DOCUMENT RESUME

ED 137 567 CE 010 550

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TITLE Analytical and Data Needs for Health Manpower Planning. A Pragmatic Overview. Report No. 76-46.
INSTITUTION Health Resources Administration (DHEW/PHS), Bethesda, Md. Bureau of Health Manpower.
BUREAU NO HRP-0008843
PUB DATE 20 Feb 76
NOTE 42p.; Best copy available

EDRS PRICE MF-$0.83 HC-$2.06 Plus Postage.
DESCRIPTORS Administrator Role; Data Analysis; *Data Collection; Employment Projections; Health Occupations Education; *Health Personnel; *Information Needs; Information Utilization; Labor Supply; *Manpower Needs; Manpower Utilization; *Planning; *Professional Personnel

ABSTRACT

Practical observations are offered in this report on health manpower information data and analyses to provide assistance to health planners in carrying out manpower activities more effectively. Problems and considerations discussed are as follows: Timeliness and accuracy of data, comparability of definitions and coverage, confidentiality problems, disaggregation of data, sample vs. universe surveys, employer/health care setting, no data for data's sake, and flexible approach. Also discussed are broad categories of data needed, and the following areas relating to determining current health manpower supply and requirements: Characteristics of population served; number, characteristics, and distribution of practitioners; allied health manpower; requirements standards; and health manpower education. Supply projections, requirements projections, assumptions for projections, and use of models are discussed in relation to determining future health manpower supply and requirements. A brief review of priorities for data collection concludes this report. (TA)

ANALYTICAL AND DATA NEEDS FOR HEALTH MANPOWER PLANNING - A PRAGMATIC OVERVIEW

BHM/OPD/MAB
2/20/76
Report No. 76-46

Preface

This paper was prepared for the Task Force on National Guidelines for Health Planning by the Manpower Analysis Branch, Bureau of Health Manpower. It is not a comprehensive and detailed technical description of specific data elements and analytical methodologies nor is it a "how to do it" manual. It provides only some simple practical observations on health manpower information data and analyses that may provide some assistance to health planners in carrying out their manpower activities more effectively. The report was prepared by Marion Altenderfer under the direction of Howard V. Stambler, Chief, Manpower Analysis Branch, BHM.

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Introduction

Effective planning of any type presupposes adequate data and analyses of issues, trends, and dynamics based on those data. The better the data base available and the more perceptive and responsive the analyses, the more likely that planning will accomplish its desired results. Before describing any specific data and analytical needs for health manpower planning, however, it is important that it be understood what is meant by health manpower planning. A recently published report 1/ provides the following definition:

> "...a process whereby goals, objectives, priorities, and activities for health manpower development are determined in a systematic fashion, in order to ensure that health manpower resources, both current and future, are adequate to meet the requirements for the delivery of health services to a population."

Important in this process is the recognition that facts and figures are not in themselves "planning." Rather, in many respects data acquisition is the final component of an analytical process that seeks primarily to identify problems, to devise ways of studying them, and to determine means of solving them. Data, therefore, are little more than the raw material on which policy--the objective of planning--is based. With these priorities in mind, the question of data can be addressed more properly and profitably.

Despite the large amounts of money spent for health (104.2 billion and nearly 9 percent of the GNP in FY 1974), and the critical importance of planning in assuring an adequate supply of health manpower to provide the health services needed, a comprehensive, systematic and consistent data base for adequate health manpower planning does not exist. Some of the published data on supply and requirements are best described as unsophisticated "guesstimates" of questionable value. The inadequacies of current statistics are compounded by shortcomings of data related to region and locality, occupation and specialty, length of required education or training, type of employment situation, demographic characteristics, salary, and so on. In addition to the insufficiency of data, there is the

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1/ Aspen Systems Corporation. Health Manpower Planning Process. DHEW Publication No. (HRA) 76-14013.

difficulty of selecting an appropriate methodology for analyzing the present situation and for developing future projections. 2/

Data requirements, analytical insights and estimating methodology are all interdependent--each is dependent upon the others--and they are all prescribed by the broad issues that are being addressed and the underlying concepts. How one makes estimates depends on the data one has or can get, and the available data determines the choice of methodology. No methodological approach is universally applicable. Each planner must weigh the alternatives and select the methodology or mix of methodologies appropriate for his purposes and his data, and each planner must evaluate and analyze the issues and the results from his own perspective.

Area health planners find they must have answers to a multitude of questions related to manpower supply and requirements: What types of personnel are working in the health field? What kinds are needed? What educational and training programs are being offered now--what kinds of occupations are being trained, where are the programs located, from what geographic areas do they draw students, what is their capacity, how many students graduate, where do they find work? What other sources of supply exist in the area? What have been the trends in supply? What health services are being provided? By whom? How will health manpower requirements change over time? What will happen to demand in the future, if, for example, national health insurance becomes law? How will it affect services and personnel requirements in the area? Will the present supply sources be adequate for the community's needs in the future? What are the area's needs? What changes should be made to insure adequacy of supply? The questions to be answered appear to be almost endless, which underscores the need for careful, systematic planning. Furthermore, many of these questions are essentially research questions that may not be answerable in a short time frame. It is thus important that research and planning activities are separated, and that program priorities recognize this distinction.

It is not an exaggeration to say that manpower statistics are the raw materials of planning that are needed to guide the development of educational and training programs and health policies of all kinds. Appropriately analyzed, they help the planner to probe the constraints to altering the supply and to identify the proper focus of recruitment and retention efforts. They affect his evaluation of the feasibility

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2/ This section and a number of others in this report draw heavily upon Robert R. Nathan Associates' draft report prepared for the Bureau of Health Planning and Resource Development, A Critical Review of Methodological Approaches Used to Determine Health Manpower Supply and Requirements, Report of Contract No. HRA 230-75-0067. Another BHPRD draft report that was drawn on heavily is "Data and Information Needs for Health Manpower Planning," Applied Management Sciences, supported by the Bureau of Health Planning and Resource Development.

of new health policies and programs and of the likelihood of obtaining certain standards of health care. Manpower data influence his recommendations on proposed new and expanded facilities as well as new educational institutions. The planner essentially becomes the major force working to align health manpower resources with health care demands and needs.

It is essential that the health planner take a broad general review and overview of the health care delivery system in his area before starting to collect the data needed for planning. Since constraints of money, personnel, and time will make it infeasible to collect all the desired data and to answer all his questions, care must be taken not to use a fragmented, piecemeal or redundant collection approach, but rather to concentrate on those occupations and health care settings which are large and important in the area and which are critical to the planning process, not just those for which data are most readily available or obtainable. The broad view should include the amount and types of services provided by the various types of health personnel in different health care settings, the health care delivery system in which the services are provided, and proposed methods of obtaining the needed data. Care should be taken not to fragment efforts by trying to obtain "perfect" data on one health occupaton, facility or topic while ignoring the general manpower picture and the overall health care system.

Since primary data collection is expensive in terms of money, personnel, and time, a determined search for and evaluation of secondary sources should be made before any data collection plan is developed or any data collected. Many little-known local data sources exist, and national data can sometimes be used as proxies for missing local data. A modular approach can be used so that data gaps and weaknesses are clearly seen and understood and the various pieces added together after collection efforts are completed. Proxy data, national data, and old data are still useable, as are methodological approaches and analytical work already done by others. Time and money constraints almost always require the use of less than ideal data and must of necessity result in less-than-perfect health manpower planning.

Although the health planner should use available data, he should be well aware of its problems and limitations. Definitions and categories may not be comparable among health occupations. Data may be several years old. Even when current data exist, there may be no trend data upon which to base projections. Data may not be available for all of the geographic areas in which the health planner is interested. Information may exist for some health care settings but not for others. Only after carefully examining and evaluating useable data from secondary sources and other planning agencies should a data collection plan be devised to fill the gaps, and then in full awareness of uses to which the data will be (not "can be") put.

Important Problems and Considerations

Before determining exactly what type and amount of data should be collected, the planner should review any major problems and considerations that will likely determine the content and composition of his data needs. A number of special problems and considerations need to be kept in mind. One of the most important is that data do not represent an end in themselves, but simply are means to an end--to permit analysis and planning to take place or to assist in policy deliberations. Data should not be collected to sit on a shelf or because they might be interesting to have. Other considerations include: timeliness of data, comparability of data from different sources, reliability of data, problems of confidentiality, disaggregation of data, sample vs. universe surveys, employer/health care setting, need for a flexible approach, and appropriate presentation of data and analyses. These considerations may seem elementary, but are often ignored. They are treated in more detail below.

Timeliness and Accuracy of Data

Timeliness and currency of data are obviously important, but more critical for some kinds of information than for others. For health occupations with a high degree of geographic mobility or in which rapid changes are taking place, data collected several years earlier may be completely inadequate for determining present supply. On the other hand, for some health occupations, data may be adequate even when several years old. Data on the size and location of health care facilities, for example, may be useful for several years, although some changes may have been brought about by new construction and remodelling. Timeliness, of course, is most important in the determination of emerging trends, although currency of data can be over-emphasized where data would likely be expected to show little change over time, where information is readily available apart from surveys, or where changes may be relatively unimportant to the health planner, such as changes in the number of hospitals (easily determined) or small changes in age composition of the population. It is sometimes possible to increase the usefulness of out-of-date information by making adjustments based on other related data.

It goes almost without saying that accuracy and reliability are also important characteristics of data for planning. Data which are inadequate and subject to critical questioning by users are of little value for planning or analytical purposes. It is important that the accuracy of the data not be the subject of controversy or disagreement, thereby preventing planners and policy makers from dealing with the real issues associated with policy development.

Another aspect of the reliability-accuracy issue is the specific use to which the particular data are to be put. Not all data in any analysis or plan need be of the same quality or reliability, since not all data affect results equally. For example, a relatively "soft" estimate of educational attrition rates may have only marginal impact on the range of expected end product estimates of graduates in a

particular field, while "soft" estimates of the proportion of graduates locating in a particular type of geographic area may have a significant impact on the final geographic distribution estimates. Sensitivity analysis, which essentially determines the degree to which a particular analytic result is sensitive to the level of its various components, is an effective way to deal with this problem.

Comparability of Definitions and Coverage

Since the health planner generally needs to obtain data from different sources and put bits and pieces together, it is important that he investigate the comparability of definitions used and coverage included. When not entirely comparable data must be used (as they often must be), the health planner may be able to make adjustments that will improve comparability or bring about a recognition of the sensitivity of the noncomparability.

Data collected by different groups, for different health occupations, in different health care settings, or for different purposes will likely not be compatable because of the use of varying definitions of activity status, full- or part-time status, racial/ethnic category, etc. Some surveys of health workers include all persons working at particular occupations, other surveys include only those workers who have a certificate, registration, or other evidence of qualification. Sometimes professional associations survey only their own members. Even when data are for a single occupation or a single health care setting, definitions and coverage may change over time. Noncomparability is also likely to be a problem when data for several local areas or States are aggregated to cover larger areas or groups of States, or when data are collected at different times.

In using noncomparable data from secondary sources, care must be taken to note, understand and evaluate the differences, and efforts made to adjust or allow for the differences. If adjustments cannot be made to compensate for variations in definition and/or coverage, or if the variations are so large or important as to pose insoluble problems, it may become necessary to undertake primary data collection.

Confidentiality Problems

National concern about unwarranted invasion of privacy and the potential dangers of "data banks" have made some people reluctant to provide the information requested on survey questionnaires. This has potential for adverse effect on survey responses, both on the proportion of mailed questionnaires returned and on the completeness with which they are filled out. Assurances of confidentiality and of use of the information for statistical purposes only have not entirely overcome the reluctance. Care must be taken not to ask one or two overly "sensitive" questions of marginal value that may limit response to the entire questionnaire. Nevertheless, if the purposes, uses, and needs for data are properly presented to respondents, reluctance of individuals to respond can hopefully be largely overcome.

Some Federal and State agencies are imposing restrictions on the collection of information from individuals who are identified by use of a name or Social Security numbers. These restrictions pose serious problems for longitudinal studies and the unduplication of information from more than one source, e.g., from licensing boards in more than one State, and must be dealt with in the development stages of any survey. Some unique identifier for each individual must be developed and used if these types of problems are to be overcome.

This also poses problems for the health planner who wishes or needs to exchange data with other agencies in his area or with planners and agencies in other areas. However, such exchange of data can often be carried out without breaching confidentiality restrictions by deleting from the data tapes information which would permit identification of individuals. Both the Freedom of Information Act (5 USC 552) and the Privacy Act of 1974 (Public Law 93-579) should be examined closely before surveys are mounted in order to avoid unintended difficulties at later dates.

Disaggregation of Data

In most cases, gross aggregate information on the total number of health practitioners in each health occupation will not be sufficient for the health planner to carry out his analyses. Disaggregated data are thus required, e.g., by specialty and/or professional activity, by type of institution and job title. The type and amount of disaggregation needed varies from one occupation to another and from one specific use of the data to another. Since additional questions and details often have an adverse effect on survey response rates, only the amount of information clearly needed by the health planner should be included in survey instruments.

The issue of geographic disaggregation of data poses especial problems which should be kept in mind. Most geographic type collection and analysis relate predominantly to political jurisdictions, such as counties, SMSA's or regions. The introduction of Health Service Areas and sub-areas will compound data collection and analytic problems and must be considered in developing plans for future work. Ideally, of course, the area examined should be the "medical trade area," although there is little consensus as to what this should be or how it should be defined. Overall, the different geographic entities and the possible need for data on several or more of them should be kept in mind.

Sample vs. Universe Surveys

Primary data collection is always time consuming and expensive in terms of both money and personnel. The tendency is to use universe surveys too much. Consideration should always be given to the possibility of using sample surveys rather than universe coverage whenever possible. In reaching a decision on this question, the degree of accuracy and detail desired must be carefully balanced against the cost of obtaining returns. If it is decided that a sample survey is adequate, the same considerations must then be taken into

account in determining sample size needed, and the sampling plan to be employed. The greater the disaggregation of data needed, the larger will be the sample size required to obtain a given degree of accuracy. However, many questions cannot be adequately answered by means of a sample survey, particularly when the need is to obtain data for small geographic areas or for occupations with small numbers of practitioners, or to obtain head counts on which to base the drawing of samples to collect more detailed data.

Employer/Health Care Setting

For pharmacy, nursing, and most allied health occupations the majority of the health personnel are employees of organizations, while for medicine, dentistry and many other health professions, the majority of the active practitioners are self-employed and engaged in independent, partnership, or group practice. Quite different data collection techniques and survey instruments are generally needed to obtain information about these two general classes of health personnel. Detailed information on educational background, work experience, mobility, etc., usually must be obtained directly from individual workers no matter what their form of employment, since data obtained from surveys of employers, e.g., hospitals, nursing homes, laboratories, etc., can generally provide only basic employment/payroll counts. When both establishment surveys and surveys of individuals are used, comparability problems often arise when attempts are made to merge the two. Especial care must be taken to avoid overlap of data, and double counting of personnel who work in more than one establishment or work both for an employer and as a solo practitioner. The health planner must recognize the various problems and try to adjust for them, especially when data are collected from employers on their employees.

No Data for Data's Sake

The reason why health planners collect data is to enable them to carry out analyses of health manpower supply and requirements needed for health planning activities. While data acquisition is a necessary first step, it should never be looked on as an end in itself. For data to be useful in health planning it must be evaluated, analyzed, and interpreted, and finally translated into answers to relevant questions. Manpower data, for example, must be looked at in relation to the educational, economic, political, and social climate, and health manpower supply and requirements information must be interpreted in relation to these factors. Projections of health manpower supply and requirements must take account of past and anticipated changes in these factors, no less than the manpower changes directly concerned with the provision of health care. The end product must reflect an understanding of all facets of health manpower and its services and not simply manpower data alone. But, as indicated earlier, it is important to separate the longer-term research questions and issues not susceptible to immediate resolution from the analytic efforts needed to complete a rational, short run manpower plan.

Analysis of data may be simple or complex, depending on the sophistication of the methods being used, the expertise of the analyst, the reliability and detail of the data, and the complexity of the issue being examined. At the simplest level, analysis is the organization of data into tabular or chart form so that it can be easily displayed and comprehended. This type of analysis may also involve computation of simple statistical relationships or trends. The health planner can not just present data, he must interpret and explain them, and describe their implication.

Since most of the health planner's work involves presentation of his plans and recommendations for action to government officials, educators, health professionals, and the general public, such presentations should be simple and nontechnical to be most effective. Tables, charts, and analyses must be understandable by persons who do not have highly technical or specialized background or training. It is important for the health planner not to get so immersed in the data that he and his staff are the only ones who understand the data and the points being made.

Flexible Approach

As a final consideration, the health planner needs to be flexible in his approach to data collection and analysis. No single survey instrument or single system of data collection will serve all situations or all purposes. Similarly, there is no single way to analyze data and, unfortunately, no single unarguable interpretation of all data. Too rigid a technical approach in an area so fraught with uncertainties and complexity can serve no one's purpose.

Broad Categories of Data Needed

Health manpower planning involves collection, compilation evaluation, analysis, and presentation of a tremendous variety of types of data. In its simplest terms, its objective is to evaluate the current and expected future supply of health manpower and the services they provide, and to balance this against current and projected requirements so that plans can be made to insure that supply and requirements will be in equilibrium. In theory, hundreds of items of information can be used, but the most needed data generally fall into several broad categories:

1. Characteristics of population served. Since utilization of and need for health services differ by such characteristics as age, sex, race, and income, disaggregated information reflecting these characteristic needs to be available and analyzed for the relevant population.

2. Number, demographic (age, sex, etc.) and practice characteristics, and distribution of providers by practice location and setting. These factors affect the amount and types of health services provided.

3. Requirements and need for services. The services being provided by health manpower reflect only actual utilization, which may differ substantially from the demand or "need" for services and manpower. The quality of services provided, though currently nearly impossible to measure, also affects total demand or need for services.

4. Manpower and services provided in different health care settings. Each type of setting--short-term hospital, group practice, mental institution--has its own manpower profile and its own set of services. The health planner also needs to know the number, size, type, and location of the facilities in which health care is provided to the population of his area.

5. Geographic and occupational mobility of practitioners. The existing supply of health manpower in a geographic area or in a health occupation is heavily dependent on the net mobility resulting from practitioners moving in or out of the area or changing from one health occupation to another.

6. Manpower attrition and Labor Force Participation. Losses from deaths and retirements need to be estimated in order to determine future supply.

7. Income and salary. The income and earnings potential of occupations have a major impact on both recruitment of students and retention of health workers.

8. Applicants, students, graduates. Trends in the numbers of applicants, first-year enrollments, and graduates are critical in evaluating the effectiveness of training institutions and in estimating the future supply of health manpower.

9. Characteristics of training institutions. Information on capacity, plans for expansion, and amount and sources of financial support of training institutions is essential for understanding the role--past, current and future--played by training institutions.

Determining Current Health Manpower Supply and Requirements

The broad categories of data needed for health manpower planning were mentioned above. The present section deals in more detail with the data needed to measure current supply and requirements, the cornerstone of all manpower planning. Data about the population served is discussed first, followed by a discussion of data on health practitioners, requirement standards, and health manpower educational institutions, students, and graduates.

Characteristics of Population Served

The size and characteristics of the population are the basic determinants of the demand for health services and therefore for the demand for health manpower. Account must be taken not only of the numbers of people, but also of the proportions of the very young and the very old, the ethnic and racial composition (since some diseases are en

to certain groups), the income and educational level, and the rural-urban-suburban-inner city distribution.

Not only does the age composition of the population affect the overall requirements for health manpower, the impact of age is especially critical for some professions or specialties. For example, a population with an unusually high proportion of old people will require a higher than average number of physicians who specialize in geriatrics. A higher proportion of orthodontists would generally be required for a population with a high proportion of children.

Demand is strongly influenced by consumer income and by the price of health services. The income and price elasticity of demand have been important factors in the sharp increase in demand over the past decade, as family incomes have risen and health insurance has lowered the effective price ("out of pocket cost") of services. In addition to the rising demand for health care accompanying rising income, rising educational levels of the population have been accompanied by greater recognition of the importance and desirability of health care. Of course, morbidity plays a major role in determining demand levels.

Number, Characteristics, and Distribution of Practitioners

For each health occupation the health planner should know not only the number of providers and allied workers in the planning area and those entering or leaving it, but also their demographic characteristics, education, practice setting or employer, specialty, and amount and type of services provided. Ideally these characteristics should be known for each individual so that the health planner can cross-tabulate the data as needed.

For the 13 health occupations licensed in most States, the Cooperative Health Statistics System being implemented by the National Center for Health Statistics in conjunction with State agencies should provide a great deal of the necessary information on health care providers. At present planning of a health manpower component is underway in more than 20 States, although it may be several more years before all States are included in the system. However, the health planner should investigate the availability of data from this source for his planning area.

Demographic Characteristics. The number of services provided by health practitioners, the labor-force experience, and death and retirement rates vary with sex and age, making this information essential for adequate planning. Other practitioner characteristics such as marital status and racial/ethnic category also influence the supply of manpower and services available or expected to be available.

Education. Information on the location of a health worker's school and his year of graduation provide a means for determining past and current sources of supply for an area. There are different kinds and levels of educational preparation needed by different health personnel, and information about workers' educational preparation helps in assessing current supply and provides a means for estimating

future supply. For example, since a masters degree is required for many administrative and supervisory positions in nursing, the health planner should know how many of the professional nurses in his area are graduates of associate degree, diploma, or baccalaureate programs.

Specialty. Information on specialty is important not only for medicine, osteopathic medicine and dentistry, but for most other fields. With the advancement of medical knowledge, the continued growth of new techniques and methods of treatment, and the general trend toward specialization in all aspects of work, these data should take on increasing importance.

In the field of medicine, there are about 35 specialties recognized by the American Medical Association and 22 American Specialty Boards which grant certification as a measure of competence. In 1973, 83 percent of all active M.D.'s reported themselves as specialists, up from about 70 percent 10 years earlier. The health planner needs to have a measure of the actual amount and type of services provided by different specialists, such as hours of work per week, number of patient visits, type of conditions treated. Since many physicians devote part of their practice to a secondary specialty, such information is important inaccurately assessing the supply of specialists and the services being provided. Since many specialists treat only one type of disease or one part of the body, they are not interchangeable with other specialists and numbers of total M.D.'s are of limited use to the health planner. Also, many specialists deliver some primary care, and there is overlap in some services provided by different specialists, even by tertiary or "super" specialists.

For dentistry, there are eight specialties recognized by the American Dental Association but specialists constitute only about 10 percent of all active dentists. Here, again, however, different specialists provide different kinds of services to different segments of the population, making the total number of dentists a not completely acc measure of supply.

The same situation applies to other health workers as well. Although most optometrists and podiatrists are general practitioners, many spend some time in practice of a specialty. In veterinary medicine, about half the practitioners in private practice specialize in either the care of food animals or in the care of pets; the other half have mixed practices.

In nursing, specialites such as public health nurse, nurse anesthetist, nurse midwife, etc., have existed for some time. More importantly, recent developments in nursing have led to a growth of expanded roles for professional nurse practitioners in such fields as pediatrics, family practice, and geriatrics.

Among allied health occupations some workers are registered or certified while others have no formal credentials. Information is needed on not only total health workers in an area but also on the

types and settings of those positions which require credentialling or the workers who have such credentials.

Practice Setting and Type of Employer. The principal concern of health planners is the supply of health manpower providing health care to an area's population. Considerable numbers of active practitioners are engaged in activities such as teaching, research, and administration, in which they are not directly providing health care. Even among physicians providing patient care, several different practice settings may be involved--individual physician's offices, clinics, hospitals, etc. The manpower requirements and the type and amount of services provided are also different in such practice settings as mental health and community clinics, hospital outpatient departments, and industrial clinics. Similarly, care in hospitals is provided by the full-time physician house staff, visiting staff, and, in some hospitals, by interns and residents (who spend some of their time in education and training). Services and manpower data by level of care--primary, secondary, tertiary--may also help planners in doing a better job. Information about all of these factors is important in obtaining a full manpower picture.

Of greatest importance are the few types of health care facilities, e.g., hospitals and nursing homes, where the majority of health practitioners work. Obtaining information on the number, size, type, and location of such facilities generally needs to be given a higher priority than information on other facilities. Knowledge of the numbers and types of health workers employed and the health services provided by each health care facility in the area is an essential part of the inventory of current supply of health manpower.

Productivity. In simple terms, productivity is a measure of output per unit of input, often measured in terms of output or services per person per unit of time. For health manpower, output may be defined as units of service (visits, days of hospital care, surgical procedures, laboratory tests, etc.). A more sophisticated measure would be based on the numbers of each of a variety of procedures performed. Whatever measure of productivity is used, the information must be disaggregated by, among other things, specialty, age of practitioner, and practice setting, since these factors impact on productivity. The input side of the equation may include only the practitioner and the number of hours he works or it may also include aides, assistants and equipment as well.

Mobility. There are two kinds of mobility that must be taken into account in health manpower planning--geographic mobility and occupational mobility. The first involves the movement of health personnel from one location to another; the second, from one health occupation to another. Mobility of either type may take place at various career stages of the practitioner--upon graduation, during post-graduate training, or after a period of time in actual practice or work.

The local supply of health manpower is affected by movement of personnel both in and out of the area. In any given year about 1

American in 16 moves to a different county and about 1 in 30 moves to a different State, often for non-work related reasons. In the case of health professions (physicians, dentists, nurses, and other highly trained personnel), the geographic movement has historically been towards larger communities and to metropolitan areas, where there may be increased opportunity for specialty practice, higher earnings, and an atmosphere more conducive to professional development. In a local area, of course, the supply of health manpower can change when practitioners leave the area to practice elsewhere or come into the area from other locations. In some areas, these two movements may balance each other, in others, the dynamics of out-migration and in-migration may result in a net loss or net gain to the area's supply.

One aspect of geographic mobility is comparatively easy to quantify. Surveys of health personnel working in an area can obtain the location of health training or place of residence before training. This information can be used as an indication of the movement of new workers into the area. However, information on how long health personnel may work in an area is difficult to obtain, since data on the supply of persons actually working in an area yield only average number of years worked in the area. Work histories often can provide the necessary insights needed to complete the picture.

Another type of mobility that affects the supply of health manpower is movement from one health occupation to another. This type of movement is often from an occupation requiring less education and training to one with a longer training period. Some employers of health manpower have set up career ladder programs to encourage workers to advance to higher-level, better paying positions. There is also some movement between health occupations at the same general preparation and salary level because of the changing interests and skills of workers and relative demands for their services.

Income or Salary. The earnings potential in a particular health occupation has an impact not only on the recruitment of young people into the occupation, i.e., the supply, but also on retention of workers in the occupation or area. Inactive workers can sometimes be drawn into or back into the labor force by prospects of more favorable incomes or benefits. For these reasons, income information is essential fo making estimates of the supply of health manpower. The health planner needs to know the relation between earnings and the length and cost of training for each health occupation. He needs information on how earnings in one health occupation compare with those in other occupations; in one practice setting or with one type of employer or another; and between different geographic areas.

There is a wide gap in earnings between physicians and dentists and most other health service occupations. Nurses in particular have sometimes been underpaid relative to comparable professionals in other fields and this is reflected in shortages from time to time. For example, increased demand for hospital nurses often tends to bring about improvements in pay and work conditions for nurses and an increased supply of nursing students and graduates. In addition to

long-run responses of this kind, it is often possible in the short run to draw nurses from the potential supply by offering higher pay or hours of work compatible with their work preferences.

Services Provided by Practitioners in Various Settings. From the point of view of the general public (the consumers of health care) the availability of the various health services is more important than the availability of health manpower per se. Since there is great variation among health practitioners in patient load, productivity, auxiliaries, complexity of services provided, etc., information about the amounts and types of services available, needed, and utilized provide a more accurate picture of the situation than the simple number and type of health care providers.

To evaluate the current supply of dentists, for example, it is not enough to know the number of patients seen per unit of time. The health planner ideally should also know how many fillings, extractions, prophylactic treatments, etc., are performed. Similarly, the type of services provided by a hospital for example, determines the manpower profiles in that setting. Also, since many health procedures are performed by more than one type of health worker, the health planner needs to know such things as how many refractions are performed by ophthalmologists and how many by optometrists.

The health planner does need information on specific health services provided but he must be careful not to get bogged down by too much detail. It is sometimes possible to use national data as proxies or to conduct a sample survey to obtain the needed details. A useful source of data on physicians' services is the National Disease and Therapeutic Index, a continuous study of private medical practice which obtains case histories of patients from a representative panel of physicians. Another source is the National Ambulatory Medical Care Survey conducted by the National Center for Health Statistics of the Health Resources Administration.

Allied Health Manpower

Although all of the previously described problems and considerations apply nearly equally to the health professions and to allied health workers, a special category of problems exists within the allied health fields. The urgent and almost overwhelming need for reliable statistical information on occupations in the allied health field makes necessary separate mention of these occupations.

Owing to the large and rapidly growing numbers and types of workers in this field, information for planning purposes is literally non-existent--whether at the national, State, or local level--on allied health workers. Problems associated with developing an adequate and reliable data base on allied workers include the following:

1. Lack of consensus on the parameters of the allied health field and on the definitions of allied health professions and occupations.

2. Lack of reliable estimates of current and past supply.

3. Limited information on characteristics of workers.

4. Limited information about the impact of task delegation, currently or in the future.

5. Extensive use of crude estimates and professional judgment in assessing the past and present situation.

Extra efforts must be made by planners to locate and use secondary, proxy or other data on allied health workers. Attempts to obtain complete counts and characteristics information on allied workers may very well prove infeasible. Sample surveys of only the major employers--nursing homes and hospitals--may be one solution. Another may be use of the limited national data, adjusted to local circumstances. Fortunately, over the next few years, results from several major surveys by the National Center for Health Statistics (both within and outside the CHSS) should provide some useful data on allied health workers.

Requirements Standards

A major problem in estimating requirements for health manpower is the selection of an acceptable methodology and/or standard to use in evaluating existing supply in the planning area. No single method of measuring requirements has proven entirely satisfactory or universally applicable. Another factor to be considered in estimating requirements for health services and consequently for health manpower is whether to measure requirements in terms of medical need as evidenced by health status, morbidity, and disability rates; in terms of economic demand for services/manpower; or on the basis of professional judgements.

The data needs for different methodologies and standards vary considerably and the health planner may find that a complex simulation model cannot be used because the needed data do not exist. On the other hand, a model using readily available data may be too simple to provide good estimates of requirements. It is important for the planner to evaluate carefully the data available, the potential methodologies and their data requirements, and the degree of precision needed for the issues at hand.

There are a number of methods currently used to estimate requirements. These include: (1) Ratios of practitioners to population; (2) professional judgements as to types and amounts of care needed; (3) health needs as shown by morbidity and disability data; (4) economic demand or perceived need; (5) actual utilization of services, and (6) vacancies in various health care settings. Most past studies are not pure examples of any single methodology but rather a pragmatic mix or blend of approaches.

Ratios to Population. By far the most popular and frequently used approach to estimating requirements is that of ratios of practitioners to population. In this method the following formula is used:

$$\frac{\text{Manpower}}{\text{Population}} \times \text{Population of planning area} = \text{estimated manpower requirements}$$

Manpower, the numerator in the ratio, may refer to discrete occupations, as radiological technologist, or to generic categories, as allied health occupations. The term may be limited to health personnel providing service in a particular setting, as nursing homes, to a particular type of care, e.g., pediatric, or it may be all-inclusive, encompassing the totality of workers in the health industry. It may also relate to total, active, or licensed personnel, or to full-time equivalent personnel.

Population, the denominator of the ratio, may be defined in different terms depending upon the planner's concerns. For example, total community population may be used if the problem deals with environmental health; citizens 60 years of age and older if the concern is staffing nursing homes; the residents of a geographically defined service area if the issue is adequate ambulatory care.

A variation on this method is to use in the denominator of the ratio something other than population. For example, the number of hospital nurses might be calculated in relation to hospital beds, and the resulting ratio multiplied by the number of beds in the planning area.

The crucial part of this method is the choice of the ratio to be used, since the validity of the estimate depends on the appropriateness of the ratio. Examples of the types of ratios which are used include the mean or median for all States or for all areas of a certain kind, the ratio in the highest State or area, the ratio in areas judged by experts to be well served, or simply a ratio deemed to provide adequate or optimal care.

Adequacy ratios for various medical specialties for both current and future requirements is presented in the table which follows.

"Adequacy ratios" of specialists per 100,000 population obtained from literature review

Study	All MD's	All specialties	Primary care	Specialty care	Surgical specialties	Medical specialties	Allergy	Anesthesiology	Cardiovascular disease	Dermatology	Family practice	General practice
Group I												
(3) Burnett (80)												
(5) Comm R. Med (73)												
(10) Gravenstein (80)								11				
(17) Lee-Jones (33)												
(20) McPhedron (70)												
(27) Schonfeld (72)			133									
(31) Walters (80)												
Group II												
(1) Anesthesia Tr. (71)								11				
(2) Brehman (73)		156	156									
(5) Comm. R. Med (72)												
(6) Delaware (80)		116						4	1	1		
(12) Hughes (72)												
(8) JAMA (72)												
(14) Knowles (70)												
(14) Knowles (80)								11				
(16) Lawton (73)		151	80		15							
(7) Med. Econ. (61)							4	7	1	2		50
(7) Med. Econ. (67)	158		89	66			4	7	1	2		50
(25) Paxton (72)	156						4	7	4	3		101
(18) Md. Council (72)			101									
(22) Minuck (70)								5				
(23) Nacor (75)												
(26) Peterson (90)					28							
(29) Texas M.A. (71)		138	79	59			4	6	1	2		40
Group III												
(5) Comm. R. Med (72)												
(4) Clawson (70)			58					2		3		
(15) Knowles (67)	109		72	37								
(9) Corby (72)	98						0.3	4		1		20
(19) H.I.P. (71)		100								1	15	
(19) Mason (72)	107		70	28				2		2		
(24) North Car (67)					7		2	2		3		
(28) Somers-Kaiser (72)		95	56	36	9	28				3		
(30) [illegible]-Median (67)							1	2		3		
(30) [illegible] Mean (67)	109		72	37			2	2		3		

"Adequacy ratios" of specialists per 100,000 population obtained from literature review (continued)

Study	General Surgery	Internal medicine	Neurological surgery	Neurology	Obstetrics gynecology	Ophthalmology	Orthopedic surgery	Otolaryngology	Pathology	Pediatrics	Psychiatry	Radiology	Urology
Group I													
(4) Turners (80)										12			
(5) Comm. R. Med (72)													
(20) Greenblatt (80)													
(24) Lee-Jones (33)													
(25) McMahon (70)	9		0.6				4	1					1
(27) Schonfeld (72)													
(31) Roberts (80)					5								
Group II													
(1) Anesthesia Dr. (71)													
(2) Brahman (73)													
(5) Comm. R. Med (72)													
(6) Delaware (80)		11			9	2		2	3	7		3	2
(12) Hughes (72)													
(14) Jones (72)	9												
(16) Marsh (70)			1										
(18) Maxwell (80)													
(22) Lawton (73)			1	1	10	5	5	3		10	7	5	3
(7) Med. Econ. (61)	10	5	0.7	1	10	5	1	2	3	4	2	3	5
(7) Med. Econ. (67)	10	20	1	1	9	5	3	4	5	10	10	7	3
(28) Simon (72)	10	20	1	2	9	5	4	4	5	10	10	7	3
(30) Wis. Council (72)													
(32) Wisnom (70)													
(33) Wiser (73)												11	
(34) Patterson (90)													
(29) Texas M.A. (71)	10	20	1	1	9	5	3	3	3	10	7	5	3
Group IIa													
(5) Comm. R. Med (72)													
(8) Clawson (70)	9	30	1	0.8	10	3	4	3	1			4	2
(14) Knowles (67)													
(19) Worby (72)	7	24			10	3	3		2	11	2	4	3
(21) Welch (71)	6	24			11	4	4	2		22	2	4	1
(26) Wilson (72)	8	23	0.9	0.9	10	4	4	2	1	14	1	3	2
(4) North Car (67)		45		1	9	3	4	5	2	18	3	4	2
(23) Somers-Kaiser (72)			1	0.8	10	4	4	3		17	0.7		2
(33) Bradbury Plan (67)	7	45		1	8	3	3	4	2	16	2	4	2
(35) Philadelphia (67)	7	45		1	9	3	3	5	2	18	3	4	2

Note: Number in parenthesis before study refers to listing that follows this table; number in parenthesis after study refers to year for which estimate or funding was made. A few studies are included here without numbers--study estimates were not amenable to population ratio display. See

Sources and Notes for Tabulation of Adequacy Ratios

1. Anesthesi Training Grants Committee, Report: "Research Training in Anesthesiology," National Institute of General Medicine, June, 1971--Ratio computed as part of RAS paper, based on the statement that the current supply of anesthesiologists can do only half the required work.

2. Brehman, George E. Jr., "A Study of Physician Manpower Demand and Supply in Pennsylvania," Harrisburg, Pennsylvania, Department of Education, 1973--Ratio derived for Pennsylvania based on the 1967 Medical Economics Survey.

3. Burnett, R.D. "Pediatric Manpower Needs--Can They Be Met?" Ped. Clin. North America, 1969, pg. 781-789--Assumes an average increase in productivity of 25 percent. Additional numbers needed are also reported. Ratio was computed by RAS from numbers reported in article.

4. Clawson, D.K., Bennett, R.L., and Steen, M.K. "Planning Residency Programs Based on Physician Projections," presented in AMA meeting in 1972--Derives HMO needs in Washington, Alaska, Montana and Idaho, from Kaiser-Permanente averages. Only numbers needed reported.

5. Delaware Health Planning Council, Delaware Health Manpower Needs and Health Personnel: 1970 Status and 1980 Projected Need, Wilmington, 1971--Ratios computed by RAS for this paper using series I-E population projections, Current Population Reports, Series P-25, No. 477, Bureau of Census, U.S. Department of Commerce, Washington, D.C., 1972.

6. Editorial, "How Many People to Support a Specialist," Medical Economics, Oradell, New Jersey, October 30, 1967-- Contains results of the 1961 and the 1967 Surveys.

7. Editorial, Journal of American Medical Asscciation, Volume 219, No. 12, March 20, 1972, pg. 1627.

8. Gorby, John T. and Associates--See text of this paper on "adequacy ratios."

9. Gravenstein, et al. "Analysis and Forecasting of Anesthesia Manpower in Cayuga County, Ohio." School of Management, Case Western Reserve, Cleveland, 1972.

10. Greenburg, G.L. "Manpower in Pathology, 1969-1975." Journal of American Pathology, 1971, pg. 551-563.

11. Hughes, et al. Surgery, March, 1971.

12. Jones, Michael W., et al. "Physician Supply--An Analysis of Specialty Distribution." California Medical Association.

Socio-Economic Reports, Volume XIII, No. 3, San Francisco, March, 1973.

13. Knowles, J.H. "The Quantity and Quality of Medical Manpower: A Review of Medicine's Current Efforts." Journal Med. Ed., Volume 44, February, 1969--The anesthesiology ratio computed by RAS; assumes no task delegation; also reports HMC averages.

14. Knowles, J.H. "Radiology--A Case Study in Technology and Manpower." The New England Journal of Medicine, Volume 280, No. 23, June 5, 1969--Contains statement that while radiologist supply is growing 5.7 percent annually, demand is growing at a 7.2 percent.

15. Lawton, Robert P. "Physician Manpower Series: A Report on Physician Distribution in Florida. State University System of Florida and Florida Regional Medical Program, Office of Manpower, Tallahassee, June, 1973--All specialties figure excludes AN, PTH, F, AM, FOP, GPM, OM, and PH., "Primary Care" excludes OB/GYN. Based primarily on medical economics surveys.

16. Lee, Roger I. and Jones, Lewis, W. The Fundamentals of Good Medical Care. University of Chicago Press, Chicago, Illinois. Values computed in needed specialist hours per year were all physicians--283, 131, G.P.--2,315,539, All Specialties--51,592, U--1,658, N--2,972, P--1,820, OPH--16,170, Other--1,724, OBG--5,792, OTO--5,545, IM--6,216, GS--7,729, D--429, OPS--1,546.

17. Maryland Council for Higher Education: A Projection of Marylands Health Manpower Needs Through the 1900's. Baltimore, 1969--Excludes full-time hospital based GP's.

18. Mason, H.P. "Manpower Needs by Specialty." Journal of the American Medical Association, Volume 21, No. 12, March 20, 1972, pg. 1621--Averages (means) of several HMO's.

19. McPhedron, N.T. and Ekstrand, C. Study of Surgical Practice in Alberta for 1970. Unpublished paper, Faculty of Medicine, University of Calgary, Calgary, Alberta, 1970--Based on surgery actually performed in Alberta. Assumes no large unmet need existed, assumes no over-utilization, and assumes average productivity.

20. Medical Economics Surveys. See listing number seven above.

21. Minuck, M. "Editorial: Future Manpower Needs in Anesthetic Practice." Canadian Anesthestics Society Journal, Volume 17, No. 1, January, 1970--Ratio computed by RAS based on statement that the current supply in Canada is optimum, although shifts in demand are predicted.

22. North Carolina Legislative Research Commission. Report on the Committee on the Physician Shortage in Rural North Carolina, Raleigh, 1969--Reports unpublished HMO data for 1967; means of six HMO's.

23. Paxton, Harry T. "Doctor Shortage, It's Narrowing Down to Primary Care." Medical Economics, March 19, 1973, pg. 104-107--Internal Medicine category excludes Gastroenterologists, the supply of whom it is stated, needs to be doubled. Primary care includes internal medicine.

24. Peterson, O.L., et al. "The Production, Attrition, and Biological Life-Time of Surgeons in Relation to the Population of the United States." Anals of Surgery, October, 1972--Concerned with board-certified surgecns only.

25. Schonfeld, H.K., et al. "Numbers of Physicians Required for Medical Care." New England Journal of Medicine, 286, March 16, 1972--Primary Care is defined as internal medicine and pediatrics, only.

26. Somers, Anne P. "The Kaiser-Permanente, Medical Care Program--A Symposium." The Commonwealth Fund, March, 1971--"Primary Care" includes family and general practice, obstetrics/gynecologists, pediatricians, and internists; surgical specialties exclude urology; data from Northern and Southern California components averaged.

27. Sullivan, M.S. Health Manpower Sourcebook. Health Services Education Council, San Jose, California, 1974-- Contains results of 1972 Medical Economics Survey.

28. U.S. Department of Health, Education, and Welfare. Public Health Service, Bureau of Health Manpower Education, Health Manpower Perspective, 1967. Washington, D.C., USGPC, 1967, Publication No. 1667.

29. Walters, J.H. "Maternity Care in the Future--The Canadian Picture." Journal of Medicine, Williams and Wilkins, Co., 1970--Based on population projection which takes into account the projected percent change in the female component of the population.

Note: As indicated above, most references provided estimates of specialists needed; based on information provided in the sources, the respective population ratios were computed.

The attributes of the manpower-population ratio method--its simple data requirements, low cost, ease of understanding and application--explain its appeal and popularity. However, one should be aware of its basic limitations. To assume that population size explains manpower requirements not only ignores important influences that do not operate through population, but also changes in all the factors that impact on services demanded or needed by the population. Such variables as population density, the organization of the delivery system, the money available to pay for health services, and the productivity of manpower are examples of factors that are overlooked in the ratio method. In using the ratio method, the planner assumes, explicitly or implicitly in the choices of the ratio, that these variables operate in his situation in the same way as in the situation from which the ratio is selected. Despite these caveats, it should be pointed out that other more sophisticated methodologies may use the manpower-population ratio as an input in preparing their estimates.

Professional Judgements. Another method of estimating requirements is to obtain professional judgements as to the amount and type of care required to diagnose and treat specific illnesses and conditions as well as to provide preventive services. The method can be complex or comparatively simple. The illnesses and conditions for which manpower needs are developed may be very detailed, or they may be only broad visit-based categories. The results may be calculated to develop manpower requirements for a particular specialty or aggregated into requirements for all physicians. They may be based on actual visits or man-hours normally expended (i.e., utilization based) or they may be based on medical need for an illness, disease, or specialty.

Because of difficulties in obtaining the expert judgements needed, the vast amount of data needed about the population served, the services utilized or needed and the health manpower providing the services, and the length and complexity of the methodology, means that this approach is seldom used. The most extensive use of this method was in the Lee-Jones study of 1930. 3/ In this study, expected incidence rates were developed for a number of broad disease types, and the number of physician hours required to diagnose and treat each disease type were estimated from a physician opinion survey supplemented by patient records. Hours of physician time needed were aggregated over all disease categories and converted to numbers of physicians.

A recent study by Yale University School of Medicine 4/ estimated the number of physicians needed to provide "good" primary medical

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3/ Lee, Roger I. and Jones, Lewis W. The Fundamentals of Good Medical Care. Chicago, University of Chicago Press, 1933.

4/ Schonfeld, Hyman K, Heston, Jean F., and Falk, Isidore S. Number of Physicians Required for Primary Medical Care. The New England Journal of Medicine, 286, 571-576, March 16, 1972.

care. The data on number of services and time per unit of service were obtained from interviews with physicians. The data on incidence and prevalence of diseases and conditions requiring care were developed from information from the National Center for Health Statistics. Similar types of studies have been done for other health professions, such as optometry and podiatry. This type of method tends to be unrealistic since no recognition is taken of the economic demand for services, nor of the way in which the services estimated are actually being provided by the existing manpower.

Health Needs. Another method, similar to the professional judgement approach, consists of estimating health manpower requirements based on the health status of the population in the planning area and the manpower needed to attain and maintain "good health" for that population. A mass of information is needed. On the services side, detailed data are needed on the health status of the population and the volume of services needed to provide the care required to maintain and improve that health status. On the manpower side, detailed data are needed on the time required to perform various services and on the productivity of each health worker. The main advantage of the health needs approach is its logical basis of "what ought to be." Major disadvantages are the difficulties of measuring general health status and defining health needs, since experts differ widely among themselves in these areas. Also this approach requires detailed, disaggregated and complete data on total needs, as well as highly sophisticated computational techniques. It is therefore likely to be extraordinarly expensive and time consuming, and impractical for most planners to seriously consider.

Economic Demand. The economic demand approach to estimating requirements focuses on the "effective" demand for health care--the willingness and ability of consumers to pay for health services--as the basic determinant of the demand for manpower. Manpower requirements are derived from an estimate of the monies available from all sources to pay for care, including wages and salaries, or from an estimate of the services consumers are willing to buy, taking into account the tasks performed and the productivity of health personnel. Effective demand for manpower may be elicited from employers or analytically deduced from health expenditures or service utilization data.

As indicated, a variety of techniques may be used to calculate the economic effective demand and to convert this demand for services into manpower requirements. A survey of employers or an area skill survey is one approach. Another is to analyze empirical evidence of the utilization of services by population groups in relation to measures of disease or illness, personal income and other health system determinants. The most sophisticated techniques employ mathematical models, using regression analysis, mathematical programming, and simulation methodologies. These, too, are often impractical, costly and time-consuming for a planner to use.

The economic (effective) demand approaches have the advantage of estimating requirements that relate to job opportunities. When the

planner's frame of reference is the manpower demanded in the labor market, he properly turns to these methodologies. However, there are situations where service targets or health needs, not effective demand, is the key determinant, as in assessing the impact of a proposed program in public or environmental health. Moreover, most of the economic demand methodologies require substantial data, technical expertise and financial resources.

Utilization. Utilization of services and manpower is sometimes used as a proxy for effective demand, although the two differ according to the amount of unfilled demand, which is not directly measurable. This "quasi effective" demand for services may be identified from utilization records, under the assumption that use of services indicates the level of consumer demand, including the perceived medical need and the willingness and ability of the consumer to pay for these services. In this method, the estimate of health manpower requirements is derived from the estimate of the demand for (or utilization of) services. The demand for (or utilization of) services in turn is based upon the pattern of service utilization of each group of the population and the number and characteristics of the persons in that group.

Again the data requirements are extensive. They include data on the population of the area by demographic characteristics, the manpower requirements by type of care (doctor's office, hospitals, other institutional care, laboratory, pharmacy, and other types of services), and information on the utilization of services by demographic characteristics of the population and by type of care. However, where local data on utilization of services do not exist, national data on physician's visits and dental care provided by national surveys (National Center for Health Statistics) may be used as proxies.

Vacancies. The use of vacancy data is one of the most popular ways of estimating requirements, but generally only for nursing and allied health personnel who are employed mostly by institutions. The method is sometimes called an "area skill survey" or employer survey. In this approach, information is gathered from the best informed respondents-- employers--in recognition of the fact that they should know better than anyone else how many workers they need, i.e., would hire, at some point in the future, and the considerations that go into these decisions. This method answers the basic questions: How many job openings are there today and for which occupations? How many are filled? Part-time, full-time? What are the plans for employment expansion? How many jobs will be available or open in the future? In addition, however, the method can collect additional pertinent data, e.g., statistics on facility size and occupancy and on institutional training programs and educational activities.

The strong points of the employer survey approach is that the source of information is theoretically the best informed respondent, especially for the short term. In addition, relative to other methods, data collection is simple and inexpensive. Another advantage of the method is that it takes account of the economic climate of the

individual planning area and thus tends to be more practical than some of the other methods for measuring requirements for health manpower on a more general basis.

However, there are inherent weaknesses, both operational and conceptual, in this approach. Some vacancies exist because employers may be offering jobs at less than the going wage, which do not attract workers even though they are available in the market area. It is also often difficult to identify every employer in the population to be surveyed. The sampling frame, therefore, may not cover the universe. The number of respondents is critical but unpredictable since respondents may elect not to respond for a wide variety of reasons. Consequently, there may be unmeasurable sampling errors. Adjustments for nonrespondents may require information on the characteristics of nonrespondents that are not available or are costly to obtain.

Response error is difficult to avoid: the particular respondent who is filling out the questionniare--someone like an administrative assistant in the personnel department--may not know some of the answers; the data requested may be too difficult to obtain from the records; the respondent may not be motivated to respond but may view the survey as an unproductive, irrelevant activity; and the data collection instrument may be so long and so complex that the willing respondent inadvertently errs. When employers deal entirely with their own needs for growth, turnover, etc., there is also a possibility of overlapping or duplicative needs or losses because of the narrow framework in which each respondent operates. Similarly, ther is no common underlying set of assumptions about common considerations, such as the size of gross national product, health expenditures, etc. Such underlying assumptions should be provided to employers whenever such surveys are conducted, and exceptional care should be taken in developing questions and analyzing responses.

Essential data requirements for this method are current employment and budgeted vacancies for each health occupation in each health care setting. In addition, for an understanding of the functioning of the labor market, information should be gathered on job descriptions, wages, demographic and educational characteristics of workers, turnover, and length of time jobs are vacant. Data on characteristics of the health care setting as e.g., (for hospitals) number of beds staffed and not staffed, number of inpatient days, and plans for expansion are also important.

Health Manpower Education

As part of the picture of current health manpower supply, the health planner should also obtain information on the institutions in his area that are training health manpower. Such information might include type of control, sources of financial support, capacity, physical facilities, faculty, admission policies, geographic sources of students, type and location of practice of graduates, educational philosophy, etc. The number of students in each year of the training

program and their demographic characteristics and sources of support will provide valuable insights about potential health manpower supply, even though part of that supply may be trained on-the-job or outside the immediate area. There are many other aspects of educational institutions that need to be understood in order to provide a framework for manpower analysis.

Determining Future Health Manpower Supply and Requirements

Projections of health manpower supply and requirements necessitate not only data on the present manpower situation but also on how that situation has changed and may change over time. In addition to the supply and requirements data already mentioned-- such as characteristics of the population served, characteristics of practitioners, services provided, and requirements standards-- a whole panoply of other information is needed. These additional needs involve, on the supply side, the manpower inflows and outflows of graduates and practitioners, such as deaths, retirements, and inmigrants and outmigrants. On the requirements side, changes in the characteristics and health status of the population served, developments in the health services delivery system, and provider productivity changes are needed to make projections.

The health planner's picture of current health manpower supply and requirements in the planning area serves as the basis for the move into the future. This is done largely by building on the current area profile and using past trends to understand the dynamics of and changes in the system. This does not mean that the health planner may simply extrapolate past trends into the future. The trends of past do not always lead inevitably into the future; many events of the past do not recur and many trends do not automatically continue. The causes of past changes need to be unearthed and understood. Then, assumptions made on the continuation or modification of past trends into the future have more validity. This section deals with those analytical and data needs peculiar to projections.

Supply Projections

Estimates of the future supply of health manpower must measure the movement of personnel into and out of the current supply. The additions or inflows to supply are largely graduates from education and training programs, but they may also be transferees from other geographic locations or newly trained personnel from other occupations, or workers reentering the labor force. The losses or outflows are more clear--deaths, retirements, and transfers to other areas and other occupations. Re-entry is especially important in occupations with large numbers of women, e.g., nursing, pharmacy, the allied fields.

The relative importance of the several determinants of supply varies according to the specific health occupation, the sources of new supply, and the means of generating that new supply. Among the health occupations requiring long periods of training (physicians and dentists, for example), the capacity of the educational institutions

is the long-range constraint. The capacity of the schools is not a static constraint, however, since places can be made for additional students, although the lag between planning for new capacity and output of additional health workers may range from a few to as many as 10 years.

For physicians, the rate of immigration of foreign-trained physicians can be almost as important as the number of graduates of U.S. medical and osteopathic schools in determining the future supply. Among nurses and other female-dominated fields, the inactive segment provides a major potential addition to the supply, part of which may be responsive to a return to the labor force if pay and working conditions are made attractive enough.

Graduate Inputs to Supply. The data needed for graduate inputs to supply depend to some extent on the length of the projection period--long-range projections require additional types of data. For projections covering only a few years, inputs of graduates can be estimated from the numbers of students in the entering classes of health occupations training programs for the current and immediately past years, taking into account an attrition factor. For longer projections periods, it will be necessary to obtain data on the pool from which applicants to these training programs are drawn and to project independently first-year enrollments. This will involve data on college graduates for most health professions and high school graduates for allied health occupations, as well as estimates of the impact of new legislation--Federal, State and local--on future enrollments. An important source of information of use in projecting the flow of students into health professions training is the continuing study of the American Council on Education of the career choices of college students, and the population and labor force projections prepared by the Bureau of the Census and the Bureau of Labor Statistics.

Deaths, Retirements, and Re-entrants. Estimates of losses to the health manpower supply from deaths and retirements can best be calculated in two stages. Losses due to mortality can be estimated by applying sex-age-specific mortality rates from life tables to the number of health personnel in that sex-age group to obtain the expected number of deaths. A refinement of this method is to use mortality rates specific for the health occupation for which projections are being made. Such data are only available for a limited number of occupations however. To estimate losses to the supply from retirements, working life tables may be used. Since such tables are not available for all health occupations, proxies must frequently be employed by the health planner.

While re-entrants to the labor force may be a factor in supply projections for any health occupation, the numbers are probably significant only for those occupations with large proportions of women. The best example is professional nursing where a large pool of inactive nurses exists--30 percent of all licensed professional nurses in 1972. Some of these inactive workers might be attracted back into the labor force or into a particular occupation if working conditions

or personal circumstances were different. Data on personal and professional characteristics of inactive workers and the threshhold conditions that would return them to active status are important but difficult tc obtain.

Geographic and Occupational Mobility. Some of the problems encountered in the measurement of both geographic and occupational mobility were discussed earlier under current supply of health manpower. Because of the expense and difficulty of obtaining data to measure mobility, proxies must often be used. For those occupations which are licensed, applications for licensure on the basis of reciprocity or endorsement may be used as one proxy measure of geographic movement between States.

When data to measure mobility are not readily available and a longitudinal study is not feasible, an alternative procedure is to estimate net changes in the supply based on historical trends. This approach circumvents the need to measure separately the components that make up additions and losses to the supply. In adopting this method, the health planner assumes that the relationship between inflows from new graduates, immigration, and occupational transfers and the outflows from deaths, retirements, and emmigration will continue to follow past trends. The data needed for this method are the numbers of active workers in a specified occupation for the planning area for a number of years in the past, preferably by age. From these data, a trend equation can be calculated which may then be used to estimate future supply. Of course, if there is a drastic change in the planning area, such as opening of a new school, the method may lead to inaccurate projections.

Requirements Projections

Manpower estimates for future requirements can generally be derived using the same methodology as for current requirements, with the addition of future population and delivery system parameters. The possible methods are practitioner/population ratios, professional judgements, health needs, economic demand, utilization rates, and vacancies. It is the time frame, not the technique, that largely differentiates current from future requirements. The validity of requirements projections will depend upon the realism of any assumptions about the future and the quality of the data for the past and present.

Reasonable estimates of future requirements for health manpower may be developed from an analysis of the detailed characteristics of the population and its demand for health care; the organization of the delivery system, and the pattern of health manpower staffing and utilization; the inflows and outflows of sources of supply and the functioning of the labor market. However, with regard to each field of analysis, area statistics (and in many instances, national data) are limited; for example, area data on health care needs, services used, medical expenditures, labor productivity, the personal characteristics of workers and their relative wages are seldom available. Not only are current data missing but reliable information

about the past may not exist, and what is available may not be consistent or comparable over time as a result of different definitions, coverage, time span and data collection methods. Moreover, the sources of information may be misleading; for example, certification registries and licensure records overstate the supply by including professionals not in the labor force or in the local area, but omit employed practitioners who are not credentialed. The data problem is magnified by the proliferation of health occupations and titles, numbering in the hundreds, with the same job title used at times to describe slightly different sets of functions and responsibilities. To compound the problem, disaggregated data for relevant labor market and health service areas are woefully inadequate; most manpower data have been collected at the State and national levels.

As with current requirements estimates, no simple guidelines nor consensus exist about the most appropriate methodology for projecting requirements. The lack of agreement reflects the general lack of knowledge about the forces influencing the demand for health care, about the conversion of that demand into manpower requirements, and about the supply responses to changing circumstances. It also reflects differing opinions about concepts and definitions. Even when there is agreement on factors that must be measured, there is a vacuum in our knowledge of how best to proceed. For example, we know that head counts by discrete occupations are misleading; that the health professions function in a complex web of complementarity and substitutability. But we do now have operationally practical techniques to measure the manpower input in health teams or other staffing patterns. However, there is no accepted method for measuring the output of health workers, nor even agreement on the output to be measured--visits, hours, expenditures, income, etc. In other words, there are inadequate input and output measures to translate in an accurate way the manpower demand and supply into the demand and supply of services and vice versa.

Projecting local conditions into the future is an awesome task. Future requirements for manpower in the health service industry will be influenced by policies and programs whose impact can only dimly be seen, e.g., the introduction of a national health insurance plan or the spread of health maintenance organizations. Similarly, the supply of manpower will be influenced by new efforts, such as the direction of federal support for health manpower training and education, task delegation, or increased labor force participation of women. In addition to the broad forces operating nationwide, the local planner must take into account specific local factors and their effect upon health manpower in the future. Moreover, the adequacy of the future supply in relation to future demand for health manpower will depend in large part on geographic and specialty distribution, subjects of which we have limited understanding and information.

Changes in Characteristics of the Population. The need and demand for health services and therefore for health manpower are different for populations with different age, sex, race, and income characteristics. Therefore, projections of health manpower

requirements must take into account changes in the composition of the population of the planning area. This is difficult to do accurately at the national level, but at the State level, predictions become even more subject to error, and at the sub-State level, it is extraordinarily difficult to make accurate projections. The local area health planner must either assume that national or State projections can be used as proxies for his area or produce his own projections with accompanying caveats.

Changes in Services Demanded. Changes in the demand for services often result from changes in the income level of the population which then result in greater or lesser ability to pay for services. Changes in the proportion of the population covered by health insurance or in the type of coverage and deductibles also affect demand for health services. For example, demand for types of care covered by health insurance tends to be higher (because of lower out-of-pocket costs) than for non-covered care. An increase in the educational level of the population may lead to a greater awareness of the value of health services and so to an increase in demand for services. Cost of services--in both time and dollar terms--strongly influences demand levels as well.

There is also a tendency in health services for supply to generate its own demand. In a relatively affluent society with income for discretionary spending, the presence of a physician, a hospital, or mode of treatment, tends to activate demand. Technical advances may change the demand for health care and for the numbers and types of the health manpower to deliver it. Therefore assumptions must be made about possible changes of this kind and their incorporation into requirements projections.

Changes in Practitioners' Productivity. Even if the demand for health services remains constant, the requirements for health manpower may change because of changes in practitioner productivity, task delegation, and changing methods of health care delivery, such as a shift toward group practice. For example, delegation of routine tasks by highly trained professional personnel to less highly trained assistants could very well decrease the requirements for the former but increase requirements for the latter, although not necessarily on a one-for-one basis.

Technological advances which lead to the substitution of equipment for manpower may also affect practitioner productivity. The advance of technology also may increase the efficiency and productivity of health personnel and services can sometimes be provided by fewer, and often more specialized, personnel. For example, while biochemistry has greatly increased the types of laboratory tests and their uses in diagnosis, the development of sophisticated equipment such as the autoanalyzer has made it possible for a technician to perform many tests on a blood sample more speedily and at relatively lower cost than formerly. Increased technology may also, however, increase manpower requirements; for example, development of and widespread use of dialysis equipment has resulted in growing employment of dialysis technicians and nurses. Thus technology on the one hand may increase

the demand for health services, and on the other hand may raise productivity and thereby reduce the number of persons required to provide services.

Impact of Changes in Health Care Delivery System. The system for the delivery of health care services is composed of the facilities, the personnel, and their relationships to patients in the organization, to the administration, and to the financing of health care services. Delivery of physicians' services on a fee-for-service basis through the offices of individual physicians is different in many important ways from delivery through the outpatient department of a hospital or the clinic of a prepaid group or HMO. These differences influence not only the overall demand for services but also the amount and type of services being provided and the number and occupational mix of the personnel providing them. Shifts in the utilization of services between, for example, inpatient and outpatient care, or between treatment and prevention of illness, produce corresponding shifts in demand for health service personnel. One study of the impact of HMO's on future health manpower requirements found that fewer physicians and nurses but more eye-care workers, dentists, health administrators, and some allied health workers would be needed.

Impact of Changes in Payment for Services. All health planners must take cognizance of the impact of the national health insurance program that appears certain to be enacted in the next few years. The removal or lowering of the financial barriers to care will inevitably shift the demand for medical services and the demand for manpower upward but not necessarily equally across the board. The differential impact on services and on manpower will reflect the coverage, beneficiary contributions, and provider reimbursement formulas that are adopted, on the one hand, and the price elasticity of demand, on the other. In the face of the uncertainties about the kind of national health insurance program that will finally emerge and of the changes in utilization as consumers react to lowered medical prices, the conceptual problems the planner faces in adjusting his manpower estimates for the impact of national health insurance are very great. However, one study of the impact of national health insurance on future health manpower requirements applied an effective demand methodological approach, assuming constant utilization rates and changing population and income. Three different demand models were structured. Several types of demand curves, alternative national health plans, and several levels of price elasticity were assumed. Changes in the utilization rate without national health insurance and under the archetypal plans were determined. Demand shift factors were calculated and applied to target year manpower requirements, in order to estimate the impact of the alternative health insurance schemes on manpower.

Effects of Changes in Supply. Health care is one of the sectors of the economy in which supply is an important determinant of demand. However great the need, effective demand presupposes a supply of facilities and personnel. Moreover, the availability of health services as the consequence of the discovery and application of new

medical and dental technology in itself generates a demand, as we have seen again and again. This is particularly true with the proliferation of specialized services. In the face of the consumer's imperfect knowledge, the physician and dentist become the professional adviser or even the decision-maker: Once the consumer has placed himself in the physician's hands, the physician plays a major role in deciding the amount of service consumed.

The influence of supply on demand is nowhere as clear as in health resources planning. Whenever services are limited by the unavailability of facilities or personnel (e.g., inadequate hospital capacity or lack of the full range of medical/dental capabilities), as may be the case in rural or remote areas (villages in Alaska are extreme examples), the effective demand is truncated accordingly. Planning expansion of the supply of services must take account explicitly of the effective demand for services and personnel which will be activated by the supply. (There is some information that indicates that little or no increase in supply is forthcoming when demand rises.)

Assumptions for Projections

Both supply and requirements projections depend on many alternative assumptions about a large number of factors. The resulting combinations can lead to a multitude of alternative estimates, no single one of which is the best estimate for all purposes. A range of estimates for both supply and requirements needs to be developed in order to provide the most reasonable alternative possibilities for planning and policy determination.

Since the particular assumptions made for each element in the projection of health manpower are so important in determining the outcome, the health planner should clearly state each assumption used, together with the basis or rationale for the assumption. This will enable others to accept or reject his projections depending on whether they agree with his various assumptions. Spelling out the assumptions used will also permit other health planners and analysts to replicate health manpower projections for their own areas.

Use of Models

The health planner should attempt to employ health manpower models as operational tools. These models should be used on a continual basis by health planning analysts. Continual use will generate an inventory of information that can be used to address decision problems in a responsive manner.

Many different types of models have been developed geared to specific methodologies and aspects of health manpower planning. The health planner must choose the model or models best suited to his purposes. A recent report prepared for the Bureau of Health Manpower

may be helpful 5/ this two-volume report includes descriptions of 56 models of many types and an indepth analysis and evaluation of two large-scale models.

Priorities for Data Collection

The priorities for data collection for health manpower planning will differ from place to place, depending both upon the data already available and the special needs of the health planners. The amount of data to be collected will be determined, at least in part, by the availability of money and staff. There is no single priority order that can possibly apply to all areas or to all planning efforts, since the priorities are determined by data already available, the resources that can be expended, and the skill and expertise of the planner, not to mention the policy questions that are of most significance in the area. Overall, however, it can be said that the primary need is for an understanding of how the health care system works, and the role that manpower plays in that system. In specific manpower terms, however, the first step is to assess the minimum amount of data needed and available, and whether suitable data are presently being collected elsewhere. Only then should a system be set up for collection. If money and staff are available, additional data needed for more accurate and detailed projections can be added to the collection plan. In addition to providing the base data for manpower projections, the data system can become a research tool to explore the impact on health manpower of changes in the evolving health manpower delivery system.

In general, the highest priority should be given to inventories of active practitioners in office-based and hospital settings. Also of great importance are utilization data and data about the population served. Emphasis should be on obtaining information about those things that are peculiar to the planning area, since national data may be used as proxies in many instances where the local area does not appear to differ much from the national picture. A list of some sources for proxy data is shown in the bibliography on page ___.

The development of a uniform data base for State and local health manpower planning by New Jersey should be useful to other planners faced with similar lack of data. 6/ The major steps taken in New Jersey included setting up an interagency advisory committee representing State education and health departments, comprehensive health planning agencies, regional medical programs, State medical and hospital associations, and the various universities and colleges training health manpower. This committee determined a minimum data set created data collection processes for both licensed and

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5/ Vector Research Inc. A Health Manpower Model Evaluation Study. Vol. I. Analysis of Health Manpower Models; Vol. II. Health Manpower Model Inventory. DHEW Publication No. HRA 75-19.

6/ Dars, Lewis and Tomson, Jon. Development of a Uniform Data Base for State and Local Health Manpower Planning. Trenton, New Jersey, State Department of Higher Education, 1974.

nonlicensed health manpower which provided for periodic updates, developed computer software to generate health manpower information, desseminated health manpower information, created computer data files accessible to bona fide users, and developed mechanisms to insure continuity of the system.

Conclusion

The task of the health manpower planner is not easy. He is faced with a lack of adequate information about current supply and requirements for health manpower, and there is no consensus among experts as to the best way to proceed. Since a major part of his task is to try to ensure that there will be a balance between the future supply and requirements in his planning area, the health planner must understand the current picture before he looks too far into the FUTURE.

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