

# NEW FRONTIERS IN MEDICAL STATISTICS<sup>1</sup>

MORTIMER SPIEGELMAN<sup>2</sup>

## INTRODUCTION

OUR health progress, since the beginnings of the public health movement and of advance in medical science, has been epitomized in a large body of mortality data and a very fragmentary body of morbidity data. Such data, however, are not merely to be admitted as records of accomplishment; they also have other functions, undoubtedly more important. Morbidity and mortality data enable us to detect new health problems, to plan programs for their control, to gauge the progress of these programs, and finally to measure the extent of their success. A typical example of such uses of morbidity and mortality data is furnished by the recent experience with the Salk vaccine for poliomyelitis. Examples of this kind are rather common among the infectious diseases, both the acute and the chronic, which are now very largely under control in our country.

Although we still have an important residue of health problems in the infectious diseases, attention has shifted rapidly to the chronic degenerative and wasting diseases typical of the older ages, but by no means entirely so. A few figures will indicate the importance of the age element in this shift. In 1900, only 22 per cent of all deaths were at ages 65 and over; this rose to 56 per cent by 1955, and may reach 62 per cent by 1975. In 1955, the cardiovascular-renal diseases and cancer jointly accounted for 70 per cent of the total deaths. Also prominent in our current mortality picture is fetal death and death in early infancy. The problem remains important because improvement at this stage of life has been very slow while our birth rate continues at a high level. These newly

<sup>1</sup> Based on a paper presented at the meeting of the Biostatistics Section of the New York Area Chapter of the American Statistical Association, May 10, 1956. This paper does not describe the widening area of application of mathematical statistics to medical and public health problems; this is surveyed by Bailey, N. T. J.: The Scope of Medical Statistics. *Applied Statistics*, November, 1952, 1, p. 149.

<sup>2</sup> Associate Statistician, Metropolitan Life Insurance Company.

emphasized problems of morbidity and mortality are difficult to us now not only because their causes are obscure in large degree but also because we believe, and most likely with good reason, that they arise from a complex of causes.

#### DETERMINANTS OF MORBIDITY AND MORTALITY

From a very broad viewpoint, the determinants of morbidity and mortality trends may be classified as follows (1):

1. *Scope, Quality, and Quantity of Health Services.* Research and invention in the medical and allied sciences has been stimulated in the postwar era by private and public funds. New immunizations prevent disease, new diagnostic techniques detect disease, and new therapies and surgical procedures extend impaired lifetimes. Older preventive and curative methods have also been improved. At the same time, medical care and public health facilities have become available to larger proportions of the country's people.

2. *Personnel in the Health Services.* The personnel in the medical, public health, and allied professions is now benefiting from improved training, the use of better tools and equipment, and better facilities for the exchange of ideas.

3. *Financing the Costs of Medical Care.* The rapid growth of voluntary health insurance plans in the United States in the postwar years has brought the advantages of a high quality of medical care within the reach of a large and growing proportion of the population.

4. *Consumers of Health Services.* With health insurance coverage widely held, many can now give early attention to their illnesses. In addition, health education and publicity given to medical advances have made the population more health-conscious.

5. *Economic Progress.* Contributions to health progress have also come from the economic progress which has brought a higher standard of living with more abundant, better, and more varied food, with a healthier work and home environment, and with time for healthful recreation.

At this point, it can only be generalized that, in each of these

five categories there are elements susceptible to measurement that may help our understanding of morbidity and mortality characteristics and trends. Important in this connection is the need for indices for measuring the level of health which takes into account not only morbidity and mortality, but also other factors in the wellbeing of individuals in the community, such as nutrition and mental state (2).

#### NEEDED MORTALITY AND MORBIDITY DATA

Some specific needs in mortality and morbidity statistics can be cited (3). In the area of mortality statistics, we need first of all an insight into the variations in the quality of cause of death data among the States and even within them. Those of us who have had occasion to study such data have found some very puzzling differences between neighboring States, particularly in the case of the cardiovascular diseases.

We know very little about socio-economic variations in mortality in this country. Some work now in progress in the National Office of Vital Statistics is based upon data for groups of occupations which may represent a social-economic stratification (4). However, within each such group, there may be significant variations according to the educational attainment of the family heads, family income, family size, and many other factors.

Our present system of vital statistics cannot provide the basic data for studies of this kind. However, there are such possibilities in the suggestion that there be established sampling areas in which the facts on the cause of death certificates would be supplemented by further data gathered from the family, the attending physician, and the hospital or clinic. Any social, medical, or genetic information from such sources should be fruitful in the study of perinatal mortality and the chronic degenerative and wasting diseases (5).

Particularly with regard to the latter, we have not yet taken full advantage of the information on the present death certificate by intensive studies of multiple causes. Useful demon-

strations of multiple cause tabulations have been made by the New York City Department of Health (6) and the Illinois State Department of Health. These directions in the study of mortality—that is, multiple cause tabulations and data supplemental to the death certificate—lead naturally into the area of morbidity statistics.

Morbidity data of varying scope and quality have come to us from many sources. A common approach for the collection of morbidity data for the general population is through the single visit or periodic visit survey. Unfortunately, there has been no systematic pattern in the conduct of such surveys so that no means for ascertaining variations in morbidity characteristics and trends throughout the country is on hand. However, a very bright ray of hope appeared in the recommendation for periodic and special health surveys contained in the President's health message to the Congress in January 1956. This proposal was enacted into law in July of the same year. The opportunities for the development of morbidity data will depend, of course, upon the resources put into this program. There will also be many problems and perhaps among the most important will be that of the quality of the causes of morbidity reported. The issue was made quite clear in a paper by Dr. Trussell and his colleagues on some results of the Hunterdon County survey (7). The frequency distributions of specific morbid conditions for the same persons were found to be different when reported by a family member, when reported by physicians who were informed of the diagnoses as given by the patients, when reported by physicians not so informed, and when found by clinical evaluation.

Since the chronic illnesses are usually of vague origin and long duration, the usual type of single or periodic visit survey can hardly provide an adequate picture of antecedent circumstances or of long-term medical care. The new approach for information in this area has been through the longitudinal or cohort type of study. Most of such studies begin with a body of lives with some specific morbid condition and trace them

forward for a period of years during which a record is kept of their morbidity and mortality. Examples are found in the follow-up studies of cancer patients. A step forward was taken in the Framingham study, scheduled to last twenty years, in which a sample of presumably healthy individuals are to be observed at frequent intervals for the onset of heart disease (8). The observations for these individuals will be correlated with their background data and medical care data. Worth noting at this point are the data regarding the incidence of morbid conditions among presumably healthy groups that may emerge from screening surveys using rapid diagnostic techniques (9).

#### MEDICAL CARE DATA

The proportions of the population requiring various forms of medical care may increase not only because of the aging of the population but also because advances in medicine are prolonging the lifetime of those with physical impairments. Unsolved problems and needs in the area of medical care statistics have been pointed out in a report of a joint committee of the Medical Care and Statistics Sections of the American Public Health Association presented at the Annual Meeting in November 1953. Problems lie not only in measuring medical care needs and demands for services in the community, but also in measuring the volume and quality of services available and of services rendered. The distinctions between the needs and demands for medical care services, and between services available and rendered may easily be overlooked. Flowing from these issues are questions with regard to terminology, the standard and content of medical care services, and the units by which to measure these services.

Without commonly accepted definitions and uniform standards of classification, measurement, and tabulation practices, a community can hardly gauge and plan to meet its medical care problems and to study the trends in these problems. Comparisons among communities become impossible. The difficulties become evident in studies of the great variety of medical

care programs for the indigent in this country in which services are rendered by voluntary and governmental agencies at the local and State levels (10). A community may know how many general assistance and public assistance cases it has on its rolls but it may not know how many are in receipt of medical care because one person or family may use a number of facilities. Difficulties of measurement are also apparent in efforts to compare the services available and rendered by the great number and variety of private medical care plans set up in recent years for the self-supporting (11).

#### SOCIAL RESEARCH RELATED TO HEALTH

Historically, the public health movement had its roots in the social problems arising out of the Industrial Revolution. At no time has sight been lost of the bearing that social and economic influences in the environment may have upon health and disease and, as with everything else, concepts in this area are becoming more penetrating. Ever since the social observations which led John Snow to his classic discovery of the spread of cholera in a London area through a faulty water pump, problems of environment in relation to health have continued (12). Today, a leading question is that of the incidence of cancer of the lungs in relation to smoking habits and also to air pollution in the community (13). The problem of cholera a century ago was perhaps no less obscure than that of cancer of the lung currently; in both, the role of statistical observation has earned its place.

Local surveys of morbidity have established a few demographic, social, and economic factors related to the prevailing state of health (14). Thus, it is known that the prevalence of illness, whether disabling or not, advances with age after adolescence; that the illness rates are higher for women than for men, contrary to the situation in mortality; that the rates are higher in the less favored occupation classes; that they are higher for the unemployed than the employed, perhaps because the very ill lose employed status; and that housewives

have an illness record with higher rates than women at work.

The search now is for more fundamental social and economic factors bearing upon the state of health and medical care. For example, it has been observed that, in many countries of Western Europe and English-speaking countries elsewhere, mortality from the cardiovascular-renal diseases has been rising among males at ages 45–64 years, but falling at other ages for males and at all ages for females (15). There is no evident explanation for this anomaly; however, it has been suggested that this trend among middle-aged males may reflect a rise in the stresses and strains of modern economic life. The situation leads to an area of research in which social and other stresses are related to the onset and course of disease; statistical studies may offer significant clues in this area as they have in others.

Many other facets of social problems in relation to health are being studied statistically at the present time (16). These are concerned principally with attitudes, motivations, and relationships, between persons, groups, and within groups. For example, data for a report published by the Health Information Foundation on public attitudes toward prescription costs and the drug industry were gathered from a representative sample of the general population (17). Another sampling survey supported by the Health Information Foundation is concerned with a multiplicity of factors bearing upon the utilization of health facilities and services by the general population. A survey in three cities sought answers to the question why some persons appear for diagnostic x-ray screening while others do not (18). From a random sample of physicians, the American Medical Association obtained statements of attitude toward voluntary health insurance (19). Other examples deal with patient-doctor relationships and with attitudes toward medical care (20). In a more general way, a committee of the Social Science Research Council is exploring the possibilities for studies of the relationships between preventive medicine and social science research (21).

## MEDICAL ECONOMICS

Any student of medical economics is soon impressed by the complexities in trying to measure how much of our productive resources enter into health programs and medical care, both public and private. The difficulties arise not only from a lack of adequate data, but also from the extent to which these resources are intermeshed with the many facets of our production. It may perhaps help to visualize the scope of our public health and medical care facilities if its volume were represented by a box into the top of which were led a series of pipes to deposit the resources put into it from the many sources, and out the bottom of which were led another series of pipes corresponding to the various services rendered.

A very large out-flow would show the specific medical care services purchased by personal consumers. Such data are published annually in the Social Security Bulletin (22). These data may suffice for national accounting purposes, but they represent an awkward conglomeration for a close study of our medical care bill and our plans to meet it. Included in these data, but without distinction, are such items as aspirin, water bottles, physicians' services for very minor illness, and also the services involved in costly major illness. Lumping of such figures can hardly provide a basis for comparison with the medical care costs covered by voluntary health insurance, as is done in the reports published in the Social Security Bulletin.

The situation shows a need for data regarding individual and family expenditures for medical care to provide detail distributed according to such items as family income, occupation of family head, place of residence, the number of family members and their sex and ages, the specific illnesses experienced and their duration, and the medical charges incurred according to services rendered (23). Cross-classification in such detail requires a large body of data. Also, because costly illnesses are usually of long duration, a lengthy period of observation may be required. This aspect of medical care economics would



be filled out if unit charge data were available from providers of specific services.

### CONCLUSION

The maintenance and promotion of health has become a major industry in this country and the outlook is that it will continue to grow. As with other industries that plan production for a contemplated market, the health industry will require a substantial body of pertinent data encompassing its many ramifications.

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