INDICATORS OF COMMUNITY HEALTH STATUS FOR HEALTH PLANNING

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The National Health Planning and Resources Development Act of 1974 (P.L. 93-641) mandates Health Systems Agencies (HSAs) to assess the health status of residents of their planning areas. To satisfy this mandate, HSAs must be able to measure health status and to give such measures empirical content. There are barriers to pursuing effectively both activities. First, it is not clear what dimensions of health status planners should assess and monitor, although numerous measures have been developed. Second, given the capacity to measure health status, limitations on the statistical activities of HSAs suggest that most empirical analysis in support of health planning will be conducted with aggregate information routinely available.

This paper addresses four questions that raise fundamental considerations in the design and estimation of health status measures suitable for local health planning. What considerations are central to the design of health status measures? What segment, if any, of the technology of measuring health status can be adapted to local areas? How can HSAs reconcile the need to measure health status with the available resources and the restrictions placed on their use? Finally, what longer run developments in health status measurement are desirable, and what can be done to facilitate their achievement?

Dimensions of Health Status Measures

The purpose of measuring community health status is to summarize the health of human populations. Measures can be developed theoretically not only for physical health, but also for mental health and social functioning. The manner in which health status is measured clearly depends upon the manner in which health is defined. As Lerner [9] has pointed out, this is a particularly difficult problem because health is a multidimensional characteristic.

Three general considerations are fundamental to the design of health status measures for health planning. These considerations are: (1) measurement of health-related conditions, including both conceptual and statistical issues; (2) determination of the size and structure of the population at risk in the geographical area for which estimates are being made; and (3) specification of intervention approaches with respect to prevention and treatment of conditions that adversely affect health status.

Conditions

In developing health status measures for health planning, particular attention must be given to the identification and classification of health-related conditions, including functional conditions not derivative of any unique disorder or illness in clinical terms. Certain conditions are interesting simply because it is known that medical care could prevent their occurrence or control their effects, including death. In particular communities, recognition of high prevalence rates for preventable or controllable conditions gives these conditions the visibility to encourage efforts to reduce their prevalence, possibly by reducing incidence. Health status measures that relate to these conditions would be especially valuable tools for the identification of problems and the evaluation of intervention programs.

Populations at Risk

Determination of populations at risk is frequently easier from a conceptual standpoint than an empirical one, especially at lower geographical levels. Delineation of populations at risk in demographic terms facilitates the estimation process, at least to some extent, owing to the generally wider availability of demographic statistics. The problem can become quite complex when the population has been conceived in non-demographic terms. Persons at risk of contracting an illness against which a preventive inoculation is available, such as tetanus or diptheria, are generally those who have not been exposed to the inoculation. Depending upon the availability of information about levels of immunization in the population, health planners may or may not have a useful screening device for determining populations at risk.

Intervention

Health status measures will be particularly useful for health planning when they relate to planning, implementation, and evaluation of health services. Activities of planners with respect to health status can usefully be categorized in terms from preventive medicine. Thus, they may be oriented to primary prevention, the reduction of the incidence of a condition. They may also be oriented toward secondary prevention, reducing the incidence of complications of an illness or injury, or tertiary prevention, reducing the levels of residual disability or other long-term effects, given that an illness or injury has occurred. It follows that health status measures are needed that reflect different effects, ranging from changes in the incidence of a condition through changes in rates of residual disability.

Approaches to Design of Health Status Measures

Siegmann [16] suggests that current strategies for health status measurement are divided between the development of disciplinary research indicators and policy research indicators. The former consist of measures designed to summarize population health levels, possibly to provide a basis for allocating health resources. The latter consist of measures designed to identify the effect on health status of particular health

programs; measures in this category are meant to support evaluation research. Siegmann concludes her assessment of the technology of health status measurement by suggesting that disciplinary research indicators and policy research indicators might serve as points of departure for the development of an epidemiology of health.

The measurement strategy of greater interest to HSAs, following the Siegmann typology, is the development of policy research indicators. If an important function of health status measures in health planning is to facilitate an improved understanding of the relation of health status to the allocation of resources to health programs, then policy research indicators at the local level must be thoroughly investigated and fully exploited. But the technology of health status measurement, and specifically the technology adaptable to local areas, simply has not reached the point where health planners can expect to have access to a wide range of useful measures. Furthermore, until the data systems to support newer measurement schemes have been fully implemented, and until the feasibility and validity of these schemes have been demonstrated, local health planners will simply have to resort to less precise, and possibly less useful, measures of health status. [4]

Current Measurement Possibilities

This section of the paper identifies possibilities for measuring health status which do not seem to exceed the legal, institutional, and technical constraints under which local health planning must operate. An examination of approaches one might reasonably expect HSAs to employ in the measurement of community health status suggests the following classification scheme: (1) the use of mortality data to summarize the risk of dying in an existing population; (2) the use of mortality data to infer conditions of morbidity; (3) the use of morbidity data to measure the incidence and prevalence of specific conditions; (4) the use of utilization and treatment data to measure the absolute frequency of specific conditions in a selected segment of an existing population; (5) the use of indicator measures which are known or suspected covariates of health status; and (6) the use of synthetic measures of health status. There are precedents for each approach, and each approach has specific advantages and disadvantages.

Risk of Death

The use of mortality data to summarize the risk of dying is the traditional approach of demography to measurement of health status. The most refined mode of analysis is the life table, an analytical technique for expressing mortality in terms of probabilities. Concepts and methods surrounding the construction of life tables are well developed, and the life table provides measures of mortality which are easily interpreted. Unfortunately, even abridged life tables for relatively short time intervals cannot be constructed for all levels of characteristic and geographical detail. Statistical standards may preclude the estimation of life table functions for many health planning areas. Furthermore, the speed with which local health statistics are processed for planning applications may present problems.

Morbidity Inferred from Mortality

Since the risk of dying represents only a single dimension of health status, it is necessary to consider other approaches. The use of mortality data to infer morbidity recognizes another element of the classic relation of vital events and health status. Several recent studies illustrate the potential of this approach [3,6,15]. All three studies are concerned with the relation of morbidity and mortality, and all three have local adaptability due to their primary reliance on vital statistics, but their use at the HSA level cannot go unquestioned, because inferences concerning morbidity from mortality data are not as direct as one would wish.

Incidence and Prevalence of Morbidity

The use of morbidity data to measure the incidence and prevalence of specific conditions follows the classic tradition of epidemiology. Data sufficient to construct incidence and prevalence measures can be obtained from either surveys or reporting systems. Measures based on morbidity data represent an improvement over inferential mortality methods with respect to the directness of measurement, but the approach is not without limitation. Survey-based measures are subject to all of the usual problems of sample estimators, including random and systematic errors. Reporting-system-based measures are subject to problems of completeness of coverage and of response error.

Furthermore, given the comparative advantage of surveys as a method of data collection at higher geographical levels, one is not likely to find much in the way of subnational sample data on morbidity. Greater geographical detail will almost certainly accompany measures derived from reporting systems, but the larger bureaucracy required to operate a reporting system, particularly a national system, will invariably restrict the flow of information, thus reducing the processing speed and the timeliness of the information. Both surveys and reporting systems must operate under the present uncertainties surrounding privacy and confidentiality, and these factors add to the general problem of data access for organizations like HSAs.

A final limitation concerns the conceptualization of morbidity. If health status implies something beyond a simple assessment of the presence of illness, then technically astute HSAs may become disenchanted with the performance of such common measures as "disability days" and "work-loss days [19]." A recent review of newer sociomedical indicators identifies at least four that give promise of meeting criteria of reliability, sensitivity, and applicability to community populations [17].

Morbidity Inferred from Utilization and Treatment

The fourth measurement approach is based on the notion that populations in treatment and populations utilizing medical services may resemble populations at risk of various conditions. Data on medical services utilization from both consumer and provider perspectives are highly standardized, owing to the increasing use by the National Center for Health Statistics (NCHS) and other agencies of abstracting systems and "minimum basic data sets."

Much of the information on utilization of health services is derived from household interviews conducted at the national level. A prime example is the current estimates program of the Health Interview Survey (HIS), which provides national data on such variables as health care expenditures and physician visits. The NCHS Hospital Discharge Survey produces annual data on the utilization of inpatient services at short-stay hospitals, and the recently implemented National Ambulatory Medical Care Survey (NAMCS) produces both medical and nonmedical statistics on physician episodes obtained from a national sample of cooperating physicians.

The problems of using utilization and treatment data to measure health status are considerable [25]. The expected number of persons in treatment is theoretically the product of the population at risk of a specific condition, the unconditional risk of this condition, and the probability of medical service utilization given the presence of the condition. The expected number of persons with a specific condition in the larger population can then be computed either by multiplying the population at risk by the unconditional prevalence rate or by dividing the number of persons in treatment by the propensity of persons who get sick to seek professional assistance. Unfortunately, although both approaches are theoretically correct, neither is easily given empirical content. The former approach is impractical because neither the prevalence rate nor the population at risk are known with precision, and the latter approach is impractical because reliable estimates are never available on the completeness of coverage of treatment programs. Furthermore, since persons entering treatment are not drawn at random from the population with the condition of interest, one cannot expect treatment statistics to portray accurately the true nature of the problem.

A second limitation of utilization data involves both the amount of geographical detail one can expect to obtain and the speed with which the data are processed. Most of the better known utilization data sets are produced by NCHS at the national level and cannot be disaggregated to provide even divisional and state detail without some loss in either precision or characteristic detail; it should be noted that the survey design does permit publication of regional and selected SMSA estimates from the HIS. Altogether, these limitations would seriously restrict the use of such data by HSAs, even if processing time were not a problem.

Treatment data do not suffer as much from problems of geographical detail, although the speed with which these data are processed varies significantly from place to place; some reporting systems are still not automated, while others change too rapidly to become efficient under any one system design. It is in this light that the advantage of data produced at the national level can now be seen. Despite problems of geographical detail and processing time, national data systems are able to capitalize on the greater technical competence of system personnel, which implies better design procedures and more rigidly enforced standards of quality control. Few states can produce utilization or treatment data sets of comparable stature, although a number of states have developed statistical systems in selected areas that produce reliable information on a regular basis, with appropriate characteristic and geographical detail. The comparative advantage of national utilization data sets from the standpoint of technical refinement makes them prime candidates for synthetic estimation in health planning areas.

Social Indicators of Health Status

The use of indicator measures which are known or suspected covariates of health status represents the conceptual point of departure for the construction of ecological models of health status. There are several precedents for this approach. First, the National Institute of Mental Health has developed the Mental Health Demographic Profile System (MHDPS) [23]. This system is designed to facilitate the estimation of indicator measures and the construction of indicator models for local mental health needs. The demographic data items (social indicators) were selected from 1970 census data to permit delineation of meaningful social areas and subsequent inferences concerning community health status. A second precedent is the Social and Health Indicators System piloted by the Bureau of the Census, Census Use Study, in Atlanta and Los Angeles [24]. The objectives of this system are quite similar to those of the MHDPS, and both systems are census-based, although the Atlanta and Los Angeles programs were designed to accept local data.

There are several important limitations to the use of indicator measures to describe health status. First, almost all of the measures now available are derivative of the decennial census. The utility of census-based measures declines rapidly as the census becomes less recent in time, despite efforts to update census information; the problem is almost certainly greater at lower geographical levels. The mid-decade census, to begin in 1985, should reduce considerably the problems associated with intercensal estimation, even for small areas.

A second limitation is the compatability of census data and data locally produced. The failure of the decennial census to include even basic information on health subjects means that many HSAs will find a need to supplement census data with data locally produced on subject items not found on a census schedule. The need to combine

local data with census data raises questions of the compatability of geographical areas and the comparability of definitions for common terms. One approach to this problem is to manipulate local data to fit the census framework, but this may not always be the best solution. Census regions are designed primarily to facilitate data collection. Whether areas like census tracts and minor civil divisions can be considered meaningful ecological units of analysis, or whether one can build meaningful units by aggregating these areas, is quite another matter.

A final limitation of most indicator measures is their essentially static nature. Aigner and Simon [1] have shown that cross-section estimators behave quite differently from their time-series counterparts, and this cautions dynamic inferences from static indicator models. Since many statistical systems supporting health services research have only recently come into existence, there is not a wealth of time-series information with which to study the behavior of indicator measures over time.

Synthetic Estimates

Synthetic estimation methods have considerable appeal for HSAs because synthetic estimates are conceptually and mechanically simple and potentially useful. Synthetic estimates are indirect measures, not in the sense that they are covariates of some condition, but rather in the sense that they measure the condition without direct observation. A recent report by NCHS [21] on state estimates of disability and utilization of medical services provides an example.

Estimation through direct observation at the state level is not permitted by the current design of the National Health Survey. The HIS presently generates national data on disability and medical services utilization, however, and if one were willing to assume that both factors are related to such variables as age, sex, race, and family income, then differences among states with respect to disability and medical services utilization might simply reflect differences with respect to the control variables. This implies, of course, that the age-sex-race-income specific disability and utilization rates, observed in the national survey, are constant among states. Whether this is a strong assumption, or even a defensible one, remains an empirical question, dependent largely upon the situation under study. If one is willing to make the assumption, then state estimates are simply a matter of weighting the schedules of survey rates by the age-sex-race-income specific state populations.

Although synthetic estimates are potentially useful in areas where circumstances preclude other forms of measurement, one must be extremely careful in the interpretation of such estimates, because their statistical properties are not well known [5,11]. Only further empirical research can establish the extent to which the "homogeneity-of-risk" assumption underlying synthetic estimation has any practical validity.

Directions for Further Research

Implied in the previous sections is the conclusion that current efforts at estimating health status of populations for local health planning are constrained by limitations of: (1) conceptual and statistical aspects of health status measurement; (2) quantity and quality of data available with the appropriate characteristic and geographical detail, and the requisite frequency; and (3) dynamic models of health status. The remainder of this paper is devoted to consideration of a series of issues and recommendations with respect to measures, data, and models.

Multiple Measures

We believe that global measures of health status are of limited use to local health planners; even sets of comparative summary measures for subareas within an HSA may be incomplete or misleading. Rather, a variety of measures focused on components of health status needs to be devised and used to estimate levels of health in sectors of the population that are at risk of particular conditions. Some of these measures are easy to estimate from data currently available on a regular basis; others will have to be invented and the data collected to use them. Imagination and experimentation will be required to determine the dimensions and combinations of population, condition, and intervention outcomes that are of greatest interest to measure.

Some of the problems associated with summary measures of mortality for small populations can be overcome, as Kleinman [22] suggests, by computing separate parallel measures for segments of the population divided by age: infants, and ages 1-34, 35-64, and 65 and over. A possible refinement in some larger communities would be to take infants, children aged 1-14, then 15-year age groups from 15 to 74, with an open category 75 and over. These seven groups seem to capture some important differences by age in risk of conditions important to planning. Indeed, a set of preventive measures has recently been proposed for each of seven age groups, starting with the fetus and mother and extending through the life cycle to older adults [2]. If some of the services recommended for each of these groups were to be designated for special programming, appropriate health status measures for the specific conditions of interest and age-graded populations at risk would be in order.

In addition to age, sex and race are standard factors by which rates are often adjusted or specified. Given an age-sex-race breakdown of the population, what measures should health planners try to estimate for these groups? For mortality in populations of 25,000 or more, Kleinman [7] argues for years-of-life-lost measures, at least for the population under age 65 or 70, as displaying the best combination of statistical properties, including stability, availability of data, and sensitivity to conditions along the age span.

For any given level of statistical precision, the requirements of characteristic, geographical, and temporal detail will tend to conflict. This fundamental constraint must be confronted, although it will no doubt be dealt with differently, depending on the use for which estimates are intended. As we see it, there is no escape for health planners from these dilemmas, only a set of solutions of varying utility according to the situation.

Comparability of Estimates Among HSAs

HSAs will probably develop unique sets of health status estimates based on the most relevant combinations of conditions, populations and interventions. For other purposes, however, such as comparisons among areas with respect to particular dimensions of health status or for allocation of program funds with respect to need, some minimum basic set of measures should be estimated for all HSAs. It would be helpful, therefore, if national standards were promulgated in the near future, recommending appropriate definitions, data sources, and computations for a variety of measures, some of which would be calculated for all HSAs and some of which would not. But each would be comparable from one area to another within the set of areas for which it was available. The standards and estimates presently provided for infant mortality and total mortality in the Statistical Notes for Health Planners [20,22] provide an excellent start in the direction we are suggesting. At the same time as we advocate national standards and comparability, we would also encourage HSAs to be the sources of innovations in small-area measurement and estimation that could be adapted for use throughout the country.

Synthetic Estimates

Many measures of health status ultimately depend on observations drawn from a survey. Because of the strong comparative advantage of the survey as a scheme for data collection in large populations, methods of inferring from larger to smaller areas are of utmost importance. In addition, the costs associated with data collection and analysis, in general, and with surveys, in particular, will make it necessary to limit the scope of direct observation and to rely as much as possible on indirect methods of estimation. Therefore, synthetic estimation deserves particular attention.

Some important questions for consideration, as these techniques are developed and applied, are:

1. What are the appropriate characteristics on which to base synthetic estimates of various measures? To what degree do geographical units vary with respect to these characteristics? What is the effect of this variation on the synthetic estimates compared with estimates based on the assumption that a general population rate at one level of aggregation applies to all lower levels?
2. In the case of synthetic estimates, fixing the level of characteristic detail and allowing the geographical level of aggregation to vary assumes that the risk of any condition for any population group does not vary geographically. How geographically homogeneous is the risk of health-related conditions of concern to planners?
3. What are the optimal geographical units for development of synthetic estimates? At what level should surveys or other direct observations be made and to what level can they validly be projected, using synthesizing techniques?

Some evaluations of synthetic estimation procedures at the national level have already been made [5,14,21]. Additional work needs to be done at the local level.

Ecologically Homogeneous Areas

One response to the problem of balancing needs for geographical and characteristic detail is to work with areas relatively homogeneous in population characteristics. In general, designation of such areas makes the tasks of measurement and planning easier, since one dimension of variation is eliminated. Therefore, the development of procedures in social area analysis and factorial ecology for the designation of ecologically homogeneous areas would be an asset to local health planning [12].

Several studies have pointed out the importance of looking at small-area variations in population characteristics, prevalence of conditions, and availability and utilization of services [26]. Others are taking advantage of mortality data available by census tract to investigate the extent to which mortality risk varies by tract, given variation in tract population characteristics [10].

Social Indicator Models

Since health planning is ultimately concerned with resource allocation, presumably with the objective of improving health status, more attention will need to be paid to covariates of health status and to the conditions under which the status of populations changes. Further exploration is needed of the extent to which covariates--especially those for which estimates are regularly made at appropriate levels of geographical detail--can be used to make estimates of health status in the absence of surveys, registration, or reporting systems. In cases where it is expensive and/or difficult to obtain direct observations, then a good indicator, taken from a social indicator model, may actually provide as much information as a survey, but at a much lower expenditure of funds and effort. To the extent that this approach proves to be appropriate and practical, it can be related to periodic surveys for benchmarking purposes. An indicator scheme for states and local areas is a desirable long-run objective of this enterprise.

Only a bare beginning has been made, however, in establishing the characteristics of communities associated with different levels of health and in understanding the factors associated with changes in health levels. Social indicator models, both cross-sectional and time-series, need to be developed to provide a context for interpreting estimates of health status and a basis for appreciating the interrelation of health and non-health variables. Recent attempts to develop dynamic social indicator models for selected health status measures include the work of Land and Felson [8] and of Brenner [18].

The approaches discussed above commend themselves on various grounds as productive directions for developing and implementing health status measurement schemes for local health planning. Other steps that we believe will facilitate the research and development process are (1) the re-orientation of existing data collection efforts toward providing statistics for local areas and (2) the reinforcement of interagency organizational linkages, both vertically from the federal to the state and local levels and horizontally among federal agencies [13].

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