Planning for the Distribution of Personal Health Services

VICENTE NAVARRO, M.D., D.M.S.A., Dr.P.H.

PLANNING for personal health services involves four steps, closely related but conceptually different: the elaboration of the plan, its acceptance by those affected, its implementation, and its evaluation. These four steps, united in a cyclical time sequence, are emphasized differently, depending on the social, political, and economic environment in which the planning takes place. In environments unfamiliar with or unreceptive to the concept of planning, discussions among planners tend to focus on acceptance and implementation, while in environments with a clear commitment to planning, the focus is primarily on the elaboration of the plan and its evaluation. Differences in the importance accorded to each of the four steps motivate much of the lively discussion on the purpose and value of planning (*1*).

This paper reviews the methods used in the first step, the elaboration of the plan. It deals with planning for adequate and appropriate distribution of health resources. The six methods described are based on (*a*) morbidity, (*b*) mortality, (*c*) utilization, (*d*) distribution, (*e*) system performance, and (*f*) system structure. These methods were developed in a variety of situations that differ in time, location, and country.

Methods Based on Morbidity

Although the level and structure of morbidity are believed to be important determinants of health resources utilization, morbidity data often have been overlooked in the planning of health services.

Two sequential steps are to be followed in planning health services in relation to morbidity: first, to survey the extent and character of so-called "need" for medical care as determined by the morbidity of the chosen population—this morbidity can be either "perceived" by the individual or "defined" by the health professional—second, to translate the need defined by morbidity into health resources.

The use of data from morbidity surveys of general populations for planning purposes has been described elsewhere (*2*). The conversion of morbidity data into measurement of health resources needed usually has relied on subjective judgment—"expert professional opinion."

Several investigators in different countries—Lee and Jones (*3*) and Falk and associates (*4*) in the United States, Kalimo and Sievers (*5*) in Finland, and Forsyth and Logan (*6*) and Barr (*7*) in the United Kingdom, among others—have surveyed morbidity patterns in either general or specific populations, for example, hospital populations, and have calculated needed health resources to cope with the morbidity reported.

Among the most detailed studies is that reported by Popov from the Soviet Union (*8*). This study included several cities and rural dis-

Dr. Navarro is assistant professor, department of medical care and hospitals, Johns Hopkins University, Baltimore. *The study was supported by a research grant (CH-00158-04) from the National Center for Health Services Research and Development, Public Health Service.*

tricts in which "experts" on delivery of medical care considered that demand for personal health services was met; for example, there were no waiting lists for hospitalization. The extent of satisfied demand was indicated by the amount of utilization of the personal health resources. For the survey every member of the community was given a card, on which all use of medical and hospital facilities was recorded for an undetermined period of time.

Following the utilization survey, a health examination survey was carried out on the whole population by medical specialists. The return for this survey, according to a summary of Popov's report by Burkens (*9*), was high but precise figures were not given. Elderly people in particular were reluctant to cooperate in such studies. The objective of this massive health investigation was to determine the extent of the "iceberg of need" (*10*), the submerged as well as the visible parts, based on a professional definition of need.

The two Soviet Union surveys of utilization and need were compared and analyzed; "overuse," "underuse," and "misuse" of health resources were estimated. To make this judgment, standards for use of health resources for different types of morbidity were defined by "experts" on the delivery of medical care. They calculated, for instance, the average number of hospital beds required per year per 1,000 population from the formula:

$$K = \frac{A \times R \times P(N - 3\sqrt{N})}{365 \times N \times 100} \qquad (1)$$

where

- K is the average number of hospital beds required per 1,000 persons per year.
- A is the morbidity (conditions or persons) per 1,000 persons estimated from the utilization and need surveys.
- R is the percentage of A (conditions or persons) judged by the experts to require hospitalization.
- P is the average length of hospital stay in days.
- N is the average number of currently available beds in all hospitals in the region under survey per year.

In this mathematical formula two assumptions are made: (*a*) that the number of beds available equals the number of beds demanded and (*b*) that the demand for beds, reflecting the number of hospitalizations, follows a Poisson distribution.

Among the limitations commonly attributed to the method of estimating potential demand for health services, based on measures of need determined by morbidity surveys and defined by expert standards, are the following.

First, the method uses as the basis for planning the highly subjective concept of need instead of the more objective one of demand. The fact that need exists does not imply that it will be expressed as demand for services.

Second, adequate morbidity data are scarce (*11a*, *12a*). In a recent review of morbidity statistics said to be available in 98 countries, Smith commented that "administration and planning of services in most countries lack this kind of basis [morbidity and utilization statistics] to an extremely serious extent" (*13a*). The present reality is that "health administrators faced at first with the virtual necessity of doing without an adequate numerical basis for their decisions have now come to feel that they can dispense with statistical information. The results of this may be seen in many countries today where the available services bear very little relation to the health needs of the communities they are supposed to serve" (*13b*). The main reason for this scarcity is the high cost of obtaining reliable morbidity information; however, this cost should be weighed against the benefits obtained from the data. The increasing pressure for morbidity and utilization data is the result of their demonstrated value, not only for planning health services but also for epidemiologic surveillance and for studies of the effects of medical and social intervention (*13b*).

Third, the method requires a consensus of medical opinion on how best to care for each condition. This consensus is difficult, if not impossible, to reach in some cultural environments (*11b*, *12b*, *14*).

Methods Based on Mortality

In their calculations of required health resources, some authors have preferred to plan on the basis of mortality data rather than morbidity data (*15*, *16*). The reasons given for this preference are (*a*) mortality statistics are more reliable than morbidity statistics, (*b*) mortality data are available annually for most localities,

whereas morbidity data are not similarly obtainable, and (*c*) when morbidity data are available, translation into health resources required to meet need or demand, or both, requires the difficult process of establishing criteria for services.

The assumption made in all planning based upon mortality data is that there is a constant ratio of health resources utilization to mortality. However, technological, demographic, and socioeconomic changes, among others, condition changes in utilization as well as changes in mortality, and hence the validity of the hospital bed utilization to mortality ratio may be questioned.

Methods Based on Utilization

In the approach based on utilization, the present use of personal health resources is taken as a reliable indicator of future use, and the objectively quantifiable concept of demand is preferred to the subjective notion of need.

Within this approach, two closely related concepts must be considered. The first is "adequacy of resources"—the availability of sufficient facilities to meet the demand for them. The second is "distribution and coordination of resources"—the geographic and functional relationships between resources and population.

Methods based on demand. Among the methods designed to calculate the health resources required to meet future demands, the most frequently used has been extrapolation of the present ratio of health resources to population (conditioned by current demand) to the future projection of the population (*17–19*). This method takes into account only increased demand due to demographic growth. It assumes that the workloads carried in the past are the best and most objective guide to the requirements of the future (*20*). Sometimes this demand is corrected to exclude overuse and include underuse, according to expert judgment. The main reservation to this correction, however, is that definitions of overuse or underuse are matters of opinion and depend on the criteria selected; they may reflect value judgment regarding the purposes of the health resource.

Bailey (*21*) introduced the concept of the "critical number of beds," which has been widely used in England (*22*). This is the number of beds that will just keep pace with current demand. It is calculated by noting the change in the length of the waiting list for hospital admissions over a given period of time and adding this change to the satisfied demand, that is, the patients actually admitted to the hospital during the same period.

The method is illustrated by the following hypothetical utilization experience for a general hospital by a population of 10,000 for a 1-year period (*20a*).

Satisfied demand—actual admissions (1)	1,070
Discharges (2)	1,047
Total demand for hospitalization—actual admissions plus waiting list (3)	1,094
Desired change in waiting list to meet all unsatisfied demand (4)=(3)−(1)	+24
Average length of stay in days (5)	16.3
Bed patient days (6)=(5)×(2)	17,066

The critical number of hospital beds per a population of 10,000 is calculated from the formula:

$$C = D \times S \qquad (2)$$

where

- C is the critical number of hospital beds,
- D is the daily demand for hospitalization, and
- S is the average length of stay in the hospital.

An example is:

$$C = D \times S = \frac{1{,}094 \text{ total annual hospital admissions}}{365 \text{ days}} \times 16.3 \text{ days} = 47.2 \text{ beds}$$

To determine the desired occupancy rate (total available hospital beds per total occupied hospital beds), Bailey (*21*) and McPhee (*22*) divided hospital admissions into elective and nonelective (emergencies). They observed that elective admissions tend to follow a normal distribution. They defined the occupancy rate by choosing a desired turnover interval, that is, the average number of days a bed is vacant between successive hospital admissions. They considered nonelective admissions to follow a Poisson distribution and accordingly they chose the occupancy rate from prepared tables on "variation of beds required based on a Poisson distribution" (*23*).

Recently, Drosness and associates (*24*) published one of the first studies in the United States on variations in daily hospital bed census in an entire municipality (Santa Clara County, Calif.). They concluded that for all hospital

bed units studied (medical, surgical, obstetrical, and pediatric) a normal distribution gives a more accurate description of variation in daily census than does a Poisson.

Planning based on these methods of extrapolating into the future past and present demand can be criticized because it not only maintains the status quo but it also magnifies the size of its defects. Another shortcoming of such methods is that they usually do not take account of shifts in demand related to socioeconomic changes in the population or to scientific and technological developments in medicine.

A further reservation about the use of these methods has been created by Roemer's (*25*) and Newell's (*26*) findings that supply appears to promote demand, although Rosenthal (*27*) and Sigmond (*28*) questioned these findings. This divergence of opinion seems to indicate that there is as yet no clear understanding of the effect that supply has upon demand for hospital beds.

Comparative method. Similar to the methods based on demand, the comparative method takes the ratios of resources to population from an area or region where health resources are considered adequate to satisfy demand and applies these ratios to another population (*29*). This method suffers from the same defects as the previous one, as well as two others; few areas or regions are truly comparable, and even fewer where the demands, to say nothing of the needs, of the population are satisfied.

Methods based on analysis of demand. A more sophisticated approach than simple extrapolation to the future either of present demand or of ratios of resources to population is that based on analysis of present demand (*30*). This method represents, in fact, market analysis of consumer use. Brooks and associates (*31*) predict future demand by multiple regression analysis of 117 variables, such as demographic data, mean life expectancy, mean effective buying income, average length of stay in hospital, average occupancy rate, ratio of physicians to population, and others. Monthly figures are collected for each of these variables for 5 years, and then multiple regression techniques are applied to establish the relation between the number of patients in each hospital department and the 15 to 20 most important factors. The number of patients expected per month in each department can be predicted by estimating the value of the factors for that month. The number of beds needed by departments or by the whole hospital is estimated by multiplying the number of patients per month by the average length of stay and dividing by the average number of days in a month.

Feldstein and German use two methods: (*a*) extrapolation of present supply and demand and (*b*) in relation to estimates of population growth, analysis of selected socioeconomic factors that affect utilization (*32*). By predicting the future level of these factors they derive estimates of future hospital utilization.

Reinke and Baker have developed a new analytic method, the multisort technique, that improves the analysis of the effects of multiple demographic variables on utilization (*33*). Multiple regression techniques can be used to analyze effects of demographic variables, but interactions may be overlooked entirely or inadequately identified. Analysis of variance has proved useful in handling interactions, but uneven distribution of observations among cells creates orthogonality. The multisort technique is an approximation procedure that simplifies computations while maintaining the analysis of variance approach. The procedure assigns weights to cells for all factors, according to the rules for evaluating main effects; thus, the assessment of interactions is approximate but not tedious (*33*).

Swedish workers base their estimates of required medical and hospital resources on a demographic analysis of hospital utilization. Because of the polarized age distribution of the country, they are particularly interested in differences in utilization by different age groups (*34*, *35*). Swedish health planners therefore use an index, the "consumption unit," which reflects differences in utilization by different age groups rather than by the number of persons, for estimating future demand.

An example of the Swedish approach is presented in the Göteborg plan (*36*). The mean annual number of physician visits for each age group is related to the mean annual number of physician visits for all age groups (231.6 visits per 100 persons) to obtain the consumption unit, which measures the proportional consumption

Annual number of consumption units per person in the city of Göteborg, Sweden, 1967

Age group	Number of visits per 100 persons (V)[1]	Number of consumption units ($C.U.$)[2] per person
0–15	125. 0	0. 540
16–19	154. 0	. 665
20–29	196. 9	. 850
30–39	236. 0	1. 019
40–49	274. 9	1. 187
50–59	311. 1	1. 343
60–66	345. 2	1. 491
67 and over	308. 9	1. 334
Mean number of visits ($\overline{V}$)	231. 6	

[1] Data taken from Swedish National Insurance Board Study, 1963 (reference 35).

[2] $C.U.=\frac{V}{\overline{V}}$; for example:

$C.U.$ for age group 0–15 years $=\frac{125.0}{231.6}=0.540$.

per age group (right-hand column of the table). The total number of consumption units for the region can be estimated by multiplying the consumption unit for each age group by the number of people in Göteborg in each age group in 1963, 1970, 1975, and 1980.

By taking into account differences in the consumption of medical and hospital services by different age groups, the method gives more detailed estimates of future consumption than those estimates based on the growth of the entire population.

Methods Based on Distribution

The concepts of distribution and coordination refer to the geographic and functional relationships between resources and the population served. To study these characteristics two methods have been used: the "facilities-centered" (*37–40*) and the "population-centered" (*41*) approaches.

In the facilities-centered approach a group of facilities, usually hospitals, is surveyed to define the population served by these hospitals. This method requires collection of information about hospital discharges, according to patients' places of residence, for each hospital in the community or region being studied. For each hospital in the region, the proportion of its total patients from each small area (county, township, municipality) can be calculated and the percentage of the area's total population can be estimated. By applying the percentages for each hospital to the total population of each small area and adding them, the population served by each hospital in the region can be estimated. By estimating projected changes in the populations of these areas, one can predict future hospital use and thus future requirements for the whole region. The defect in this method is that it does not consider the influence of selective bias in choosing a hospital by residents in the same small areas.

Schneider (*42*) in the United States has described a conceptual model for evaluating the locational efficiency of health resources—physicians' offices and hospitals—using a facilities-centered approach in his analysis. The locational efficiency measures the costs of operating a hospital which may be attributed to its location.

The population-centered method is based on the analysis of the current patterns of hospital use by a defined population. The initial step is to define the survey population as the residents of a particular geographic area. The pattern of bed utilization for this specified population is then determined by analyses of bed-use data from hospitals both inside and adjacent to the defined area. This method measures current use of hospital beds rather than demand for beds.

The population-centered method has been used more often for planning hospital beds than for manpower planning. It has the advantage of fostering the idea of community care with the hospitals as an essential but not the only component.

Forsyth and Logan (*6*) have used both facilities-centered and population-centered methods in Barrow-in-Furness in the north of England. A factor facilitating the use of both approaches was Barrow's peninsular geography and consequent clear regional boundaries.

The study in the Soviet Union mentioned earlier (*8, 9*), which was based on estimates of morbidity and utilization, also used both of these methods. Engel (*43*) and Godlund (*44*) used a modification of both approaches in their plan for regionalization of the health services of Sweden. A similar approach was used more

recently in Göteborg (*35*). It was decided to centralize the super-specialties, such as neurosurgery, in one teaching hospital which would be the principal medical center of a region. Using hospital utilization experiences of different surveyed populations, as well as experts' opinions, the Swedish planners defined the desired ratio of super-specialty beds to population. By defining the minimal desirable size for the super-specialty units in regional hospitals, they were able to define the optimal size of a region. For example, if the experts defined the minimal size of a plastic surgery unit as 60 beds and the suggested number of beds for plastic surgery patients per 100,000 persons as 5.5, then the minimal size of a region that could generate enough patients to support a plastic surgery unit would be $(60 \times 100{,}000) \div 5.5 \cong 1$ million persons.

With respect to geographic distribution of regional centers and their size, the Swedish planners gave primary importance to the accessibility of the regional hospital center for the population living in the region. The constraints chosen as the basis for selection were travel times and costs. No person within a region should have to travel more than 4 hours round trip by car or public transport.

The travel times for alternative locations of regional centers were shown on isochrone maps. (Isochrones are lines which join points situated at similar traveling times from a given center. If travel cost instead of time is used, isochrone maps can also be used as travel cost maps, isodapan maps, since travel cost is proportional to travel time.) The isochrone maps for each alternative location were placed over the population projection maps for each future year. The population living within each travel time zone was then estimated. The location chosen was that which minimized aggregate travel times and costs.

Methods Based on System Performance

In planning personal health services based on analysis of the performance of the system, the required resources are determined by the amount and type needed to achieve a defined output, measured in terms of performance such as reduction or control of death, disease, disability, or discomfort. Effectiveness is the relationship between input and output in the system performance method.

Unfortunately, little is known about the effectiveness of different health services systems. Most analytic studies of health services have been concerned with productivity, expressed in terms of efficiency, but not with effectiveness.

The paucity of effectiveness studies is due to present limitations in knowledge of methods to measure the different variables in the output as well as in the input of the system and their interrelationships. Except in a few instances, relationships between the system and its performance are not known; even less is known about methods of quantifying them. For example, there is no evidence that providing X units of prenatal care will save Y children's lives.

The absence of objective measurement of the relationship between systems and performance explains the use of subjective measurements, such as the opinions of experts or the experiences of other areas or countries, as described in the earlier sections dealing with planning based on morbidity and mortality. Actually, subjective measurements may be regarded as variants of the system performance method. (The increasing use of panels of experts to develop quantitative estimates of phenomena in social services has been studied by the RAND Corporation (*45*).)

An example of the panel-of-experts approach is the method used by the Centro de Estudios de Desarrollo (CENDES) and the Pan American Health Organization (PAHO) in health planning (*46*). In this method the main goal is to decrease mortality by disease categories, subject to the constraint of cost. Although it would be possible to take morbidity into account also, only mortality is considered owing to the lack of data on morbidity. The first step is to establish a priority rating for each cause of death by disease category based on the incidence of death, that is, the proportion of deaths due to each disease category to total deaths. The relative importance of the disease category is measured by an arbitrary score based on age at death and the degree to which premature deaths caused by this disease could be prevented. This preventability is defined either by experts' opinions or epidemiologic studies.

For nonreducible morbidity and related nonreducible mortality, the CENDES and PAHO method defines two alternatives: (*a*) in the so-called minimum alternative, the future resources required are calculated by extrapolation of current demand determined by nonreducible diseases and (*b*) in the so-called maximum alternative, the future resources required are defined by experts' opinions of what resources should be provided to care for the present and prospective demand, regardless of cost. For reducible morbidity and mortality, the resources needed are divided into preventive and curative resources. The number of preventive resources required is defined by experts' opinions of standards of prevention needed, according to the minimum alternative, to keep morbidity and thus mortality at the current ratios, or, according to the maximum alternative, to reduce morbidity and mortality as much as possible, regardless of the cost.

The number of curative resources required is based in both alternatives on the ratio of utilization to mortality, that is, "a correlation between the mortality rate for each reducible disease and the hospital and consultation rates for the same disease" (*46a*).

In the United States, the Indian Health Service of the Public Health Service has developed a planning method that defines its objectives as quantifiable reduction of morbidity and mortality (*47*). The determination of health problem priorities is based on a Health Problem Index, which takes into account morbidity, mortality, and utilization for each category of disease. The resources required are estimated by the plan of action chosen, with choices based on a cost-benefit analysis of the different alternatives.

The difficulties in applying similar approaches in open health services systems, in contrast to the closed system of the Indian Health Service, have been discussed by Kissick (*48*). Several other studies have used a comparable approach for certain categories of diseases (*49*, *50*).

Methods Based on System Structure

System structure methods are based on the knowledge of the internal relations among the system's parts, and therefore they require knowledge not only of the system's static aspects—the counting of the system's parts and the measuring of their productivity as the number of services per part—but also of its dynamic aspects. They are based on the knowledge and understanding of the referral and transferral system, which provides the dynamic relationship among the system's parts. By considering the dynamic aspects and knowing the population defined according to the desired demographic or epidemiologic interest, or both, one can then speak of the probability (transitional probability) that a person will be in a particular flow from one part of the system to another.

Navarro and Parker (*51*) have described a planning model based on these concepts. The model, based on the Markovian process (*52*, *53*), is used to predict resource requirements, to calculate change in these requirements in simulated situations, and to estimate the best alternative for reaching a desired goal in the presence of a defined constraint. In "prediction" and "simulation" the required resources are obtained from the multiplication of the vector representing the utilization of health services by the transitional probability matrices representing the dynamics of the system. In the last application or "goal seeking" the problem solved is to minimize the "change" or "cost" subject to reach the desired goal. This minimizing of change or cost is the objective function in a mathematical quadratic program (*54*).

Williams and associates (*55*) have used a Monte Carlo technique to simulate present and future situations in a hospital outpatient clinic to improve its efficiency.

The advantage of the mathematical models in planning is that they allow greater clarity and precision than purely intuitive methods. Further, the use of probability models is essential to describe patterns of happenings that could occur with their relative chances of occurrence (*56*). This allows maximum flexibility to the planner to face the continuously changing health services system. The validity of these models, of course, depends on the validity of their implicit assumptions.

REFERENCES

(*1*) Myrdal, G.: Beyond the welfare state. Yale University Press, New Haven, Conn., 1960.

(*2*) Logan, R. F. L.: Assessment of sickness and

health in the community: needs and methods. Med Care 2: 173, pt. 2; 218, pt. 3 (1964).
(3) Lee, R., and Jones, J.: The fundamentals of good medical care. The University of Chicago Press, Chicago, 1962.
(4) Falk, I. S., et al.: The development of standards for the audit and planning of medical care: I. Concepts, research design and the content of primary physician's care. Med Care 6: 101 (1968).
(5) Kalimo, E., and Sievers, K.: The need for medical care: Estimation on the basis of interview data. Med Care 6: 1 (1968).
(6) Forsyth, G., and Logan, R. F. L.: The demand for medical care. Nuffield Provincial Hospitals Trust Publication. Oxford University Press, New York, 1960.
(7) Barr, A.: The extent of hospital sickness. Brit J Prev Soc Med 12: 61 (1958).
(8) Popov, G. A.: Questions of theory and methodology of health services planning [in Russian]. Ministry of Health of the Soviet Union, Moscow, 1967.
(9) Burkens, T. E.: The estimation of hospital bed requirements. World Hospitals 2: 110 (1966).
(10) Last, J.: The iceberg—completing the clinical picture in general practice. Lancet No. 7297: 28 (1963).
(11) Baker, T. D.: Dynamics of health manpower planning. Med Care 4: (a) 205; (b) 208 (1966).
(12) Klarman, H. E.: Some technical problems in area-wide planning for hospital care. J Chronic Dis 17: (a) 735; (b) 738 (1964).
(13) Smith, A.: Morbidity statistics. A report on current practice in member countries of the World Health Organization. Report of the 11th meeting of the Expert Committee on Health Statistics. Report No. H.S./W.P. 60.1. World Health Organization, Geneva, 1967, (a) p. 28; (b) p. 26.
(14) World Health Organization: Estimation of hospital-bed requirements. Report on a symposium convened by the Regional Office for Europe of the World Health Organization. Report EURO–295. Copenhagen, 1966, p. 8.
(15) Elliot, E. B., et al.: Hospital resources and needs. The W. K. Kellogg Foundation, New York, 1946.
(16) Commission on Hospital Care: Hospital care in the United States. The Commonwealth Fund, New York, 1947.
(17) Bane, F.: Physicians for a growing America. Report of the Surgeon General's Consultant Group on Medical Education. PHS Publication No. 709. U.S. Government Printing Office, Washington, D.C., 1959.
(18) National League for Nursing: Nurses for a growing nation. New York, 1957.
(19) U.S. President's Commission on Health Needs of the Nation: Building America's health. U.S. Government Printing Office, Washington, D.C., 1953.
(20) Navarro, V.: Planning in the hospital services. Diploma in medical services administration thesis. University of Edinburgh, 1965, (a) p. 15.
(21) Bailey, N. T. J.: Statistics in hospital planning and design. Appl Stat 5: 146 (1956).
(22) McPhee, J.: Application of statistics to hospital planning and management. Department of Social Medicine, University of Edinburgh, 1965. Processed.
(23) Molina, E.: Poisson's exponential binomial limit. D. Van Nostrand Co., New York, 1942.
(24) Drosness, D. L., et al.: Uses of daily census data in determining efficiency of units. (Parts I and II.) Hospitals 41: 45, 65 (1967).
(25) Roemer, M. I.: Bed supply and hospital utilization: A national experiment. Hospitals 35: 36 (1961).
(26) Newell, D. J.: Problems of estimating the demand for hospital beds. J Chronic Dis 17: 735 (1964).
(27) Rosenthal, G. D.: The demand for general hospital facilities. American Hospital Association Monograph 14. Chicago, 1964.
(28) Sigmond, R. M.: Does supply of beds control costs? Mod Hosp 93: 6 (1959).
(29) Ewing, O. R.: The nation's health: A ten year program. Federal Security Administration, Washington, D.C., 1948.
(30) Feldstein, M. S.: An aggregate planning model of the health care sector. Med Care 5: 369 (1967).
(31) Brooks, G. H., et al.: A new development in predicting hospital bed needs. Int Nurs Rev 11: 33 (1964).
(32) Feldstein, P. J., and German, J. J.: Predicting hospital utilization: An evaluation of three approaches. Inquiry 2: 13 (1965).
(33) Reinke, W. A., and Baker, T. D.: Measuring effects of demographic variables on health services utilization. Health Serv Res 2: 61 (1967).
(34) Engel, A., et al.: Regionsjukvarden. Riksplan för samarbete inom specialiserad sjukhusvard av sarskilt tillkallad ukredningsman. Stateus Offentliga Utredningar, Stockholm, 1958.
(35) Höglund, T., et al.: Sjukvardsplan for Göteborg. AB Svenska Telegrambyran GBG/Typograpa, Göteborg, 1966.
(36) Navarro, V.: Methodology in regionalization and health planning. A case study: Sweden. Department of Medical Care and Hospitals, Johns Hopkins University School of Hygiene and Public Health, Baltimore, 1967. Processed.
(37) Llewelyn-Davis, R., et al.: Studies in the function and design of hospitals. The report of an investigation by the Nuffield Provincial Hospitals Trust and The University of Bristol. Oxford University Press, New York, 1955.
(38) Barr, A., and Davies, J. O. F.: The population served by a hospital group. Lancet No. 7005: 1104 (1957).
(39) McKeown, T., et al.: A balanced teaching hospital. Oxford University Press, London, 1965.

(40) Bridgman, R. F.: An international study on hospital utilization. World Health Organization, Geneva. 1967. Processed.
(41) Ferguson, T., and McPhail, A. N.: Hospital and community. Oxford University Press, New York, 1954.
(42) Schneider, J. B.: Measuring the locational efficiency of the urban hospital. Regional Science Research Institute, Philadelphia, 1967.
(43) Engel, A.: The Swedish regionalized hospital system. *In* The Hospital Services of the Western European Conference. King Edward Hospital Fund, London, 1962.
(44) Godlund, S.: Population, regional hospitals, transport facilities and regions. Department of Geography, The Royal University of Lund, Lund, Sweden, 1961.
(45) Brown, B., and Helmer, O.: Improving the reliability of estimates obtained from a consensus of experts. RAND Corporation, Santa Monica, Calif., 1964.
(46) Ahumada, J., et al.: Health planning: Problems of concept and method. Pan American Health Organization Publication No. 111. Washington, D.C., 1965; (*a*) p. 63.
(47) U.S. Public Health Service: Program packaging. Division of Indian Health, Bureau of Medical Services, Washington, D.C., 1966.
(48) Kissick, W. L.: Planning, programming, and budgeting in health. Med Care 5:201 (1967).
(49) Klarman, H.: Present status of cost-benefit analysis in the health field. Amer J Public Health 57:1949 (1967).
(50) U.S. Public Health Service: Disease control programs. Motor vehicle injury prevention program. Office of the Assistant Secretary for Program Coordination, Washington, D.C., 1966.
(51) Navarro, V., and Parker, R.: A mathematical model for health planning: Prediction, simulation and goal seeking. Paper presented at the fifth scientific meeting of the International Epidemiological Association, Primosten, Yugoslavia, 1968.
(52) Bartholomew, D. T.: Stochastic models for social processes. John Wiley & Sons, Inc., London, 1967.
(53) Loeve, M. M.: Probability theory. Van Nostrand, Princeton, N.J., 1963.
(54) Navarro, V.: Systems approach to health planning. Paper presented at the Social Systems Dynamics Session of the 21st annual conference on Engineering in Medicine and Biology, Houston, Tex., 1968.
(55) Williams, T. W., et al.: Simulation modeling of a teaching hospital outpatient clinic. Hospitals 41:71 (1967).
(56) Bailey, N. T. J.: The mathematical approach to biology and medicine. John Wiley & Sons, Inc., London, 1967.

Grants for Staffing Narcotics Addiction Treatment Centers

Staffing grants are now available to nonprofit agencies for the operation of narcotic addict treatment and rehabilitation facilities. The National Institute of Mental Health, which will administer the grant program, has issued preliminary guidelines to assist eligible community agencies in developing plans for treatment programs.

Grants are available to community agencies for an initial period for salaries of personnel to staff the new rehabilitation facilities. Funding covers up to 75 percent of the professional and staffing costs to operate a new facility or a new program housed in existing facilities for the first 15 months. Thereafter, maximum Federal support is 60 percent for the second year, 45 percent for the third, and 30 percent for the fourth.

The program was authorized by Congress under the amendments to the Community Mental Health Centers Act which provide $4 million during fiscal year 1969 for the construction and staffing of specialized facilities for addicts, and for developing training programs for such treatment. Although current funds have been earmarked only for staffing grants, funds for the construction of new facilities will also be available after July 1, 1969.

The program will be administered by the Center for Studies of Narcotic and Drug Abuse in the Division of Narcotic Addiction and Drug Abuse of the National Institute of Mental Health. Applications for funds can be made by public or other nonprofit organizations through the associate regional health directors for mental health in the Regional Offices of the Department of Health, Education, and Welfare.