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**STATISTICAL INDICATORS
FOR THE PLANNING
AND EVALUATION OF
PUBLIC HEALTH PROGRAMMES**

**Fourteenth Report of the WHO Expert Committee
on Health Statistics**

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WHO EXPERT COMMITTEE ON HEALTH STATISTICS

Geneva, 1-7 December 1970

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STATISTICAL INDICATORS FOR THE PLANNING AND EVALUATION OF PUBLIC HEALTH PROGRAMMES

Fourteenth Report of the WHO Expert Committee on Health Statistics

The WHO Expert Committee on Health Statistics met in Geneva from 1 to 7 December 1970. Dr W. P. D. Logan, Director of the Division of Health Statistics, opened the meeting on behalf of the Director-General.

INTRODUCTION

In his opening remarks, Dr Logan said that the World Health Organization had for many years been concerned with the development of national health planning. In a series of meetings of WHO expert committees, technical discussions and regional conferences the need had been expressed for good statistical data as a basis for health planning and evaluation. The statistical data actually required for this purpose had never been specified in detail, however, the possible requirements having been expressed only in general terms. Experience had shown that health statisticians had all too often found difficulty in providing health planners with statistical information relevant to their needs. In addition, health planners frequently failed to determine precisely what their needs were. Much planning and evaluation lacked a firm statistical base; planning and evaluation could be improved if the right kind of information was available and used.

It would be the task of the Committee to concentrate its attention on the problem of the exchange of information between the health planner and the statistician, to define the types of statistics needed in various circumstances, and to indicate how they could be used to provide meaningful and useful health indicators. The expression "public health programmes" in the title of the meeting was intended to cover all the activities of the organized health services. It should not be taken in any restrictive sense but be understood as referring to the full range of both environmental and personal health services, including their preventive, curative and rehabilitative components.

HISTORICAL BACKGROUND

Statistical collections in relation to health planning were considered at the Eighteenth World Health Assembly in 1965, when the basic statistical requirements for an analytical approach to the provision of health services were discussed. It was established that these requirements comprised demographic data, vital statistics, morbidity data, inventories of public and private institutions and categories of manpower, and data on expenditure. The collection and use of statistics in national and local health services was the subject of the technical discussions at the Nineteenth World Health Assembly in 1966, where it was agreed that statistics would play a growing and essential role in the planning, organization, surveillance and evaluation of health services. Although increasing activity in the field of health planning could be observed, together with a growing recognition of the need for information to assist in the preparation of more realistic plans, the overall situation was considered to be far from satisfactory. Countries at an early stage in the development of their health services, it was pointed out, were woefully short of statistical information of any kind, while countries with long-established health statistics services, often of a high degree of complexity, had developed them without consideration of the needs of planners and administrators.

During the late sixties, health administrators in both the developed and developing countries became increasingly conscious of the need to review critically the services for which they were responsible and to seek a more informed basis for their organization. This was the result of a number of factors. Against a background of rapid population growth, migration and urbanization, health consciousness had increased among the consumers of health services, leading to increased demand for more and more complex types of health care. Scientific and technological advances had extended both the range and the cost of the services that could be offered. Other services and sectors of the economy were in competition with the health services for the available resources, whether in terms of money, manpower or facilities, so that the administration, in allocating resources to the health services, had to weigh up the advantages to be gained by so doing, as compared with those to be expected from investments of other kinds.

The need to provide an economic justification for allocating resources to the health services acted as an incentive to health administrators to seek data whereby the effectiveness and efficiency of such services, from the point of view both of individuals and the population as a whole, and the benefits derived, could be measured and priorities and alternatives established in the consideration of new or modified services. This new situation meant that the statistics available had to be used in new ways,

while the need was felt for additional types and sources of information which would have to be handled by means of statistical systems specifically designed for the purpose. Appreciation of the need to plan and evaluate was increasing, but the problem of how to go about it still remained.

In 1968 a WHO Expert Committee on Health Statistics considered the types of statistics required for the planning, administration and evaluation of health services and pointed out the need for a systematic approach to the production of statistics that would lead to more efficient health services.¹ According to that Committee, statistics are needed: (1) to assist in the administration and co-ordination of health services and their effective management; (2) for the short- and long-term planning of services; (3) for measuring accomplishment in terms of effectiveness and efficiency; (4) for research purposes and to provide background information for use by the administration, legislative bodies and the public. The manner in which all these requirements could be satisfied on a regular basis was also indicated. The Committee's report was intended mainly to induce health administrators to take a new look at the range of statistical information available to them with a view to the employment of such data in evaluating the efficiency and effectiveness of their health services.

Apart from emphasizing the need for planning and evaluation in the administration of health services so as to enable them to operate effectively and efficiently, however, the report did not go into detail about the way in which the working processes themselves could be carried out. Given the full range of pertinent data, covering all aspects of health, the problem remained of establishing meaningful relationships between sets of data. The Committee left this question for further review and discussion, in view of the fact that the complexity of modern health services makes it difficult to provide any specific guidelines as to the indices that could be produced for planning and evaluation purposes.

The WHO Study Group on Measurement of Levels of Health, which met in 1955, put forward many ideas that are now regarded as of great practical importance in the planning and evaluation of health services.

The WHO Expert Committee on National Health Planning in Developing Countries,² the WHO Expert Committee on Hospital Administration,³ both of which met in 1967, and the WHO Expert Committee on Training in National Health Planning,⁴ which met in 1969, recognized

¹ *Wld Hlth Org. techn. Rep. Ser.*, 1969, No. 429.

² *Wld Hlth Org. techn. Rep. Ser.*, 1967, No. 350.

³ *Wld Hlth Org. techn. Rep. Ser.*, 1968, No. 395.

⁴ *Wld Hlth Org. techn. Rep. Ser.*, 1970, No. 456.

the need for data as well as for training health planners and administrators in the methods of statistics, epidemiology, demography, operational research, economic analysis and systems analysis. The precise manner in which health statistics and health planning were to be brought together for the purpose of reaching informed decisions bearing on the organization of health services was, however, not specified.

At the Inter-regional Conference on Training of Health Statistical Personnel, held in 1968,¹ the training of intermediate and auxiliary level health statistical personnel was discussed in detail and training curricula for the two levels were proposed. Guidelines for the organization of such training were also agreed, but there was no discussion of the knowledge of national health planning needed by such personnel nor of the ways in which they can play their part in the health statistical work for this purpose more effectively.

AIMS OF THE COMMITTEE

At the outset the Committee recognized that there are two central issues to which it must address itself : (1) the relationship between health statistics and health planning, and (2) the identification of the health information systems and statistics required (and capable of being developed) if the processes of planning and evaluation are to be fully effective.

In approaching these two issues, the Committee recognized that a new stage in the evolution of health services has been reached. Those responsible for the provision of health services face new problems that require new attitudes, concepts, methods and information, and above all new kinds of health statistics and their utilization in practice.

THE NATURE OF HEALTH PLANNING

Planning has been widely used in a number of fields but it is only comparatively recently that it has been accepted in social services such as education and health. It is essentially an administrative instrument intended to provide a more rational basis for decision-making. Perhaps its most important concern is with the allocation of scarce resources and with ensuring that services are made available and provided in a more equitable manner. Administration is concerned with questions of the allocation of resources, and planning is intended to improve decision-

¹ World Health Organization (1968) *Inter-regional Conference on Training of Health Statistical Personnel Report* (unpublished document WHO/HS/Nat. Com./68.238).

making in this connexion. The processes involved and the associated tasks have certain features that are the same in all countries. The names given to planning processes, like those given to the agencies, institutions and offices responsible for doing the work, are of little consequence compared to the processes themselves. The tasks involved will be accomplished by different means in different countries.

The principal concern of the health planner is with the health of the population, and he is consequently also concerned with the planning of health services; the overall objectives are similar.

Although a variety of names have been given to specific aspects of planning methodology, four broad approaches may be identified in most planning activities :

(1) *Deductive planning*

Broad policies and objectives are established at the highest level of the organization and detailed proposals for implementation flow downwards to those who provide services. Standards tend to be "normative" in the sense that they are developed by experts or derived from current experiences and activities.

(2) *Inductive planning*

Local experiences, services and practices are identified and efforts are made to co-ordinate and consolidate them so that greater benefits can be made more widely available. The objective is to improve what is already available in the expectation that the overall services to the entire population will thereby be improved.

(3) *Impressionistic planning*

This is the type of *ad hoc* professional and institutional decision-making to which most clinicians and administrators have been accustomed in the past. Decisions and choices are made on the basis of experience, pressures, minimal information and rough estimates of needs and possibilities. The process is more intuitive and political in character than rational or scientific and can scarcely be regarded as planning in the strict sense of the term.

(4) *Idealistic planning*

The aims of the plan are stated only in the form of unattainable ideals. Action is encouraged by exhortation, but precise objectives or methods of achieving them are not specified.

In practice, elements of all four approaches can be found in all methods of health planning. In addition at least five steps are generally recognized as constituting the planning process :

(a) *Situational analysis* or the description, definition and statement of the problem, its characteristics and dimensions in relation to population and time; information based on statistical and other data is an essential ingredient of such an analysis.

(b) *The formulation of alternative tactical approaches* to the handling and solution of the problem. The emphasis here is on the formulation of alternative solutions or plans and the working out of their implications in terms of cost, potential effectiveness and the decision-making process.

(c) *Decision analysis* or the selection of a plan, based on discussions of the alternatives and the balancing of political, cultural, social and economic considerations against estimates of the biological, psychological and social consequences.

(d) *Discussion and implementation* of the plan selected. These two functions are combined under the same heading since the procedures and actions to be carried out depend for their success on the acceptance of the plan by both providers and consumers of services.

(e) *Evaluation* of the results achieved by the services in relation to the problems, situations or populations concerned. Evaluation is essentially concerned with the measurement of the results achieved or benefits obtained in relation to the effort expended.

The steps described above probably form part of all methods or systems of health planning, whatever their political or cultural background, whether or not the overall process is explicitly divided up in this way.

If health planning is to move beyond its present empirical stage and to become more than a mere expression of altruistic aspirations or the implementation of popular but ineffective measures, a more scientific approach, based on appropriate methods and suitable types of information, will have to be adopted.

PROBLEMS OF EVALUATION

Measurement of the effectiveness and efficiency of health services is an essential part of evaluation. Complex problems are involved and additional research is needed.

The essential relationships between effort expended and results achieved

in relation to a plan and its implementation can be derived from a simple model involving four factors :

Effort (planned) a_1	Results (planned) b_1
Effort (achieved) a_2	Results (achieved) b_2

A variety of names may be given to the ratios that express the relationships between the above factors. For example, the ratio b_1/a_1 may be called the planned efficiency, and may be compared with the achieved efficiency (b_2/a_2). The reasons for discrepancies between the planned and achieved results, as indicated by the ratio b_1/b_2 , could be the object of special studies, for example, of institutions, professionals, or high-risk populations.

The Committee discussed and defined certain terms used in evaluation as follows :

(a) *Efficacy* : the benefit or utility to the individual of the service, treatment regimen, drug, preventive or control measure advocated or applied.

(b) *Effectiveness* : the effect of the activity and the end-results, outcomes or benefits for the population achieved in relation to the stated objectives.

(c) *Process* : the procedures, methods or arrangements by which the effort was expended and the effect achieved.

(d) *Structure* : the human resources, knowledge, technology, organization, facilities, equipment, and finances that assist or constrain the expenditure of effort and the achievement of effects or end-results.

(e) *Efficiency* : the effects or end-results achieved in relation to the effort expended in terms of money, resources, and time.

(a) *Efficacy*

The controlled clinical trial is universally regarded as the most objective method for evaluating the utility, benefit, or efficacy of drugs. The methods used can also be employed to determine the efficacy of surgical and medical regimens as well as that of administrative and management procedures. Essentially, the controlled clinical trial provides a means of finding out whether the proposed activity, such as a screening procedure, or a diagnostic, therapeutic or rehabilitative regimen, is beneficial. If it is beneficial, how beneficial is it? Under what circumstances is it beneficial? The same questions may be asked about its harmful properties and about the regimen it is designed to replace.

Many ethical, administrative and technical problems are involved in the conduct of clinical trials. They nevertheless constitute a power-

ful tool, and the fact that they have not been used prior to the introduction of new therapies and procedures in the past should not prevent administrators and planners from insisting that they should now be carried out before any new therapy, procedure or service is introduced.

The first step in evaluating existing services, therefore, might be for statisticians and planners to examine the evidence for the efficacy of the drugs, procedures and regimens recommended for use by the health services. This is no easy task, since much of clinical medicine and many widely accepted public health programmes are based only on authoritative pronouncements and established tradition. Critical review of the components of existing health services will not be accomplished in a short time. This approach should be used as a point of departure for educating administrators, politicians, professionals, and the public. The statistician has a most important role to play in inquiring about the evidence for the alleged benefits to be derived from new health services and related measures.

(b) *Effectiveness*

Another aspect of health planning is concerned with the application of procedures accepted as being useful to all persons in the population who can benefit from them. Since planning is essentially a mechanism for allocating resources so as to achieve maximum benefits for the population, emphasis should be placed on the use of efficacious procedures and on the enunciation of clear statements of the end-results, outcomes or benefits expected. The measurement of effectiveness is far from simple. Its feasibility is increased, however, if administrators and clinicians state precisely what they hope to have achieved at the end of a given time interval. Clear statements of objectives make measurement of effectiveness relatively easy; ambiguous or obscure statements make it difficult or impossible. Where biological results or clearly defined markers cannot be specified, the number of days of inactivity, disability or discomfort may be used instead. Where information on severity, urgency or anxiety is available, a crude index in terms of days of impaired health for any particular population can be worked out; comparisons between different areas, periods and populations then become possible.

(c) *Process*

The processes by which health services are provided are largely the concern of professionals. Preventive measures, diagnostic investigations, surgical operations and therapeutic regimens are all means directed towards the achievement of stated end-results. The volume and nature of these procedures in relation to the known risks and benefits can be reviewed by various forms of medical audit. Here the analysis of medical care

processes is carried out by groups of various types whose task is to examine the management of patients' problems in the light of normative or other standards. Local reviews of this kind within institutions or geographical regions can be aided by computer analyses. This process becomes a self-regulating device for considering not only the medical care given to individuals but also the nature and availability of services to the population as a whole.

Techniques for "management by exception", such as those used in industry, permit objective inquiry into departures from the usual standards of practice. For example, such procedures can identify individual practitioners or institutions differing significantly from the average in the use of resources such as drugs or laboratory tests. Inquiries are made without any criticism being thereby implied. Indeed it is frequently the unusual way of dealing with a problem that establishes new precedents. These in turn result in revisions of traditional normative standards.

Although end-results constitute the most meaningful basis for assessment from the viewpoint of the patient, various stages in the process of providing services can be identified. Such identification helps to clarify plans and to suggest ways in which health services can be organized and monitored.

Process analysis includes the consideration (on the basis of suitable measurements, where possible) of questions such as the following :

(i) Is a hierarchy of objectives specified? Must these objectives be achieved in accordance with a specified timetable? Are the objectives and components of the services interrelated and mutually consistent?

(ii) Are the criteria for measuring the "success" of the services explicitly stated? Are there provisions for measuring the degree of "success" or for distinguishing between "success" and "failure"?

(iii) Are the organizational arrangements for providing the services the best possible or available? Are any alternative arrangements desirable or possible?

(iv) Are the work procedures amenable to analysis and study? Do they have clearly defined aims and are these aims achieved? Could they be achieved by other means?

(d) *Structure*

The examination of the organizational structure, facilities and equipment through which the services are provided is related to process analysis. The study of institutions, staffing patterns, payment and financing mechanisms and of the characteristics of the health services themselves is useful as a means of finding the causes of variations in the end-results or in effectiveness and efficiency.

(e) Efficiency

Efficiency in the achievement of end-results can best be measured when the resources to be employed are closely associated with the work performed. This is an area in which modern methods of fiscal control and cost accounting can be used. When administrators are responsible only for expenditure and not for what is achieved as a result, true managerial accountability is impossible. The problem of relating expenditure to the functions performed can be solved only by the introduction of scientific accounting practices. This approach to the measurement of efficiency is therefore essential and deserves much further study.

Administrators and planners can do little to improve the collective efficiency of professionals and institutions unless two conditions are satisfied. Firstly, it must be accepted that all are jointly responsible for the health care of the population concerned. Failure to prevent illness, to detect disease or to care for patients both compassionately and economically reflects adversely on all the physicians and institutions serving that population. Acceptance of responsibility for the care of populations, whether defined geographically or by some form of registration or enrolment, is central to much contemporary thinking about efficiency in the organization of health services.

The second condition to be satisfied is that an appropriate information system must exist. The information provided by this system needs to be related to the problems and objectives of the organization and be such as to lead to changes in its plans and practices. The concepts of modern management can be applied at institutional, local, regional, and national levels. The results of efforts to increase efficiency can be examined at many levels. Regions can be compared before and after the construction of a new hospital, for example, and the changes in the incidence of disability and in absenteeism in the population related to the expenditure involved.

HEALTH STATISTICIANS AND HEALTH PLANNERS

Despite the acknowledged achievements of health statistics, it is generally agreed that the functions of planners and statisticians are too seldom linked. The planner must frequently depend on unsuitable or inadequate information as a basis for formulating his plans. Even more frequently the statistician is asked to provide information that is not available or to devise evaluation schemes after plans have been initiated or implemented.

Obstacles to the use of statistics in health planning

Eleven major obstacles to the use of statistics in health planning can be identified :

(a) Planners and statisticians do not collaborate or do not share a common sense of responsibility and commitment to a joint task.

(b) Administrative relationships between the two activities are often dysfunctional in the sense that they are located at different levels in the hierarchy of the ministry of health or health department. In other instances the responsibility for the collection and provision of health statistics is assigned to a central government statistical agency or to a ministry other than that responsible for health and health services planning.

(c) The administrator may fail to provide the personnel, equipment and money required for the work agreed by both planner and statistician to be necessary.

(d) Ignorance of each other's methods, skills, and experience persists. For example, the planner may be unaware of the statistical and epidemiological data available or the statistician may fail to make use of mathematical models, indexes, data collection methods and planning techniques taken over from other sectors of society for use in health services planning.

(e) Differences exist in educational background, professional orientation, expertise, and status. In the absence of a university-trained professional statistician, a statistical clerk or technician may be expected to provide statistical services. It may not always be realized that the contributions made by personnel in the different grades will not be the same. In other instances, empirical planners may have had little exposure to quantitative methods or concepts.

(f) Too often the planner fails to specify in detail the goals and objectives to be achieved or the statistician fails to ask questions that would result in clear statements of such goals and objectives. Broad goals, such as "improving the health of the people", are not readily measured by currently available statistical indices.

(g) There is a lack of recognition of the fact that both the making of changes in the organization, staffing, distribution, and financing of health services and the establishment of health and health information systems take a long time.

(h) Inflexibility with respect to planning methods or statistical information systems and lack of imagination in defining or recognizing health problems and in designing statistical measures for such problems are not uncommon.

(i) There are differences in time scales and in perspective. The statistician may be concerned with events that have already occurred and with retrospective analyses, whereas the planner may be concerned with forecasting future events and with the decisions that will bring them to pass.

(j) There are differences in methods of working. The planner may be used either to proceeding in stages, using his judgment where necessary, or to devising global models for use in comprehensive health planning. The statistician may be used to a planned data collection scheme that has been logically developed and methodically executed.

(k) There may be disparities in the power assigned to each of the two functions. The statistician may be regarded as an objective collector of data with no direct influence on events. The planner may be regarded as a decision-maker or a close associate of the decision-maker with considerable influence in the upper levels of the organization.

Improving the use of health statistics in health planning

Effective health planning requires a combination of quantitative data, acceptable conceptual models, clearly expressed objectives, explicitly stated policies, and responsible decision-making. Statisticians and mathematicians, operational researchers, systems analysts, planners, policy-makers, and administrators all have a vested interest in and responsibility for the health services available to the populations they serve. The most important factor in health planning is thus the administrative link between these various groups, and in particular that between statisticians and planners. How can a purposeful dialogue be initiated and the responsibility shared?

Although administrative relationships may vary, it is generally recognized that the constructive application of information in planning involves four separate functions: data collection, analysis, interpretation, and use. These functions are not mutually exclusive, and one of the tasks of the health administrator is to see that they are all carried out and co-ordinated with one another.

There is general agreement that independence and objectivity must characterize the first two functions, and feasibility and policy orientation the second two. Traditionally the first two have tended to be the responsibility of statisticians and the second two that of planners. It is now urged that the two disciplines and the four functions should be closely co-ordinated. The nature and extent of the dialogue between those concerned with these previously separate but closely related activities will depend upon the personnel involved, their levels of training and expertise, the utility of their contributions, the extent of their individual and collective responsibilities, and the administrative leadership provided.

Whether the production of health statistics and the planning of alternative courses of action for the development of the health services are regarded, for example, as activities of equal status under a common director, are represented by similar departments in a large bureaucracy, or are shared by partners of equal rank on a health services planning board is less important than the achievement of joint participation in the discharge of common responsibilities.

Mutual respect between the health statistician and the planner, from the point of view of the contributions that they can make, is essential for effective work. This relationship is akin to that now existing between the biostatistician and the clinical or laboratory investigator. Formerly the biostatistician was often asked to "analyse" data from studies with which he had had no previous contact. It is now universally recognized that the biostatistician must be involved at the earliest stages in the conception and design of a research study. The same relationship should be created and fostered in the case of health statisticians and health planners.

It is recognized that, in many countries, the status of statisticians is lower than that of planners. The importance of improving the education and training of health statisticians therefore needs to be emphasized, but they will acquire the status to which they are entitled only to the extent that they can give expression to the needs and aspirations of the people. They will then be able to co-operate with planners on an equal footing.

The joint responsibility of the statistician and the planner is to devise methods for :

Collecting data that will describe and measure the needs of individuals and populations.

Processing, reducing and presenting data relevant to norms, resources, objectives and other factors.

Distributing the information in the form of alternative plans and proposals to decision-makers at various levels.

Analysing data that will permit the measurement and evaluation of the effect of the services provided.

From this dynamic point of view, health planning is seen as a continuous process in which both planner and statistician participate at all levels. Its most important features comprise continuous responsibility, population-based services and statistics, and an improvement in the overall climate for decision-making.

The task of the health administrator responsible for creating a useful planning service is to examine critically the relationship between statistics and planning or, more accurately, between the statistician and the planner. By identifying the sources of misunderstanding, distortion,

or friction and by appreciating the desirability of establishing optimal working relationships, the administrator can also work towards the goal of improving the decision-making process in his organization.

A start may perhaps be made by ensuring the collaboration of the planner and statistician in creating and developing the health information systems that will guide the planning process and assure constructive evaluation.

Deficiencies in existing information systems for health planning should be identified. Both planners and statisticians should be aware of what data are available and what are needed for health planning. This is probably essential in both developing and developed countries and at national, regional and local levels. Progress towards the achievement of the desired goal can be accomplished by a series of steps. For example, changes can be made in the data collecting processes so as to provide more useful routine data for planning, and new types of data can be collected so as to fill the gaps in information. Planning methods can be related realistically to the information systems available and the introduction of sophisticated techniques of health planning postponed until a long-term plan has been developed for the simultaneous introduction of advanced health information systems.

STATISTICS FOR HEALTH PLANNING AND EVALUATION

Many data collection systems exist and produce health statistics of varying types and quality. The Committee examined so-called routine health statistics and considered new methods of data collection and analysis in the light of the problems previously discussed.

Vital and health statistics

Vital statistics have so far provided most of the traditional direct and indirect measures of health and disease in populations, but they can nevertheless yield unduly optimistic estimates that distort the true state of affairs as a result of under- or over-reporting, incomplete coverage, and errors introduced at the time the primary records are established. Of the various indices produced, several have stood the test of time; none, with the possible exception of mean expectation of life, can be regarded as a measure of health. The others, including crude, standardized, age- and sex-specific, cause-specific, infant, perinatal and proportional mortality rates, are all measures of ill-health.

The use of mortality indices as the sole basis for planning health services is highly unsatisfactory. In developed countries, where the number of deaths per year in the age range one week to 55 years may be small, mortality rates are not likely to reflect the need or demand for

medical care, particularly on the part of persons suffering from chronic illnesses. In developing countries, mortality rates may also fail to reflect the total demand for services, though for other reasons. For example, the control of gonorrhoea and trachoma may absorb substantial sums of money and resources but neither has a fatal outcome except in rare instances.

The administrative, clinical, and financial records kept by health institutions, e.g., hospitals, outpatient departments, polyclinics, and health centres, or by insurance or financing agencies, are frequently a source of morbidity data and data on the use made of the health services. The value of these data for planning purposes depends on the extent to which they are related to persons and events and are population-based. If they include demographic, socio-economic, and place of residence data, their value is enhanced considerably.

Abstracts of records of hospital discharges and attendances by ambulatory patients can be used in some countries to provide essential information.

Environmental health statistics

Statistics related to environmental conditions, including physical, chemical, biological, and social factors, should not be overlooked by those responsible for the planning of health services. Many of these statistics may have only an indirect bearing on the provision and effect of health services, but their trends should be analysed so that changes in health status due to environmental factors are not incorrectly attributed to the effect of personal health services.

Indices of health

Health planners would like to have a single index of health status but would probably be satisfied with a number of reliable indices. A single index would express in a single figure the combined effect of a number of components measured independently. Difficulties arise, however, over the unit to be used for this purpose. In economics, a monetary unit can generally be used whereby a number of highly diverse components can be combined. A promising possibility in health is the use of duration of disability as a common unit for this purpose, and the way this or some related unit of functional impairment could be used should be the subject of research. Even if a suitable unit could be developed there remains the problem of the weighting factors to be used in combining the various components. If duration of disability were the common unit, what weight would be given to a slight disability of given duration as compared to a severe and painful disability of the same duration? How could a disability of infinite duration (death) be allowed for?

In any event, in the absence of more adequate basic data on the health status and on the levels of disability, functional impairment and activity limitation of individuals and populations, it is difficult to see how useful indices can be constructed. Thus the ideal index of health has yet to be developed, although it can be stated that such an index should satisfy the following requirements :

(a) *Availability*. It should be possible to obtain the data required without special complex investigations.

(b) *Completeness of coverage*. The index should be derived from data covering the population of an entire country or that part of it to which the index is supposed to refer.

(c) *Quality*. The national data should not vary with time and place in such a way as to have any substantial effect on the index.

(d) *Universality*. The index should, as far as possible, be the expression of a group of factors that determine and affect the level of health.

(e) *Calculation*. The index should be calculated in as simple a manner as possible and the calculation should not be costly in terms of the resources required.

(f) *Acceptance*. The index should be widely accepted and used and no doubts should exist in respect of the methods employed for developing the index or for interpreting it.

(g) *Reproducibility*. When the index is used by different specialists under different conditions at different times the results should be identical.

(h) *Specificity*. The index should reflect changes only in those phenomena of which it is the expression.

(i) *Sensitivity*. The index should be sensitive to changes in the phenomena concerned. Allowance should be made for the effect of inflation on the index.

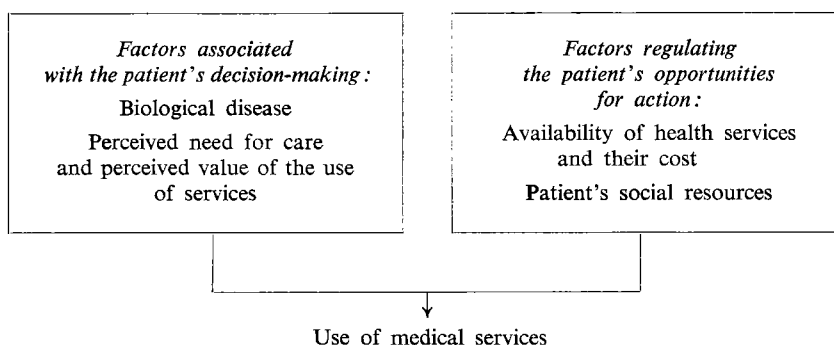
(j) *Validity*. The index should be a true expression of the factors of which it is supposed to be a measure. Some form of independent or external evidence for this should be provided.

Survey statistics

Statistics for use in health planning and evaluation need to be problem-orientated, population-based and related to persons and events. Traditionally health statistics, in contrast to vital statistics, have tended to be activity-orientated and institution-based.

To establish statistical systems of this type, some concept of the functions to be performed by the health services provided for a population is required. The health administrator should usually have a model

whereby the relationship between the medical care process and the provision of health services can be appreciated. One such model has been proposed,¹ and is reproduced here in a simplified form.



In the absence of inexpensive, sensitive, reliable and valid early indicators for most biological diseases, this model implies that the measurement of the patient's perceived need is of major importance since it provides the basic information required for determining the objectives towards which the health services serving a population should be directed. The perceived need for care and the perceived value of the use of the health services both usually precede the utilization of these services.

More attention should be paid to defining the terms used, particularly if statistical measures are to be developed that will make comparisons possible between results obtained at different times and places. Several types of need and demand can be identified :

(a) *Perceived need* : the need for health services experienced by the individual and which he is prepared to acknowledge. Under certain conditions it may exceed the professionally defined need.

(b) *Professionally defined need* : the need for health services recognized by a health professional from the point of view of the benefit obtainable from advice, preventive measures, management or specific therapy. Under certain conditions it may exceed the perceived need.

(c) *Scientifically confirmed need* : the need confirmed by objective measures of biological, anthropometric or psychological factors, expert opinion or the passage of time. It is generally considered to correspond to those conditions that can be classified in accordance with the International Classification of Diseases.

¹ Kalimo, E. (1969) *Lääkintäpalvelusten käyttöön vaikuttavat tekijät* [Determinants of medical care utilization], Helsinki, Sosiaaliturvan tutkimuslaitos.

(d) *Potential demand* : the demand for health services corresponding to whichever is the greater of the perceived and professionally defined needs for each particular condition or for all the conditions affecting a given population.

(e) *Expressed demand* : the demand actually made on the health services available to a population. It may be greater than the actual utilization because of the existence of waiting lists, limited resources or differences between patients' perceptions of their needs and professionals' definitions of those needs.

The measurement of these variables, with the exception of the scientifically confirmed need and the expressed demand, usually requires the use of well-established survey techniques. The utility of surveys in both developing and developed countries is widely accepted. The household interview survey and the health examination survey both make use of the methods employed in epidemiological and social survey sampling, observation and recording. They should be regarded as fundamental components of a comprehensive health information system for planning. When properly designed, these two types of survey should be able to provide information that is otherwise unobtainable. They enable estimates to be made of need, demand and reported utilization in relation to physiological, anthropometric and psychological parameters for representative samples of the population. In addition, data can be obtained on important related conditions, such as inactivity, disability and pain, as well as on their duration, severity and urgency and on social factors. The latter could include demographic and socio-economic characteristics, such as occupation, education, and income.

For the purposes of health information systems, it is usually best not to rely on omnibus, multipurpose surveys designed for other purposes. Large-scale social surveys usually deal with a variety of topics of which health forms only a small part. The data are not collected with a view to their use in health planning, and the interviewers are seldom specially trained for interviewing in the field of health problems and services.

The objectives of the survey need to be distinguished from the mechanisms or the statistical system involved. With respect to the objectives, the survey has the great advantages of flexibility, relevance and speed. It can include both routine questions and *ad hoc* inquiries about such matters as nutrition, fertility or drug consumption.

Surveys can be carried out before and after changes are introduced, thus enabling comparisons to be made.

While survey data may be regarded as somewhat "soft" in comparison, for example, with cause-of-death data based on the results of hospital autopsies, they may prove to be much "harder" as predictors of needs

and demands for health services and of the extent to which such services are used, and, in most instances, they are much more useful for planning purposes. Questions of validity, reliability, response, coverage and bias all need to be taken into account, but the same is true of the vital statistics and morbidity data derived from professional and institutional records. The quality of the data and the purposes for which they are to be used need as much consideration as the sources of the data and the mechanisms for obtaining them.

Social indicators

The influence of social factors on health and on the use and non-use of health services is well recognized, and considerable research has been conducted on social indicators and on level-of-living indicators by the United Nations.¹ Among the groups of indicators considered to have an effect on health were those related to physical development, food consumption, education, working conditions, housing, transportation, employment, clothing, recreation and social insurance coverage.

Data on morbidity, disability and functional impairment are probably much more sensitive indicators of health, well-being and productivity than are mortality data. Once the former are available, the use of correlational analysis and factor analysis should suggest associations between these data and social indicators and level-of-living indicators.

The search for a single global indicator of health status may be protracted, and in the meantime the use of multiple indicators arranged in profiles or patterns should make comparisons between areas, regions and nations possible. Analyses of this kind, in which health statistics and health services statistics are associated with indicators of the social, biological and physical environment, should be useful in assessing the extent of the effect produced by the health services on the health and well-being of the population. This will be difficult, and the health planner and the statistician need to appreciate that an integrated social statistical system, of which health statistics constitute a major component, is required. The technical methods are available but the data and the statistical systems for their collection are usually either lacking or inadequately developed.

HEALTH INFORMATION SYSTEMS FOR HEALTH PLANNING

The development of statistical systems that make possible the identification and measurement of perceived and professionally defined need and

¹ United Nations (1961) *International definition and measurement of levels of living. An interim guide*, New York (E/Cn.3/270/Rev.1 E/Cn.5/353) (Sales No. 61.IV.7).

the evaluation of the effectiveness of health services in relation to these needs is not a simple matter. To link these with measures of efficiency and of medical care processes, and all of them with social and environmental indicators, complicates the task further.

Requirements to be satisfied by health information systems

Certain requirements to be satisfied by health information systems may be identified.

The system should be population-based. This implies the necessity of identifying persons positively, preferably by means of some form of unique numbering system, and of identifying place of residence or domicile. If the place of residence is known and the persons concerned are identified, various fractions of the basic data can be analysed in terms of different political and administrative units or catchment areas. The numbers of persons in the population who receive services can be related to the numbers of persons who need services and to the benefits they receive. Counts of persons in relation to selected attributes and events are more useful in the planning of health services than are counts of the activities of institutions or professionals. Record linkage at the local, regional and national levels is a desirable step towards the achievement of these goals, but its practical application is some years away in most countries and is, of course, dependent upon the availability of some means of identifying persons positively. It seems probable that, with the necessary safeguards to ensure that privacy and confidentiality are preserved, record-linkage systems will eventually become commonplace.

The system should avoid the unnecessary agglomeration of data. When data on persons, events or activities are summarized at the institutional or local level prior to being passed to the regional or national level, much of value may be lost. The basic data should be retained in their original form in which they are available for any form of analysis, either as a whole or in the form of a systematic sample, to meet the managerial and planning needs at any administrative level.

Although computers have undoubtedly revolutionized the processing of information, mechanical data processing can be readily applied to many information systems if premature or unnecessary agglomeration of data is avoided.

The system should be problem-orientated. This implies that it should be able to detect and assess the significance of new or unexpected developments or of changes in the situation. Flexibility, rapidity of response and freedom from unnecessary redundancy are important. Repetitious recording of trivial activities unrelated to patients' needs or to the end-results of care is wasteful. Rigid adherence to outmoded record forms or data-processing routines is best avoided. Unnecessary duplication

and transcription of data are not only wasteful but contribute to error. There is probably no health statistics unit in existence that would not benefit from critical scrutiny with respect to the statistics it produces and the uses to which they are put, particularly in so far as they are used for health planning.

The purpose of health information systems is to assist in the management of the services needed by the population, not to produce data for their own sake or accumulate records for unspecified purposes. Measures of patients' subjective and objective needs and the means of evaluating services should both be built into all health information systems. This implies that each system should be capable of producing estimates of the level of functional impairment and of the duration of impairment, as reported by patients. Uniformity and consistency within the statistical systems themselves are also important so that time-series and trends may be identified and used as a guide to the making of projections for the future.

The system should employ functional and operational terms. For example, the data should be related primarily to persons, functional status and events rather than to institutions, activities and processes. The former are what concern patients and populations, the latter are of principal interest to those responsible for providing care. Operational terms, such as episodes of illness, treatment regimens, health teams and groups of laboratory tests, are apt to be more useful than isolated items of information that are of little utility when considered alone. Much work needs to be done in establishing adequate classification schemes for the many components of health services.

The point just discussed may be illustrated by some of the questions that a health information system may be called upon to answer :

(a) How much disease and disability is treated outside hospitals, in relation to diagnosis or to problem and care requested ?

(b) What proportion of diseases or symptoms appear for the first time and then reappear within some definite period ?

(c) What is the mean number (and the variation in the number) of doctor/patient contacts during each episode of illness by diagnosis, age, sex and socio-economic class ?

(d) What treatments are given, what is the variation in the duration of treatments and what are the outcomes ?

(e) What are the rates of referral to specialists and to hospitals ?

(f) How do groups of patients with high and low morbidity and disability indices vary with respect to doctor consultation rates ?

(g) How do the drugs prescribed vary by service, type of patient, episode of illness and doctor ?

The system should express information briefly and imaginatively. Tables and charts that will be useful to both planners and administrators should be used. While retaining his objectivity, the statistician should attempt to draw the attention of the planner or administrator to the information he is providing and stimulate his interest in it. For example, the presentation of data in the form of population estimates or as percentages of the population in his own administrative unit, may be more useful to the planner or administrator than their presentation as standardized rates. To a considerable extent, statistical data of the type being discussed should be freely available to all responsible officials and investigators who wish to analyse them.

The system should make provision for the feedback of data. An adequate feedback of data not only to the administrators and planners but also to the clinicians and local administrators who produce them, is essential since difficulties are likely to be encountered in maintaining both the quality and the response rate if those who provide information are unable to see that it serves any useful purpose.

Development of new classification schemes

The use of household health surveys as well as of record systems, particularly those dealing with ambulatory services, calls for the development of new classification schemes for symptoms, complaints, conditions and problems brought initially to the primary care level of the health services.

In both developing and developed countries, primary care accounts for the great bulk of medical care consumption, as measured either by the number of visits to health professionals or by the time they spend in dealing with the symptoms and complaints presented to them initially. In perhaps a majority of the contacts between patients and health professionals, a diagnostic label in accordance with the International Classification of Diseases cannot be reliably attached to the patient's complaint. The development of a classification scheme that will make it possible to investigate the content of primary medical care and to make comparisons between different arrangements for providing such care seems desirable. A large part of the total resources of any health care system is inevitably devoted to the provision of primary medical care to the general population, and it is becoming increasingly important to study such care with a view to improving its effectiveness and efficiency. There is thus an urgent need for the development of a classification scheme for symptoms, complaints and conditions. Related methods for classifying functional impairments, inactivity, disability, discomfort, severity, urgency and the duration of such conditions are also needed. It is also important to define the units of service, such as visits, vaccinations,

referrals, X-ray examinations, laboratory tests and episodes of illness. Methodological work in this important area is essential if greater precision is to be achieved in the measurement of need, demand and utilization.

A related problem, particularly in developing countries, is the need for a classification scheme for lay terms for causes of death as applied to persons who were not receiving medical attention at the time of death.

The classification and coding rules for hospital morbidity data are also in urgent need of attention. The International Classification of Diseases is not entirely satisfactory from this point of view, but of greater concern is the absence of clear recommendations with respect to the data to be collected. It is of much greater value to know the reason for the patient's admission to hospital and the reason why he was kept there for a particular length of time (which may be different) than to speculate on the primary pathological event that initiated the causal sequence resulting in hospitalization. These questions of terminology and classification deserve much more attention than they have received to date.

Design of health information systems

In previous sections the nature of the information needed for health planning has been discussed and the principal methods of data collection reviewed. It is the task of the health statistician and the health planner to design health information systems specifying the information requirements, the indices and indicators to be used, the type of data to be collected and the methods to be employed for their collection. Countries will differ in their data collection methods and in their sources of data; some will use record systems, others will use surveys and some will use both. All, however, will want to consider eventually including most of the following components in a health information system for health planning for national, regional or local use—vital statistics, environmental health statistics, household interview statistics, health examination statistics, accident statistics and health services statistics.

Types of health services statistics

The following are some types of health services statistics considered particularly relevant to the planning of health services.¹

(a) Hospital discharge statistics

A data collection system based on records prepared at the time of discharge is the most reliable method for measuring the burden of morbidity presented by the population to its general hospitals. It is the only

¹ See also *Wld Hlth Org. techn. Rep. Ser.*, 1969, No. 429.

basis on which such hospitals can be compared regularly, both within a given community and between one community and another, in terms of differences in the characteristics of the cases and populations concerned. It is an essential tool for the management of both health services and their institutions. A census is the most reliable method of obtaining data from hospitals for the chronically ill, and especially from those for the mentally ill.

(b) *Ambulatory medical care statistics*

Knowledge of ambulatory medical care is lacking to a large extent. Without knowledge of the content of medical practice it is difficult to see how the objectives of medical education can be defined, how primary medical care centres can be correctly staffed, or how the burden of morbidity and disability presented initially to the health services of an area, region or country can be estimated. Data that cover this end of the spectrum of health services are urgently needed for planning purposes in all countries. Two approaches are possible.

(i) *Ambulatory medical records.* Where physicians and institutions are required or prepared to participate, a simple form, precoded so as to keep writing to a minimum, can serve as the primary source of information. The original constitutes the patient's clinical record and the copy is forwarded for tabulation and analysis.

(ii) *Ambulatory medical care surveys.* Essentially the same information can be obtained through a sample survey of all practising physicians in a given area, region or country. This approach may be preferable where primary care is not institutionalized, where there is a large amount of private practice or where much of the primary care is provided in doctors' consulting rooms or surgeries. Efforts should be made to obtain a required minimum amount of information from the entire sample or universe to be studied. Analysis may be carried out on a sampling basis in relationship to administrative and other needs. Where a routine record system of this type is used and where there is virtually universal coverage of physicians and patients, this procedure could replace the survey. It should be recognized, however, that in this complex area, a sample survey may yield more reliable estimates than a supposedly continuous reporting system used by only a fraction of the physicians concerned and where participation cannot be guaranteed.

(c) *Drug surveillance statistics*

Adverse drug reactions, polypharmacy and the cost of drugs are all problems that deserve the attention of health administrators. The

prescribing patterns of physicians and the drug-taking habits of patients require surveillance in many situations. Duplicate prescriptions may be collected or *ad hoc* surveys conducted. While these approaches do not provide information on drugs supplied without prescription by pharmacies or consumed by patients they do provide information on an area of increasing concern and importance. Information on drug production should also be obtained.

(d) *Health facilities statistics*

Effective planning requires that up-to-date information should be available on institutions, beds, examination and treatment rooms, X-ray units, laboratories and other facilities. This may be obtained by reporting or registration procedures or by means of surveys.

(e) *Health manpower and training statistics*

Information about the manpower resources available to staff the health services is essential. Inventories of health manpower and of educational and training resources should be supplemented by data on the precise tasks carried out by different grades of health personnel. There is much opportunity for research in this area.

(f) *Expenditure and financial statistics*

Any study of the efficiency of the health services must be based on information on the expenditure on these services and on their effectiveness. This is also an area where research is needed.

Conclusions

No one of the components described above (the list is not necessarily exhaustive) can alone provide all the information needed for planning health services. Each has its strengths and weaknesses and each can be used to supplement one or more of the others. For example, hospital discharge statistics and ambulatory medical care statistics provide no information on patients who are ill but do not seek or obtain medical care; only household interviews or health examination surveys can provide these data, which are essential for planning.

If a choice must be made, perhaps household interview statistics should be taken as the starting point since they alone measure perceived need. Such information should be of great utility in both developing and developed countries.

EDUCATION AND TRAINING IN STATISTICAL METHODS FOR HEALTH PLANNING

If health statisticians and planners are to assume new responsibilities for establishing population-based health information systems that can be used in the improvement and evaluation of health services or for modifying existing systems for this purpose, new approaches to education and training will be needed. The present arrangements do not appear to be producing sufficient numbers of personnel who are prepared for the tasks they face. The problems involved are considered below in relation to the three grades of personnel concerned.

Since labour is such a costly component of most statistical systems, considerable effort should be directed towards the development of efficient and economical systems for collecting, processing and producing information.

Much additional attention needs to be given to the education and training of all three levels of health statistics personnel, as well as to the education of their associates in administration, planning and clinical work. It seems unlikely that the changes envisaged by the Committee will be made unless the whole question of education and training in this field is examined in considerably greater detail by other more specialized scientific groups and working groups.

(1) *Professional personnel*

Health statisticians

A professional health statistician should have a background in mathematics, economics, behavioural sciences, demography or medicine. Graduate education to the master's or doctoral level should provide for the acquisition of skills and methods in the field of the quantitative analysis of data relating to health, health services and health systems, as they affect populations. Attention needs to be paid to the acquisition of an understanding of the methods and philosophy associated with different approaches to health planning. A substantive course in quantitative methods, including those derived from health statistics, demography, epidemiology, social surveys, behavioural sciences, operational research, systems analysis and economic analysis, appears essential. Specialization in one or two analytical methods should probably be required. Emphasis on the variations in the biological and behavioural aspects of health and on problems and services related to health seems important, even at the expense of reduced emphasis on mathematical statistics.

Health planners

The professional education of health planners and health administrators and managers should probably include similar courses. Traditional one-year courses for all-purpose health officers and providing elementary training in biostatistics, epidemiology and health planning may be inadequate in the future. Specialization and the acquisition of analytical skills seem essential if the problems identified by the Committee are to be tackled. Health planners will need training in considerable depth in quantitative methods. Joint seminars or projects provide a method whereby statisticians and planners can learn to work together.

Clinicians

The inclusion in medical curricula of courses in quantitative methods applied to the problems of health and disease in populations is essential. It is particularly important that all physicians should acquire an understanding of the epidemiological viewpoint and should appreciate that their role in providing adequate records and in reporting data on health and disease is of vital importance. Physicians provide much of the basic information required in the planning and evaluation of health services, and steps should be taken to increase their appreciation of this responsibility. Similarly, the physician should learn to make use of the reports from the health information system in managing his own patients and in understanding his practice in relation to the needs of the population.

(2) *Intermediate personnel*

Training at this level needs to include an understanding of the design and function of health information systems and of the objectives and concepts of health planning. Basic skills in data processing and in analytical techniques should be improved by the acquisition of more specialized skills in one or more disciplines.

(3) *Auxiliary personnel*

Training is usually based on fairly intensive courses supplemented by on-the-job instruction. Emphasis is placed on the practical aspect of statistical work, special attention being paid to problems of accuracy and consistency in preparing the primary records from which so much of the subsequent health information is derived. Experience with mechanical data processing equipment should be provided where more sophisticated electronic equipment and computers are not available.

RESEARCH AND DEVELOPMENT IN STATISTICAL METHODS FOR HEALTH PLANNING

Research on the statistical aspects of health planning is often neglected. It is frequently assumed that statistical data will be generated automatically by the various operations of the health services and that these data will be suitable and sufficient for the planning of such services and for evaluating their effectiveness. This is not the case; the development of statistics for health planning requires a great deal of research. Without such research the collection of statistics may become routine, automatic, obsolete and of little value to a progressive health service.

In practice, it is difficult to establish and maintain research activities within an organization responsible for data collection and tabulation or even within the broader organization responsible for the administration of the health services. The day-to-day administrative demands made on an operating statistical unit leave little time for any study of future needs and new methods. Inevitably research is pushed aside; it is always the first activity to be postponed, to suffer cuts in its budget, and to have its key personnel moved on to the task of immediate data production.

This problem of competing demands on chronically limited resources raises organizational questions. One possibility would be for the statistical research organization to be independent of that responsible for collecting and tabulating data. Another would be for the health statistics methods research unit to be outside the health agency entirely, although the stimulating feedback from users to research workers might then be lost.

Statistical research should proceed along two broad paths. The first involves the analysis of the statistical facts themselves, i.e., the substantive or content aspect of health data. The second relates to research on the development of improved statistical theories, concepts and methods. This research in statistical methods is perhaps more properly the prime responsibility of the statistician than is the analysis of data, since substantive analysis is also a major interest of health administrators.

Health statistics research can be divided up into a number of different categories, each covering one of the many aspects of the whole range of problems, as follows :

- (1) *Substantive or content analysis* :
 - (a) Development of substantive categories
 - (b) Analysis of data *per se*

- (c) Relation of health variables to other variables
- (d) Health trends
- (2) *Design of new collection techniques :*
 - (a) Application of sampling
 - (b) New survey methods
 - (c) New statistical systems
 - (d) Synthetic estimates
- (3) *Development of general indices :*
 - (a) Problems of definition and concept
 - (b) Index construction
 - (c) Model building
- (4) *Operational research :*
 - (a) Administrative improvement of traditional systems
 - (b) Reliability studies
 - (c) Systems analysis

Each of these topics could be the subject of an extensive discussion, but a few comments will be made about each of the major headings, more to explain what is meant than to enumerate all the possible research problems.

(1) *Substantive or content analysis*

The problems of substantive analysis really begin long before data are collected, since analysis is based on the formulation of concepts, the definition of the concepts in operational terms, and agreement on classification systems such that the data can be tabulated in a rational manner. Some of these steps may be routine and little more than a part of the data collection process itself. Others, however, may involve a detailed research study of what is most useful and at the same time feasible. The extensive investigations carried out by WHO and some Member countries into questions of standardizing the definition of live births and into alternative systems of classifying cause-of-death data are examples of investigations preceding the substantive analysis of health data.

Substantive analysis itself covers a wide range of questions, some of which are specific and technical in character while others are more general. The analysis of cause-of-death data is an example of the former. The overall analysis of the important causes of death should be supplemented

by investigations into the significance of methods of classifying and tabulating the complex of causes that enter into most deaths. Classification in terms of a single cause of death is an oversimplification, but a large number of multiple-cause tabulations are equally unsatisfactory.

Apart from the analysis of such technical factors, several other areas of research are of great significance to health planning. These include, for example, studies of trends in health indices such as mortality, morbidity, natality, need and disability and in indices of health manpower, facilities and services. Each of these health indices, to some extent, provides a measure of one aspect of the health planning problem. Changes in these indices with time measure to varying degrees the success, failure or effectiveness of the health services.

Equally important for health planning is the analysis of health data in relation, at any given time, to a number of other demographic, social, economic and geographical variables. Demographic variables have long been related to health factors, and tabulations by age and sex are considered minimal. The same is true to a large extent of geographical factors. Tabulations by administrative units and by urban and rural population are standard. This is not the case, however, with other important variables. Analysis of health data in relation to social status, income, education, ethnic origin, and occupation is not common and yet the use of health statistics for health planning would seem to require data of this type.

In many instances research studies of trends in health indices and studies of such indices in relation to other variables are published as separate reports. As such they have great value. There is also a need, however, for studies taking a broader view and considering in a single analysis all the factors affecting the health of the population. Attempts have been made in several countries to carry out a general study of this kind. From the standpoint of health planning, such overall research studies are of great value, while from that of health statistics no more forceful way exists of revealing the gaps in health planning data than the attempt to prepare a comprehensive factual account of the health of the population.

(2) *Design of new collection techniques*

Many different types of health data are obtained from sources and processes not primarily intended for the provision of health statistics. Such data are seldom satisfactory from the point of view of health planning. If health data are to be obtained which are specially intended to serve health planning purposes, data collection methods will have to be invented that are quicker, administratively less cumbersome, cheaper and more problem-orientated than existing routine data collection systems.

In statistical procedures of this kind, sampling techniques will play a large part. Sampling is essential in virtually all types of household surveys and in many other types of data collection. In addition, more extensive use of sampling may have to be considered in the collection and tabulation of many types of data collected on a complete coverage basis by means of administrative procedures. In spite of this, research into sampling theory is probably not an area in which research should be carried out by health statisticians. Consideration of applications of sampling theory is most important, but work on the theory itself can be left to specialists.

Research into response, or non-sampling, error is quite a different matter. The non-sampling errors in health statistics are of major importance and cast doubt on the validity of data essential for health planning. Furthermore, research on this type of error is the direct responsibility of the health statistician and cannot be left to the casual interest of general statisticians. Rapid progress has been made in recent decades in the field of health surveys, but the techniques used are still in a primitive form, and further research is required.

The health survey method is now well established in spite of its technical defects, but most surveys are narrow in purpose and carried out more as individual studies than as part of a statistical system. New developments, however, give promise of statistical systems designed to serve the needs of health planners. An example is the dual-record vital-event-recording system being tried out in several countries where registration systems are defective. The dual-record system involves the continuous recording of vital events in small sample areas together with periodic population surveys. It is then possible to match vital events in the surveys with those reported in the continuous recording process, thus making possible an estimate of events missed by both and hence reliable estimates of total birth- and death-rates. Such dual-record systems, originally designed to produce estimates of birth- and death-rates, could serve many other health statistics purposes, since as statistical procedures they are not subject to legal or other administrative constraints. The unified dual-record techniques produces data not only on health, demographic, and other variables, but also the data necessary for computing specific rates in all the required categories. Much research remains to be done on the design and application of these new systems.

Any statistical processing system that uses sampling methods to achieve economy and to improve control suffers from the fact that, as the sample size is decreased to take fuller advantage of the benefits of sampling, the possibility of compiling data for smaller health administrative units diminishes. A promising area of research is that of the study of methods for breaking down national aggregates into "synthetic" estimates of greater validity for smaller geographical units. A well-established method

in health statistics is to standardize death-rates for small areas by converting them into the rates that would be found if the characteristics of the local population conformed to those of a standard national population. The process under consideration is just the opposite. National data can be "destandardized" by converting them into the values that would be found in a local community, given the population characteristics of that community. The standardization of death-rates is usually employed only in connexion with sex and age distributions, but both the standardizing and the "destandardizing" processes are applicable to many other variables. A most useful area of research would be the study of the possibilities and limitations of such approaches in producing synthetic estimates of health variables that would be more useful in local health planning than overall national aggregated totals.

(3) *Development of general indices*

Apart from the general problems of index construction, health has a number of special problems, one of which is the relative inertia or stability of the health status of a population. The economic activity of a society can change substantially over a short period, accompanied by changes in costs, employment and production, so that economic changes can be reflected even by quite a crude index. In the health field, however, apart from epidemics, the health status of a whole population changes slowly. A very sensitive index is therefore required as a measure of change over a short period of time.

Another factor affecting certain variables which might form the components of a general index is analogous to inflation in economics. If indices, such as the number of patient visits or hospital admissions, are included in the general index as measures of the need for medical care, as such care becomes more generally available the index will rise. This might be taken as an indication that need was increasing whereas need might have remained constant but availability have improved.

An even more serious problem in constructing health indices is the fact that, for most health statistics, deficiencies in the statistics themselves tend to result in too favourable a picture. In other words, most health statistics are not "fail-safe". For example, if the data on deaths are incompletely collected, the national total will be too low and no action will be taken because of the overoptimistic picture of the situation obtained. The development of health statistics variables that are fail-safe is a problem requiring extensive theoretical study and research.

(4) *Operational research*

The design and administration of effective statistical systems require increased effort in the field of operational research. Some of this research

can be directed towards the improvement of existing traditional sources of health statistics, namely the vital registration system, hospital discharge data, and health surveys. Other research projects of this kind must be directed towards the development of new systems and methods. As has already been mentioned, one area of importance is the study of the effectiveness and efficiency of alternative statistical methods themselves. This could lead to the overall systems analysis of all the components of the health information system itself. Studies of the validity, reliability and comparability of data collected by different components of the systems are also of importance.

CONCLUSIONS AND RECOMMENDATIONS

The Committee has, of necessity, been selective in the issues considered. Much work must be left to subsequent expert committees, scientific groups and working groups. The Committee has, however, sought to recognize and respond to current trends calling for changes in many of the ways of thinking and acting typical of health professionals over the past half century. Two major themes emerge.

Firstly, it seems clear that health services will be organized to meet the needs of entire populations and not merely of selected groups who are the subject of special programmes. The entire population, both the sick and the healthy, will need to be able to call on services for the protection and maintenance of health, as well as a full range of preventive, curative and rehabilitative services. The traditional divisions between preventive and curative services and between "public health" and "private medicine" are becoming blurred. Health services are now being seen as part of the basic social services of a country and it is increasingly the intention to ensure that they are effectively and efficiently organized.

Secondly, it seems clear that to achieve this objective, management principles will have to be applied to health services. Limited resources, infinite needs and competing demands make it certain that systematic planning, careful monitoring and critical evaluation will be required. This can be accomplished only if the requisite information systems are developed, the administrative and planning skills to use the information provided by these systems are available, and clinicians and other health personnel are prepared to work in an organized fashion.

These developments need to be supplemented by vigorous basic methodological and developmental research to test the feasibility and practicality of health information systems.

The Committee believes that the time has come for change and recommends that WHO should urge countries to :

(1) *Initiate and further develop health information systems to meet the needs of health planning.* Most countries need to examine critically their existing statistical systems and the uses to which the information they provide is put in planning. The full range of components required to produce integrated national, regional and local statistics can be introduced gradually and should ultimately cover :

- (a) Vital events and demography
- (b) Environment in relation to health
- (c) Morbidity, including subjective and objective aspects
- (d) Utilization and non-utilization of services
- (e) Drug production and consumption
- (f) Facilities and equipment
- (g) Manpower and training
- (h) Expenditure and finance
- (i) Social aspects of health

The following data collection methods can be used :

- (a) Routine records and reporting
- (b) Surveys
- (c) Registers
- (d) Record-linkage
- (e) *Ad hoc* studies

(2) *Make arrangements for promoting the use of health information systems in health planning.* This might be accomplished through a national commission associated with the body responsible for vital and health statistics. Whatever the auspices under which this body operates, the Expert Committee recommends that the national commission should be established at a high level within the Ministry or Department of Health and that it should contain representatives not only from the agencies concerned with health planning and health statistics but also from other agencies and bodies concerned with social, economic and other data having a bearing on health and health services.

(3) *Stimulate and support research into scientific methods for the study of health, health services, health manpower, health facilities, health planning and health systems from the point of view of their effect on the population.* Such research should be directed towards the development of methods making use of the techniques of health statistics, biostatistics,

epidemiology, demography, the behavioural sciences, operational research, systems analysis and economic analysis.

(4) *Stimulate and support the introduction of courses on the application of scientific methods to the problems of health, health services, and health systems in schools of medicine, schools of public health and related institutions.* These courses should include instruction in the methods of health statistics, biostatistics, epidemiology, demography, the behavioural sciences, operational research, systems analysis and economic analysis.

(5) *Prepare periodic reports on the health status of the population in relation to the health services planned and provided.* These reports should supplement the traditional annual statistical reports prepared for other purposes. They should illustrate and emphasize new ways of using health information systems in health planning within the country. WHO could use such reports as a source of information for other countries and as a means of disseminating useful ideas and providing opportunities for the evaluation of trends in health statistics and health planning.

The Committee believes that WHO should also study the possible development of :

(1) *A model health information system for health planning.* The model should include a description of the components needed from the point of view of data collection, processing and analysis, and consideration should be given to the problems of organizing, staffing and using the system.

(2) *Internationally acceptable definitions, classification schemes and coding rules for the following types of information :*

- (a) Symptoms, conditions and complaints particularly those presented at the primary medical care level and their severity, urgency and duration
- (b) Hospitals morbidity data in relation to the purposes for which services are used, and to health planning
- (c) Disability, functional impairment and inactivity data
- (d) Lay terms for causes of death as applied to persons not receiving medical attention at the time of death
- (e) Data on ambulatory care services, including visits, immunizations, laboratory tests, X-ray examinations and episodes of illness
- (f) Health care functions of physicians, nurses, medical assistants, auxiliaries and other health personnel
- (g) Health care facilities including beds, examination and treatment rooms, and laboratory, radiology and other services and facilities
- (h) Data on health expenditure and finance

(3) *A formal information exchange system for the rapid communication of reports on methods, systems, policies and data from one country to another. Although this can be done bilaterally and informally, there is a need to formalize and strengthen such relationships so that the development of statistical systems for health planning can be speeded up.*

(4) *Formal arrangements for reviewing current health statistical systems and their use in health planning within each country.*