.2	0.4	.10
Psychiatry	8.5	9.2	9.4	9.6	9.9	10.1	1.5	.23
Child psychiatry	2.0	2.3	2.5	2.7	2.9	3.1	55.5	.92
Physical medicine and rehabilitation	2.5	2.5	2.7	2.9	3.0	3.2	38.5	.89
Radiology	1.3	1.6	1.2	0.8	0.5	0.1	29.5	.86
Diagnostic radiology	3.0	3.6	4.1	4.6	5.1	5.6	239.7	.98
Therapeutic radiology	1.5	1.8	2.0	2.2	2.4	2.6	154.7	.97
Miscellaneous	6.7	6.7	6.7	6.7	6.7	6.7	–	–

[a]Actual figures.
[b]The degree to which simple linear regression represents actual historical trends in the individual specialties is reflected in the F and Revalues.
[c]Figures may not add to total due to independent rounding.
[d]Includes gastroenterology, pulmonary disease, cardiovascular disease, and allergy.
[e]Includes aerospace medicine, public health, general preventive medicine, occupational medicine, "other," and unspecified,

The "F Test," as applied to the regression on historical residency data, measures the statistical significance of the linear trend as an estimate of past changes in the number of first-year residentsby specialty 1966.76, Values of F greater than 6,6 are statistically significant at the 95-percent confidence level,

R^2, the square of the Pearson product-moment correlation coefficient, is frequently referred teas"TheCorrelation index"Onascale from zero to one, it measures the degreeto which the linear trend estimates the actual changes in the number of first-year residents, by specialty, 1968-76.

SOURCE: *Interim Report of the Graduate Medical Education National Advisory Committee to the Secretary, Department of Health, Educa(/err, and We/fare,* Washington, D.C : Health Resources Administration, DHEW publication No. (HRA) 79-633, p 129-130

venient from a data availability point of view, but it does not necessarily follow that physicians are available to the populations they are matched against. Nor are populations identified on these bases comparable, and one area (e. g., county) may have people with significantly different health problems than people in other areas. So in addition to the basic problem of being able to count the numbers of practicing physicians and their clinical specialties in an identified area, there is the additional problem of whether these physicians actually provide medical services to the designated population (including whether they may be providing services to people in adjacent areas). This qualification becomes important when such comparative data are used to implement programs that single out "health manpower shortage areas" for support. In these aid programs, a specific physician-to-population ratio is chosen as the cutoff point and used in conjunction with other indices of medical need to determine

Table 16.—Active Physicians (MD), by Major Specialty Group: Actual 1974; Projected (under the basic assumption) 1980-90

Specialty group	Base year 1974	Projected 1980	Projected 1985	Projected 1990
	Number of active physicians			
Total	348,960	430,150	500,340	566,940
Primary care	133,240	166,790	203,370	239,830
Other medical specialties	18,930	26,580	33,800	41,080
Surgical specialties	97,720	113,200	122,160	129,610
Other specialties	99,070	123,580	141,050	156,410
	Percent distribution			
Total	100.0	100.0	100.0	100.0
Primary care	38.2	38.8	40.6	42.3
Other medical specialties	5.4	6.2	6.8	7.2
Surgical specialties	28.0	26.3	24.4	22.9
Other specialties	28.4	28.7	28.2	27,6
	Rate per 100,000 population			
Total	165.5	193.1	213.8	231.3
Primary care	63.2	74.9	86.9	97.9
Other medical specialties	9.0	11.9	14.4	16.8
Surgical specialties	46.3	50.8	52.2	52.9
Other specialties	47.0	55.5	60.3	63.8

SOURCE: *Interim Report of the Graduate Medical Education National Advisory Committee to the Secretary, Department of Hea/th. Education. and We/tare.* **Washington. D. C,: Health Resources Administration. DHEW publication No, (HRA) 79-633; p. 155.**

whether an area is eligible or not for aid. This concept of "shortage" is a question more basic to comparing supply with requirements and is discussed in the chapter on requirements.

The distribution of physicians by the most common methods of description and quantification is summarized in tables 18 and 19 and figure S. Table 18 provides physician-to-population ratios for selected specialties in the aggregate and for the States with the highest and lowest ratios. Table 19 contrasts non-Federal MDs in metropolitan with nonmetropolitan counties. And figure 5 contrasts the supply of surgeons and primary care physicians as grouped by HSAS. DHHS also compiles these statistics through a "GINI index, " a statistical tool that expresses unevenness as a single number. To compute the GINI index, the percentage of the total population is graphically accumulated on one axis and the percentage of practitioners similarly accumulated on the other axis, starting with the area with the lowest physician-to-population ratio and going to the area with the highest ratio. If the distribution were perfect, the result would be a 45-degree "line of equality. " The GINI index is the ratio of the area between the actual curve and the line of equality to the total area under the line of equality (USDHEW, 1979b).

The GINI index value varies between zero, indicating no maldistribution, and 1.0, indicating the greatest possible maldistribution. In general, smaller index values (indicating less unevenness) can be expected when making comparisons among larger geographical units. This can be seen in the following GINI index for active non-Federal MDs in 1973:

By State (50 States) 0.161
By Census-Defined State Economic Area
(173 areas) ... , ...0.292
By county (3,071 counties). 0.361
(Source: USDHEW, 1979b)

Osteopathic physicians (estimated at 17,700 in 1980 out of a total supply of active physicians of **447,800)** are unevenly distributed among the States because they were not allowed to practice in some States until recently and because of the limited number of schools. In 1977, Michigan had **2,760** osteopaths, Alaska, only 7. More than 20 States had less than 100 osteopathic physicians and students.

Table 17.–Supply of Active Physicians (MD), by Specialty: Actual 1974; Projected 1980-90

Specialty	Number of Dhvsicians				Percent distribution			
	1974	1980	1985	1990	1974	1980	1985	1990
Total active physicians.	348,960	430,150	500,340	566,940	100.0	100.0	100.0	100.0
Primary care.	133,240	166,790	203,370	239,830	38,2	38.8	40.6	42.3
General practice	46,530	39,290	32,870	26,350	13.3	9.1	6.6	4.6
Family practice	9,480	22,380	39,190	56,480	2.7	5.2	7.8	10.0
Internal medicine	54,780	73,280	91,020	108,530	15.7	17.0	18.2	19.1
Pediatrics.	22,460	31,830	40,290	48,470	6.4	7.4	8.1	8.5
Other medical specialties.	18,930	26,580	33,800	41,080	5.4	6.2	6.8	7.2
Dermatology	4,470	5,830	6,720	7,610	1.4	1.4	1.3	1.3
Pediatric allergy	480	870	1,210	1,500	0.1	0.2	0.2	0.3
Pediatric cardiology	590	850	1,030	1,200	0.2	0.2	0.2	0.2
Internal medicine subspecialties[a]	13,120	19,030	24,850	30,730	3.8	4.4	5.0	5.4
Surgical specialties	97,720	113,200	122,120	129,610	28.0	26.3	24.4	22.9
General surgery.	32,100	34,700	35,210	35,140	9.2	8.1	7.0	6.2
Neurological surgery	2,990	3,470	3,360	3,710	0.9	0.8	0.7	0.7
Obstetrics and gynecology	22,080	26,620	30,040	33,230	6.3	6.2	6.0	5.9
Opthamology.	11,220	12,630	13,210	13,730	3.2	2.9	2.6	2.4
Orthopedic surgery.	11,550	14,280	16,170	17,890	3.3	3.3	3.2	3.2
Otolaryngology	5,870	6,640	6,980	7,310	1.7	1.5	1.4	1.3
Plastic surgery.	2,330	3,370	4,280	5,150	0.7	0.8	0.9	0.9
Colon and rectal surgery	680	800	890	980	0.2	0.2	0.2	0.2
Thoracic surgery	2,100	2,750	3,080	3,350	0.6	0.6	0.6	0.6
Urology.	6,790	7,960	6,620	9,150	1.9	1.9	1.7	1.6
Other specialties.	99,070	123,580	141,050	156,410	28.4	28.7	28.2	27.6
Anesthesiology.	13,330	15,600	16,210	16,830	3.8	3.6	3.2	2.9
Neurology	4,200	6,070	7,360	8,520	1.2	1.4	1.5	1.5
Pathology.	12,310	15,860	18,120	20,020	3.5	3.7	3.6	3.5
Forensic pathology.	220	360	540	700	0.1	0.1	0.1	0.1
Psychiatry	24,740	28,560	29,900	30,690	7.1	6.6	6.0	5.4
Child psychiatry	2,730	4,460	5,970	7,730	0.8	1.0	1.2	1.3
Physical medicine and rehabilitation	1,780	2,450	2,780	2,990	0.5	0.6	0.6	0.5
Radiology.	11,900	11,710	10,950	9,970	3.4	2.7	2.2	1.8
Diagnostic radiology.	3,650	8,180	13,440	18,660		1.9	2.7	3.3
Therapeutic radiology.	1,200	2,000	2,760	3,420	: : :	0.5	0.6	0.6
Miscellaneous	23,010	28,320	33,030	37,670	6.6	6.6	6.6	6.6

[a] Includes allergy, cardiovascular disease, gastroenterology, and Pulmonary disease,
[b] Includes aerospace medicine, general preventive medicine, occupational medicine, public health, unspecified, and "other Specialties."

NOTE: Figures may not add to subtotals and totals due to independent rounding.

SOURCE: *Interim Report of the Graduate Medical Education National Advisory Committee to the Secretary, Department of Health, Educat/err, and Welfare,* Washington, D.C : Health Resources Administration, DHEW publication No. (HRA) 79-633, p. 153.

These estimates of MD and DO locational distribution do not address the question of future distributional patterns. Such predictive efforts are used for programs which intend to place physicians in identified areas of shortage and for which such shortage designations also make the identified areas eligible for governmental (Federal and State) funds.

Prior to the Health Professions Educational Assistance Act of **1976,** different criteria had been developed for designation as a Health Manpower Shortage Area (HMSA) for BHM programs and as a Medically Underserved ..Area (MUA) for the Bureau of Community Health Services' (BCHS) programs. Following the passage of the 1976 Act, these definitions have been consolidated under the HMSA designation. Thus, once designated a HMSA, such areas: 1) would be eligible for National Health Service Corps (NHSC) staffing of Corps practice site, 2) would be areas in which students who borrowed money under health professions student loan programs could practice in lieu of repaying the loans in money, 3) would be eligible for grants in various health manpower training programs,

Table 18.–Patient Care MDs (non-Federal) by Selected Specialties and for High and Low States (1976)

Specialty	MDs per 100,000 population, all States	Ratio for highest State	Ratio for lowest State
All specialties	137.0	New York. 198	South Dakota. 78
Primary care[a]	58.4	New York. 84	Alaska 35
General and family practice	23.9	California 30	Alabama. 19
internal medicine	22.2	Massachusetts 43	South Dakota 7
Pediatrics	8.9	Maryland 17	South and North Dakota. 3
Obstetrics and gynecology	9.3	Maryland 16	South Dakota 3
General surgery	13.5	New York. 20	South Dakota and Alabama. . . . 2
Psychiatry	9.0	New York. 20	South Dakota and Alabama. . . . 2
Ophthalmology	4.9	New York. 7	South Dakota 2
Orthopedic surgery	4.9	Massachusetts, Connecticut, and California. . . 7	South Dakota, Alabama, and Mississippi 3
Anesthesiology	5.3	Massachusetts. 9	South Dakota. 1

[a]Deflned as general arlcJ family practitioners, Internists, and pediatricians

SOURCE. /nter/m Report of the Graduate Med/ca/ Education National Adv/sory Committee to the Secretary, Department of Hea/tn, Educat/on, and We/fare, Washington, D.C : Health Resources Adminlstratlon, DHEW publication No. (HRA) 79-633, pp. 65-87,

Table 19.—Non.Federal Physicians (MD) Providing Patient Care in Metropolitan and Nonmetropolitan Areas 1963.76

Year	Number of physicians: All counties	Metropolitan	Nonmetropolitan	MDs per 100,000 population: All counties	Metropolitan	Nonmetropolitan	Percent of MDs: All counties	Metropolitan	Nonmetropolitan
1963	225,427	178,403	47,024	120.3	144.2	73.8	100.0	79.1	20.9
1964	232,067	184,298	47,769	122.0	146.8	73.9	100.0	79.4	20.6
1965	239,482	189,211	48,271	123.2	148.7	73.6	100.0	79.7	20.3
1966	241,473	192,871	48,602	123.7	148.9	74.1	100.0	79.9	20.1
1967	247,256	200,880	46,376	125.4	150.0	73.3	100.0	81.2	18.8
1968[b]	236,458	192,242	44,216	118.7	141.6	69.7	100.0	81.3	18.7
1969	245,368	200,247	45,121	121.8	145.7	70.5	100.0	81.6	18.4
1970	252,778	206,676	46,102	124.2	148.7	71.5	100.0	81.8	18.2
1971	261,335	217,187	44,148	127.5	152.9	70.1	100.0	83.1	16.9
1972	266,587	225,424	41,163	128.5	152.9	68.6	100.0	84.6	15.4
1973	270,412	231,529	38,883	129.1	150.9	69.4	100.0	85.6	14.4
1974	276,070	235,994	40,076	130.9	153.3	70.4	100.0	85.5	14.5
1975	287,837	249,218	38,619	134.8	156,9	74,1	100.0	86.6	13,4
1976	294,730	255,102	39,628	137.4	158.2	74.4	100.0	86.6	13.4

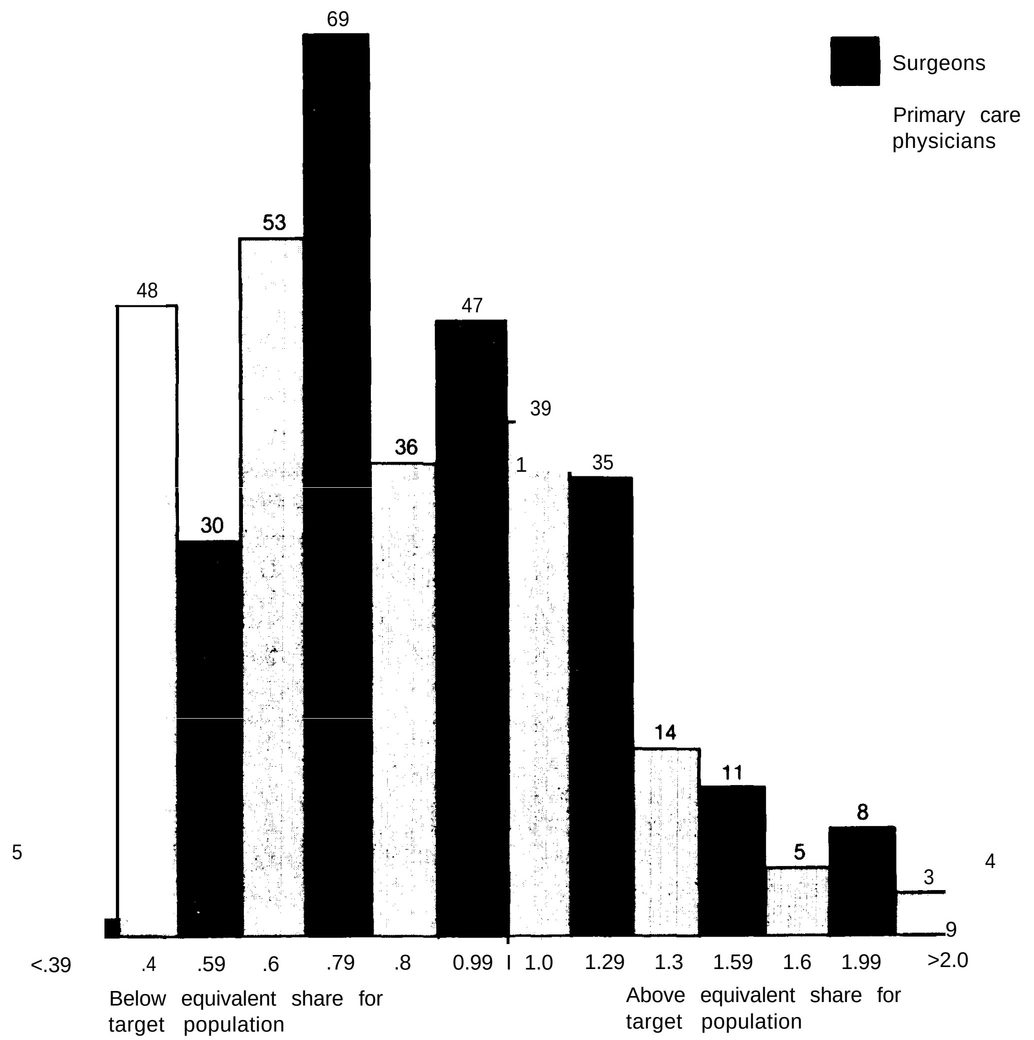
[a]For 1963.66, metropolitan Counties include those in SMSAs on basis of 1962 population and nonmetropol itan counties include those adjacent to metropolitan counties and isolated rural and semirural counties.
For 1967-76, metropolitan counties include those in SMSAs on basis of 1967 population and nonmetropolitan counties include potential metropolitan counties and all others outside SMSAs.
[b]Beginning in 1968, the AMA changed its methods of classifying physicians to reflect the number of hours spent in various activities and specialties. This resulted in a loss in physicians in patient care with corresponding Increases in physicians in "other activities" and inactive.
Based on annual reports on the distribution physician in the United States by the American Medical Association, 1963-67.

SOURCE: *Interim Report of the Graduate Medical Education National Advisory Committee to the Secretary, Department of Health, Education, and We/fare,* Washington, D.C.: Health Resources Administration, DHEW publication No. (HRA) 79-633, pp. 91-92.

4) would be eligible or given preference for grant funds for several BCHS programs such as the urban and rural health initiatives, and 5) would be the only areas in which rural health clinics could be certified for reimbursement of nurse practitioner and physicians' assistant services under Medicare and Medicaid.

Through the 1976 Act shortage designation for eligibility for NHSC physician services is now available not only to geographic areas (the old emphasis on alleviating rural shortages), but also to population groups and institutional settings of care. The former include Native Americans, migrants, and the aged. The latter include hospitals, state mental health facilities, rehabilitation facilities, long-term care facilities, community health centers, community mental health centers, migrant health centers, and Federal and State prisons.

Figure5.— Frequency Distribution of Physician Availability Indexes—primary Care Physicians and Surgeons for the 204 HSAs



The availability index is a weighted average of the ratio between the portion of the Nation's physicians in each of the HSA'S counties and the portion of the Nation's population living in each of those counties. If the HSA has attracted a portion of the Nation's physicians equivalent to its portion of the U.S. 'S population, its physician availability index would be 1.0.

SOURCE. *Inter/m Report of the Graduate Medical Education National Advisory Committee to the Secretary, Department of Health, Education, and Welfare,* **Washington D.C. Health Resources Administration, DHEW publication No, (HRA) 79-633, p. 95.**

From this wide array of potential shortage areas, the NHSC program had to develop subsets that would actually receive Corps attention.

NHSC includes obstetrician-gynecologists as primary care physicians, in addition to family practitioners, general practitioners, pediatricians, and internists. Psychiatrists are included for mental health facilities and osteopaths also are included, although not specifically in their projections, which concern allopathic physician supply.

For nonmetropolitan areas there is a primary care physician-to-population designation ratio of 1:3,500, which means that only those areas with that ratio or higher (fewer physicians) would be eligible for Corps staffing. The target ratio is 1:2,000. Once designated and selected for Corps staffing, Corps physicians would be provided until a ratio of 1:2,000 was achieved (USDHEW, 1978a).

As part of the process of planning for how much effort is needed in specific practice settings, estimates must be made of the numbers and types of physicians who will settle in these areas voluntarily. DHHS, through the joint efforts of its BHM of the Health Resources Administration and the Office of Planning, Evaluation, and Legislation of the Health Services Administration, has developed a computerized model to project the number and distribution of active, non-Federal, office-based patient care physicians in the so States and all counties from 1972 through 1990.

As the Health Professions Educational Assistance Act of 1976 enlarged the definition of HMSAS, separate estimates are made for: 1) rural counties, 2) urban areas, 3) Federal and State prisons, 4) State mental hospitals and community mental health centers, and 5) the Indian Health Service. The computerized model is used to project future supply in rural counties, but it cannot be used to project supply in the other categories. Hence, other methods must be used for these other categories. For prisons, mental health facilities, and the Indian Health Service, the sponsoring agencies have provided estimates of both supply and requirements. Essentially, these agencies forecast a steady state supply (USDHEW, 1978a).

The NHSC task force's estimates of the supply of primary care physicians in rural and urban areas are summarized below.

Rural areas.—The projections are based on: 1) existing supply (DOS and MDs, domestic and foreign graduates); 2) anticipated deaths, retirements, and relocation of existing physicians; 3) anticipated graduations, specialty choices, and practice locations; and 4) anticipated population growth. Beginning with 1972 as the base year, total physician and primary care and nonprimary care physician-to-population ratios are projected for each county (urban as well as rural) for each year. The method is thus similar to aggregate and specialty supply, with the added factor of accounting for where physicians locate.

Counties are assumed to maintain population as fixed proportions (derived from 1972 data) of their respective State populations.

Starting with the 1972 active, non-Federal, office-based, patient-care physicians in each county, year-by-year reductions from deaths and retirement are calculated.

The number of new physicians expected to enter practice is estimated by the method described earlier for aggregate supply. These numbers are summarized in table 20.

Total new physicians entering practice each year are reduced for: 1) Federal employment, 2) nonpatient care activities, and 3) practices in areas other than the **so** States.

The physician distribution among the States for 1973-87 (since updated to the 1990's) is based on the historical pattern of distribution for graduates from 1965 to 1969, modified for percent changes in State populations projected for 1972 to 1987.

The percent of physicians entering practice from 1973 to 1987 as primary care specialists is

Table 20.—New Physicians Entering Practice, 1973-87

Year	USMG	FMG	DO
1973	8,367	3,665	472
1974	8,974	5,081	485
1975	9,551	5,202	649
1976	10,391	2,709	587
1977	11,613	3,799	702
1978	12,714	5,265	809
1979	13,561	3,517	908
1980	13,607	3,895	964
1981	14,598	1,903	996
1982	15,048	2,187	1,029
1983	15,346	1,849	1,208
1984	15,789	2,372	1,308
1985	16,354	2,034	1,377
1986	16,956	2,246	1,458
1987	17,241	1,908	1,496

SOURCE: Memorandum from the Chairmm, NHSC Needs Task Force A, to the Director, Bureau of Community Health Services, Health Services Administration; the Deputy Director, Bureau of Health Manpower, Health Resources Administration; and the Chairman, NHSC Needs Task Force, Washington, D. C,, May 26,1978.

projected to increase to the proportions listed in table 21. This should be distinguished from the percent of the total physician supply that is projected to be in primary care (tables 16 and 17).

Physicians are projected to enter practice in county classes in the percentages summarized in table 22.

Newly entering physicians are allocated to individual counties by specialty according to the **1974** observed pattern of 30-to 44-year-old physicians of the same specialty. This new supply is added to the existing supply, modified yearly for attrition from deaths and retirements.

Table 21 .—Percent of New Physicians Expected To Enter Primary Care

Year	Percent in primary care
1973	25.2
1974	26.4
1975	28.1
1976	33.5
1977	37.5
1978	43.2
1979	43.8
1980	46.0
1981	48.1
1982	50.2
1983	52.2
1984-87.	52.2

SOURCE: Memorandum from the chairman, NHSC Needs Task Force A,to the Director, Bureau of Community Health services, Health Services Administration; the Deputy Director, Bureau of Health Manpower, Health Resources Administration; and the Chairman, NHSC Needs Task Force, Washington, D.C., May26,1978.

Urban area.—Predicting the future supply of physicians for urban areas in order to assess the need for additional physicians is not computed on a county basis. If measured by county, the number of primary care physicians is usually adequate, so the needs in urban areas are measured by the needs of certain population groups which have financial and sociocultural barriers to access instead of the geographic barriers of rural **areas, for which physician-to-population ratios serve as substantial proxy measures. Thus, an estimate of the number of physicians required to meet the needs of metropolitan low-income areas as defined by the Bureau of the Census is used.**

Such identified low-income area populations declined from 17,936,000 in 1974 to 16,554,000 in 1976, or a decline of 3.8 percent per year. But the task force concluded that the decrease is not expected to continue indefinitely and that there is a current trend for physicians in central cities to move to the suburbs. It therefore assumed that the decrease in low-income population will be offset or more than offset by the emigration of physicians from the inner city. In other words, present supply as expressed in physician-to-population ratios also predicts what the future supply will be. This average is 13.3 full-time-equivalent primary care physicians per 100,000population.

Parenthetically, it was determined that 42.3 primary care physicians per 100,000 population

Table 22.—Projected County Classes of Newly Practicing Physicians

County class[a]	MD			DO
	Family practice	Primary care[b]	Non primary care	
1	2.7	0.2	0.1	3.0
2	7.5	2.0	0.5	6.7
3	10.6	5.1	1.6	6.4
4	9.4	6.9	3.7	5.2
5	2.3	2.2	1.2	2.2
6	26.8	19.5	24.6	17.6
	13.2	12.8	13.1	13.9
7:: : : : : : : : : : : : : : :	21.9	35.5	37.0	40.1
9	5.6	15.0	18.2	4.9
	100.0	100.0	100.0	100.0

[a]AMA demographic county classification (1-4 = rural; 5-9 = urban).
[b]Excluding family practice. This definition of "primary care" includes obstetrics-gynecology, in addition to general practice, family practice, internal medicine, and pediatrics.

SOURCE: Memorandum from the Chairman, NHSC Needs Task Force A, to the Director, Bureau of Community Health Services, Health Services Administration; the Deputy Director, Bureau of Health Manpower, Health Resources Administration; and the Chairman, NHSC Needs Task Force, Washington, D.C., May 26,1978.

(a staffing ratio of 1:2,000) would be needed in these low-income areas and that the 13.3 number meant that 31.4 percent of need was already met. The analysis then goes on to say that separate analyses of the underserved population's "usual source of care" resulted in the figures in table **23** and confirmed the 31.4-percent figure.

The analysis then goes on to equate the sum of care from "hospital," "neighborhood health center," and "none" with unmet need of **62.6** percent of the population and goes on to estimate additional physicians needed on this basis. Yet only **8.6** percent of the 62.6 percent received no **care.** Hospital care does not represent "unmet need" but involves the question of what is appropriate care. And since this analysis was made to estimate the number of NHSC physicians that might be placed in these areas, identifying "neighborhood health center" care as "no care" must mean that the presumption is that such centers will be staffed only by NHSC physicians in the future.

Table 23.—Usual Source of Care for Urban Underserved Areas

	Percent
Private physicians.	31.4
Hospital (emergency room and outpatient treatment).	31.3
Neighborhood health center	22.7
None.	8.6
Other	6.0
Total.	100.0

SOURCE: Memorandum from the Chairman NHSC Needs Task Force A, to the Director, Bureau of community Health sewices, Healtfl se~ices A&ministration; the Deputy Director, Bureau of Health Manpower, Health Resources Administration; and the Chairman, NHSC Needs Task Force, Washington, D. C., May 26,1978.

SUMMARY

Comparing the methods for estimating supply with those used for estimating requirements, we would expect more certainty in the supply projections. Yet the foregoing description of supply projections shows that there are many weaknesses in the data bases, some questionable assumptions underlying the projections, different interpretations given to some commonly used terminologies such as "primary care" and "full-time-equivalent," etc.

The description of how supply projections are made can quickly become quite detailed. So let us summarize: 1) the components and primary assumptions of the supply estimates, and 2) some definitional problems that are linked to substantive issues and which are compounded by weaknesses in the data.

Supply is the sum of practicing physicians and additions of foreign and domestic medical and osteopathic school graduates (there are no foreign additions to the osteopathic supply). Attrition from deaths and retirements for the practicing physician component is estimated by age-specific rates. For specialty supply, the same death and retirement rates are applied to each specialty.

Additions to supply are the sum of foreign and domestic graduates. Estimates of first-year enrollments and attrition prior to graduation are made to arrive at the number of domestic graduates. The high, low, and basic first-year enrollment estimates all assume full cavitation funding by 1981, and 4, 7, or 10 new medical schools after **1977-78.** For FMG additions, the Canadian addition is currently estimated to equal losses from death, retirement, and emigration. Estimates of the addition to supply from other FMGs rely heavily on the presumed impact of the 1976 Act, which contained major restrictions on FMG immigration. It should be noted that the resulting total projections of supply made before and after the 1976 Act have not varied greatly (estimated at approximately 600,000 in 1990). The component projections, however, have varied wiclely. In essence, present projections of domestic graduates are larger than previous estimates, and present projections of FMG additions are less than prior estimates. In the current projections, the assumption of full cavitation funding is not very realistic and tends to increase the supply projections. On the other hand, the additions from the FMG supply may be too optimistic in terms of legislative impact on decreasing this source of supply, particularly with the large pool of U.S. citizens studying medicine abroad, for whom immigration restrictions are not applicable, although they have to pass a competency exam in order to practice medicine in the United States.

Additions to specialty supply use projections of first-year residency trends to allocate foreign and domestic graduates among the specialties. The predictive power of first-year residency choices is a problem because they may not reflect ultimate specialty practices. This is particularly true for internal medicine, where at least one-third of the first-year residency positions is used as a general medicine traineeship for physicians ultimately subspecializing or choosing another specialty altogether. The trend in specialty choice is determined by the trend reflected in the years 1968, 1970-74, and 1976, years in which major changes were occurring in the structure of postgraduate medical training programs. Statistical techniques also limit the applicability of these trend years up to 1981, at which point the distribution is held constant for future years.

Methods for predicting the locational distribution of physicians are generally similar to those for aggregate and specialty supply. For rural areas, the active, non-Federal, office-based physician supply in each county is reduced for deaths and retirements. The supply of new physicians is allocated to individual counties by specialty according to the 1974 observed patterns of 30- to 44-year-old physicians of the same specialty (counties are allocated to nine classifications from rural to urban). For urban (inner city) areas, physician supply is assumed to decrease (no numbers given), reflecting continued emigration to the suburbs. For prisons, mental health ,services, and the Indian Health Service, future supply is generally assumed to hold constant at its present rate.

In addition to absolute numbers, a relative standard is used, the physician-to-population ratio, which is also commonly expressed as the number of physicians per 100,000 population; e.g., 1:1,000 or 100/100,000. This ratio is used to provide a more complete quantification of supply; i.e., we need to know not only the numbers of physicians in practice, but also the populations which they serve.

For aggregate and specialty supply, the Census Bureau's Series II (or Series III, which projects slower growth) estimates of population are used. As these reflect the 1970 Census, more accurate information will be available from the upcoming 1980 Census.

For locational distribution, the population estimates try to be more specific, as supply estimates are part of programmatic efforts to identify HMSAS. For rural areas 1972 State population estimates are used, and counties are assumed to maintain fixed proportions of their respective State populations. For urban areas, the population is that identified by the Bureau of the Census as metropolitan low-income areas. Although these low-income populations have declined (17,936,000 in 1974 to 16,554,000 in 1976, or a decline of 3.8 percent per year), the physician-to-population ratio is assumed to hold constant in the future because of the previously mentioned expectation of continued emigration of physicians out of the inner cities.

It should be obvious that supply, as referenced to population, depends not only on the physician supply projections, but also on the population projections. An example is the distinction between projections of physician supply which include or exclude Federal physicians. In projecting supply for rural areas, table 19 estimated that there were 287,800 active non-FederaI MDs in 1975. **Table 9 estimates that there were 363,400** active MDs (including Federal) in 197s (377,500 minus 14,100 DOS). The 287,800 figure was used to allocate physicians among all counties. However, in subtracting the Federal physician supply, no effort was made to decrease the population by a proportional amount (these Federal physicians were active and presumably providing patient care). In addition, 1967 population estimates were used in table 19, whereas table 9 used population estimates that included projections of population growth.

On the physician side of the ratio, table 9 assumed that a portion of "not classified" MDs were active; whereas table 19 excluded this category from its count (approximately 30,000 phy-

60-618 O - 80 - 6

sicians, or about 10 percent). In addition, table 9 included DOS, table 19 did not.

So even though at first glance the differences in the number of active physicians represented in tables **9** and 19 (377,500 v. 287,800) might seem accounted for from the exclusion of Federal MDs, "not classified" physicians, and DOS in table 19, the method of quantifying the population also contributed to the different physician-to-population ratios (176.8/100,000 v. 134.8/100,000).

We have already seen that there are definitional problems associated with quantifying physician supply. These definitional problems will take on even more significance once we begin to quantify requirements and try to match that with supply. Two basic problems are involved: 1) the amount of patient care that is attributed to the average physician, and 2) the type of patient care provided.

The first problem is usually couched in terms such as "productivity" or "full-time-equivalent," which attempt to provide a common reference by which the number of physicians can be equated to a certain volume of patient care services. For example, physicians' assistants in prisons were assumed to be equal to 0.5 physicians (USDHEW, 1978a). In this case, a physician was equal to a full-time-equivalent (FTE), whatever the particular hours or number of patients seen by prison physicians. Implicit in this definition are assumptions on physician productivity. Other uses of FTE are more explicit. Indiana uses a definition of a FTE primary care physician as a general or family practitioner in the age group 35 to 39, which has the highest output in terms of visits per year for that specialty (Hindle et al., 1978). A more common method is to use average productivity figures by specialty, either as measured by the average patient care hours worked per week (hospital and ambulatory care), the number of patients seen per week (usually expressed as the number of ambulatory visits), or both. And still another method is to estimate what percent of time is spent on nonpatient care activities and subtract that percentage from the total (aggregate or by specialty) supply. These productivity or FTE estimates are crucial when comparing supply with requirements, because they are the basic methods underlying the comparison. Given the same basic numbers of physician supply as provided through "head counts" by the methods summarized earlier, whether supply equals, falls short, or exceeds demand obviously depends on the productivity assumptions applied to the physician.

The definition of "primary care" involves more than the simple identification of which specialties "qualify" for that designation. Yet we have already seen that what specialties count as primary care is quite confusing. Even if we limit the specialties to general practice, family practice, general internal medicine, and general pediatrics, there can be great variations in the quantification of primary care physicians, because over 50 percent are in the internal medicine category. Yet, at various times, some subspecialties of internal medicine are included and some are not. For example, table 13 excludes dermatology, gastroenterology, pulmonary disease, cardiovascular disease, and allergy from the primary care internal medicine subspecialties, but *includes* allergy and immunology, diabetes, endocrinology, geriatrics, hematology, immunology, infectious diseases, neoplastic diseases, nephrology, nutrition, oncology, and rheumatology.

The Institute of Medicine (1978) reviewed 38 definitions of primary health care, and concluded that primary care cannot sufficiently be defined by the location of care, by the provider's disciplinary training, or by the provision of a particular set of services. It then goes on to elaborate on what it considers primary health care's five essential attributes: 1) accessibility, 2) comprehensiveness, 3) coordination, 4) continuity, and 5) accountability.

In a study examining the general care content of different specialty practices, the data was disaggregate into five components: 1) first encounter, 2) episodic care, 3) principal care, 4) consultative care, and 5) specialized care (Aiken et al., 1979). Principal care was defined as:

> There is evidence of continuity; the physician reports having seen the patient before and considers him or her to be a regular patient. Com-

prehensiveness is suggested, since the physician indicates that he or she provides most of the patient's care.

Principal care thus falls short of the Institute of Medicine's definition of primary health care. Obviously, quantifying the supply and requirements for specific physician specialties will differ between these definitions, and they will substantially affect the quantification of specialty distribution.

This difference also points out the use of specific assumptions on FTEs and productivity. If many specialty types are providing principal care, the use of FTEs will serve as proxy measures for some part of the total demand for the specific specialties. But the different specialties may also have different productivity rates. For example, internists generally see sicker and older patients than seen by general and family practitioners, and their average patient loads may be considerably less than the latters' (table 24).

Different results can be easily obtained on: 1) what exactly is primary health care, 2) which specialties qualify, 3) the proportions within each specialty which provide principal health care, and 4) the use of different productivity values for each specialty. And different requirements projections also easily result when these factors, in addition to the specialty care responsibilities of each specialty, are used to translate these FTE/productivity values into head counts for each specialty. And similar estimates must be made for the supply head counts in order to ultimately compare the supply with the requirements projections.

Table 24.—Estimated Principal"Provider Patient Loads of General Practitioners, Family Practitioners, and General Internists

Specialty	Average number Of Persons covered per physician
General practitioner.	870- 965
Family practitioner.	1,004-1,127
General internal medicine	468- 523

SOURCE. L. H Aiken et al , "The Contribution of Specialists to the Delivery of Primary Care,'" 1979, table 4.

3. Requirements

3. Requirements

INTRODUCTION

Faced with what seemed to be a straightforward question on what our country's physician supply is and will be, we have found that supply projections are not definitive and need to be revised periodically. And in somewhat circular fashion, supply projections can be substantially dependent on deliberate Federal actions at the same time that Federal actions are somewhat dependent on supply projections.

Even if there were agreement on the assumptions underlying the supply projections, what the projections mean in terms of meeting the requirements for physicians would still be unclear, as the numbers represent self-designated specialties, general estimates of physicians in actual patient care activities, and general estimates of the locational distribution of the supply of physicians. In order to compare supply with requirements, common standards of quantification (e.g., full-time-equivalents (FTEs), what counts as primary care and what types of physicians provide it, etc.) must be applied to both estimates.

The limitations imposed by definitional problems compound the problems that arise from the specific assumptions underlying the supply projections. Reaching agreement on the assumptions underlying the projections (e.g., the future prospects for cavitation and its effect on the number of domestic graduates) is a separate question from agreeing on questions such as what counts as primary care and how the volume of primary care is to be translated into specific numbers of physicians in the various specialties. In other words, the separate projections for supply and requirements and comparisons between the two have both best-guess and value-laden assumptions undergirding the methodologies.

The first task in estimating requirements for physicians is to decide what method should be adopted. A 1977 review of the literature (USDHEW, 1977a) concluded that the approaches could be categorized into one of four groupings and pointed out that the first relates to treatment of all medical needs, as determined by disease prevalence and morbidity data, and that the other three categories deal with the *demand* for care, as derived from the opinions of health professionals, calculations of service requirements and manpower productivity, and observed staffing patterns in prepaid group practice settings (health maintenance organizations, or HMOS). The four categories were defined as:

- *Medical need based ratio.* —A ratio which describes the number of health professionals required to care for a given population if all disease conditions that require treatment (existing utilization plus unmet needs) are actually treated. Data on morbidity or disease incidence and prevalence must be used.
- *Professional judgment based ratio.* — A ratio which reflects the opinion of health professionals or health manpower experts regarding the number of health professionals needed to meet the expressed demands for care of a given population. This cluster encompasses "ideal," "adequate," and "minimally acceptable" ratios. The standard is derived from an aggregate assessment of the manpower situation, without detailed consideration of utilization or productivity factors.
- *Demand/productivity based ratio.* —A ratio which describes the number of health professionals needed to care for a given population, as derived from specified assumptions about services demanded and/or manpower productivity. Calculations may account for changes in technology, health insurance coverage, composition of the population, utilization of allied health personnel, and similar factors.

- *HMO based ratio.* **—A** ratio which directly reflects or is derived from observed staffing patterns of prepaid group practice.

This review concluded that three of the four approaches required special "leaps of faith:"

> Need-based standards are appropriate for planning only if consumers are both able and willing to express all medical problems or demands for services. Acceptance of professional judgment based standards requires blind faith in the knowledge and foresight of those consulted—especially ironic in that "medical expertise" (knowledge of diagnosis and treatment requirements) is only one of many types of information needed to estimate manpower requirements. Adoption of HMO based standards (adjusted HMO staffing patterns) assumes that most care will be provided through this delivery mode which integrates both financial and delivery system variables.
>
> The fourth approach, the calculation of requirements estimates based on explicit utilization and productivity assumptions, requires no leaps of faith, but neither does it provide unambiguous guidance. It is viewed, nevertheless, as the most valid approach available for estimating health manpower requirements. Its value to the health planner is that it focuses attention on the parameters which determine manpower requirements. In doing so, it lays the groundwork for integrating manpower with health system planning. In this broader context, policies can be formulated to influence these parameters and modify health manpower requirements in a socially desirable manner.

Another criticism frequently leveled at projections of the future requirements for physicians is that the modeling effort may be a static, snapshot picture of the health care system and does not sufficiently account for change. This criticism is most frequently raised when a single physician-to-population ratio, as derived from a particular modeling effort, is used to project future requirements. The use of **a** fixed ratio represents the conclusion that physician requirements should (or would) change in direct proportion to population growth. A fixed ratio does not take into account any trends toward increasing *per capita* use of physician services. Thus, the use of a fixed physician-to-population ratio versus the use of changing ratios will lead to quite different estimates of the future requirements for physician services. If changing ratios are used: 1) the rate of change adopted will have a significant effect on the calculation of future requirements, and 2) at some point, a leveling off of the rate of change has to occur.

Table 25 compares supply with requirements using the studies in the literature review just cited (USDHEW, 1977a) that led to the *highest* estimates of requirements. Each of these studies estimated requirements for a specific year: for the HMO method, estimates were made for 1972; for the need-based method, estimates were for 1974; for professional judgment, 1975; and for demand / productivity, the year chosen was 1980. As these projections excluded osteopathic physicians, the supply column in table 25 is limited to allopathic physicians (MDs). Taken together, table 25 shows that there was an approximate balance between supply and requirements in the 1970's.

Table 26 is modified from a 1970 analysis (Hansen, 1970) of physician requirements projections for 1975, the year which is the basic starting point for current projections. Again, we see a fairly wide range of requirement estimates, with the midrange approximately in balance with the actual supply.

Table 25.–Comparisons of Aggregate Physician (MD) Supply With Requirements Using Different Modeis

	Rate/100,000	Target year	Total	supply
HMO.	153.6	1972	321,000	333,000
Need-based.	167.8	1974	355,600	351,000
Professional judgment. .	187.3	1975	400,000	366,000
Demand/productivity . . .	182.8	1980	407,000	430,000 (projected)

SOURCE: See text.

Table 26.—1960's Projections of Physician Requirements in 1975 (actual supply in 1975 equals 378,000)

Projection study	Requirements	supply	Deficit (–) or surplus (+)
Bane Committee Report (1959)FJ	330,000 (minimum)	312,800	– 17,200
		318,400	– 11,600
Bureau of Labor Statistics (1966)b . . .	305,000	—	—
Fein (l967)c.	340,000 to 350,000	361,700	+ 21,700 to + 11,700
	372,000 to 385,000		– 10,300 to – 23,300
National Advisory Commission on Health Manpower (1967)[d].	346,000 (minimum)	360,000	+ 14,000
Bureau of Labor Statistics (1967)' . . .	390,000	360,000	– 30,000
Public Health Service (1967)[f].	400,000	360,000	– 40,000
	425,000		– 65,000

[a]Surgeon General's Consultant Group on Medical Education, Frank Bane, Chairman, *Physicians for a Growing America* (Washington: Government Printing Office, 1959).
[b]U.S. Bureau of Labo, Statistics, "America's Industrial and Occupational Manpower Requirements, 1964-1975." In: The *Outlook for Technological Change and Employment,* Appendix Volume I to *Technology and the American Economy,* report of the National Commission on Technology, Automation, and Economic Progress (February 1966).
[c]Rashi Fein, *Th-Doctor Shortage: An Economic Analysis* (Washington: The Brookings institution, 1967).
[d]National Advisory Commission on Health Manpower, *Report,* vol. II. (Washington: Government Printing Office, 1967).
t? Bureau of Labor Statistics, *Health Manpower* 1966-1975, *A Study of Requirements and Supply* (Washington: Government Printing Office, 1967).
[f]Public Health Service, *Health Manpower, Perspectives 1967,* (Washington: GPO, 1967).

SOURCE: W. L. Hansen, "An Appraisal of Physician Manpower Projections," *Inquiry* 7: 102-113, 1970.

Two other observations are of interest. Fein's estimates are provided in two sets of numbers. The first set, **340,000** to **350,000** is based on population growth alone. This would be analogous to the use of a fixed physician-to-population ratio to predict, in 1967, the demand in 1975. The second set of numbers, **372,000** to **385,000,** is based on an increase due to all factors. It would be analogous to including further increased requirements due to increasing per capita utilization of physician services. Finally, it should be noted that the estimates of "requirements" of the Bureau of Labor Statistics (BLS) were revised markedly between 1966 and 1967, increasing from 305,000 to 390,000. In essence, it was a judgment that, given rising demand for physician services, **85,000** more physicians could be employed.

In pursuit of quantifying future "appropriate demand" or "requirements," little attention has been paid on past and current balances or imbalances between the supply of and requirements for physician services. Policy has been 1ess concerned with whether the projections were correct than with the effect of such projections on current decisionmaking. Thus, this assessment concentrates on the two modeling efforts that will have the most impact on Federal health manpower policy, the sustained modeling and projection activities of the Bureau of Health Manpower's (BHM) Division of Manpower Analysis, and the yet-to-be completed deliberations of the Graduate Medical Education National Advisory Committee (GMENAC).

ECONOMIC MODELS

The Bureau of Labor Statistics Model

The U.S. Department of Labor's BLS provides projections of demand and training needs for the major occupations every 2 years (BLS, 1979a). Thirteen occupational groupings are analyzed, including the health occupations. The health occupations are medicine; dentistry; nursing; medical technologists, technicians, and assistants; therapy and rehabilitation; and other health occupations. These projections relate manpower to projected economic demand (expenditures) as provided by the Bureau's model of the future economy, which projects the future gross national product (GNP) and its components—consumer expenditures, business investment, governmental expenditures, and net exports; industrial output and productivity; the labor force; average weekly hours of work; and employment for detailed industry groups and occupations.

Current projections are based on the following assumptions:

- the institutional framework of the U.S. economy will not change radically;
- current social, technological, and scientific trends will continue, including values placed on work, education, income, and leisure;
- the economy will gradually recover from the higher unemployment levels of the mid-1970's and reach full employment (defined as an unemployment rate of 4.7 percent in 1985 and 4.5 percent in 1990); and
- trends in the occupational structure of industries will not be altered radically by changes in relative wages, technological changes, or other factors.

Beginning with population projections by age and sex from the Bureau of the Census, projections of the total labor force are derived by using expected labor force participation rates for each group. The labor force projection is then translated into the level of GNP that would be produced by a fully employed labor force. The GNP projection is then divided among its four major components—consumer expenditures, business investment, governmental expenditures, and net exports. Each component is broken down by producing industry. Medical care falls under the consumer expenditure component. Estimates of future output per hour are derived from productivity and technological trends in each industry, and industry employment projections are derived from the output estimates. These projections are then compared with employment projections through the use of regression analysis. Comparison of the two methods is used to identify inconsistencies of one method with past trends or with the Bureau's economic model, and the projection is adjusted **as needed. Projections of industry employment are translated into occupational employment projections for each industry (201 industry sectors and 421 occupation sectors). The growth rate of an occupation is determined by: 1) changes in the proportion of workers** in the occupation to the total work force in each industry, and 2) the growth rate of industries in which an occupation is ccmcentrated.

In addition to occupational employment projections, attrition from the existing work force is calculated to estimate average annual replacement needs for each occupation over the projection period.

Supply estimates assume that past trends of entry into the particular occupation will continue. These estimates are developed independently of the demand estimates; i.e., wages do not play a major role in equating supply and demand.

Table 27 summarizes these projections. 1985 projected employment (demand) of 520,000 physicians, up from 375,000 in 1976, equals the projected supply (see tables 9 and 10).

Table 27.—Bureau of Labor Statistics Projections of Physician Supply and Requirements, 1985

Employment, 1976		375,000
Projected employment, 1985		520,000
Percent growth, 1976-85		37.8
Average annual openings, 1976-85		21,800
Growth		(16,000)
Replacement		(5,800)
Available training data:		
	1975-76	Projected 1976-85 (annual average)
MD degree	14,163	15,997
DO degree	806	1,128

SOURCE: *Occupational Projections and Training Date,* **Bureau of Labor Statistics, Department of Labor, Washington, DC., Government Printing Office, Bulletin 2020, 1979, pp. 64-65.**

BLS, in its forthcoming revisions of its estimates to include 1990 projections, will adopt the midpoint of the range of projections from the BHM model for physician requirements. BLS considers the BHM model as more sophisticated for two reasons. First, while the BLS model incorporates population as a variable, no consideration is given to the varying utilization rates of the demographic components. Women use more physician and hospital services than men, and older people require more care than the young. The BHM model does capture these aspects of demand. Second, the BHM model estimates the effects of possible price elasticity for physician services and provides a narrow range of the resultant expected demand for physician services.

BLS also points out that both its and BHM's models cannot measure and project the capacity of physicians to stimulate demand. A downward bias in the projections would result if physician-stimulated demand reflects real need for medical care. To the extent that physician-stimulated demand reflects unnecessary care, the demand estimates would introduce an upwards bias to the projections.

BLS also points out two other factors which would bias the BHM projections in an upward direction. The inclusion of data points from 1968 and 1969 for projecting utilization rates reflect the sharp growth in utilization attributable to Medicare and Medicaid startup. (As we will explain later, we agree that 1968 and 1969 data points should be excluded in determining utilization trends, but not for the reason given by BLS). Second, BLS points out that as the coinsurance (that part of fees paid by the patient) has been and is projected to continue dropping, the effective price of physician services has dropped as well. BHM's assumption of a constant price elasticity means that a percentage drop in coinsurance from 20 to 10 percent would result in the same percent increase in the demand for physician services as would a drop in coinsurance from 50 to 40 percent. A more likely effect would be that consumer demand would gradually be saturated as the percentage coinsurance decreases (BLS, 1979b).

The Bureau of Health Manpower Model

BHM uses a demographic projection method which makes certain assumptions about medical care utilization and physician productivity to arrive at its estimates for physician requirements. The general method is not specific to physicians and is applied to **29** general types of health manpower, ranging from selected MD specialties to broad allied health groups. Although specialty-oriented estimates for physicians can be calculated from the total population's utilization of specific types of care by cross-multiplying the projected size of each population subgroup by its associated utilization rate, the method is presently not considered reliable enough to use in projecting specialty-by-specialty requirements.

The basic assumptions are:

- No major unforeseen events wiIl occur in the projection period, including the enactment of a comprehensive program of national health insurance (NHI).
- Supply and demand were in balance in **1975.** As we have seen from tables **25** and **26,** past estimates are in genera] agreement with this assumption.
- Physician productivity does not change substantially between 1975 and 1990.
- Price elasticity, the sensitivity of demand to net price, remains constant between 1975 and 1990. (Different choices of price elasticity of demand coefficients, representing alternative rates of consumer response to price changes for a given personal health service, are used to present the range of estimates.)
- Nondollar costs of obtaining care do not change substantially during the projection period.
- No major health care or manpower substitution occurs between service categories.

The model is developed in three stages which, in practice, may be separated or combined as desired. The most rudimentary stage is termed the "framework." It estimates future demand from the anticipated impact of population growth and demographic shifts (age, sex, income distributions) on the economic demand for medical services, with physician productivity assumed to remain the same. In this first or framework stage:

. The U.S. population is projected to 1980, 1985, and 1990 by age, sex, and income subgroups in 40 components (5 age by 4 income by 2 sex groupings).

- For each of the 40 subgroups, **a** utilization **rate for each of 20 types of health service settings (e.g., general medical office visit, inpatient hospital admission, nursing home stay, vision care, laboratory services, etc.) was estimated from recent National Health Interview Survey data and other sources for the 1975 base year and the future years.**
- The percentage increase in utilization for each of the 20 types of care is obtained by summing over the population and dividing the future year utilization by the 1975 base year utilization for that type of care.

The second stage, called the "baseline" configuration, attempts to factor the effects of historical trends in per capita utilization of medical services into the general model. In this second stage:

- Utilization, by each of the 20 care types, is adjusted to account for future increases that represent continuation of recent trends. Economic and noneconomic trends are analyzed separately. Economic trends interpret the effects of price and insurance copayment charges on changes in utilization. As noted earlier, the price elasticity is assumed to be constant over the period **1975-90.** The utilization projections in each of the 20 care types are then individually adjusted for the future years, based on these projections of price and coinsurance payment. After removing price effects from the past utilization trends, the remainder (representing education, consumer preference, patient-care physician supply, etc.) is the noneconomic trend. This noneconomic effect is assumed to continue in a linear fashion into the future and per capita utilization adjustments for each care type are made.
- The adjusted increases in future care utilization are then applied to the 1975 estimates of the distribution of the **29** manpower categories in each of the **20** care types to give a preliminary estimate of the future manpower required to provide the projected care utilization.
- Adjustments are then introduced to account for trends in the manpower required to provide a given amount of care utilization. For physicians, it has been previously noted that the assumption is that productivity remains constant from **1975-90.**
- Demand is then summed over the 20 types of care to arrive at the baseline forecast of future demand.

These estimates assume no major departure from historical experience. The third stage, the "contingency" modeling capability, is a separate component that has been used to explore the possible impact on the economic demand for physician services of the following contingencies:

- The impact of NHI can be estimated by adjustments to the utilization increases through new economic trend adjustments which provide for different NHI copayment possibilities.
- Expanded-function task delegation can be factored in by new adjustments to the manpower staffing trends based on alternative assumptions of midlevel practitioner employment and their productivity rates.
- Expanded use of HMOS is treated by alternative estimates of the population enrolled in HMOS in future years and separate utilization rates, trends, and staffing assumptions for this part of the population.

The Framework

To predict the impact of population growth and demographic shifts, the model starts with the basic assumption that supply and demand were in balance in 1975 and calculates per capita utilization rates for each of 40 population segments (age by sex by income categories) with respect to 20 forms of health care. Table 28 displays the population matrix utilized; table 29 indicates the various health care categories. Note that the BHM health care categories include care setting (office-based, short- and long-term hospital care, nursing homes) as well as types of care (pediatric, surgical, psychiatric). Thus, the capability of the BHM model to make distinctions among physician specialties is not very fine-grained. The basic distinctions made are between general medical, pediatric, obstetrics-gynecology, psychiatric, vision, surgical,

Table 28.—Population Matrix Used in the BHM Model

	Family income			
	Under $5,000	$5,000-$9,999	$10,000-$14,999	$15,000 and over
Males				
Under 14				
14-24				
25-44				
45-64				
65+				
Females				
Under 14				
14-24				
25-44				
45-64				
65+				

SOURCE. JWK International Incorporated, Evaluation of *Project SOAR (Supply, Output, and Requirements),* **draft report, DHEW contract No. HRA 232.78-0140, 1979.**

Table 29.—Health Care Categories Used in the BHM Model

Setting	Form of care
Medical office	General care
	Pediatric care
	Obstetric-gynecological care
	Psychiatric care
	Vision care
	Other medical office care
Short-term hospital	Outpatient care
	Surgical care
	Medical care
Long-term hospital	Psychiatric care
	Other long-term hospital care
Other care settings	Nursing home care
	Dental care
	Veterinarian services
	Optometric care
	Podiatric care
	Other patient care, not elsewhere specified
Noncare settings	Pharmacy services
	Laboratory services
	Noncare activities, not elsewhere specified

SOURCE JWK International Incorporated, *Evaluation of Project SOAR (Supply, Output. and Requirements),* **draft report, DHEW contract No HRA 232 78-0140, 1979**

podiatric care, and "all other. " Finally, it should be noted that the overall model applies to 29 categories of health manpower (including veterinary medicine). Accordingly, all 20 health care categories do not come into play in estimating physician demand.

Utilization rates are "calculated for each applicable category of health care for the 40 population subgroups (based on recent National Health Interview Survey data, etc.). Changes in population size and in demographic distribution (age by sex by incomes) are calculated for future years. 1975 utilization rates for each category are then projected onto the future population estimates and the results are summed to obtain expected utilization of services.

Based on population and demographic shifts, physician demand is expected to increase by **9.5** percent between 1975 and 1990 (Cultice, **1979)** yielding an estimated demand of **414,336** in 1990. This corresponds to a projected increase in the population of 10.5 percent in the same period. Of the **414,336** physicians, 229,276 are expected to be in demand in office-based settings (versus 205,196 in 1975), and 126,008 in short-term hospital care (versus 117,573 in 1975). The remaining **59,052** physicians are expected to be in demand in other care settings.

The anticipated population changes between now and **1990** that are most pronounced and appear most likely to impact on utilization patterns are: 1) an aging population, and **2)** strong signs of upward income mobility, measured in constant (1970) dollars.

Although the U.S. population is aging, that does not mean the 1990 population will be an elderly one. Growth in the over-65 category will, in fact, be small (from 9.5 percent of the total population to **12.3** percent). Rather, the bulk of the population will be in the prime of adulthood, **25** to 44. The percentage of Americans in this age category is projected to grow from 23.6 to 32.9 percent. Correspondingly, the percentage of persons under 25 is projected to drop sharply (from 46.3 to 35.4 percent).

The projected shift in income distribution is more dramatic than the age shift. The percentage of individuals whose family income, measured in 1970 dollars, lies below $10,000 is projected to shrink from 50.6 to 20.2 percent, while the percentage of those with family incomes of $15,000 or greater is projected to grow from 23 to 58.1 percent—a complete reversal of the percentages in the below $10,000 and above $15,000 groups respectively.

These population changes are summarized in table 30.

Changes in the age and income composition of the population can be expected to bring about changes in patterns of utilization of medical services. Specifically, we can anticipate that those forms of care more heavily used by the elderly and by those with higher incomes will grow more rapidly than those forms used by the young and by the poor, and that physician services most closely associated with the former will also experience a higher rate of growth. Thus, the greatest growth rates are projected for nursing home and podiatric care (both utilized more heavily by the elderly) and for psychiatric, vision, and dental care (services used more by those with higher incomes). Conversely, the lowest growth projections are for pediatric care and hospital outpatient care (more frequently used by the poor). The population shift into the 25 to 44 age bracket is also expected to increase demand for ob-gyn care somewhat, because these are the childbearing years. It is worth observing that though the U.S. population is aging, we will not be faced with providing for the medical needs of a heavily geriatric citizenry as of 1990. The major growth is going to be in the age group 25 to 44, which is traditionally a comparatively healthier age group relative to both children and the elderly.

It is also noteworthy that most of the health care areas projected to grow as a result of demographic shifts are areas in which services are not provided by physicians (dental care, podiatry) or only partially so (vision care, nursing home services).

The projected growth rates for the 20 types of health services is summarized in table 31. Note that the growth factor attributable solely to overall population growth is 110.5 percent; i.e., the population will have grown 10.5 percent between 1975 and 1990. Thus, surgical care is projected to grow at barely over the overall population growth rate (0.4 percent higher), and both general medical office-based care (108.9 percent) and medical care in short-term hospitals (103.3 percent) are projected to grow at less

Table 30.—Projected Shifts in Age and Income Distribution, 1970-90

	Percent distribution, by year[a]				
	1970	1975	1980	1985	1990
Age					
Under 14	26.8%	23.20/o	20.50/.	19.5%	19.4%
14-24	19.5	20.8	20.5	18.5	16.0
25-44	23.6	25.1	28.1	31.1	32.9
45-64	20.6	20.4	19.8	19.2	19.4
65 +	9.5	10.5	11.1	11.7	12.3
Total	100.O%	100.070	100.O%	100.0%	100.0°4
Incomeb					
Under $5,000	19.90/0	16.6 "/0	11.6%	9.9%	8.6%
$5,000 -$9,999	30.7	23.4	20.2	16.9	11.6
$10,000 -$14,999	26.4	24.1	24.3	21.2	18.7
$15,000- and over	23.0	35.8	43.7	51.9	58.1
Total	100.0%	100.O%	100.070	100.O%	100.O%

aColumns may not add due to rounding.
bIn 1970 dollars.
SOURCE: JWK International Incorporated, *Evaluation of Project SOAR (Supply, Output, and Requirements)*, draft report, DHEW contract No. HRA 232-78-0140, 1979,

Table 31 .—Projected Utilization Growth Factors, 1975-90

	Projected growth 1975-90
Medical off ice	
General care	108.9
Pediatric care	101.1
Ob-gyn care	120.5
Psychiatric care	124.7
Vision care	123.8
Other care	111.0
Short-term hospital	
Outpatient care	95.6
Surgical care	110.9
Medical care	103.3
Long-term hospital	
Psychiatric care	118.9
Other care	110.5[a]
Other care settings	
Nursing home care	127.3
Dental care	121.6
Veterinarian services	110.5[a]
Optometric care	116.4
Podiatric care	127.2
Other care	110.6a
Noncare settings	
Pharmacy services	111.7
Laboratory services	110.5[a]
Noncare activities	110.5[a]

[a]Age-, sex-, and Income-specific utilization rates are either inappropriate or unavailable for these categories The growth shown (110.5) IS that attributable solely to theoverall growth of the population.

SOURCE. JWK International incorporated,.EvaluatiOflof *Project SOAR (Supply, Output, and Requirements)*, draft report, DHEW contract No. HRA 232.78-0140,1979.

than the overall population growth rate of 110.5 percent.

These projections deal with utilization of medical services as an expression of economic demand, not medical need. We do know, however, that higher income has traditionally been associated with improvements in health status; i.e., less need for medical care. Tables 32 t0 35 give some indication of the differential health status and utilization patterns of high- and low-income groups. Clearly, low-income groups are sicker and use more medical services, particularly hospital care, than higher income groups.

An evaluation completed under contract to BHM of its general demand model (JWK International, 1979) raises the question whether "new arrivals" in the upper income brackets would exhibit the same patterns of utilization or the same underlying patterns of medical need as long-time members of upper income categories. Conceivably, the "new arrivals" in the upper income categories might lag in exhibiting the lower utilization rates of the higher income brackets.

We might also question whether the relationship between utilization of medical services and income is indeed constant over time, which is what is implied by projecting 1975 income utilization rate differentials to the **1990** population. If we had done such an exercise 15 years ago (that is, attempted to project 1975 utilization from a 1960 data base) we would have underestimated the actual utilization rates of low-income groups. Over this time period the utilization rates of the poor have risen more rapidly, and, in the area of physician visits, the poor now use more services than the nonpoor, whereas, previously they used less (see table 34).

These questions are raised not so much to critique the assumptions that went into the BHM framework model—which are quite plausible assumptions —but merely to point out that even the most plausible of assumptions may finesse a great deal of uncertainty.

The Baseline Configuration

The "baseline" configuration factors in the effects of historical trends in per capita utilization of medical services. Two major component trends are distinguished in the analysis. The price-related component is that portion of the change in utilization that is expected to result when changes in the price of a particular form of *care* or medical service affect consumer decisions to seek that care or service. The non-price-related component is a residual that measures the effects of all other possible influences combined, including such factors as changes in the accessibility of care, changes in population, changes in consumer taste and preference, changes in medical technology, environmental changes, and changes in disease prevalence and incidence. The non-price-related component is the greater of the two.

The language of the BHM model is the language of economics, which tends to treat medical care like any other "consumer product, "

Table 32.—Prevalence of Selected Chronic Conditions Reported in Health Interviews, by Family Income (United States)

Family income	Arthritis (1969)	Asthma (1970)	Chronic bronchitis (1970)	Diabetes (1973)	Heart conditions (1972)	Hyper-tensiona (1972)	Impairment,b back or spine (1971)	Hearing impairment (1971)	Vision impairment (1971)
	Number per 1,000 persons 17-44 years								
Under $5,000 . . .	46.9	34.1	28.4	11.4	32.5	48.9	59.4	55.4	43.2
$5,000-$9,999 . .	40.5	23.6	22.3	8.7	23.3	40.8	50.5	44.0	31.7
$10,000-$14,999	38.7	24.4	21.8	8.4	22.5	35.9	47.4	39.3	28.7
$15,000 and over	35.9	26.8	23.7	8.0	24.3	29.8	42.4	35.8	30.9
	Number per 1,000 persons 45-64 years								
Under $5,000 . . .	297.8	53.5	44.2	74.1	139.3	172.7	102.8	158.9	114.1
$5,000-$9,999..	200.3	33.5	38.7	43.8	92.5	125.4	67.2	118.1	57.4
$10,000-$14,999	163.7	23.7	29.0	37.8	74.3	121.3	62.3	107.3	45.9
$15,000 and over	159.8	22.7	30.3	30.5	66.6	105.3	52.2	85.9	48.9

[a]Without heart involvement,
[b]Except paralysis.
SOURCE: National Center for Health Statistics, "Selected Reports from the Health Interview Survey," *Vital and Health Statistics,* Series 10.

Table 33.—Number of Disability Days per Person per Year by Family Income (United States, 1973)

Family income	Restricted activity days	Bed disability days	Work-loss days
	Days per person ages 17-44 years		
Under $5,000.	21.1	8.3	6.5
$5,000 " $9,999.	14.6	5.7	5.9
$10,000 -$14,999.	11.9	4.8	4.8
$15,000 and over.	11.4	4.4	4.6
	Days per person ages 45-64 years		
Under $5,000.	45.7	15.5	7.5
$5,000 " $9,999	25.1	8.7	7.3
$10,000 -$14,999	16.9	5.9	5.5
$15,000 and over.	14.0	4.5	5.3

SOURCE: National Center for Health Statistics, "Current Estimates from the Health Interview Survey. 1973." Vital *and Health* Statistics, Series 10, No. 95; and unpublished data.

with the assumption that utilization is generated by consumer demand. It has frequently been argued, however, that much utilization of medical care is physician generated. The model does take such factors into account. What it does not do is differentiate between consumer- versus provider-generated changes in per capita utilization of medical care.

The price-related utilization trend is calculated through out-of-pocket costs to the consumer. Over the years, the price of health care relative to the Consumer Price Index (CPI) will have risen for some forms of care and declined for others. In all (or almost all) instances, however, the actual out-of-pocket expenses to the consumer will have declined due to the increasing use of private and public health insurance. For those forms of care for which the net price to the consumer has declined, per capita utilization would be expected to increase.

We will not describe in any detail the technical aspects of utilization trend analysis. Conceptually, however, the process involves the following steps:

- The observed utilization trend over the baseline time period (1968-76) is factored into its price- and non-price-related components.
- A linear least squares regression equation is fitted to the non-price-related utilization trend and the resulting straight line is extrapolated forward in time to **1990.**

Table 34.—Number of Physician Visits per Year by Poor and Not Poor Status and for Whites and Others (United States, 1964 and 1973)

Aae and year	Total		Whites		All others	
	Poor	Not Poor	Poor	Not poor	Poor	Not poor
	Number of physician visits per person per year					
17-44 years						
1964	4.1	4.7	4.5	4.8	3.3	4.2
1973	5.7	5.0	5.8	5.0	5.6	4.8
45-64 **years**						
1964	5.1	5.1	5.2	5.1	4.9	4.6
1973	6.3	5.4	6.1	5.4	7.1	5.3
	Percent with no physican visits in past 2 years					
17.44 years						
1964	24.2	18.1	23.2	17.7	26.6	22.9
1973	13.4	12.8	13.1	12.7	14.5	13.5
45-64 **years**						
1964	29.2	21.7	28.0	21.3	33.1	29.0
1973	20.6	16.9	21.4	16.9	17.0	16.9

Definition of poor IS based on family Income. Under $3,000 in 1964.
Under $6,000 in 1973
In each case, this included about one.fifth of the population.

SOURCE National Center for Health Statistics, unpublished data from the Health Interview Survey

Table 35.—Number of Discharges From and Average Length of Stay in Short-Stay Hospitals, by Income and Color (United States, 1964 and 1973)

Age and year	Total		Whites		All others	
	Poor	Not poor	Poor	Not poor	Poor	Not poor
	Number of discharges per 1,000 population					
17.44 **years**						
1964	181	161	188	164	163	132
1973	198	148	190	148	223	149
45.64 **years**						
1964	146	148	159	151	102	111
1973	225	152	238	153	174	133
	Average length of stay in days					
17-44 years						
1964	6.9	6.3	6.8	6.2	7.1	8.0
1973	6.4	6.0	6.0	5.9	7.2	7.0
45-64 **years**						
1964	14.4	9.7	12.8	9.5	22.6	13.5
1973	12.8	9.3	12.3	9.0	15.3	13.0

Definition of poor is based on family Income Under $3,000 in 1964
Under $6,000 in 1973
In each case, this Included about one-fifth of the population

SOURCE National Center for Health Statistics, unpublished data from the Health Interview Survey

- In a separate process, the historical values of coinsurance and price, defined **as the** ratio of CPI for health care to CPI for all items combined, are calculated. These values are then multiplied to yield the projected net price (out-of-pocket costs) to the consumer for the year or years in question.
- The projected net price to the consumer is then applied to a demand curve with an assumed elasticity. This demand curve relates the price (to the consumer) of a given form of care to the demand for that care. Based on that relationship, the extrapolated non-price-related utilization is adjusted upward

or downward to reflect the estimated impact of price changes during the years ahead.

Current trend analysis employs "high" and "low" assumptions of price elasticity. Thus, two alternative price-adjusted utilization growth trends are projected. Table 36 shows alternative utilization growth rates based on high- and low-elasticity assumptions for four types of medical care.

The utilization trend analysis is an extremely important element in the BHM general demand model. 1990 demand is projected to be 596,217 as compared to a 1975 demand of 378,376. of the 217,841 additional physicians, 181,881, or 83 percent of the difference, is attributable to the assumptions made about rising per capita utilization. Table 37 summarizes the projected rise in physician demand between 1975 and 1990, separated into population / demographic and per capita utilization trend components.

The projection of the per capita utilization trend is perhaps the most problematic aspect of

Table 36.—Estimated Growth in Per Capita Utilization, Four Forms of Health Care

	Projected per capita utilization in 1990 relative to baseline utilization in 1975	
	High elasticity	Low elasticity
Medical office services	1.45	1.37
Short-term hospital services. .	1.38	1.29
Dental office services	1.28	1.29
Community pharmacy services	1.58	1.50

SOURCE: JWK International Incorporated, Eva/uatiorr of Project *SOAR (SIJpp/y, Output, arr~ Efequiremerrfs),* **draft report, DHEW contract No. HRA 232-78-0140,1979.**

Table 37.—increase in Demand From Population and Per Capita Utilization Changes, 1975 to 1990, BHM Model

	1975	1990
Demand	378,376 (assumed equal to supply)	596,217 (projected)
Increase.	—	217,841 (projected)
Population effect		(35,960)
Per capita utilization effect		(181,881)

SOURCE: See text.

the BHM general modeling effort because of the difficult philosophical and methodological issues involved in identifying and projecting trends.

Methodologically, one problem is that the non-price-related utilization trend includes changes in per capita utilization that occur as a result of demographic changes, including age and income shifts. Thus, the BHM model double counts the effects of age and income, and the estimates are inflated accordingly.

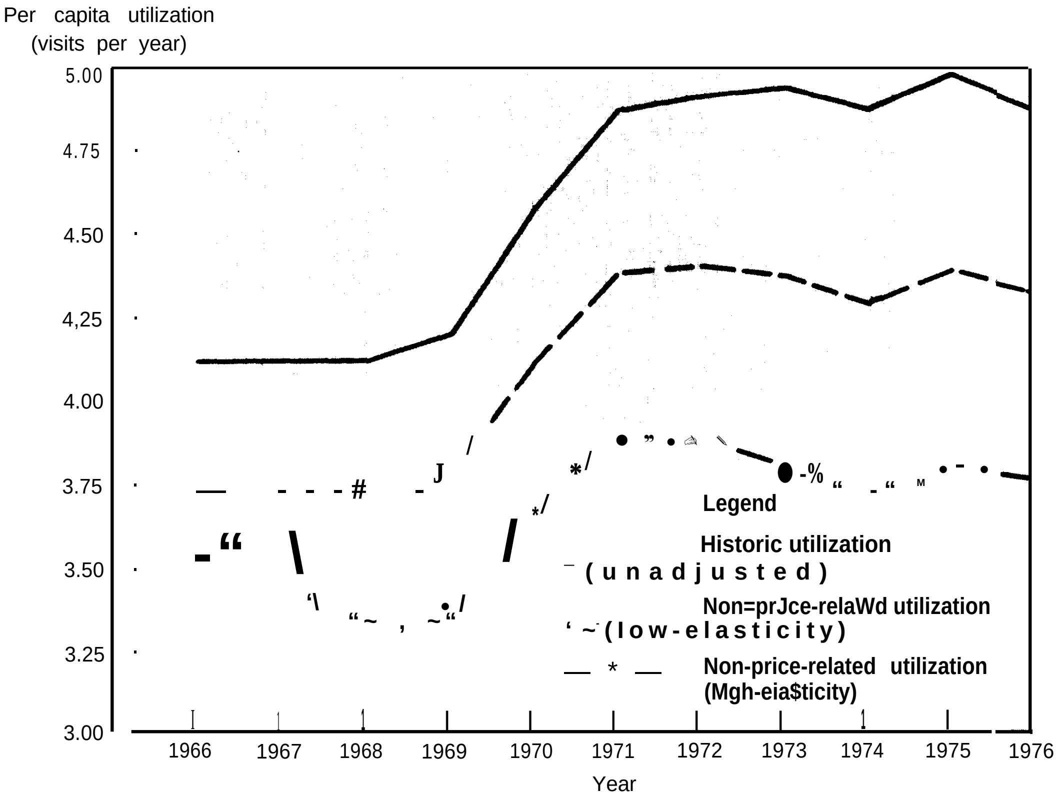
While this problem is relatively easy to correct (and the model is in the process of being adjusted so that age- and income-related trends will be counted only once), the sensitivity of the estimates to alternative starting dates for trend projection is more difficult to remedy.

The first task in trend analysis is to identify a time period for which data will be collected and analyzed. Until recently, the time period covered began in 1966 and extended through the latest year for which suitable data were available (currently 1976). The starting date was moved forward to 1968 because of concern that the increases in utilization of medical services that occurred during the startup period of Medicare-Medicaid tend to misleadingly inflate the trend data when 1966 is used as a starting point. If the desire is to remove the unique historical impact of Medicare-Medicaid startup from the projection of a longer term societal trend in utilization, it is questionable whether moving the starting date of the trend analysis from 1966 to 1968 is sufficient. With respect to Medicaid, many States did not yet have their Medicaid programs fully in operation in 1968, and important amendments to the original legislation were also passed during this period, most notably, expanded nursing home coverage.

The choice of starting date is extremely important because, for most kinds of medical care (short-term hospital care excepted), the slope and even the direction of the trend line changes rather dramatically if the starting date is moved from the late 1960's to the early 1970's.

Figures 6 to 9 summarize unadjusted per capita utilization and high and low elasticity, non-price-related utilization for the years 1966

Figure 6.—Per Capita Utilization of Physician Office Services, 1966-76



SOURCE JWK International. Inc , Evaluation 0f *Project SOAR (Supply, Output, and Requirements),* draft report, DHEW contract No HRA 232.780140, 1979

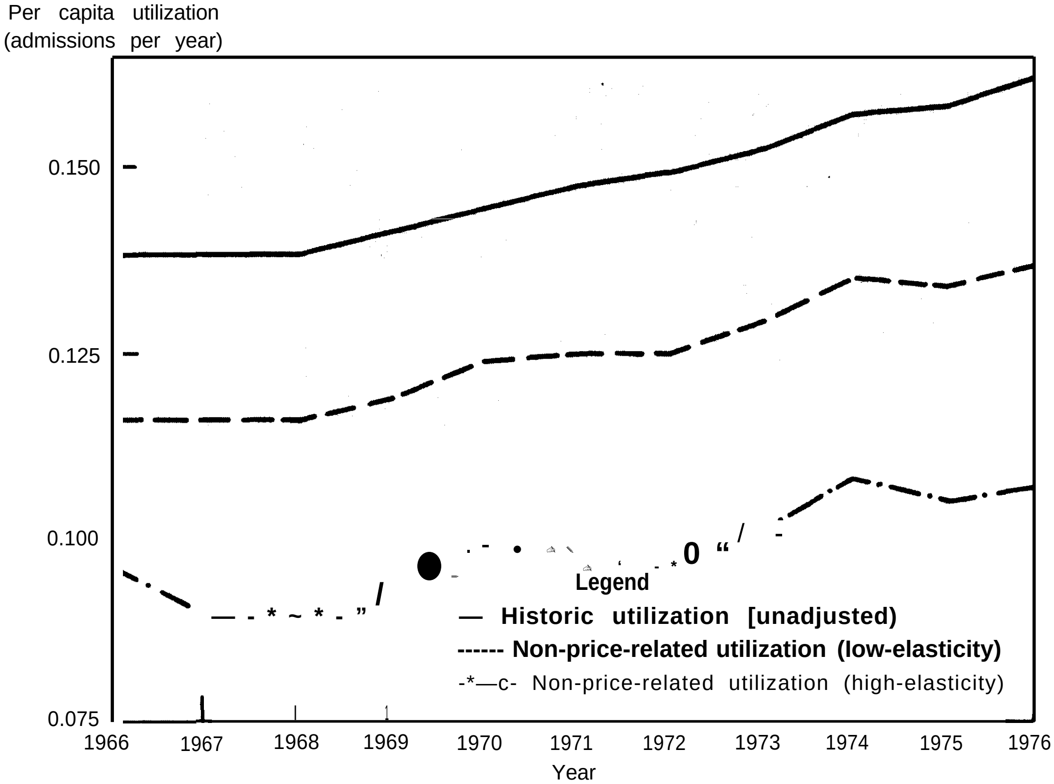
to 1976. Only one set of data points (utilization of short-term hospital services) displays a consistent, natural linear trend. In the case of the other services (physician office visits, dental care, community pharmacy), the utilization data being extrapolated do not consistently display a pattern for which linear extrapolation can be justified.

The mathematics of trend projection (linear regression analysis) involves fitting a straight line to the data points. Clearly, such a conceptual simplification of reality is less distorting of the world's true complexity when the data points themselves tend naturally to conform to a straight line pattern when graphically portrayed. Philosophically, the issue is one of consistency. Trend projection in general and the methodology of linear regression in particular assume that reality—in this instance per capita utilization of medical care—exhibits a reasonably consistent pattern; whether it be one of increasing, decreasing, or remaining steady.

Figures 10 to 13 take the high-elasticity data points of figures **6** to **9** and fit straight lines to the data points for the years 1966-76, 1968-76, and 1971-76. Except for short-term hospital services, distinctly different trends can be projected, depending on the starting date. For physician office services, a start date of either 1966 or 1968 is seen to yield a distinctly upward trend, whereas a start date of 1971 shows a downward slope. In the case of dental office visits, starting the trend analysis in 1968 produces a flat projection; starting in 1971 produces a decline. For community pharmacy services, the trend lines started in **1966** and 1968 show a sharp upward rise even though per capita utilization has been declining since 1973.

The magnitude of the disparities in per capita utilization growth produced by different start dates is quantified in table **38.**

Figure 7.— Per Capita Utilization of Short"Term Hospital Services, 1966-76



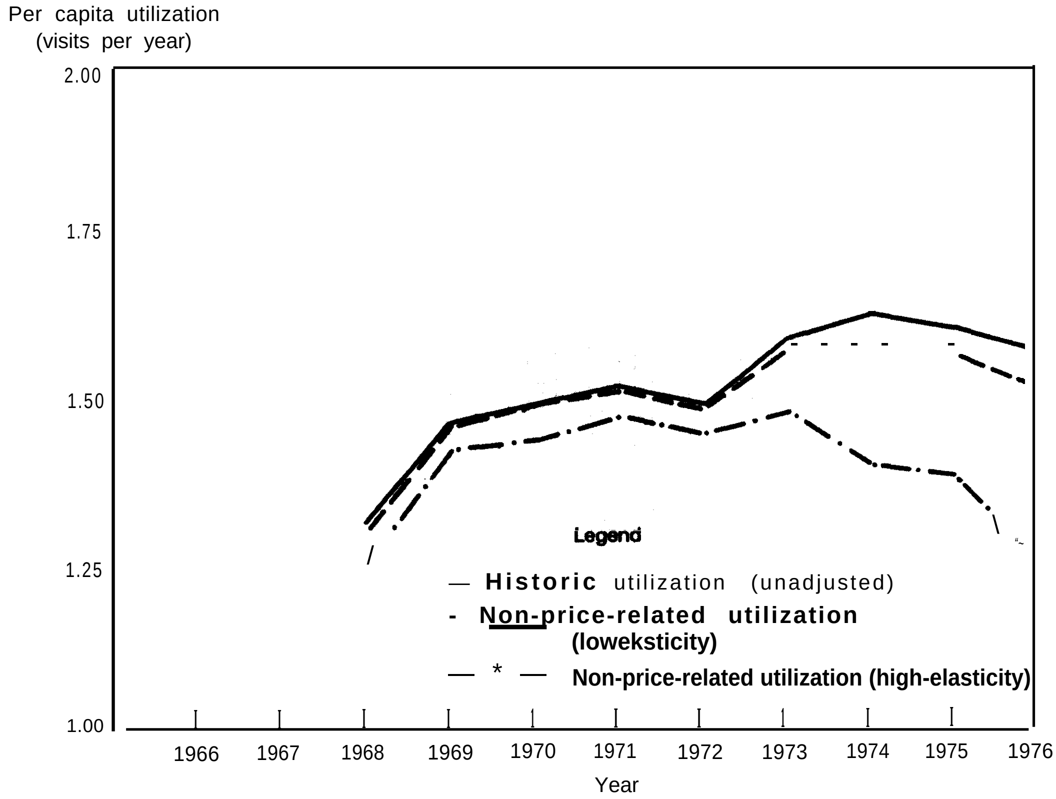
SOURCE JWK International Inc Eva/uaflon of Pro/ect SOAff (SuPPfY, *Output, and F?equlrements),* draft report. DHEW contract No HRA.232.78-0140, 1979

Clearly, the considerable variability of these results (except in the case of short-term hospital services) points to the need for caution in extrapolating utilization trends to project future physician demand, A slight change of 1 or 2 years in the time period covered in the trend analysis can produce enormous differences in the projections. It is evident, however, that the choice of a pre-1970 start date followed by linear trend extrapolation is bound to result in drastically different estimates from estimates which use a post-1970 start date.

BHM's review of its general demand model (JWK International, 1979) suggested that instead of linear extrapolation, a logarithmic fit would produce a somewhat better trend extrapolation (for all but short-term hospital services), less sensitive to the Medicare-Medicaid startup years. Table 39 shows the difference in the non-price-related per capita utilization trend between **1975-90** produced by employing logarithmic versus linear extrapolation.

The review concluded, however, that, while it is possible to reduce the disparities produced by selecting different start dates for trend analysis by using an alternative form of extrapolation, it was difficult to rationalize the use of a particular functional form of trend fitting, and that there was simply no reason a priori to expect the data to follow a logarithmic as opposed to a linear (or any other) pattern. In addition to mathematical retooling, the evaluation suggested more use of human judgment rather than mechanistic methods, perhaps through projections of what would be "most likely, " based on classic Delphi techniques or simply averaging the response of a suitably selected group of knowledgeable individuals.

Figure 8.— Per Capita Utilization of Dental Office Services, 1968-76



SOURCE JWK International, Inc *Eva/uat/on of Project SOAR (SUPPIY. OufPUf and Recrulremerrts),* draft report, DHEW contract No HRA.232.78.0140, 1979

BHM states that the reasons it continues to use the 1968 start date are: 1) the historical observation of rising per capita use of physician services, 2) the more base years used to establish the trend, the sounder the methodology of trend extrapolation, and 3) its conclusion that the **1968** and 1969 data points do not reflect Medicare and Medicaid startup activities (Cole, 1980).

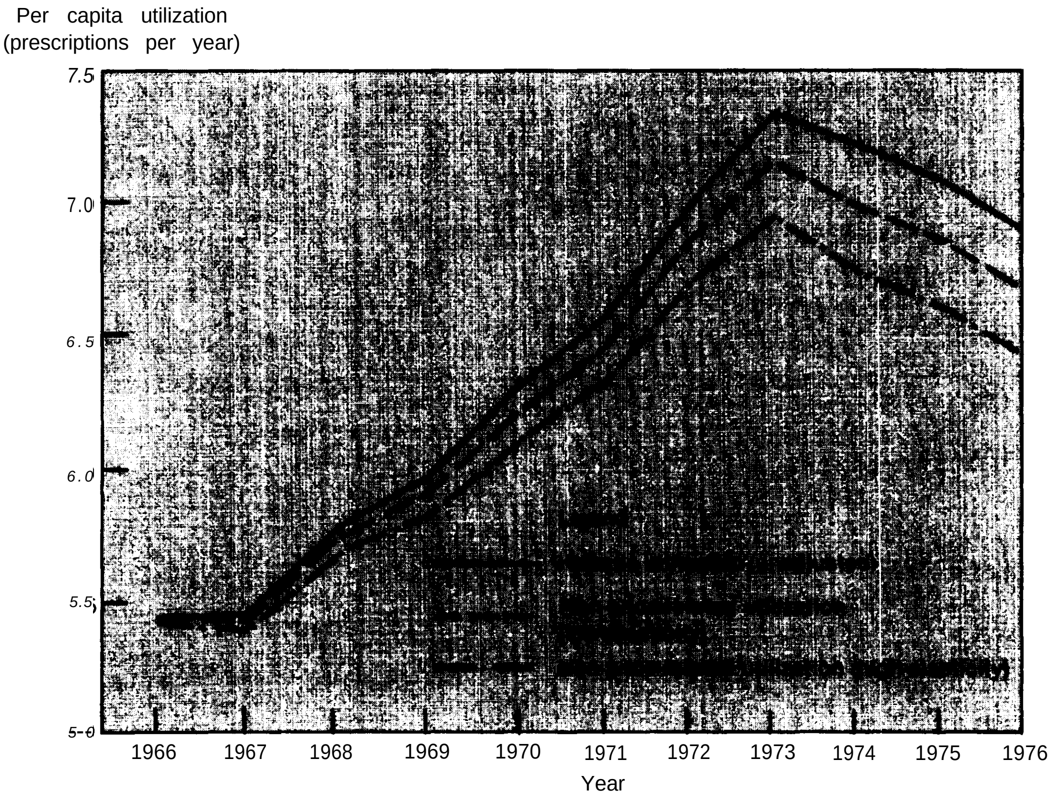
The problem, however, is not whether these statements are correct or not. Instead, the problem stems from the specific rate of increase in per capita utilization of physician services that were used to calculate physician demand in addition to that derived from demographic changes. We have simply pointed out that BHM's use of **1968** as the starting point results in a trend line radically different from actual utilization data from 1971 to 1976 (see figure 10). It is necessary to point this out, because the projections of physician demand issued by BHM combine the estimates of demand due to demographic changes with that due to increasing per capita use of physician services without an indication of the very different results that occur if the starting date for trend projections is changed by just 2 or 3 years. Even BHM's *internal evaluation* has suggested that more human judgment, rather than mechanistic methods, be used.

Contingency Modeling

The contingency modeling capability has been used to explore the possible impact on economic demand for physician services from: 1) alternative forms of NHI, 2) various rates of growth of the HMO movement, and 3) increased use of midlevel practitioners or "task delegation. "

The effects of NHI on utilization are assumed to be mediated through a lowering of the out-of-

Figure 9.—Per Capita Utilization of Community Pharmacy Services, 1966-76



SOURE JWK International, Inc , *Evaluation of Project SOAR (Supply, Output, and Requirements),* **draft report, DHEW contract No HRA-.232-.78-.0140, 1979.**

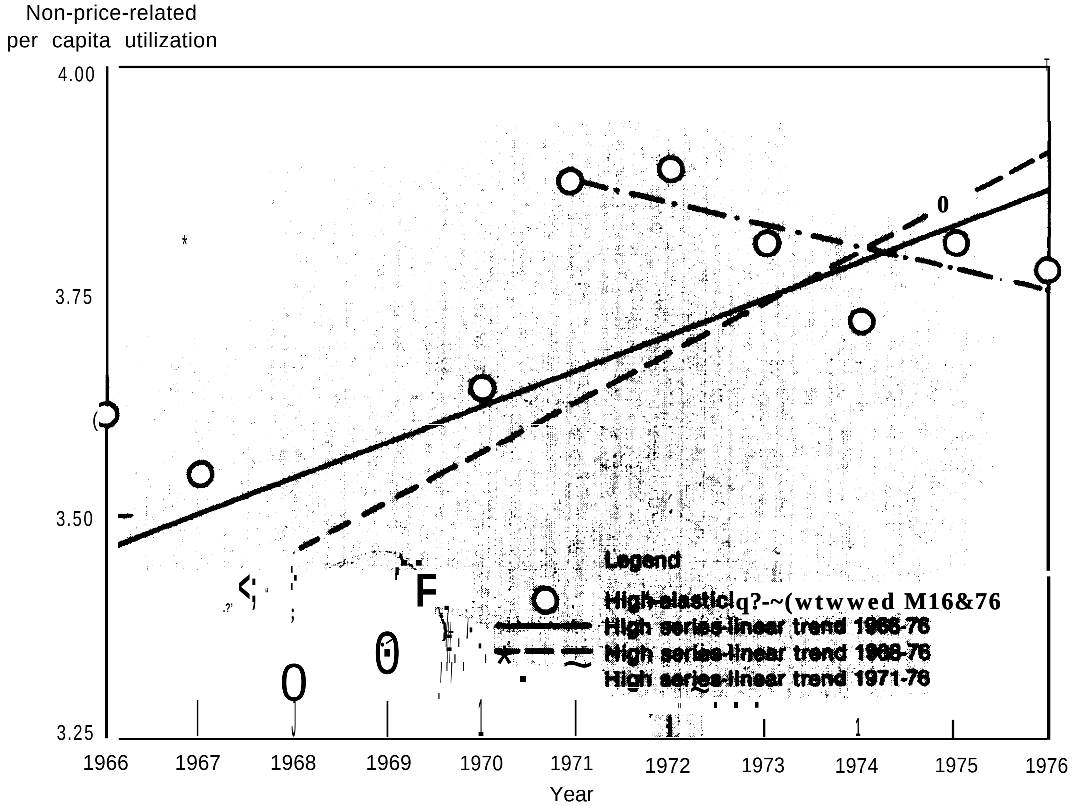
pocket costs to consumers for medical services of various types. It is assumed that coinsurance under NHI would be lower than it would be without NHI. Clearly, the greater the gap between the average coinsurance rates projected for future years in the absence of NHI and seems likely under NHI, the more utilization would be expected to rise under NHI.

Three NHI plans have been modeled, assuming rates of coinsurance of 5, 10, and 15 percent. A recent rough estimate of the impact of NHI in 1990 assuming a 10-percent coinsurance rate with and a 25-percent coinsurance rate without NHI, employing a log linear fit, results in a 13-percent upward demand shift.

Trend estimates suggest, however, that overall, as coinsurance falls, the gap between out-of-pocket costs to the consumer with or without NHI is narrowing. This means that while those portions of the population who currently have little or no medical insurance would surely experience a great drop in out-of-pocket expenses and would increase their utilization of medical services accordingly, *in the aggregate,* most Americans would not experience such a major drop in out-of-pocket costs. Thus, *if* the coinsurance rate continues to decline without NHI, the expectation would be for the eventual impact of NHI on utilization and physician demand to be less, the longer the delay in enacting an NHI plan, particularly if the plan enacted had a comparatively high coinsurance rate (e.g., 15 percent rather than 5 percent).

With respect to the impact of HMO growth on utilization, currently available data on HMO growth suggest that only **6** percent of the population can be expected to belong to HMOs in 1990. This is not enough to appreciably lower utilization or physician demand.

Figure IO.— Non-Price-Related per Capita Utilization Trends, Physician Office Services, 1966-76



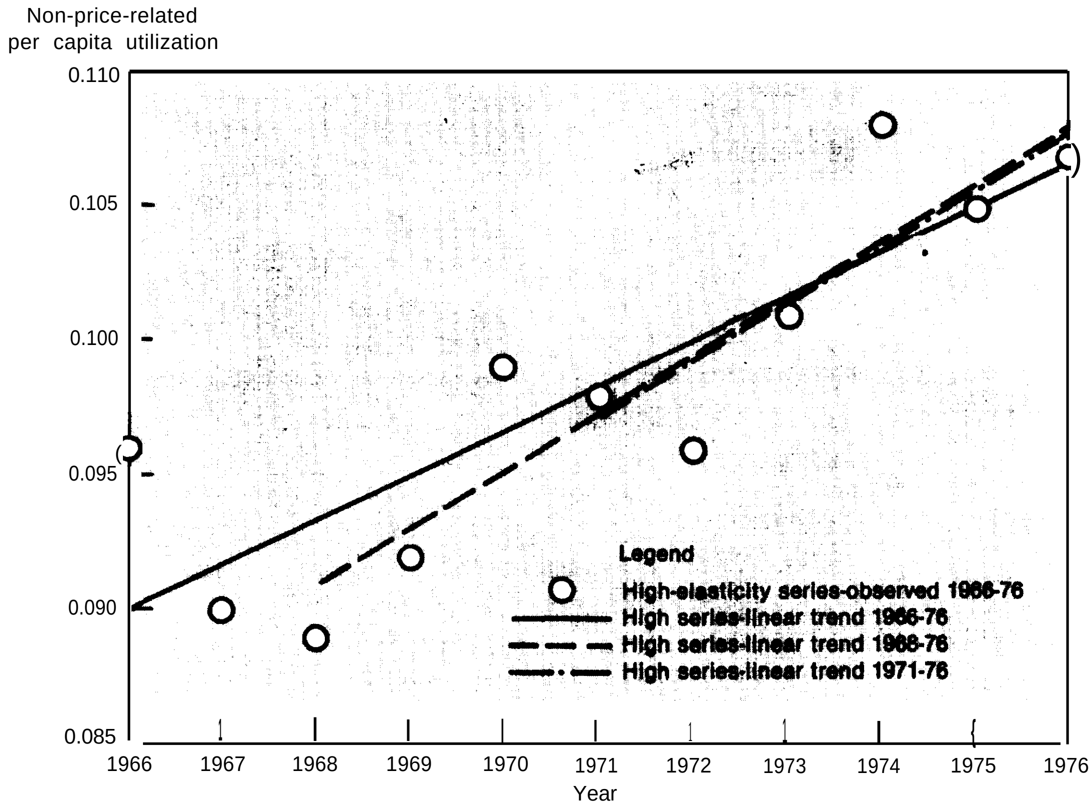
SOURCE JWK /nternat/ona/, Inc., Eva/uat/on of Project SOAR (Supply, Output, and Requirements), **draft report, DHEW contract No HRA.232. 78-0140, 1979.**

In the case of task delegation to midlevel practitioners, the productivity enhancement factor is estimated at 30 percent. Here again, however, the effect of expanded task delegation is projected to be negligible in 1990—on the order of 2 to 3 percent. This minor effect is due to the projected limited supply of nurse practitioners and physicians' assistants, based on current training levels.

Productivity

Finally, productivity of physicians in 1990 is assumed to remain the same as productivity of physicians in the base year 1975. Productivity in the base year is addressed indirectly in the form of a staffing matrix which shows the number of units of manpower engaged in each separate form of health care activity during that year. Because productivity is assumed to be constant, the ratio of services to manpower will be the same in **1990** as in 1975, and it is on this basis that manpower estimates are generated. The total number of estimated active physicians as of 1975 was obtained from the American Medical Association (AMA), with the various specialties regrouped to provide a more compact typology. Physicians were then allocated to particular specialties and care settings based on care profiles. As a result, the numbers used are not head counts of physicians claiming particular specialties, but are estimated FTE physicians providing a particular type of care. For example, the percentage of time the average general practitioner (GP) devotes to providing ob-gyn **care** is assigned to the ob-gyn category, while the estimated percentage of GP practice devoted to pediatric care is assigned to pediatric care. Thus, physician demand is calculated in terms of the nature of the services provided, as well as

Figure 11.- Non-Price-Related per Capita Utilization Trends, Short-Term Hospital Services, 1966-76



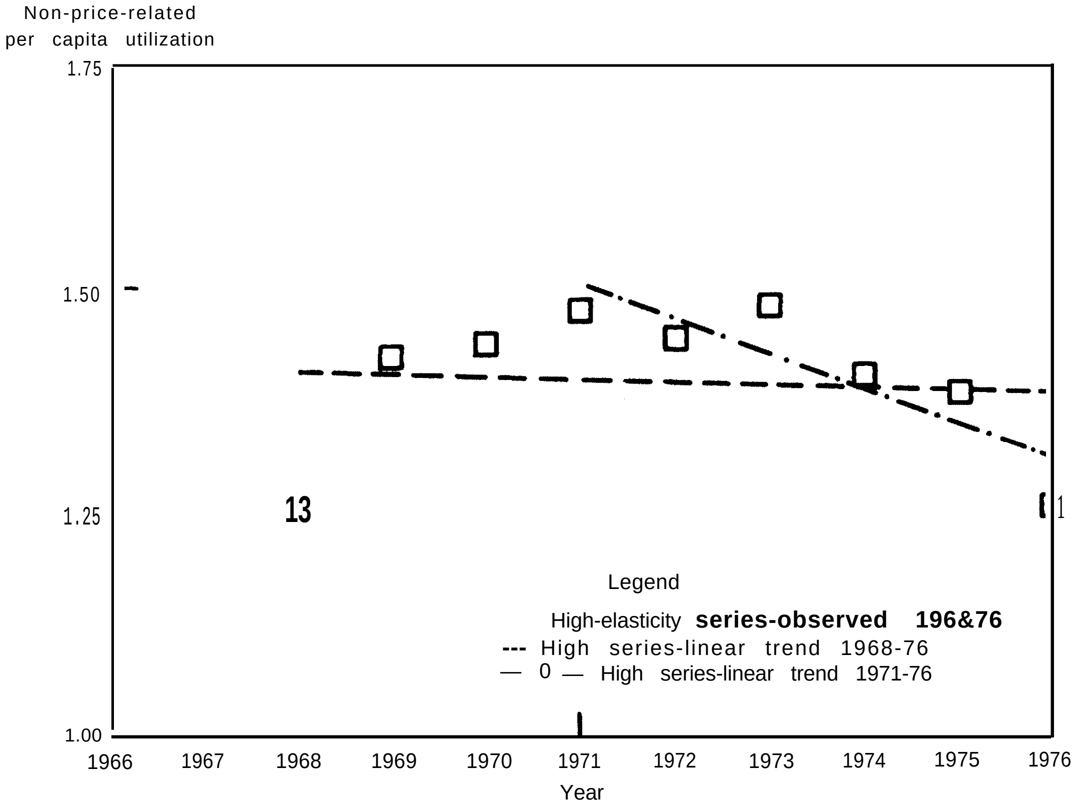
SOURCE. JWK International, Inc .*Evaluation of Project SOAR (Supply, Output, and Requirements),* draft report, DHEW contract No HRA-.232-78-0140, 1979

in terms of physician specialty categories. Table **40** shows the allocation of physicians by type and setting of care in the 1975 base year. Table 41 is an illustrative computation of the 1990 manpower demand for pediatricians. These figures are derived from the "framework" model; i.e., the projected growth in utilization in table 41 is based only on anticipated population growth and demographic shifts.

THE GRADUATE MEDICAL EDUCATION NATIONAL ADVISORY COMMITTEE MODEL

As we have seen, the BHM estimates are products of a market-oriented approach that tries to predict the future economic demand for medical services if current trends in utilization continue without major disruption. In contrast, GMENAC seeks to define physician requirements in terms of the type and amount of care that medical professionals believe should be utilized in **1990,** in light of available data and medical judgment as to the prevalence of biologic conditions and the ability of the medical profession to provide useful therapeutic and preventive care. The main aim of the GMENAC modeling effort is to generate estimates of physicians trained in particular specialties so that graduate medical education programs can be revamped accordingly. Table 42 summarizes the specialties and subspecialties for which estimates are being planned or considered by GMENAC. Of these categories 14 to 26 are ex-

Figure 12.—Non-Price Related per Capita Utilization Trends, Dental Office Services, 1968-76



SOURCE JWK International. Inc. *Evaluation of Project SOAR (Sum/Y. Output. and Requirements),* **draft report, DHEW contract No** HRA-232-78.01 40, 1979

pected to be completed (McNutt, 1979). While an aggregate estimate of physicians required in **1990** is not the principal objective of GMENAC, such a number can readily be generated simply by adding the estimates for each specialty, once those numbers are available and if all specialties are covered.

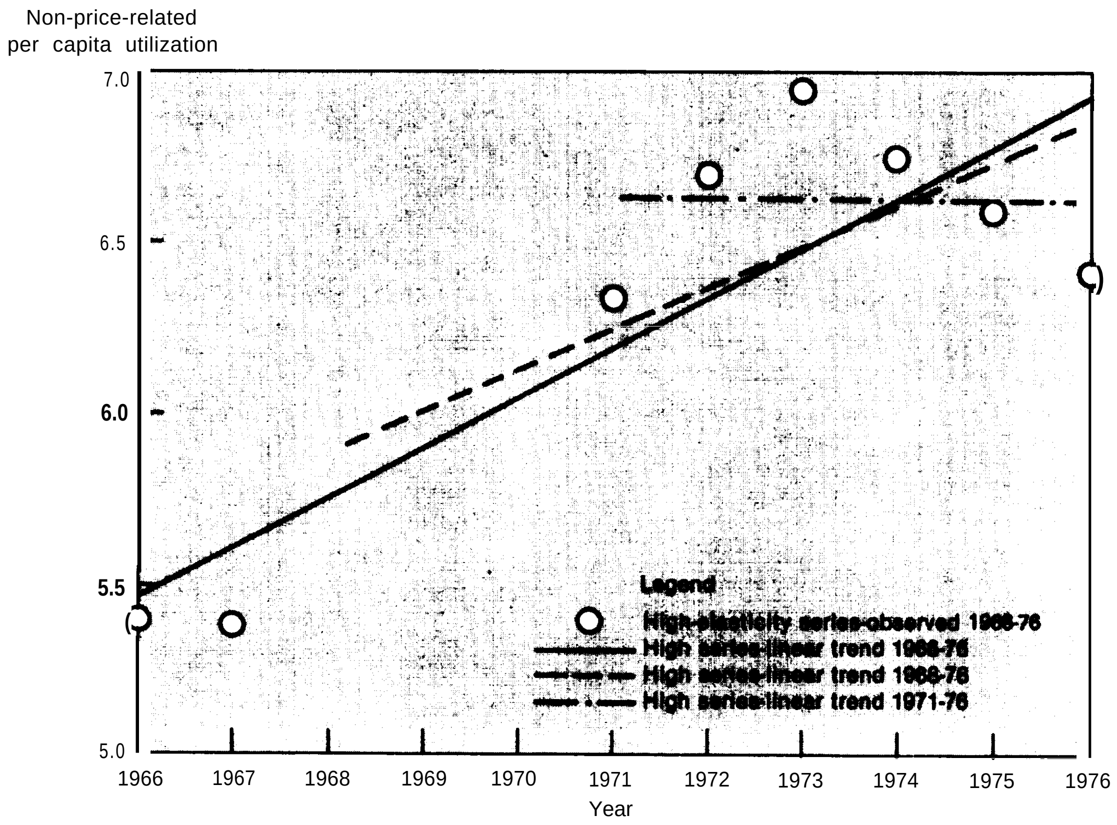
As of this time, no estimates for any specialty group are available from GMENAC. The estimates should be released in 1980, provided GMENAC undergoes no further delays and meets its scheduled date for publication of the final report.

The formal definition of "need for care" employed by GMENAC is as follows:

> An individual is said to need medical care if a pathologic finding exists or if the individual will benefit from such care. Need for care thus refers to: 1) persons with a given morbidity for whom intervention by a physician is appropriate for diagnosis and treatment, and 2) persons without morbidity for whom preventive services are appropriate.

Thus, in the GMENAC model, population-based estimates of morbidity (biological need) are adjusted to determine the proportion of persons with a given morbidity who are in need of physician intervention. In addition, the quantity and type of preventive services appropriate for certain population subgroups are normatively estimated. Further, the model takes into account other uses such as insurance physical examinations and visits by the "worried well. " The result is what GMENAC terms an "adjusted-needs" model which is used in conjunction with U.S. Census population projections to estimate the need for physician care in 1990. Figure 14 illustrates the procedure of arriving at an adjusted needs estimate for one particular type of biological condition, varicose veins.

Figure 13.—Non-Price.Related per Capita Utilization Trends, Community Pharmacy Services, 1966-76



SOURCE JWK International, Inc , *Evaluation of Project SOAR (Supply, Output, and Requirements),* draft report, DHEW contract No. HRA-.232-.78.0140, 1979

Table 38.—Dependence of Trend Projections on Alternative Starting Dates in the Baseline Data

	Elasticity	Projected growth in non-price-related per capita utilization, 1975-90 (1975 = 100) — Start date: 1966	1968	1971
Physician office services	High	116.3	123.0	89.9
	Low	123.1	127.3	95.4
Short-term hospital services . .	High	123.8	131.4	123.4
	Low	123.9	129.9	129.9
Dental office services.	High	NA	97.5	56.3
	Low	NA	123.3	106.9
Community pharmacy services	High	135.6	129.4	100.1
	Low	140.1	134.1	105.6

SOURCE: JWK International Incorporated, *Evaluation of Project SOAR (Supply, Output, and Requirements),* **draft report, DHEW contract No. HRA 232-78-0140, 1979,**

Table 39.—Comparison of Linear Versus Logarithmic Extrapolation of Utilization Data

Form of services and price elasticity	R^2 (percentage of variance explained by regression)		Projected growth in non-price-related per capita utilization, 1975-90 (1975 = 100)	
	Linear extrapolation	Logarithmic extrapolation	Linear extrapolation	Logarithmic extrapolation
Physician **office**				
High	43.20/o	43.50/0	116.3	103.1
Low	65.7	66.2	123.1	104.4
Short-term hospital				
High	75.7	73.5	123.8	104.4
Low	90.1	88.5	123.9	104.3
Dental office				
High	00.7	00.4	97.5	101.7
Low	59.1	60.3	123.3	106.5
Community pharmacy				
High	76.4	77.6	135.6	110.6
Low	81.1	82.3	140.1	111.3

SOURCE: JWK International Incorporated, Evaluation of *Project SOAR (Supply, Output, and Requirements)*, draft report, DHEW contract No. HRA 232.78-0140, 1979

Use of such adjusted needs estimates has important implications. If, for example, we compare estimates of physician requirements based on biological need and appropriateness of medical intervention with estimates based on projecting current patterns of utilization of physician services into the future, we can anticipate some differences in the types of physician services on which the estimates of overall physician requirements would be based. The GMENAC model, for example, implies that patients will not receive physician services merely because they want such services and can pay for them; i.e., factors that translate into "effective economic demand" in a market-oriented model. Using the GMENAC model, a proportion of the current and future economic demand for care might be discounted, because the persons seeking physician services might lack sufficient biological need for services or might be seeking services inappropriate to their biological condition, or might be seeking care for biological conditions for which no useful physician interventions are presently available. From what is known about current patterns of utilization, such a downward adjustment of "economic demand" to meet standards of true biological need and appropriate, useful physician intervention would have the greatest impact on primary care (defined as "first contact" **physicians).** The reason is that a high volume of complaints seen by primary care practitioners are nonserious, self-limiting conditions for which no effective medical treatment currently exists (e. g., "colds," nonbacterial sore throats, and similar conditions). However, the adjusted needs approach does take into account some proportion of the demand for care that is generated by the so-called "worried well" and persons with vague symptoms, probably psychological in origin, for which the patient seeks a physical cause and medical cure.

Conversely, there are also medical conditions for which beneficial interventions are available which do not, however, generate demand. The would-be patient may be unaware of the condition or of the availability of effective treatment or preventive cure, or, for whatever reason, has chosen not to seek it. On this dimension, a need-based model would tend to overestimate physician requirements.

The GMENAC model accordingly provides for some downward adjustment of medical need estimates to conform to patterns of future utilization that can *realistically* be anticipated, even though such adjustments imply an acceptance that the true medical need for physician services will never be wholly met. Finally, much has been written in recent years concerning *over* and unnecessary utilization of medical services that is physician rather than consumer generated. To the degree that over and inappropriate utilization are factors in current patterns of utilization and ongoing trends in utilization, economic demand models include such unnecessary services in projecting physician requirements. In contrast, an adjusted need-based mod-

Table 40.—Allocation of Physicians by Type and Setting of Care for the 1975 Base Year, BHM Model

		Medical office					
	Total	General care	Pediatric care	Ob-gyn care	Psch. care	Vision care	Other care
Physicians (MD)	340,280	46,493	21,453	16,255	15,080	8,820	76,406
General[a]	116,430	36,476	9,932	2,895	1,081	—	26,995
Pediatric	21,746	568	12,061	—	—	—	271
Obstetrics-gynecology	21,731	2,634	—	12,964	79	—	—
Opthalmolgy	11,129	—	—	—	—	8,820	—
Psychiatry	26,502	—	—	—	13,837	—	—
Surgery[b]	76,017	3,516	—	396	63	—	24,003
Secondary specialist[c]	48,322	3,299	—	—	—	—	25,137
Noncare specialist	18,403	—	—	—	—	—	—
Physicians (DO)	14,532	11,072	47	47	35	24	464

	Short-term hospital			Long-term hospital	
	Out pt. care	Surgical care	Medical care	Psychiatric care	Other care
Physicians (MD)	8,481	63,701	35,680	9,334	3,314
General[a]	5,660	1,351	21,292	3,103	1,476
Pediatric	638	49	6,179	—	131
Obstetrics-gynecology	—	5,156	—	—	—
Ophthalmology	—	1,991	—	—	—
Psychiatry	1,746	—	1,392	6,231	—
Surgery[b]	—	45,289	—	—	—
Secondary specialist	437	4,374	6,124	—	1,707
Noncare specialist	—	5,491	693	—	—
Physicians (DO)	312	254	1,210	—	166

	Other care settings						Noncare settings		
	Nursing home	Dental care	Vet. care	opt. care	Pod. care	Other care	Lab service	Pharm. service	Non care activities
Physicians (MD)	594	—	—	—	—	2,611	4,309	—	27,749
General[a]	594	—	—	—	—	—	—	—	6,115
Pediatric	—	—	—	—	—	—	—	—	1,849
Obstetrics-gynecology	—	—	—	—	—	—	—	—	898
Ophthalmology	—	—	—	—	—	—	—	—	318
Psychiatry	—	—	—	—	—	—	—	—	3,276
Surgery[b]	—	—	—	—	—	—	—	—	2,750
Secondary specialist	—	—	—	—	—	—	—	—	7,244
Noncare specialist	—	—	—	—	—	—	4,309	—	5,299
Physicians (DO)	—	—	—	—	—	—	—	—	901

[a] Includes general and family practice, internal medicine, and "specialty unspecified" (presumed to be predominantly in primary care)

[b] Includes general surgery, neurological surgery, orthopedic surgery, otolaryngology, plastic surgery, colon and rectal surgery, thoracic surgery, urology, and anesthesiology.

[c] Includes allergy, cardiovascular diseases, dermatology, gastroenterology, pediatric allergy, pediatric cardiology, pulmonary diseases, radiology, diagnostic radiology, therapeutic radiology, neurology, physical medicine and rehabilitation, and "other specialties."

[d] Includes occupational medicine, general preventive medicine, public health, aerospace medicine, pathology, and forensic pathology

SOURCE: JWK International Incorporated, *Evaluation of Project SOAR (Supply, Output, and Requirements)*, draft report, DHEW contract No. HRA 232.78-0140, 1979.

cling effort such as GMENAC's tries to factor out some unnecessary services from its estimates.

There is controversy over the definition of "unnecessary" services. The GMENAC model would presumably reflect expert opinion in respect to whether particular conditions require a physician visit, and whether these conditions could benefit or not from further treatment. Figure 15 summarizes the component processes that are involved in translating adjusted medical need estimates into projections of physician requirements by specialty. Epidemiological data on the frequency of specific biological conditions in the population are used as the starting point. Data on conditions that are known to be treated by physicians in a given specialty or specialty groups are selected based on analyses of current practice content by self-designated specialists and estimates of the training content in each specialty.

Table 41.— Illustrative Computation of Manpower Requirements

1. According to table 40, the Nation's pediatricians were involved in 1975 in the following forms of health care activity, in the numbers shown:

	Number of pediatricians engaged in this activity (1975)
Medical office	
General care	568
Pediatric care	12,061
Other care	271
Short-term hospital	
Outpatient care	638
Surgical care	49
Medical care	6,179
Long.term hospital	
Other care	131
Other settings	
Noncare activities, not elsewhere specified	1,849
Total	21,746

2. Runs conducted by the Division of Manpower Analysis indicate that between 1975 and 1990, utilization of each of the foregoing forms of care will have undergone the following growth (or reduction):

	Projected utilization growth factor (1975-90)
Medical office	
General care	108.9
Pediatric care	101.1
Other care	111.0
Short-term hospital	
Outpatient care	95.6
Surgical care	110.9
Medical care	103.3
Long-term hospital	
Othercare	110.5
Other settings	
Noncare activities, not elsewhere specified	110.5

3. Applying these projected growth factors to the correspcmding 1975 supply of pediatricians, the following table of projected 1990 manpower requirements is produced:

	Number of pediatricians engaged in this activity(1975)	Projected utilization growth, 1975-90	Projected 1990 manpower requirements (column 1times column2)
Medical office			
General care	568	108.9	619
Pediatric care	12,061	101.1	12,194
Other care	271	111.0	301
Short-term hospital			
Outpatient care	638	95.6	610
Surgical care	49	110.9	54
Medical care	6,179	103.3	6,383
Long-.term hospital			
Other care	131	110.5	145
Other settings			
Noncare activities, not elsewhere specified	1,849	110.5	2,043
Total			22,349

SOURCE JWK International Incorporated. *Evaluation of Pro/ecf SOAR (SuPP/Y Outpuf* **and RequlremefrfsL draft report. DHEWcontract No liRA232.78-Ol@. 1979**

Table 42.—Specialty Areas and Subspecialties for Which Requirements Estimates Are Being Planned or Considered by GMENAC

- Obstetrics-gynecology
- Dermatology
- Adult medical care
  - Family practice
  - General internal medicine
  - Allergy and immunology
  - Hematology
  - Cardiovascular disease
  - Infectious disease
  - Endocrinology and metabolism
  - Nephrology
  - Pulmonary disease
  - Gastroenterology
  - Rheumatology
  - Medical oncology
- Pediatric medical care
  - Family practice
  - General pediatrics
  - Allergy and immunology
  - Pediatric hematology-oncology
  - Pediatric nephrology
  - Pediatric endocrinology
  - Pediatric cardiology
  - Neonatal-perinatal medicine
- Otolaryngology
- General surgery
- Colon and rectal surgery
- Orthopedic surgery
- Thoracic surgery
- Ophthalmology
- Urology
- Neurosurgery
- Plastic surgery
- Pathology
- Radiology
- Psychiatry and neurology
- Anesthesiology
- Preventive medicine
- Nuclear medicine

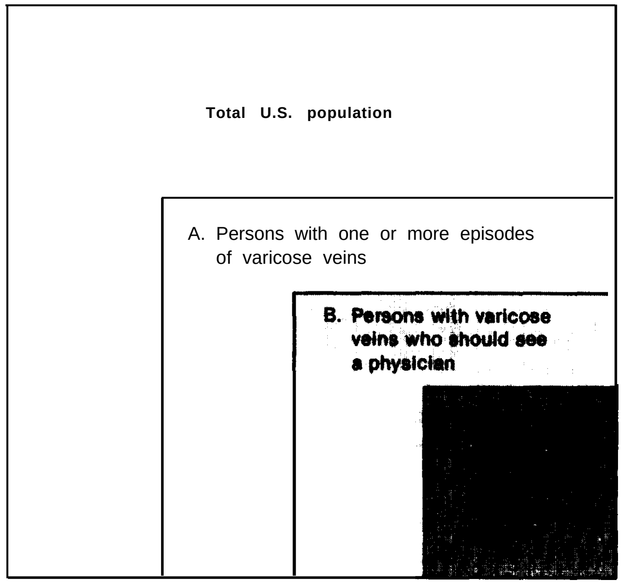
SOURCE *Interim Report o/ the Graduate Medical Education National Advisory Committee to the Secretary, Department o/ Health, Education, and We/fare,* **Washington, D.C. Health Resources Administration, DHEW publication No (HRA) 79-633, p 206**

These data on current incidence and prevalence of conditions, it is important to note, are subject to various limitations in terms of validity and reliability. The following quote, taken from the workbook prepared for the general surgery advisory panel, is illustrative:

> There is a general problem in the national data sets with coverage of conditions treated by general surgeons. Population based clinical examination data provide the best source of data for estimates of incidence and prevalence of disease and injury. Such data for general surgery conditions are limited, however. The data set that contains the most extensive coverage of conditions is the Health Interview Survey (HIS). However, conditions in HIS are self-reported and thus represent an individual's knowledge and perception of a condition, and not necessarily an accurate measure of disease or injury. In addition, in HIS, reporting of morbidity is contingent upon a person's taking one or more of various actions, such as restriction of usual activities, bed disability, work loss, or seeking medical advice. A further problem exists in obtaining reliable estimates for low-prevalence conditions (less than 1 to 2 percent of the population), The sample of persons with rare conditions is usually small, and thus these estimates tend to be unreliable. Since many of the general surgery conditions occur with low frequency in the total population, they are difficult to estiimate accurately. In general, the available morbidity estimates presented for the general surgery conditions are thought to be underestimates of actual morbidities in the U.S. population. Given the limitations of the national morbidity data, the estimates of the proportions of persons with general surgery conditions is presented to the panel for review and revision.

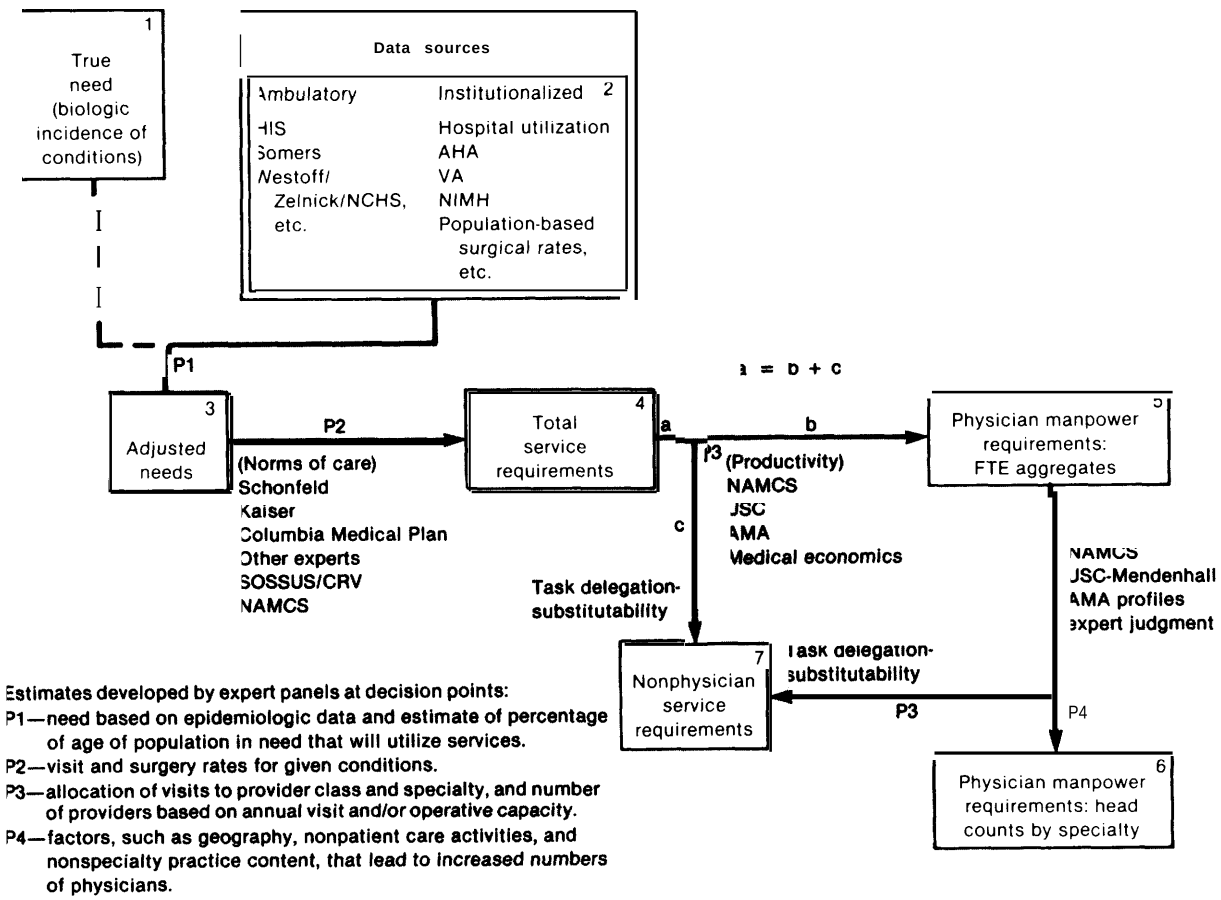
Accordingly, the GMENAC advisory panels of experts for each specialty area use their professional judgment to take account of possible

Figure 14.—Illustrative Procedure for Arriving at Adjusted Needs Estimates



SOURCE GMENAC Workbook for General Surgery Panel, 1979.

Figure 15.—GMENAC Model for Estimating Physician Requirements



SOURCE: *Interim Report of the Graduate Medical Education National Advisory Committee to the Secratary, Department of* Health, *Education, and Walfare,* Washington, D.C.: Health Resources Administration, DHEW publication No. (HRA) 79%33, P. 195.

over, under, or misreporting of conditions. For example, estimates of the frequency of venereal disease would be adjusted upwards, since the frequency of these diseases is known to be under-reported.

In the next phase the advisory panels of experts are asked to estimate the probable frequency of these same conditions in 1990, based on the data on current frequency adjusted by their judgments concerning changing disease patterns, host responses and technology, efficacy of preventive strategies, and any other factors they might believe to have an important impact. The specialty panel of experts also estimates what proportion of episodes of a given condition should receive a physician's care in 1990 and what proportion of these should be seen by the panel's medical specialty (e. g., general surgery, general pediatrics, psychiatry) versus some other specialty. Here the panel members again employ their own intuitive judgments concerning the frequency of self-limited conditions, the availability of effective therapeutic or preventive care, and any other such factors that might be expected to influence the degree of benefit persons with particular conditions might be expected to derive from receiving care from a physician and from a particular type of specialist. In making these and other similar kinds of judgments, specialty panels are instructed to think in terms of the *average* patient. A modified Delphi process is used to achieve consensus. The final product emerging from the deliberations of the expert panel at this phase is a list of diseases, diagnoses, preventive activities, operations, and counseling requirements expressed in terms of population rates and disease or diagnostic categories.

GMENAC staff then apply these estimates of medical need to census projections of the size, age, and sex distribution of the U.S. population in **1990.** The GMENAC model apparently does not consider future changes in income distribution and the impact these changes might be expected to have on population health needs. Adjustments for the unusual needs of some groups of people as well as those previously excluded from the health care system are introduced at this phase of the model.

In the next phase, the panels of experts determine norms of care for each disease or diagnostic category. Here again, the panels will have available to them data on actual utilization rates from a variety of sources such as HMOS and the National Ambulatory Medical Care Survey's published research studies. Each panel may recommend increases or decreases in the prevailing rates of utilization, based on its perceptions of what constitutes good medical care and what technology is likely to be available in the future. The norms of care maybe expressed as visits per episode of illness or annual encounter rate per chronic condition or some other unit of service. During this phase of the study the panels also consider which conditions can be treated in the office, which require hospitalization, and what is the appropriate length of hospital stay. Again, each panel examines existing data on utilization (e.g., Hospital Discharge Survey) and adjusts it up or down for its estimates of appropriate care for the average case. Finally, the panels estimate the proportion of inpatients and office visits that can be delegated to physicians' assistants or nurse practitioners. Although actual figures are not available, GMENAC staff report that the panels have been willing to delegate significant amounts to paraprofessionals compared to what is currently delegated. GMENAC staff predict that the specialty panels will recommend increased task delegation and will specify where increased task delegation to paraprofessionals is most appropriate.

Perhaps the single most problematic aspect of the GMENAC modeling effort occurs in the next phase. This is the reconciliation of conflicting estimates by the various specialties as to what proportion of a given disease or diagnostic category "belongs" to each specialty. The extent of the problem is likely to be mitigated somewhat because each specialty panel contains a few representatives from other specialties. In particular, generalists (general practitioners, family practitioners, and general pediatricians) are represented on the specialty panels (surgery, dermatology, etc.) and vice versa. This is important because it is essential that a specialty's estimate of the conditions it should handle match those of the generalists who make the referrals. At this point, it is difficult to determine how many problems there will be in mediating disputes between specialties. An indication of the complexity of the task facing these panels is that only 14 to 26 of the 37 specialties listed in table 42 are expected to be completed by the end of 1980.

Among the difficult questions that must be mediated during this phase is the issue of how much primary care should be provided by secondary and tertiary care specialists. The issue is a knotty one that cannot be easily settled. One reason is that wider geographic distribution of subspecialists, outside major cities, virtually requires a part-time practice of the subspecialty for some percentage of these physicians, because the conditions treated by subspecialists are comparatively rare,

The final task in the modeling process is to translate estimates of the volume of physician services into FTE physicians and then into actual head counts. FTEs are arrived at by dividing service estimates allotted to each specialty by the expected productivity for each physician in that specialty. Productivity may be expressed in terms of encounters, operations, or some other unit, depending on which is most appropriate.

As in the BHM model, it is generally assumed that physician productivity will be the same in

1990 as it is now, although this depends on each specialty panel. GMENAC staff review the available data on the typical physician practice profile and arrive at estimates of productivity for the various kinds of services the specialty provides. Table 43 displays the average practice profile of general surgeons and the preliminary productivity estimates to be used to calculate FTE general surgeons. It should be noted that, in addition to the estimate of 43 office visits per week, alternative numbers of 77.2, 58, and 51 were also cited from the data. Finally, some estimates are also made of the productivity enhancement for physicians of employing physicians' assistants and nurse practitioners and the productivity gains from organizational arrangements such as group practice and the interaction between these two factors.

Overall, the productivity estimates used in the GMENAC model are somewhat problematic for two reasons: 1) the data sources on which productivity estimates are based often exhibit considerable disagreement (in part because the definitions of service units vary; for example, some measures of time allotted to surgical operations may count operating room time only, while other measures may include all the care associated with a procedure including preoperative and postoperative office and hospital visits) and 2) little information is available about trends in productivity over time, particularly by specialty.

Table 43.—The Average Practice Profile of General Surgeons

	Hours
Hours worked	
Average number of weeks worked per year	47.0
Average number of hours worked per week	52.0
Time allocation within week	
Hours in hospital.	31.3
Hours In operating room	11,5
Hours In Inpatient vlslts.	19.8
Hours In office.	13.4
Other professional time.	7.3
Total professional time	52.0
Weekly productivity	
Office visits per week	43
Inpatient vlslts per week	45
Operations per week.	3.4
Operations per week (CRV units). . . .	34,4 CRV

SO~JRCE GMENAC General Surgery Workbook

The final step in the GMENAC model is the conversion of FTE physicians into actual head counts. In essence, this involves making some additional allocation to cover those physicians who do not practice full time but are instead involved in full- or part-time research, teaching, or administration or have taken some time out from practice for continuing education or other activities.

As a complement to the modeling effort, GMENAC commissioned a study of selected elements of consumer dissatisfaction with health care. The study, based on a scientifically designed opinion survey, was carried out by researchers at the Center for Health Administration Studies of the University of Chicago (USDHEW, **1979c).** It is not known how GMENAC plans to incorporate the report's findings into its final estimates, if indeed it plans to do so at all. The report does, however, contain some interesting findings with potential implications for manpower policy.

Broadly speaking, the report suggests that there is a tradeoff relationship between physician productivity and consumer satisfaction, and that a decrease in current productivity levels might result in greater patient satisfaction. The assumption here is that if physicians saw fewer patients, they would be able to spend more time with patients. Presumably, with more time, they would be better able to express concern, courtesy, and consideration; improvements in the quality of the doctor fpatient relationship that the data indicate some patients believe are needed.

Tables 44 and 4!5 and figures 16 and 17 summarize the findings of the consumer study in respect to levels of consumer satisfaction/ dissatisfaction with various aspects of care. Note that the single major source of consumer dissatisfaction, high out-of-pocket costs (figure 16), is not particularly amenable to solution via manpower policy. Table 45 indicates that ethnic minorities are more dissatisfied with all aspects of care than the majority white population.

Finally, the study found that consumer perceptions of the availability of care correlated highly with actual data on physician availability. In other words, people were more likely to report that their area lacked sufficient doctors in areas where there actually were lower physician-to-population ratios. Consumer perceptions of physician shortages were particularly sensitive in the case of medical specialists.

Table 44.— Proportion of Persons Whose Experience With Physician Visits Is Beyond the Critical Threshold

Aspect of visit	Crtt ical threshold	Percent of persons beyond critical threshold	Number of pat Ients beyond critical threshold (in millions)
Travel time . . . ., ...	..30 minutes or more	1170	1 5
Appointment time	Over 2 weeks	10	14
Waiting time . . ., ...	.30 minutes or more	27	37
Time with doctor	Less than 10 minutes	28	39
Information from doctor	A Ilttle or nothing	27	37
Out-of-pocket costs.	$10 or more	38	52

SOURCE *The Consumer V/ewpo/nt Whaf IS Hea/lh Care and What do We Wanf7 & A Response,* prepared for the Graduate Medical Education National Advisory Corn mlttee Washington D C Health Resources Admlnlstratlon DHEW publication No (H RA) 79.632, p 13

Table 45.—Percent of Ethnic Groups Dissatisfied With Aspects of the Medical Care System

	Aspects of the medical care system			
Ethnic group	Waiting time for an appointment	Office waiting time to see the doctor	Out-of-pocket cost of the medical visit	Humaneness and quality of the visit
Majority white	1 50/0	270/0	3 6 0 / o	10%
Urban black	27	38	43	15
Rural southern black.	26	39	45	12
Spanish heritage, Southwest	33	32	39	16

SOURCE *The Consu-mer V/ewpo/rt "What IS Hea/fh Care and W;at do We WarrP & A Response,* **prepared fOr the Graduate Medical Education National Advisory Corn. mlttee Washington, D C Health Resources Admlnlstrat(on, DHEW publication No (HRA) 79.632, p 19**

COMPARISON OF THE BHM AND GMENAC MODELS

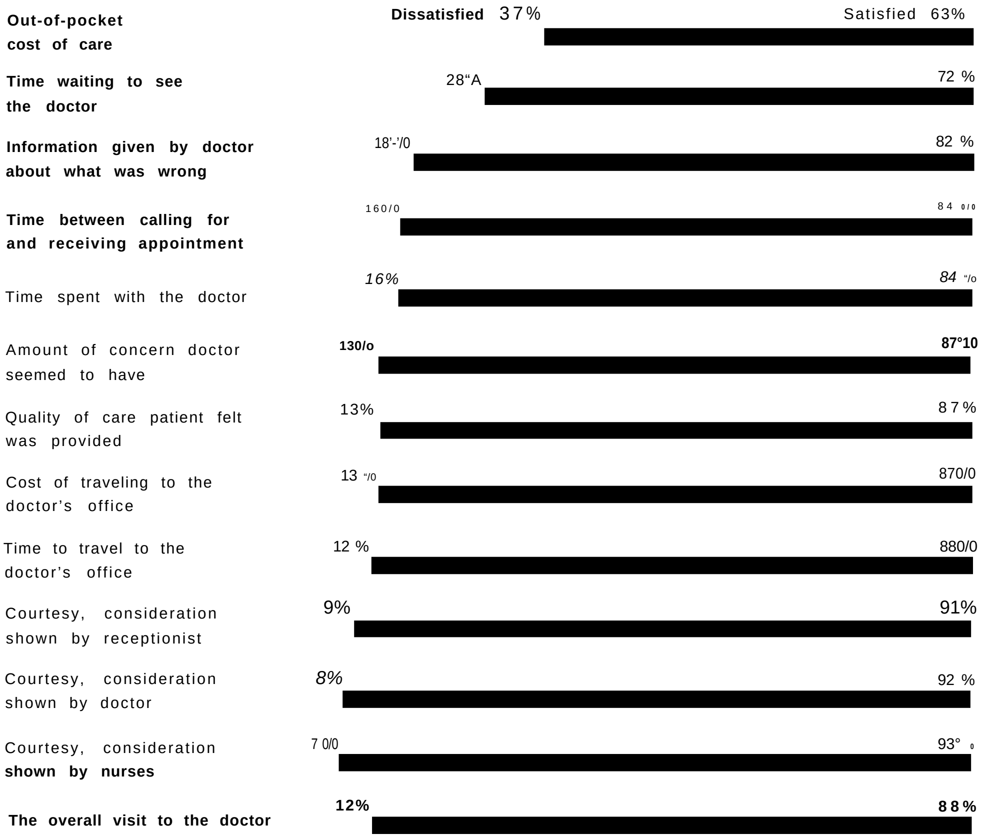
The two major modeling efforts currently underway, those of BHM and GMENAC, exemplify two quite different philosophical approaches to the task of estimating future physician requirements. The GMENAC approach is to estimate how many physicians would be needed to provide appropriate services to meet the population's medical need for care. Estimates of medical need and appropriate services are in turn based on a combination of the frequency of particular illnesses and conditions and of medical judgment as to which of these conditions can benefit from medical services, by amount and type. In contrast the BHM approach is an economic modeling effort that treats medical care as it would any other market commodity. The aim is to predict the economic demand for medical services and the number of physicians that would provide those services based on currently observable patterns and trends in medical care consumption.

Second, the GMENAC approach is a deliberate goal-setting effort based on the Committee's estimates of the numbers and types of physicians' services that should be provided or at least be available to the American citizen in 1990. Thus, the estimates GMENAC arrives at will be "target numbers, " goals GMENAC will be recommending that governmental and private sector activities be directed toward realizing.

In contrast, the BHM projects current behavior trends into the future. It is not a goal-oriented modeling effort, and its estimates are therefore not intended to be target numbers for

Figure 16.—Consumer Satisfaction With Physician Services

Among those who saw a physician in a 12-month period, percentage dissatisfied/satisfied with various aspects of the visit.



To determine whether people are satisfied or dissatisfied with their medical care, the research group asked questions of all persons who had visited a doctor during the past year. The questions probed impressions of specific aspects of the visit. "Responses were very skewed toward the positive end of the scale, " the group reports, For the total population, cost is the greatest cause of dissatisfaction Overall, the chart reveals the U.S. population is genera//y satisfied.

NOTE Because of the large sample size, the true' percentages of satisfied and dissatisfied consumers in the population are unlikely to vary by more than 1 percent

SOURCE The *Consumer Viewpoint ' What is* **Health** *Care and* **What** *do We Want" & A Response,* **prepared for the Graduate Medical Education National Advisory Corn mittee Washington, D C Health Resources Administration, DHEW publication No (HRA) 79-632**

policymaking purposes. The BHM modeling effort is probably best understood as an ongoing process of monitoring factors and trends that are or presently seem most likely to affect the future economic demand for medical services. Thus, BHM physician estimates represent the numbers of physicians that would satisfy specified levels of future economic demand for physician services.

To say that the BHM modeling effort is not goal-directed is to say that the model itself does not recommend or even assume that it is desirable or should be a policy goal to satisfy any particular level of economic demand for physician services in **1.990.** The model simply generates an estimate of how many physicians it would likely take to provide the medical services that are likeIy to be utilized by the American population in 1990, if particular conditions and trends existing now are assumed to continue on into the future.

The assumption that conditions and trends that characterize the present and recent past will continue on into the future is probably the single

Figure 17.—Consumer Satisfaction With Physician Services, by Nature of the Experience

Among those who saw a physician in a 12-month period, percentage dissatisfied with various aspects of the visit classified by the nature of the experience.

Aspect of the visit		Percentage dissatisfied
Time to travel to the doctor's office	Less than 15 minutes	4"/0
	15 to 30 minutes	1 30/0
	30 minutes to 1 hour	37 "/0
	More than 1 hour	350/o
Time between calling for an appointment and the appointment	Up to 2 days	9 %
	3 days to 2 weeks	21%
	More than 2 weeks	43%
Time waiting to see the doctor	Up to 30 minutes	13"/0
	30 minutes to 1 hour	59 "/0
	More than 1 hour	850/0

While people generally express satisfaction with most aspects of their medical experiences, there comes a time for most when they cross a threshold of tolerance. At that point, satisfaction turns to dissatisfaction. Each variable—travel time, cost, amount of time spent with the doctor, appointment waiting time—tras its special threshold. This chart matches a range of experiences with a set of variables and shows levels of dissatisfaction. Overall, it captures some sense of the dynamics of the doctor-pat/en/ relationship.

NOTE Because of the small number of people sampled in these categories, the true percents may likely vary by as much as 10 percent for this subgroup in the population Other figures in the table are unlikely to vary more than 3 points

SOURCE *The Consumer Viewpoint "What is Health Care and What do We Want?" & A Response,* prepared for the Graduate Medical Education National Advisory Committee, Washington, D C Health Resources Administration. DHEW publication No (HRA) 79632

most important assumption made by the BHM model. This assumption might be characterized as a sort of "law of societal inertia" which states that the future is going to look alot like the present and that any major differences between the present and the future are going to be the outcome of changes *already* underway that are observable as ongoing trends. The major problem is that unforeseen events, developments, interventions, decisions, etc., are quite common and are therefore quite likely to cause the future to deviate from both present conditions and from the outcome of currently ongoing trends.

Taken together, the uncertainty factors that affect modeling efforts make it advisable to view the results generated as "benchmark" estimates rather than hard predictions. Another way of viewing these estimates is to think of them as "if-then" numbers, as in "if Americans continued to utilize medical services in the current per capita amounts, how many physicians would be in demand in 1990?" It would also be accurate to characterize the BHM projections as providing a baseline or yardstick against which the comparative size and impact of particular sorts of changes—especially deliberate policy interventions—can be measured.

The BHM model also) includes separate "contingency" estimates. These are intended to gauge the probable impact on future demand for physician services of major changes that appear either likely or quite possible. Current contingency modeling efforts focus mainly on predicting the impact of alternative NHI plans. This points out that the political process and its policy outcomes are among the major uncertainty factors affecting predictive modeling. The fact that the accuracy of current predictive modeling efforts is highly dependent on the unknowable outcomes of political decisions yet to be made simply underscores the point made earlier that these estimates should be viewed as "benchmark" or baseline estimates.

As a goal-directed modeling effort, GMENAC'S most important core assumptions are that reasonable estimates of appropriate utilization of medical services and the numbers and types of physicians needed to provide those services can be derived from a combination of empirical data and professional judgment concerning "medical need. " The standard of medical need being applied to the determination of appropriate utilization of services requires a somewhat stronger presumption of linkage between medical service and improvements in health outcome than a standard based on a volume of services provided, not because they are expected to produce beneficial effects in most instances, but because in some instances they might yield improvements and in the rest of cases are believed to do no harm. The standard being used would tend to be more conservative in estimating the medical need for such marginally beneficial services, especially where the medical problem or illness is a nonserious condition.

An illustration of how this theoretical difference translates into practice can be seen in the deliberations of GMENAC'S dermatology panel on the treatment of acne. In its first round, the panel's initial estimate of medical need assumed that every case of acne should be seen by a dermatologist, and that a typical case would require six visits annually (which assumes medication and the need to monitor its effects). In subsequent rounds of discussion, however, the panel determined that this number was excessive and revised their initial estimate downward to reflect a more conservative definition of need. In lowering their original estimate of need for dermatologists to treat acne, the panel took into account such factors as the nonserious, self-limiting character of a high proportion of acne cases, the fact that medical treatment is most likely to produce improvement in severe cases and, finally, the fact that nonserious cases of acne can be treated as safely and efficaciously by appropriately trained generalists as by specialists in dermatology.

As a goal-directed model more concerned with defining what should be rather than forecasting what is likely to be, the GMENAC effort need not be as concerned with the problems posed by uncertainty factors as the BHM trend projection and contingency models must be. It is also relevant that the goals being formulated are for the comparative near-term future. Thus, GMENAC'S definitions of medical need are based on the assumptions: 1) that Americans will continue to have the same medical problems at the same demographic (e.g., age, sex, social class) rates in 1990 as they do now, and 2) that there will be no major breakthroughs in medical knowledge or technology that will seriously alter current medical practice. While these assumptions are probably reasonable for a period covering little over a decade, they might well become more doubtful if the time span were expanded.

More problematic for a near-term, goal-directed model than the uncertainties of the future are the reality constraints of the past and present. What we mean by this is that societies are not like marching bands: policy makers cannot blow the whistle and expect society (or one of its major subunits such as the health system) to execute a 90-degree turn in formation. Yet in a sense that is what efforts to establish and achieve collective goals frequently assume can be accomplished. Clearly, the more greatly a goal-directed estimate differs from anticipated supply and the shorter the time period available, the more we must implicitly assume that 90-degree societal pivots are possible; at least if the goal is taken seriously as one we ought to try to achieve.

A much more serious reality constraint is that there may be insufficient "play" or "slack" in the system to permit actual attainment of a physician "requirements" estimate that deviates drastically from the currently projected 1990 supply. At issue is what policy researchers term the relative "malleability" of key variables. The possibility of attaining a goal within a given period of time is dependent on the malleability of supply factors. Supply factors, however, are not highly malleable. The reason for this is, that, as 1990 is only 10 years away and physician training requires a long Ieadtime, most of the 1990 supply is already locked in. And even though **40** percent of the physicians in practice in 1990 will have completed training since 1979 (Jacoby, 1980), major changes in graduate medical education cannot be expected to take place and have a significant impact on the specialty distribution of the 1990 physician supply. Perhaps future goal-oriented modeling efforts should pay explicit attention to the relative "malleability" of key variables. In so doing, they might provide alternative estimates, signaling, on the one hand, goals that are capable of attainment within the allotted time span and, on the other hand, goals that are considered desirable but would require a longer time frame and are thus best considered as signaling the appropriate direction for deliberate change but not taken as immediate targets.

So far we have discussed only one set of reality constraints (i.e., limitations on the malleability of the health manpower supply) that impinges on the feasibility of a goal-oriented model of physician requirements. There are other factors as well. One is the difference between the types of conditions that ought to be seen by particular types of physicians and actual patterns of physician use. For example, a nontrivial portion of the current caseload of generalist physicians is composed of nonserious, self-limiting conditions that medical treatment can do little to cure or ameliorate (e.g., "colds"). These cases would tend to be discounted based strictly on medical need. There is little reason to expect however, that, in reality, patients would rapidly be reoriented to stop bringing such complaints to physicians or that physicians would refuse to see patients with such complaints. Thus, GMENAC'S normative model accounts for some need to provide services to the "worried well, " and the BHM estimates include present use of medical services by the "worried well" in its projections.

The need to pay attention to both goals and reality leads naturally to a consideration of the complementarily of goal-driven and trend projection modeling. Because each of these two major modeling efforts is oriented toward different purposes and focuses on rather different variables, they are, in truth, more complementary than competing. As such, each model's results can aid our interpretation of the other's.

The GMENAC model focuses on translating a normative definition of medical need into appropriate rates of utilization of medical services, while the BHM model looks on medical care as a "consumer good" and treats empirical trends in utilization of medical services as a proxy for economic demand. If the BHM demand estimates should prove significantly greater than the GMENAC estimates, this would suggest that there are powerful factors at work that are pushing utilization of medical services beyond the level medically necessary and appropriate for "good" care. This would then raise the policy question of what percentage—if any—of the projected future economic demand for medical services over and above the professional judgment-based estimates of medical need should be considered legitimate. Conversely, if the BHM demand estimates should prove significantly less than the GMENAC estimates, this would suggest that there remain and will remain in the near future significant barriers to obtaining medically necessary care. Finally, if the BHM and GMENAC demand estimates prove to be in rough parity, this would suggest that the economic demand for services is more or less in line with professional estimates of the medical need for physician services.

Obviously, since the GMENAC model has yet to generate any numbers, it is impossible to say at the present time which of these three alternatives will prove to be the case. We can say, however, that the most likely occurrence would appear to be rough parity or a BHM demand estimate that is significantly greater than the GMENAC aggregate estimate. The major reason for anticipating that the BHM estimate will most likely prove greater than or at least equal to the GMENAC estimate is that one of the major variables in the BHM model is a projected trend toward rising *per capita* utilization rates for medical services, independent of demographic changes and projected changes in price. In contrast, the GMENAC model assumes no major changes in medical need apart from changes in medical need induced by demographic shifts (e. g., an aging population), between now and 1990; hence no medical rationale for steadily rising per capita utilization of services. Thus, in order for the GMENAC estimate to logically come out larger than the BHM estimate, one would need to assume that there is *curretztly* such a large unmet medical need for services, that, despite the trend of rising per capita utilization rates, assumed in the BHM model, considerable unmet medical need will remain in 1990.

What is a reasonable estimate of requirements from the BHM economic model which might approximate aggregate adjusted need from the GMENAC modeling effort? Recall that BHM now projects demand at approximately 600,000 physicians in **1990,** or what the supply will be. We saw (table 37) that this represented an increase of 217,841 over the 1975 figure of 378,376; 35,960 was due to an increasing and changing population, and 181,881 due to projected increases in per capita utilization trends. That is, without increasing per capita utilization, demand in 1990 would be roughly 415,000.

We also saw (figures 10 through 13) that the large increase attributed to rising per capita utilization would nearly disappear if pre-1970's data were deleted from the trend base. But we would not want to discount this increase entirely for several reasons: 1) the possibility of NHI, 2) possible decreases in the average physician's workweek, and 3) increasing the time physicians spend with patients.

The possible effects of an NHI program have previously been summarized. Physicians currently average longer workweeks than most of the rest of the working population. Bringing the physician workweek more into line with the present patterns of work productivity of the labor force in general would lower productivity. Alternatively, the cushion of excess physicians might enable physicians to see fewer patients and spend more time with each one. According to the National Center for Health Statistics, about half of all office visits to physicians in both 1973 and 1977 lasted 10 minutes or less. With smaller patient loads, doctors might be able to use the additional time to provide patients with more information, education, and counseling.

For these reasons, it is difficult to estimate physician requirements. If one takes projected population changes alone, requirements in this model would be for 415,000 physicians. Some contingency is necessary to account for such factors as NHI, decreased working hours for physicians, and more time spent with patients per visit. How much of a contingency is necessary is a matter of judgment, and the reader can come to his or her *own* conclusion on what it should be over and above the increase in requirements due to population growth.

PRODUCTIVITY

Both BHM's and GMENAC'S modeling efforts emphasize the amount of medical services that either will (based on predictions of trends) or should (based on normative determinations of medical need) be used in the future. However, estimates of the number of physicians required are derived by dividing projected use by physician *productivity.* With the exception of task delegation to physicians' assistants and nurse practitioners, which would enhance physician productivity and thereby reduce aggregate physician requirements, neither modeling effort explores possible changes in productivity and their effects on requirements estimates. Rather, both models basically assume that physician productivity will remain constant through 1990. The BHM model does this by assuming that the ratio of practicing physicians to total output of physician services will be the same in **1990** as it was in 197.s. In the case of GMENAC, the main effort has been toward choosing the most reliable and accurate measures of current productivity as reflected in various empirical studies, Its modeling effort makes explicit assumptions about the average workweek, patient visit rates, etc., by each medical specialty.

But physician requirements estimates are highly sensitive to changes in productivity

(Reinhardt, 1975). As an illustration of this sensitivity, if we were to postulate that the appropriate ratio of physicians-to-population in 1970 was 185 per 100,000 (the actual ratio in the best-endowed areas) and percent growth in productivity kept pace with percent growth in per capita use of physician services, then the physician-to-population ratio would remain constant indefinitely. However, as Reinhardt points out:

> If in 1970 a set of policies could have been implemented such that average annual growth in physician productivity during the following two decades were one percentage point higher than the annual growth in the per capita utilization of physician services, then the required ratio at the end of the forecast horizon would have been only 151 physicians per 100,000. Relative to a forecast based on maintenance of the base-year ratio of 185 per 100,000 and for a population of roughly 250 million in 1990, this turn of events would have led to a reduction of about 85,000 in the number of MDs that would otherwise have been "required." The corresponding number for 1980, based on a projected population of 225 million, is 40,500. These figures must surely strike one as significant, especially if held up against the annual number of medical graduates (between 15,000 and 16,000) likely to be produced during the next several decades (Reinhardt, 1975).

Reinhardt's analysis was primarily concerned with the impact of substantial gains in productivity that might occur as a result of organizational changes in physicians' practices and of task delegation to nurse practitioners and physicians' assistants. His research also provides some data suggestive of a possible relationship between growth in physician supply and decreases in physician productivity. Table 46 (reproduced from Reinhardt, 1975) provides some data on relationships between physician supply, physician productivity, and financial factors such as average visit fee and average annual physician income. If physician supply increases (item #l) but demand for services (per capita use) remains constant (item W), then productivity (measured in patient visits per MD) will drop (item #3). The data suggest that physicians then may charge more per visit (item #7), though not necessarily enough for physicians' incomes to reach the same level as in areas with fewer physicians and/or greater demand for services (item #8).

A different approach to the question of physician productivity and its relationship to requirements estimates is to examine trends in physician productivity. According to *Medical Economics* magazine's Continuing Survey, comparing workweeks in 1965 versus 1976, office-based physicians spent 2 hours less with office patients, 2 hours less on housecalls, and 1 hour less on hospital rounds and consultations in 1976. Median time spent on all professional activities (including activities other than patient care) in a typical workweek fell from 64 hours in 1965 to 60 hours in 1976 (Owens, 1977).

More recently, Medical *Economics* reported that the number of office visits has continued to decline. Over the period 1974-78, office-based physicians were seeing 8 fewer patients per week in 1978 as compared to 1974, a median weekly number of 126 rather than 134 (Owens, 1979).

Generally, two hypotheses are given to explain recent decreases in productivity and to predict further decreases. One hypothesis is that physicians, as most other Americans, would prefer to work less and enjoy more leisure time. The other hypothesis is if growth in physician supply outpaces growth in the demand for physician services, then declines in physician productivity may occur as a means of bringing supply and demand into balance.

In the latest survey (Owens, 1979) 57 percent of the office-based physicians stated that they believed they were practicing at full capacity. Of this 57 percent, a minority (amounting to 12 percent of the entire sample of physicians surveyed) said they would prefer not to practice at peak productivity. Of those surveyed 43 percent said that they were not practicing at peak productivity. Of these, a majority said they did not want to practice at full capacity. Of the entire sample 18 percent, however, stated that they were not practicing at full capacity but would prefer to do so. Among the specialties, 31 percent of urologists, 24 percent of general surgeons, and 24 percent of otolaryngologists said that they were not practicing at peak productivity and would prefer to do so.

Table 46.—Regional Differences in Certain Health-Care Statistics, United States, 1969-70

Item No.	Year	Census divisions: New England	Census divisions: East-North Central	Census divisions: East-South Central
1. Number of active MDs involved in patient care as their primary activity, per 100,000 population	1970	161 (1.00)[a]	115 (0.71)	95 (0.59)
2. Average annual number of hours worked per MD				
a) Total practice hours	1969	2,504	2,495	2,568
b) Hours of direct patient care	1969	2,128	2.151	2,303
3. Average annual number of patient visits per MD				
a) Total patient visits	1969	4,808 (1.00)[a]	6.611 (1 .38)	8,408 (1 ,75)
b) Office visits only	1969	3,384 (1.00)[a]	4,799 (1 .42)	6.052 (1 .79)
4. Total visits per hour				
a) Total visits per practice hour	1969	1.92	2.65	3.27
b) Total visits per hour of patient care	1969	2.25	3.07	3.65
5. Average number of auxiliary personnel employed per physician	1967	1.3	1.8	2.1
6. Percentage of physicians in group practice	1969	9.3 %	17.4 0/0	19.4 0/0
7. Average fee for a routine followup office visit:				
a) General practice	1969	$6.79	$6.29	$5.21
b) Internal medicine		9.40	8.05	7.20
c) Pediatrics		7.53	6.94	5.40
d) General surgery		9.76	7.76	6.85
e) Obstetrics/gynecology		9.77	9.32	7.60
8. Average net income (all specialties)	1970	$38,019.00	$47,000.00	$41,963.00
9. Reported no. of physician-patient visits per capita:				
a) Based on survey of physicians	1969			
—total patient visits		7.7	7.6	8.0
—office visits only		5.4	5.5	5.8
b) Based on household surveys	1970	4.4	4,0	4.1
10. Infant mortality rate:				
a) White	1968	19.2	19,4	20.9
b) Nonwhite		31.8	35.4	40.5
11. Personal per capita income	1970	$4,469.00	$4,306.00	$3,146.00

[a]Figures in parentheses are indexes with New England set at 1.0

SOURCE: U. Reinhardt, *Physician Productivity and the Demand for Health Manpower, An Economic Analysis*, Cambridge, Mass.: Ballinger, 1975 (table 2-5, revised)

According to *Medical Economics,* the finding that almost one-fifth of the physicians surveyed felt that they were not practicing at full capacity but would prefer to do so "suggests that maldistribution of medical manpower plus the growing number of new doctors—nearly 35,000 have joined the ranks of office-based MDs over the past 5 years—may already have left physicians short of patients in some areas" (Owens, 1979).

In sum, the available evidence suggests that both physician preferences and the increasing number of physicians are contributing to declining productivity. Yet, some physicians still feel overworked, which suggests that maldistribution remains.

Decreased physician productivity, it is important to note, is not necessarily undesirable. If a physician is practicing in an underserved area, then high productivity is likely to reflect overwork. Under these conditions of chronic overwork, decreased productivity would probably represent increased quality. As the physician supply increases and unmet demand slackens, then decreases in productivity would, at some point, begin to represent not better quality care, but inefficiency. Table 47 summarizes one effort to quantify this relationship for primary care physicians' services (Walker and Armondino, 1977). Additional research that would increase our understanding of this relationship would be important because of the cost implications.

The possibility of further decreases in physician productivity has important, though largely unexplored, implications for the problem of the

Table 47.—Shortage, Adequate, and Surplus Levels of Primary Care' Physicians

Average primary care visits per hour	Workload evaluation	Office visits in 5.5 patient contact hours per day	Visits per 240-day year (supply)	Average annual primary care visits per person (need)	Population potentially served per full-time equivalent physician	Criteria designation
6	Too high	33	7,920	2.5	3,200	Shortage
4	Ideal	22	5,280	2.5	2,100	Adequate
2	Too low	11	2,640	2.5	1,100	Surplus

[a]General and family practice, internal medicine, and pediatrics

SOURCE J E C Walker and N L Armondlno. The *Prtrnarv Care Physm/an Issues (n D/sfr/bul/on,* Lawrence, Kan Connectlc u! Health Services Research Series, No 7, 1977

locational maldistribution of physicians. Arguments about the likely effects on physician shortage areas of increasing the aggregate supply of physicians have tended to focus on two alternative hypotheses. One hypothesis is that, ultimately, the law of supply and demand will force physicians to move into what are currently shortage areas as long as growth in supply outpaces growth in demand for services in areas that already have high physician-to-population ratios. The alternative hypothesis is that physicians have the capability to generate demand for their services, and, if exercised to any significant degree, this capability would decrease the pressure on physicians to move out into less attractive areas as aggregate physician supply increased. Whatever the case, enormous increases in the aggregate physician supply cannot be assumed to guarantee that an eventual solution to the problem of locational shortages will "naturally" occur. An attractive metropolitan area where the physician-to-population ratio is high enough to satisfy the highest reasonable levels of medical need or consumer demand for care can nevertheless continue to absorb many additional physicians if individual productivity decreases. Otherwise stated, it is quite likely that we could have a large "oversupply" of physicians in the aggregate in future years and still have shortages in particular locations.

LOCATIONAL REQUIREMENTS

The application of both the BHM and GMENAC models has relevance primarily at the national level. Shortages will always remain in specific service areas no matter how "correct" the balance between national supply and requirements are and even if supply exceeded requirements substantially. Yet locational estimates must be made at the national level: 1) to plan for the National Health Service Corps (NHSC) to meet some part of this requirement and 2) to provide guidelines and eligibility criteria for Health Manpower Shortage Area (HMSA) designations. Consequently, estimates of the requirements for physicians are used to determine need and serve as the starting point for shortage area designations, augmented by other criteria that represent barriers between the physician and the population he/she is expected to serve.

We have seen that future supply for locational distribution is estimated in similar fashion as national supply. Subtraction of the estimated supply from estimated requirements equals total unmet need.

Need in 1990 has been estimated at 16,400 primary care physicians and psychiatrists (USDHEW, 1979d). Primary care is defined as non-Federal MDs and DOS providing direct patient care who practice principally in general or family practice, general internal medicine, general pediatrics, and obstetrics-gynecology. At current budget levels, NHSC scholarship recipients now in the pipeline will result in **3,950** NHSC physicians in the field by 1990. Through NHSC scholarships and combining 1,150 physicians expected to volunteer with 900 midlevel practitioners (assumed to each equal 0.5 physicians), 34 percent of need will be met. Assuming a 10-percent conversion rate from NHSC to private practice in underserved areas, 1,000 physicians, or 6 percent of need, will be met. Finally, assuming current levels of 2,000 physicians in federally funded health centers, another 12 percent of need will be met in 1990. Together, these sources are expected to provide 52 percent of the projected need of 16,400 in 1990. These projections are summarized in table 48.

"Need" as defined for purposes of projecting future HMSAS should not be confused with the need for physicians based on estimates of a given population's economic demand or medical need for services, as described in the analysis of the BHM and GMENAC modeling efforts. In the case of shortage area projections, two physician-to-population ratios are used as criteria to determine the level of need for primary care physicians in an area:

- Designation *ratio.* —The actual minimum ratio of active, non-Federal, patient care physicians engaged in primary care to the civilian population of an area below which an area is considered to have a shortage of health manpower sufficient to justify its being counted as a shortage area in the model.
- Staffing ratio. —The theoretical maximum ratio of active non-Federal, patient care physicians engaged in primary care to the civilian population of an area used as a standard above which an area is considered to have adequate health manpower so that additional Federal intervention with NHSC staffing is no longer necessary (USDHEW, 1978a).

"Need" is the number of physicians required to reach the staffing ratio for all designated areas. The designation ratio is based on equity considerations and reflects that quarter of the United States having the least number of primary care physicians. It has been set at 1:3,500. The staffing ratio establishes a limitation upon the extent of Federal involvement and specifies the relationship between the service demands of the population and the primary care physicians available to provide those services. It has been set at 1:2,000.

The designation ratio of 1:3,500 means that areas with smaller ratios would not be included, including areas with ratios between 1:3,500 and 1:2,000.

However, because criteria for making HMSA designations were expanded under the 1976 Act to include, in addition to manpower-to-population ratios, other indicators of need such as infant mortality rates, access to health services, health status, income level, and the number of foreign medical graduates practicing in the area, the method for projecting future shortage areas and their physician needs has been adjusted in the following way:

> Comparison of projected areas with actually designated areas showed that the projection model missed part-county areas designated upon factors other than strict physician to population ratios. The physician to population ratios, strictly determined, fell within a range from 1:2,000 to 1:3,500. Therefore, the unmet need for counties with ratios between 1:2,000 to 1:3,500 is used as a proxy for part-county rural areas. (USDHIW, 1978a).

Table 48.—Need for Primary Care' Physicians and Psychiatrists in 1990

Total need	Current NHSC schoiarshl p recipients	Volunteers	Conversion from NHSC to private practice in u nderserved areas	'Current level of physicians [n federally funded centers	Unmet need
16,40C	3,950	1,600b-	1,000	2,000	7,850
1 000/0	4 ——— 8.550 (520/o) ———				480/0

[a]General &d family Practice general internal medicine. general pediatrics. and obstetrics-gynecology
[b]Includes 1300 midlevel practit loners, each equal to O 5 physician

SOURCE Outyear Size of the National Health Service Corps (N HSC)— **DECISION MEMORANDUM. from the** Assistant Secretary **for Health and the Acting Assistant Secretary** for Plan ning and Evaluation to the Secretary for Plan ning and Evaluation to the Secretary, Washington. D C , Spring 1979

The result is that, taking the year 1980, unmet need from reducing the ratio from 1 :3,500 (or more) to 1:2,000 would be 5,659 primary care physicians, with an additional 3,o37 from the proxy measure for part-county rural areas.

These designation and staffing ratios are applied to metropolitan and nonmetropolitan areas. The staffing criteria for correctional institutions were partly based on the needs identified by the Federal Bureau of Prison's Medical Director's office. DHHS'S Alcohol, Drug Abuse, and Mental Health Administration provided the 600 workload unit estimates and the 1:20,000-30,000 ratio. The Indian Health Service estimates were based on an expected increase for primary care and psychiatric physician needs of 3 percent yearly. These criteria are summarized in table 49.

These designation and staffing ratios were used to arrive at the estimated need in 1990 for 16,400 primary care and psychiatric physicians. These projections have been used to plan for future staffing of NHSC. The great majority of future NHSC physicians will come from medical school scholarship recipients obligated to serve year-for-year in the Corps. The emphasis is therefore on recruiting first-year medical students, as the total obligation will be 4 years.

Table 49.—Criteria for Unmet Need Calculation by Area

Area	Designation ratio	Staffing ratio
Nonmetropolitan	1 :3,500	1 :2,000
Metropolitan	1 :3,500	1 :2,000
Correctional institutions		
Primary care	1:1 ,000	1 :500
Psychiatry	1 :2,000	1:1 ,000
State mental hospitals (psychiatrists)	600 workload units[a]/FTE	600 workload units/FTE
Community mental health centers (psychiatrists)	1 :30,000	1 :30,000
Indian Health Service	all officially recognized tribes	3-percent yearly increase

[a]Total workload units = average daily inpatient census + 2x (number of inpatient admissions per year) + O 5x (number of admissions to day care and out patient services per year)

SOURCES Memorandum from the Chairman, NHSC Needs Task Force A, to the Director, Bureau of Community Health Services, Health Services Administration; the Deputy Director, Bureau of Health Manpower Health Resources Administration; and the Chairman, NHSC Needs Task Force, Washington, D C , May 26, 1978, and 42 CFR sec 5

Currently, an option has been adopted whereby the Corps will consist of 8,300 physicians and 2,800 physician extenders in **1990,** with the understanding that the target could be readjusted to 15,000 physicians and 2,800 physicians' assistants and nurse practitioners after a 3-year study. The latter would meet almost all projected need, but not until 1995. The **8,300-** physician target would require about 13 percent of each medical school class through 1983. The 15,000 physician target would require recruiting 25 percent of each class by 1986 (USDHEW, 1979d).

The primary care physician-to-population designation ratio of 1 to 3,500 is employed as a major criterion in the process of determining whether a particular area qualifies for official designation as an HMSA and thus eligible for NHSC placements and other aid. It is not, however, the only criterion employed, and areas with lower physician-to-population ratios may qualify for designation under certain conditions.

This is best illustrated by the criteria for geographic areas. A sample of the specific methodologies for meeting these criteria should illustrate the point. Detailed criteria can be found in the Code of Federal Regulations, title 42, section 5, appendix A.

Three criteria must be met for designation:

1. The area is a rational area for the delivery of primary medical care services.
2. One of the following conditions prevails within the area:
   (the **area** has a population-to-primary care physician ratio of at least 3,500:1,

   (The area has a population-to-primary care physician ratio of less than 3,500:1 but greater than 3,000:1 and has either unusually high needs for primary medical care services or insufficient capacity of existing primary care providers.
3. Primary medical care manpower in contiguous areas is overutilized, excessively distant, or inaccessible to the population of the area under consideration (42 CFR sec. 5, app. A).

"Rational area for the delivery of primary care" includes:

i. A county, or a group of contiguous counties whose population centers are within 30 minutes travel time of each other.
ii. A portion of a county, or an area made up of portions of more than one county, whose population, because of topography, market or transportation patterns, distinctive population characteristics, or other factors, has limited access to contiguous area resources, as measured generally by a travel time greater than 30 minutes to such resources (42 CFR sec. 5, app. A).

"Insufficient capacity of existing primary care providers" will be met if at least two of the following criteria are documented:

a. More than 8,000 office or outpatient visits per year per FTE primary care physician serving the area.
b. Unusually long waits for appointments for routine medical services (i. e., more than 7 days for established patients and 14 days for new patients).
c. Excessive average waiting time at primary care providers (longer than 1 hour where patients have appointments or 2 hours where patients are treated on a first-come, first-served basis).
d. Evidence of excessive use of emergency room facilities for routine primary care.
e. A substantial portion (two-thirds or more) of the area's physicians do not accept new patients.
f. Abnormally low utilization of health services, as indicated by an average of 2.0 or less visits per year on the part of the area's population (42 CFR sec. 5, app. A).

Several points should be noted in comparing the actual criteria used for HMSA designation with the methods and assumptions used to model and project the number of shortage areas anticipated in future years. First, the model for predicting future shortages uses the county as the geographic base to calculate physician-to-population ratios. The HMSA designation process uses a "rational service area" as the geographic base. A "rational service area, " as we have seen from the regulations, could be a county or it could be an area larger or smaller than a county. In sum, the definition of a "rational service area" contains considerable flexibility to permit responsiveness to local conditions in making the actual HMSA designations.

Additional flexibility to respond to local conditions is introduced by permitting areas to qualify as HMSAS if they have a physician-to-population ratio lower than 1:3, 500 but greater than 1:3,000 as long as they can show either unusually high needs for primary medical care services or insufficient capacity of existing primary care providers.

One final factor that differentiates the methods used in projection of future shortage areas from those used in the actual official designation process is that, in order for an area to actually receive official designation as an HMSA, a request for designation must come from the local level. Thus, a request for HMSA designation serves as a preliminary indicator that there is interest at the local level in obtaining NHSC physicians, However, remember that HMSA designation is necessary not only for assignment of NHSC physicians, but also that such designated areas: would be areas in which students who borrowed money under health professions student loan programs could practice in lieu of repaying the loans in money; would be eligible for grants in various health manpower training programs; would be eligible or given preference for grant funds for several Bureau of Community Health Services programs such as the urban and rural health initiatives; and would be the only areas in which rural health clinics could be certified for reimbursement of nurse practitioner and physicians' assistant services under Medicare and Medicaid. So HMSA designation does not necessarily mean that NHSC physicians will be recruited to provide services in these areas.

The model had predicted a need for 14,033 primary care physicians in 1979, 8,839 in nonmetropolitan areas, and 5,194 in metropolitan areas (USDHEW, 1978a). The actual number of HMSAS designated in 1979 was 1,711, with a totaI primary care physician need of 11,336. Of the HMSAS, 1,226 were in nonmetropolitan areas, with a need for 5,368 physicians, and 485 were in metropolitan areas, with a need for 5,968 physicians (Reid, 1980). Thus, there was an overestimate of physician need in nonmetropolitan areas and an underestimate of need in metropolitan areass. However, a request for designation must come from the local level, so the difference between the predicted need for 14,033 primary care physicians and the actual need for 11,336 is not surprising.

How well do the HMSA designation and staffing criteria relate to the use of primary care physician services? Some physician capacity utilization surveys have recently been made available. Salient findings from the surveys are:

> The analysis also examined the influences of exogenous factors on practice characteristics of HEW-designated physician shortage area counties—defined primarily in terms of physician-population ratios. In practical terms, none of the fully or partially designated shortage counties studied gave evidence of excess demand in the traditional economic sense, Physicians' office hours in these shortage areas were about the same as those of physicians in nonshortage areas. Nor were patient waiting times, for appointment and in the office, significantly different from those in nonshortage areas. However, a decreasing waiting time to appointment as the supply of general practice physicians increases is some indication of excess demand in shortage areas. It was found, in fact, that shortage area physicians had slightly fewer patient visits than physicians at large. (This result is substantiated by a recent study of the Health Service Administration that reported similar observations of productivity from NHSC physicians placed in shortage areas.) A control for population density (used as a proxy for travel distance to see a physician) made little difference in these results (reference and footnotes omitted) (USDHEW, 1978b).

The NHSC experience, however, could be reversed over time. Table 50 disaggregates physician encounters/physician by: 1) self-support ratio categories, 2) initial staffing years, and 3) sites with and without midlevel practitioners. Bearing in mind that the NHSC experience was only 5 years old at the time of the study, the table shows that: 1) patronage of NHSC sites builds over time, patient demand being positively and significantly related to the number of years the sites have been in operation, 2) the more mature sites tended to have higher productivity per provider, and 3) sites that were approaching the capability to be financially self-supporting showed higher productivity levels per provider.

Table 50.—Physician Encounters per Physician and Physician and Physician Encounters per Physician Hour by Selected Cohorts, National Health Service Corps (FY 1976)

		Self- supporta ratio categories			Initial staffing year				
	Sample sites	1	2	3	1972	1973	1974	1975	1976
Physician encounters/physician (all sites).	4,664 (130)	7,092 (30)	4,568 (52)	3,524 (48)	6,144 (25)	5,164 (25)	5,140 (27)	3,912 (64)	2,804 (2)
Physician encounters/physician (sites with no PEsb).	4,428 (94)	6,420 (23)	4,048 (40)	3,440 (31)	5,544 (12)	5,780 (6)	5,392 (18)	3,792 (56)	2,804 (2)
Physician encounters/physician (sites with PEs)	5,272 (36)	9,304 (7)	6,296 (12)	2,888 (17)	6,700 (13)	4,420 (5)	4,644 (9)	4,772 (8)	— –
Physician encounters/ physician hour. . . . . (all sites).	(:3;)	; ;)	&	1.8 (48)	;":)	2.8 (11)	(&)	(%:)	2.1 (2)
Physician encounters/ physician hour. . . . . (sites with PEs)	2.6 (36)	5.2 (7)	2.9 (12)	1.4 (17)	3.3 (13)	2.6 (5)	2.8 (9)	1.1 (8)	— –
Physicians encounters/ physician hour. . . . . (sites with no PEs).	2.2 (94)	(%)	2.1 (40)	2.0 (31)	2.7 (12)	2.9 (6)	2.4 (18)	1.0 (56)	2.0 (2)

aSelf-support ratios measure the relation between the total revenues from all sources and total costs experienced at sites al a given time 'Category 1 Sites are the most self supporting, diminishing to category 3
bPhysician extenders, or midlevel practitioners

SOURCE H L Heaton, et al *Comparative* Cosf and *Financial* Analysts *of Ambulatory Care Providers*, GEOMET Inc report No HF-360, DHEW contract No HSA-74-68, 1976

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