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NEW APPROACHES IN HEALTH STATISTICS

**Report of the Second International Conference
of National Committees on Vital and
Health Statistics**

WORLD HEALTH ORGANIZATION

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CONTENTS

| | Page |
|--|------|
| Introduction | 5 |
| Recent developments in health statistics and achievements of national committees on vital and health statistics | 5 |
| Important developments in health statistics in the recent past and near future | 6 |
| New types of statistics | 8 |
| New methods | 9 |
| Review of national committees' activities and achievements in the past 20 years | 10 |
| Population statistics | 11 |
| Birth and death registration and vital statistics | 12 |
| Health statistics | 12 |
| Statistics of health institutions, personnel, and activities | 13 |
| Health statistics in less developed areas | 13 |
| Users and their needs for information | 14 |
| Administration, including planning, programme management, and evaluation | 14 |
| Health indices | 14 |
| Environmental and social change as affecting health | 15 |
| Projection of future social, demographic, health care, and health resource requirements | 16 |
| Setting priorities for the allocation of health resources | 16 |
| Day-to-day monitoring and management | 17 |
| Integration of medical care records (including resources) | 18 |
| Evaluation of health care programmes and delivery systems | 19 |
| National health assessments | 20 |
| Other needs (e.g., tourism, transport, etc.) | 20 |
| Research and development | 20 |
| Communication between user and statistician | 21 |
| Major gaps in existing health data systems as perceived by the users | 21 |
| Obstacles to effective working relationships between statisticians and users | 23 |
| The role of the statistician | 23 |
| Technical assistance to users of health statistics by the health statistician | 24 |
| Meeting the needs | 24 |
| Types of statistics to be produced | 24 |
| Modification of or additions to existing systems | 24 |
| New statistical systems to meet current and emerging needs | 25 |
| Uniformity and comparability of data | 26 |
| Organization of health statistical services | 26 |
| New tools and approaches | 27 |
| Education and training | 28 |
| International collaboration | 29 |
| Implications for national committees or equivalent bodies | 30 |
| List of participants | 32 |

NEW APPROACHES IN HEALTH STATISTICS

Report of the Second International Conference of National Committees on Vital and Health Statistics

INTRODUCTION

The Second International Conference of National Committees on Vital and Health Statistics, convened under the auspices of the World Health Organization, was held at the WHO Regional Office for Europe, Copenhagen, from 1 to 5 October 1973.^a

The Conference was opened by Dr A. S. Pavlov, Assistant Director-General, on behalf of the Director-General of the World Health Organization. Further addresses at the opening meeting were made by Mr Skak-Nielsen, Director-General of the Central Statistical Office of Denmark, Dr L. Kaprio, Director of the WHO Regional Office for Europe, Dr Jørgen Fog of the World Medical Association, and Mrs Lourdes Morton of the United Nations Statistical Office, New York.

The Conference reviewed the uses of and needs for health statistics at the present time, and in the future, against the background of development, objectives, organizational structures, and programmes of work of the national committees on vital and health statistics or the equivalent bodies that exist in different countries.

RECENT DEVELOPMENTS IN HEALTH STATISTICS AND ACHIEVEMENTS OF NATIONAL COMMITTEES ON VITAL AND HEALTH STATISTICS

The basic objectives of the national committees remain as set out in the report of the First Conference of National Committees on Vital and Health Statistics of 1953,^b namely :

Objectives

(a) To help in assessing the needs of vital and health statistics, in evaluating the degrees to which the needs are met, and in securing the provision of vital and health records and statistics specific to the needs of the individuals and groups who use such records and statistics.

^a The list of participants is given at the end of the report.

^b WHO Technical Report Series, No. 85, 1954, pp. 4-5.

(b) To help to achieve essential uniformity in records, methods, and tabulations for the production of the minimum core of comparable vital and health statistics needed for national or international purposes.

(c) To assure a free flow of information and exchange of views, so that the needs and preferences of producers and users of vital and health records and statistics, at all levels, are given full expression and receive due consideration.

(d) To relate the activities and functions of diverse agencies or organizations that produce statistics, so that they work as a co-ordinated whole, avoiding both wasteful overlapping of effort and important gaps in the supply of essential statistical data.

(e) To make vital and health statistics of greater practical use and appeal.

(f) To stimulate needed statistical studies by those persons or groups best able to undertake them.

(g) To stimulate the training and supply of an adequate number of skilled workers in the field of vital and health statistics, and to encourage the interest of the medical profession in the value of the statistical approach to their problems.

(h) To assist when desirable or necessary in the implementation of international recommendations in this field.

It can be said at the outset that this second Conference succeeded in translating these objectives into practical terms, suggesting flexible approaches to the many different situations existing in the countries represented at the Conference. By separating the consideration of means from ultimate objectives, by separating primary short-term requirements from longer-term aspirations, and by recognizing the many different disciplines that might contribute at different levels to the achievement of the objectives, the Conference provided a broader insight into the information needs of health services and into the possibility of improving the provision of information.

An important difference between this Conference and that of 1953 was that on this occasion the developing countries were able to speak for themselves of their needs, on the basis of their own experience of the difficulties of attempting to develop health statistics against a background of very acute shortages of manpower of all kinds, of rudimentary health services, of severe nutrition and disease problems, and of poor communications. For their part, the developed countries recognized that, although system improvement must continue as their longer-term objective, the immediate problems centered more on making health statistics systems more responsive to user's needs. To be accepted, the systems must be seen to be worth their cost in terms of evident improvement in health services—and in better health.

Important developments in health statistics in the recent past and near future

At the First International Conference of National Committees on Vital and Health Statistics held in London in 1953, there was, as might be expected, considerable discussion of the types of health statistics that were needed

for different health programmes in developing and developed countries and also of the problem of increasing the appreciation and utilization of health statistics. There was also concern not only with the use of statistics but also with securing the cooperation of the respondents who provided the original data and wished to protect the confidentiality of their reports.

Several papers discussed at that Conference dealt with the problem of disease classification, the instruction of health practitioners in proper methods of death certification, and the training of disease coders. The training of health statisticians and the teaching of health statistics, a subject of prime importance, was discussed in several papers. It was featured among the primary objectives of WHO and United Nations action and was listed as one of the six specific objectives of national vital and health statistics systems.

The First International Conference also discussed the programmes of the international agencies in the collection of statistics, the development of international statistical standards, definitions and classifications, the improvement of national statistics, and other related activities. The major technical statistical advance presented to the Conference was the application of sampling to vital registration and to morbidity surveys.

Although all these subjects remain of prime interest and were discussed at the Second Conference as vigorously as in 1953, the Conference was able to take note of important and substantial changes and advances that had taken place in the intervening years. These changes were considered under three headings: types of statistics; methodology; and approaches and attitudes. The last is perhaps the most important since it has determined the changes in the other two aspects of health statistics. It was stressed that the drive to secure a greater range of, and more precise, health statistical data arose not merely from an attempt to measure more comprehensively the disease prevalence in the population and the determinants of that prevalence, but from new attitudes to the administration of health services. The adoption of insured schemes of health provision—whether public, private or tax provided—has stimulated a radical shift away from pragmatism and extemporization (heroically successful though this had been against the pestilences of the past) to the planned utilization of resources designed to be adequate to match predicted need. This is an entirely new management situation calling for a much more positive and purposeful approach to health statistical services.

This new situation has not been unique to health. Indeed it can be argued that the change in the approach to the utilization of statistics in the management of activity spread to medicine from other branches of economic activity where decision-making was becoming more rational and information-based. What we have been experiencing is a general advance in the level of manage-

ment skill flowing from a growing appreciation of the value of information in decision-making under conditions of uncertainty. In all spheres of economic activity the manager is concerned with planning for the future achievement of the objects of his organization in conditions that cannot be foreseen. In this situation the statistician's role is to increase the amount and relevance of timely information that can be made available and to use his skill to analyse this information in such a way as to enable the consequences of decisions to be predicted, as far as possible, before they are irrevocably translated into action ; thus the area of uncertainty is narrowed. Where information falls short of total prediction, as it usually must, the statistician can relate the outcome of events to those stages in the decision-making process that were perforce intuitive and bring into relief specific judgements that were defective ; in this way he contributes to the learning process of management. Statistics are no longer background information ; they are, along with the producers of statistics, brought right into the arena of policy-making.

New types of statistics

The new questions that health administrators have been asking are not just concerned with the quantity and population distribution of disease, the determinants and therefore the preventability of disease, and the effectiveness of both preventive and curative services, or even the costs of health services ; these matters have always been of interest to those responsible for health services. The health administrators were concerned with the relevance of information to forward planning ; with the comparison in terms of cost-effectiveness of optional strategies to combat predicted pressures in the future ; and with the relationship between health service planning and other sectors of social and economic planning, especially with other aspects of social policy. Antedating this new orientation of attitude there has been, for many decades, a much greater appreciation of the environmental factors in disease and health and an inclination to see patients as members of family and community groups. Medicine, as well as having to concern itself with social values and with population movements and changes, has had to face the challenge of vigorous cost analysis and investment appraisal. New dimensions of sociology and demography have been added to medicine.

More specifically, for the statistician, the problem is that of predicting the trend of health indicators in the future in such a way that they can be translated into demand for action ; and of predicting the costs and benefits of action. Within the information system to meet these problems there are a number of important subsystems. Health indicators embrace not only

more comprehensive measures of morbidity or of anthropometric and physiological characteristics of the population but also measures of those social and economic characteristics that are the determinants of levels of morbidity (a field of statistical study not as yet fully developed). These health indicators are specific to particular population groups so that demographic changes require to be more closely studied and population census requirements become more demanding. Much more needs to be known, too, of the activity surrounding patients in health service facilities. Activity analysis, the measurement of resource utilization in relation to specific therapeutic or prophylactic procedures, provides a whole new field of statistical measurement requiring the development of new statistical units of activity. This analysis has to extend to institutional treatment (covering both in-patient and outpatient services) and domiciliary treatment. On the economic side there is a need to develop costing units related to therapeutic objectives—even the definition of therapeutic objectives is a new statistical field calling for new types of medical classification if not for new techniques ; there is also a need to measure the effects of treatment and to assess the extent of achievement of therapeutic objectives. Also within the economic framework there is a need to study the satisfaction or dissatisfaction and indeed the motivation of those who use health services (and those who do *not* use them).

New methods

To embrace these new statistical fields of study, medicine has had to borrow heavily from a whole range of statistical methods developed for other disciplines. Demographic and actuarial methods for the study of general population changes and of long-term changes in specific groups of patients or controls ; advanced survey design, including self-recording screening questionnaires and the handling of complex sources of response or sampling error ; computer applications, including the use of simulation models of health service systems ; the design of community health record systems providing for the integration of all records of the same person and the development of more powerful methods of data-processing, for example, automated disease coding ; these are some of the methods with which those now entering medicine must come to terms. New attitudes, new statistics, new methods formed the central theme that the Conference agreed to develop in detail but with proper regard to old problems especially in the developing countries—the problems of scarce resources and competing economic priorities, of lack of trained manpower, and other difficulties associated with the necessarily slow emergence of organized health services in these circumstances.

Review of national committees' activities and achievements in the past 20 years

The Conference endeavoured to assess the progress made since the first Conference in 1953, and to delineate the major activities to be undertaken in the immediate future. In some areas of health statistics—for example, the statistics of health personnel and health establishments—there have been substantial improvements in the past 20 years but in the really basic field of vital statistics, achievement has been far from satisfactory.

Since 1950 the proportion of the estimate of the world's population that derives from total census enumeration has risen from just over 70% to rather less than 95%. The proportion depending on conjecture or undetermined methods has fallen from 5.9% to 2.8%. In Africa where information has been most lacking, the rise in the census-based proportion has been from 43% to 64%. The improvement in census data has been much greater than that in data derived from vital registration. The proportion of the population for which reliable data of live births is available has generally improved but little; in the world as a whole from 28% to 35%; in Africa from 2% to 17%; but in Asia, the proportion has remained at 7%. Almost two-thirds of the world's population (four-fifths of the population of Africa and Asia) lack adequate birth registration. For death registration the picture is just as gloomy, and it is even worse for infant mortality.

To a very large extent progress has been concentrated in the developed countries where health statistics systems are already established and adequate statistical resources are available. This progress should not be undervalued. It might be thought that it increases the information gap between the more developed and the less developed countries. It certainly can be argued that world priorities demand that more resources should be diverted from the countries of advanced development to help to assist the establishment of vital registration, or as a first step, an appropriate substitute in countries where it is now lacking. It is also true that we need to regain some sense of urgency about this major deficiency. Nevertheless, three important facts must be borne in mind. First, the countries with advanced statistics systems act as models for the improvement of statistics systems in the less developed countries, and the latter, when they do move forward, tend to catch up very rapidly, i.e., though the gap may be temporarily widened, it is likely to be closed again rapidly. The point was well made at the Conference that there is no single model of a statistical system applicable to all countries at all stages of development. There is a benefit to all countries from continued experimentation. Second, the developed countries themselves have problems of management, arising from their more complicated economies, that call for ever more advanced information systems; they cannot afford

to stand still. Third, it is not until economic development gets under way that countries find either a pressing need for, or the skilled manpower to sustain, population registration systems of any kind.

In many countries, national committees on vital and health statistics or their equivalents (the function rather than the name is important) have not only stimulated improvement in the reliability and coverage of statistics on morbidity and nutritional levels, on social and economic conditions, on health service manpower, on the availability and utilization of health service institutions and facilities, and on drug production and use, but they have pressed for a more systematic approach to the provision of information for health and welfare service planning. These committees have also been instrumental in encouraging the introduction of new statistical methods and of computer applications.

The Conference considered that national committees still have an important part to play and should pursue these efforts to remedy existing gaps in health statistics. Both the First World Health Assembly^a and the First International Conference on National Committees on Vital and Health Statistics^b recommended all governments to set up national committees and made proposals as to their composition and functioning. The WHO Expert Committee on Health Statistics, in endorsing the above recommendations at several of its meetings, emphasized the desirability of establishing national committees in all countries in view of their potential for fostering vital and health statistics. The Conference reaffirmed the basic necessity for instituting adequate recording of vital events and other elements in population change.

Population statistics

As regards population statistics, which constitute the base for more specific vital and health statistics, it is still necessary to urge that in intercensal years, annual population estimates be made for each country or territory, giving not only global figures but also age and sex distribution. Such estimates could be based on the recorded births, deaths, and migration in the whole population or in suitably selected samples. Large migrations within a country, of which accurate records can not be obtained, increase the need for censuses to be carried out at intervals shorter than 10 years. Quinquennial censuses could be envisaged, with complete enumerations of age, sex, marital conditions, and occupation, such enquiries being supplemented by additional data collected on a sample basis in conjunction with the census. Periodic sample surveys to provide population estimates

^a Official Records of the World Health Organization, No. 13, 1948, p. 304.

^b WHO Technical Report Series, No. 85, 1954, pp. 5-6.

by sex and age and perhaps other characteristics should be considered for national estimates or for geographical subdivisions of the nation.

Birth and death registration and vital statistics

Birth and death registration must still be accepted as the base for any health information system including the measurement of population change, and countries that have not yet instituted a system of vital registration are again urged to give priority to closing this gap in official statistics.

The Conference recognized that the statistics of causes of death remained one of the most important elements of health statistics, which in many countries still served as the main basis for establishing health policies.

Although considerable progress had been made in past decades at both national and international levels in this respect, there is still room for improvement, particularly with regard to the accuracy of determining the cause of death. In the interests of accuracy, it is desirable that causes of death be certified by physicians. In order to adhere to fact, the physician has in certain countries to be protected against the legal and psychological consequences of his certification of certain causes. The safeguard of professional confidentiality in these countries is therefore essential.

The complexity of biological and pathological processes is such that many deaths involve more than one cause; contributory causes ought therefore to be recorded in their proper time and causal relationships. The universal adoption of the International Form of Medical Certificate of Cause of Death recommended by the World Health Organization is still essential to the achievement of a complete description of the cause of death. Countries should, in addition, develop tabulations of joint causes based on proper samples of death certificates. Studies should also be carried out where possible to check the accuracy of medical certification at various ages and in various communities by comparison with post-mortem records and by other available methods.

Health statistics

Statistics of causes of death are inadequate to meet all the needs of health planning and research and such statistics need to be supplemented by morbidity statistics. In this connexion, reference may be made to the thirteenth report of the WHO Expert Committee on Health Statistics^a which considered the type of statistics required for the planning, administration, and evaluation of health services and called for a new look at the range of statistical information available to health administrators.

^a WHO Technical Report Series, No. 429, 1969

Although communicable diseases represent in many countries a very small part of the total morbidity, their notification still has an important public health significance and should not be neglected. As the completeness of notification depends far more upon an understanding on the part of the medical profession of their practical value to their patients and to the community than upon the legal compulsion exercised to obtain them, it is desirable that health administrations, bearing this in mind, should continuously review existing lists of notifiable diseases. They should also reduce to a minimum the work load placed upon medical practitioners in notifying communicable diseases by simplifying the procedure as far as possible.

The establishment by health administrations of panels of specialists or of general practitioners, constituting as far as possible a representative sample, and undertaking voluntarily to report one type or other of disease, communicable or otherwise, might sometimes be more effective than a blanket obligation laid on all practitioners to report a large variety of conditions. Some useful experiments of this kind have been made in attempts to develop a practical but nonstatutory form of morbidity reporting.

Statistics of health institutions, personnel, and activities

While fully aware of the difficulties involved in compiling internationally comparable statistics of health and medical institutions and of their facilities, personnel, and activities, because of the lack of universally applicable definitions and standards, the Conference recognized that there was an important demand for these types of information for health administration and especially for planning purposes, and recommended that WHO should continue its work in this field.

Health statistics in less developed areas

The Conference gave particular attention to the difficulties faced by less developed countries. In some areas, where at least a skeleton health service exists, the Conference agreed that every effort should be made to maintain adequate records and to produce summary statistics of the various diseases treated at hospitals, clinics, etc., even though such summaries might give, at times, a misleading picture, e.g., showing an apparent increase of disease prevalence in proportion to the increased facilities.

Similarly, in areas such as main towns where compulsory registration of births and deaths exists, constant efforts, directed both to the local population and to the administration, should be made to improve the completeness of registration and the quality of recording of causes of death.

In areas where full information on the health conditions of the population cannot readily be obtained by the established health and administrative

machinery, surveys should be organized, possibly by the use of mobile medical teams. These survey teams should record total populations and all vital events occurring during their survey period, and should aim at obtaining some details of causes of deaths.

Their work on the measurement of morbidity may have to be limited to certain diseases only. If possible, the sample surveyed should be representative and large enough to enable reasonably accurate morbidity estimates for the whole territory to be calculated.

USERS AND THEIR NEEDS FOR INFORMATION

Administration, including planning, programme management, and evaluation

Health indices^a

To assist in the formulation of health care plans and in the monitoring of the subsequent development of those plans it is important to be able to provide governments with information on trends in the levels of mortality and morbidity. It is desirable for planning purposes that this information should be capable of being translated either into needs for specific action or into the successfulness or otherwise of past actions. Judged by this criterion most of the readily available indices are inadequate. For example, the expectation of life at birth is an appropriate index of the general level of mortality since it is effectively age-standardized and is sensitive to changes in mortality in young age groups (the more important indications of the improving health of a population). However, it does not indicate in itself the diseases for which mortality has been either improving or has been resistant to improvement. The mortality rates for different groups of causes are interdependent so that the practice of calculating expectations of life with certain causes excluded is liable to be misleading. Similar criticisms can be levelled at the infant mortality rate and the crude death rate for all ages. At the early stages in the economic advancement of a country measures of physique (height, weight, chest perimeter, etc.) are sensitive to improvement in nutritional levels but at later stages they may be relatively insensitive, showing only perhaps an advancement in the age of maturity.

Rates of mortality (or morbidity where available) specific for sex, age, and cause provide more information about health trends but are too frag-

^a See also WHO Technical Report Series, No. 472, 1971.

mented for ready overall comprehension and they are not directly related to the provision of health services.

Indices of more relevance to health service action would include (a) rates of incidence of illness, e.g., new cases attending general medical practitioners, new cases attending hospital outpatient departments, new spells of sickness forming the basis of social security claims, per unit of population specific for sex, age, and medical cause; (b) hospital admission rates, specific for sex, age, principal diagnosis, and type of hospital and also measures of duration of stay and of bed occupancy; (c) communicable disease notification rates and statistics of the immunization state of the population; and (d) demands for associated services, e.g., screening services, dentistry, and physiotherapy related to specific population groups.

It will clearly be desirable for these indices to be related to specific socioeconomic groups in the population so that social and economic differentials can be determined. Future demand for medical services can then be related to social and economic trends in the population.

Environmental and social change as affecting health

There is now widespread agreement (reflected in the discussions of the Conference) that the social and economic environment plays a powerful part in the development and correction of disease, in determining the readiness of the population to accept the delivery of health services, and often in determining the ability of the population to gain access to health care or escape from inimical environments. Poverty increases the prevalence of disease and inhibits its relief. Medical intervention alone is not sufficient to secure improvement in community health. Measurement of the prospects for health improvement must therefore embrace the monitoring of changes in the whole complex of social and economic conditions to which the population is subjected, and the continuing study of the relationship between disease and social and economic factors. The complex now extends beyond the standard of living (nutrition, housing, education, employment, etc.) to ecological stresses, and to problems of environmental pollution.

The study of these relationships and the satisfactory measurement of social conditions present a number of difficult statistical problems. The established relationships between social conditions and health must be used to develop social indicators that serve to provide a real guide to the social and medical action (preferably in unison) that must be planned.

An immediate advance (embraced by the concept of community health records, to which reference has already been made in this report) would be the linking of medical and social case records, though here the problem of confidentiality is likely to be encountered in its most acute form. The

advantage of this link in extending the appreciation of social factors in disease was stressed at the Conference.

The World Health Organization has already done a great deal of exploratory and educational work in this field and it was urged that this should continue and that, in particular, further studies of social indicators to serve as guides in social and medical planning should be developed.

Projection of future social, demographic, health care, and health resource requirements

When the statistical problems involved in measuring social and health change have been solved, there is still the problem of establishing current trends and projecting them into the future. There are two different kinds of problem. The actual process of projection is a matter of time series analysis. This is the more tractable problem since the mathematical techniques of establishing and extending trends in statistical indices have been highly developed (mainly to meet the needs of economists). The other problem is a dual one. It is necessary to get the administrators to understand just what is implied by projection ; that in the first place it is not a once-for-all prediction of an inescapable future event but a way of demonstrating *present* trends by reflecting their long-term implications, while appreciating that either by chance or as the result of administrative action tomorrow's trend (and *its* long-term implications) may be different ; that in the second place the process of projection should be extended to yield a model of world trends from which the consequences of the adoption of different strategies may be deduced. Ideally, the model should so illuminate the process of decision-making as to enable health planners to evaluate the consequences of choosing the wrong path. If these consequences are slight, there is that much more freedom of action. If the consequences are far-reaching, freedom is restricted.

Health administrators need to be helped and educated by the statistician in the use of models and projection procedures. Management must learn to be appreciative of the limitations of these procedures but also to trust their strengths and especially their objectivity. It would be helpful if an educational programme could be established to improve the use of statistical information in the construction of future health policies.

Setting priorities for the allocation of health resources

There is increasing "recognition that the dilemma of choice, which economic considerations increasingly force upon the providers of health care, presents a fundamental problem which requires something more than

the mere exercise of chance or empiricism if a satisfactory long-term solution is to be found".^a

To ensure that the choice shall be rational requires the provision of a well designed management information system. It must be stressed that before such an information system can be designed there are much more difficult tasks for statisticians to accomplish. It is necessary first to explore the economic framework within which the resource allocation is to take place, and, next, to explore the conceptual difficulties that surround the definition of measurable outcomes for the health care system.

The special problems of applying economic principles in the health service arise from the extreme difficulty of evaluating the results of resource consumption. These problems arise whether or not health services are socialized. Expenditure on health differs from other types of expenditure, for example, on food where the consumer is capable of making personal decisions. The consumer of health care depends on the expert advice of a medical practitioner. Even if the consumer could decide, there would still be the difficulty that what he would choose to consume would not necessarily be of benefit to society. For example, the treatment of an individual case of infectious disease benefits many more persons than the infected person and his family. Moreover, what the consumer would choose to consume at any time would not be wholly determined by medical need ; the decision would be influenced by other social and economic considerations, both individual and national. Nevertheless, a starting point in making rational allocation of resources must be the regular provision of information on all types of health care need, and equally on all existing uses of resources. The need to extend further into the economic field the examination of medical strategy serves only to underline the necessity for a sound system of recording the demand for health services and the way in which these services are deployed. Who uses health services ; for what reasons and purposes and with what results ? Equally important—who does not use health services and with what consequences ?

Day-to-day monitoring and management

The day-to-day monitoring of health programmes is largely a matter of well designed, and especially of well supported intelligence services. There has to be a steady flow from the field (i.e., from all operating areas in the health services) of data that is relevant to the task of evaluating the service needs and the efficacy of the methods used to deliver those services. The

^a *Accounting for health*, London, King Edwards's Hospital Fund for London, 1973 (report of a working party on the application of economic principles to health service management).

design of such a system is a matter for clear and skilled statistical thinking. The operation of such a system requires the cooperation of large numbers of personnel of varying skills, interests, and responsibilities. To secure this cooperation it is necessary to do more than argue the benefits to the administrator of access to decision-orientated information ; it is essential to offer benefits also to the field workers in the form of a feedback of information of direct relevance to their own tasks, either facilitating those tasks or enriching their professional satisfaction.

Integration of medical care records (including resources)

Those concerned with the measurement of morbidity, whether it be for day-to-day health services management, for the projection of future needs, for preventive action, or for the establishment of a scientific basis for these activities (for example, the investigation of etiology or of the influence on disease prevalence of social and economic factors) must be able to identify the whole episode of sickness for a particular individual even though, as often, the medical care of that individual is shared by a number of different agencies or conducted with intervening periods without treatment so that the record of the whole episode is (unless special action is taken) distributed over time and over a number of different locations. Further, they should be able to bring together (at least for some medical purposes, e.g., the prospective study of environmental risks) all etiologically or physiologically connected illnesses in the life-time of an individual. Equally, for economic studies, it may be necessary to bring together all demands on a particular health service resource within the life-time of an individual.

There are two methods of achieving this integration of medical records :

1. medical record linkage, i.e., the retrospective extraction and matching of records made at different times and at different places. This can be done manually but is rarely feasible without computer assistance. This method, given the present state of computer technology and its low cost, is now regarded as less than adequate because the record integration is retrospective and cannot, without great difficulty, be sufficiently up-to-date to be of value for current treatment. The method tends to be replaced by :

2. the community health record system in which records whenever or wherever made for the same individual are simultaneously written into one central computer file for that individual. The "writing-in" may involve some selection and ordering of data ; it is an advantage of the system that this is both possible and indeed easier to accomplish at the time of recording than later.

In this latter system the advantages of instant feedback to the user are so great that, where it has been tried, medical practitioners have quickly appreciated that their cooperation is amply repaid.

The community health record system (and also record linkage) has been regarded by some as presenting grave problems of confidentiality and indeed these problems were stressed at the Conference. There are problems but these are, in practice, less serious than in conventional medical record systems, which do not have anything like the security protection that modern computer technology can provide. Nevertheless, as has been stated earlier in this report, the problems should not be ignored. Their solution must be rigorous so that all may be convinced that confidentiality is strictly protected. Above all there must be respect for the individual patient who must be fully aware of the risks of broken confidentiality, small though they may be, and of the benefits in improved diagnosis and treatment. He must give his consent as a prior condition of the record integration.

Evaluation of health care programmes and delivery systems

The problem of measuring the output from a particular health care system has already been pinpointed as a major difficulty in attempting to rationalize the allocation of resources in the health field. The same difficulty obstructs attempts to evaluate the extent to which health programmes are successful in achieving their objectives. One difficulty is that of defining objectives in such a way that their attainment can be measured either directly or indirectly (i.e., through suitable indicators). What are suitable indicators? Where a disease has clearly been eliminated this fact will be obvious; otherwise, changes in mortality rates and even in morbidity rates may not be true measures of the effects of health services intervention. Another difficulty is: How do we know that these changes would not have occurred without intervention? The method of the controlled trial can be applied to many therapeutic and prophylactic procedures but it is much more difficult to apply the method to a whole health programme. Who would be content to remain in the control population? The measurement problems here are relatively new and there is an urgency for research and experiment.

The interest of the Conference was stimulated by reports of experiments in this field. These experiments were in some instances directly initiated by national committees. Clearly, considerable progress is being made in this very difficult area of measurement. The search for true concepts and definitions is basic to statistical advance; technique is a lesser problem. Indeed if objectives are more clearly defined, the statistical techniques needed to establish their achievement are often rendered more simple. National

committees could make a valuable contribution by promoting discussion and clearer thinking about the real objectives of health services.

For its part, WHO should investigate ways of fostering research into methods of measuring the output, in terms of the effect on the health of the population, of health care programmes (including delivery systems).

National health assessments

There has been much discussion of the possibility that, on an analogy with national financial and economic accounts, there might be national assessments of health—tabular statements indicating movements in a matrix of distribution of states or levels of health in different segments of the population in response to specific inputs. If successful, such a development would possibly help to fill the present gap in information about the results of health programmes. Some experimental work already conducted has led to suggestions as to how these states or levels of health might be defined; they have to be states that can be measured on a population-wide scale, albeit on a sampling basis. The cost and labour of producing such assessments on an annual (and up-to-date) basis would be heavy and their usefulness to governments in a policy-making context remains to be demonstrated. Further study, however, is amply justified and it is to be hoped that WHO will investigate ways of supporting a research project aimed at exploring the usefulness of the concept of national health assessments.

Other needs (e.g., tourism, transport, etc.)

The recent occurrence of cholera in countries where it is not endemic has once again underlined the need for vigilance against the circulation of infectious disease by population movements from or through infected areas. Any health intelligence system must cover this hazard.

Research and development

The statistical method is now firmly established as a vital part of the equipment of research, indeed, as the scientific basis of research, in all branches of medicine. Epidemiology and many forms of therapeutic trial are all based on the comparison of groups, an essentially statistical process; epidemiology too involves the study of population structure, growth, and change and thus introduces demography as another application of statistics. Studies in environmental health are similar in several ways. Earlier in this report attention was called to a number of problems in health administration and health economics that call for research and particularly for the development of appropriate statistical methodology.

Research is concerned with questions that cannot be answered by normal intelligence systems yielding routine flows of information. Research normally calls for its own specific statistical arrangements. Nevertheless, it has to be borne in mind that alterations in trends in routine statistics may often stimulate enquiries that develop into full-scale research.

While research that is clearly a part of health care management is accepted as a cost of management and receives the necessary support of statistical services, other research, particularly at the local clinical level and outside the large national research institutions, tends to receive inadequate statistical support. As a result, much potentially useful work is poorly performed, often discouraged and equally often never brought to any conclusion. In such circumstances there is a danger that medical practice outside the teaching centres (and sometimes within them) might drift into obsolescence. National statistical organizations should provide for the needs of the medical practitioner with an enquiring mind and a scientific approach.

National committees should foster the provision of statistical support to workers in normal medical practice who are disposed to pursue research activity as a means of sustaining their interest in medicine and improving their diagnostic and therapeutic capability.

Communication between user and statistician

This is probably the most important area of study of the Conference since statisticians can only play their full role in improving health care if those who use the statistics understand and trust the statisticians and if in turn the statisticians show a proper regard for the needs of the user and do not try either to impose their own views of what those needs should be or try to take over the role of the user. It is not for the statistician to ask the questions and make the decisions; that is the role of the user, whether administrator or clinician. If the statistician is asked for advice either about needs or about the policy implications of his statistical findings, that is a different matter. The statistician can often be very helpful in this respect but if he is to foster trust and respect he must stop short of trying to instruct rather than to advise.

Major gaps in existing health data systems as perceived by the users

Existing health data systems are undoubtedly deficient in many respects. Even in countries of advanced economic development there is a lack of community health record systems, and a lack of properly organized frameworks for epidemiological study. These gaps arise partly because, in a

situation of limited resources, other claims on those resources have higher priorities, and partly because users do not perceive the statistical gaps. This is an important problem and one that brings into relief the vital need for communication and understanding between the statistician and the user. The user may be good at his job, and may recognize the value of statistical information in illuminating (but not automatically ruling) his decision-making path. Nevertheless, he may still not know enough about possible statistical sources and methods to perceive the gaps in information that it would be desirable to fill and he may not place the value of this information high enough to justify the cost of obtaining this information.

The statistician is sometimes in a better position, by virtue of his professional competence and because he is not committed to a policy, to recognize the needs (especially the longer-term needs) of the user. However, he should not try to impose his views on the user. First because whatever the advantage of his professional skills, he is not the user and does not have the user's responsibility or viewpoint. He could be wrong and if he nevertheless succeeds, by sheer pressure, in securing the expenditure of money for information which in the end either cannot be obtained, or, if obtained, is of little value to the user, then he personally, and statisticians in general, will be discredited. The statistician must try to resist his natural desire for the best in order that this shall not become the enemy of the good. He must accept that the user is likely to be sceptical about alleged information gaps until at least, by steady rather than hasty progress, he begins to prove that the advantages are worth the cost. It is the user, who has to defend statistical expenditure and the statistician cannot regard any progress as permanent until the user commits himself fully to an acceptance of the alleged gaps in information or to a need to fill them that is at least as great as the expenditure involved.

The gaps in information are greater and more fundamental in the developing countries. The very simplest measures of health needs and services are not only those that are immediately possible with limited resources but they are also the most important at an early stage of development. Useful data include : single numbers of cases of particular infectious diseases, death rates from the more important causes of death (even if only approximate), the infant mortality rate, and the crude birth and death rates ; these raw materials may be vital to any appraisal of the general health conditions of the country and of the early effect of any health and social measures that may be taken. Historians of vital statistics will recall that John Graunt in 1662 was able to make important deductions from less information than this, in England, then a developing country.

The Conference stressed that in the progress towards better health statistics the priorities in the developing countries should be kept clearly in mind.

Obstacles to effective working relationships between statisticians and users

Organizational structures and geographical location may present obstacles to effective working relationships between statistician and user,^a but these are not of primary importance. The only really important obstacle is a lack of mutual understanding and acceptance of their respective roles (see below). The following rules may be quoted for improving working relationships :^b

1. The statistician must be prepared to say what he has done as clearly and as simply as possible. There must be no "blinding with science".
2. The statistician must not lean too heavily upon his position as an expert. He must be prepared to justify what he has done and to accept criticism from non-experts (this is the best way to become recognised as an expert).
3. The statistician must be prepared to say what the figures *mean* in language that users can understand (without being patronising).
4. The statistician must avoid giving the impression that the provision of information is inhibiting the user from making his own judgement.
5. The statistician must let the user ask the questions and help him to do so.
6. The statistician must accept some of the responsibility for actions based on his information without himself claiming credit when these actions go well.

The role of the statistician

It was a continuing theme of the Conference that, as emphasized earlier in this report, the statistician must concern himself with policy-making. He should be a member of any policy-making team ; not usurping the right and responsibility of the administrator to decide (and to do his own job to his own satisfaction) but listened to and respected by the administrator as the supplier of the statistical information most relevant to the problem under consideration and as a skilled interpreter of the information, indicating the possible policy choices and the probable outcome of different strategies. In the construction of any information system the statistician must be the paramount designer and in its operation occupy a key position. Situated between the user at the centre of the system and the data collection and data processing personnel in the remainder of the system, he directs the system in order to provide a continuing dialogue between the user and the system, and to supply the answers that are specific to the questions asked by the user. It is this dialogue that is central to any information system and a system, however well supported by computer technology, that does not provide for

^a WHO Technical Report Series, No. 472, 1971.

^b BENJAMIN, B. The statistician and the manager, *OMEGA, The International Journal of Management Science*, 2 : 1-5 (1974).

this direct communication between user and statistician will be of little value ; indeed it is likely to be rejected by the intended users as having been imposed upon them without sufficient regard to their own perceived needs.

Technical assistance to users of health statistics by the health statistician

While it is among the essential qualities of the good administrator or research worker that he should both appreciate the value of information and know quickly how to use it, a certain degree of basic training is necessary if these qualities are to be fully developed ; administrators and others cannot at the present time be assumed to have had this training. It is therefore necessary that teachers of statistics in the medical field should turn their attention to ensuring not only that statisticians should be given training, but that administrators also should be educated, not to acquire competence themselves in statistical methods, but to appreciate the way in which statisticians can contribute to policy-making, and to know how best to convey to statisticians their information problems ; to know, in short, how to play their part in the dialogue to which reference has already been made.

Meanwhile, statisticians must do their best to help to remedy any present difficulty in communication from which users are suffering. Statistical offices should, in their own long-term interests, demand sufficient resources to enable them to identify their users more closely and to communicate with them ; to offer within the limits of their resources, technical assistance in the diagnosis of information needs, in the design of surveys and experiments (their advice should be given at the outset, before it is too late to repair statistical deficiencies), and in the interpretation of policy or scientific implications of statistical results.

MEETING THE NEEDS

Types of statistics to be produced

Modification of or additions to existing systems

The Conference agreed that having regard to the statistical needs described earlier in the report it would be necessary, in most countries, to add substantially to existing systems and also to modify them to make them more responsive to the working needs of users (for example by change of format). It was considered more economical to adapt existing information systems and to rebuild them in a modular fashion, gaining gradual acceptance as these additional modules proved their usefulness, rather than to substitute in one step a complete integrated system, even if this were possible.

It was urged that, in the interests of economy, old systems should be exploited to the furthest advantage before being replaced. It would be helpful to developing countries if an inventory of existing systems could be made available.

New statistical systems to meet current and emerging needs

There would, nevertheless, have to be a determined move towards a statistical system^a that would meet modern needs as already described. Such a system would have to conform to a logical design, however gradually approached. It must be planned. This design would have to relate to the objectives of health services. Equally, users would need to appreciate the objectives of the statistical system. Several countries gave an account of the progress they were making. It was suggested that the components of a health information system should include :

- (1) indicators of the state of the population (morbidity or mortality data, psychological or physiological parameters, the outcome of specific preventive or treatment measures) ;
- (2) measures of the utilization of services of various kinds ;
- (3) statistics of resources available to support this utilization, especially manpower ;
- (4) financial statistics (costs, expenditure) related to particular objectives ;
- (5) demographic, social and environmental data.

The system would need to be simplified in proportion to the limited resources in a particular country.

The need for statisticians to understand what health administrators are trying to do was again underlined, and the Conference was reminded of the need to bear in mind the requirements of social security planners and administrators. Social security schemes constituted important users and generators of health statistics.

^a Most delegates used the term "system" to refer to a logically arranged battery of statistical measures of morbidity risk or health service utilization rather than in the cybernetic sense of a network of sensors with interconnected information flows, a change in one of which would automatically affect all others. The term "systems analysis" was also loosely used to refer to the examination of this logical battery rather than to the exploration of the cybernetic network.

Uniformity and comparability of data

In order to permit a regional or world view to be taken of the health state of the population and to share, on an international scale, experience of making improvements in the economics of health care, it would be highly desirable to achieve comparability in concepts, definitions, and classifications, as well as in the level of aggregation, by which national data will be collected, computed and presented. WHO should investigate ways of bringing statisticians together to achieve greater comparability, as has been done by the regional population census working parties organized by the United Nations. These had resulted in accepted international recommendations for a minimum coverage and analysis. The meetings of the working parties had brought to light unsuspected sources of lack of comparability that were then corrected. There was equally a need in the health field to try to agree on a minimum coverage for statistics and their presentation so as to permit international comparisons as well as aggregation for the purpose of regional and world reviews.

Organization of health statistical services

There was considerable diversity of opinion as to the functions, structure, and location of health statistical services, partly because historically health services and their associated statistical services developed in different countries in different ways, partly because there were differing views of the relative advantages of, on the one hand, the economy and independence (objectivity) of centralization and, on the other hand, the closeness of cooperation with operating and directing staff and the better understanding of the nature of the data that can be achieved in a decentralized organization. In general, these divergencies are of less importance than the primary objective of satisfying the information needs of all users by whatever means may be available and the delivering of that information by whatever routes may, in particular situations, be more acceptable to the users. Nevertheless, some members of the Conference thought that the advantages and disadvantages of centralization should be argued out. The advantages are :

1. More direct management of the statistical organization from the centre of government ; therefore, closer identification with the information support of the policy objectives of government and more effective maintenance of common standards of statistical assistance in the various services of the government.
2. Concentration of scarce skills, more specific creation of a government statistical service as such and with it, the provision of a better (and more attractive) career structure for statisticians, both lay and medical.

3. The integration of the health statistical system with other statistical systems within the government machine, thus providing better statistical arrangements for overall planning and also ensuring economy of information by making sure that information of common interest is collected at one focal point only and shared between services or departments.

These advantages are impressive but so also are the following disadvantages :

1. The creation of a rather rigid central statistical programme with a tendency to ignore the immediate and very important needs of local departments.

2. The separation of statisticians from the subject material they are required to handle and from the operating personnel, particularly medical staff, whose experience is essential to the proper interpretation of the data that may be collected.

Both these disadvantages are aspects of a separation of the statistician from the user and may hamper close collaboration between the statistician and the user ; these obstacles have been set out, in some detail, earlier in this report. If centralization is to succeed, then the economies effected must outweigh the additional cost and effort of overcoming the communication problems that will be created. In some instances the communication problem has been overcome by retaining central control for professional and career structure purposes but out-posting statistical staff to work in operating departments side by side with health service workers of various kinds.

New tools and approaches

The Conference discussed in detail some of the technical means of satisfying the needs pinpointed in their earlier deliberations. This discussion embraced the following topics :

1. Continuous improvement in the definition of the concept of health and of health outcomes.

2. Development of health indicators.

3. Linkage of different types of health records from different information systems.

4. Methods of data collection, processing, storage, and retrieval.

5. Development of disease and other registers.

6. Methods of presentation and dissemination of statistical information.
7. Introduction of operational research methods.
8. Technical assistance to users of health statistics by the health statisticians.

There is a growing body of literature on all these topics both in WHO publications and in the international medical press. Many reports of experimental work are now available.

There was general agreement that the statistical methods already developed for the health field were not yet being fully applied ; for example there should be more application of the method of the controlled clinical trial to measure the effectiveness and efficiency of different modes of medical care. It was also suggested that the health statistician might well profit from an examination of the methods employed in other fields of applied statistics, for example, marketing or managerial science. In view of the growing environmental homogeneity of the developed countries, there was an appeal by some epidemiologists to developing countries to supply data relating to environmental differentials in the incidence of cancer and other diseases. It was also urged that statisticians should devote more resources to a thorough study of the users of their statistics.

Education and training

Some reference has already been made in this report to the need for teachers of statistics to ensure that statisticians are taught to be sufficiently responsive to the needs of users. This means that the curriculum must contain not only adequate theoretical content but also adequate treatment of applications. There should be copious illustration of the practical problems likely to be encountered not only, as is common, in epidemiology, but over the whole range of the health services. It is the practice of many schools of statistics to invite statisticians working in the health services to give lectures on case studies demonstrating the use of statistics in policy reviews or official research projects and this practice is to be encouraged. National committees, or equivalent bodies, can help to draw the attention of schools of statistics to this problem of relevance and realism in training. Attention has to be given to the problem of motivation, especially where medical students are being instructed in statistical methods since they tend to have an overriding concern with graduating in medicine.

It has also been noted already that there is a need to provide statistical training at the appreciation level for users of health statistics, particularly health administrators. Except for a few countries where specific courses for

health administrators are given in some universities, several countries provide formal appreciation courses for general administrators in management or business schools. While these courses pay attention to the basic principles of decision theory, they do not deal with those problems of measurement and analysis that are unique to the health field. Either the health ministries should themselves arrange in-service training of this kind for their administrators or the schools of public health should arrange such courses. In the latter case, it would be useful if the lecturers could be seconded for short periods to health departments so that they might acquire experience of administrative problems associated with the use of information ; they could then provide appreciation training on the basis of systematic rather than vicarious experience.

Special mention must be made of the training of medical record librarians who are key personnel in the securing of sound medical documentation (and accessibility to good documentation) which is the basis for the provision of reliable statistical data. More attention needs to be given to their deployment, their role in any health information system, to the provision of a professional career structure that will attract high quality personnel, and to their training within the framework of health services. The modern medical record librarian is highly trained in the subject of data storage and retrieval, computer technology and statistics, disease description and classification, and many other aspects of information science.

International collaboration

To meet the needs of international comparability and of world epidemiology, special efforts need to be made to further collaboration between countries. The present conference was regarded as a useful contribution to such collaboration. Many participants felt that an interval of 20 years between conferences was too long and that more frequent meetings should be arranged, at least on a regional basis.

It is appreciated that collaboration is not confined to conferences and that WHO does maintain an invaluable continuous service of advice and education through visits, meetings, and publications. Most participants had found this service profitable and greatly appreciated it.

Another example of international collaboration of significance to health statisticians is the World Fertility Survey, organized by the International Statistical Institute with the financial support of the United States Agency for International Development and the United Nations Fund for Population Activities, and with the collaboration of the United Nations, WHO, and the International Union for the Scientific Study of Population. The basic aims are twofold :

(1) to provide the scientific information that will enable countries throughout the world to describe and interpret their population's fertility ;

(2) to make analytical comparisons of fertility and the factors that affect it in different countries and regions of the world.

IMPLICATIONS FOR NATIONAL COMMITTEES OR EQUIVALENT BODIES

The Conference considered that while large gaps in information, especially in developing countries, remained, there was still a continuing need for national committees or equivalent bodies to exert pressure to secure greater coverage of vital registration, census enumeration, health statistics, and other basic statistical arrangements. Nevertheless, they should move forward to the fulfilment of the new statistical needs that the Conference had identified. In particular, they should improve communication and understanding between producers and users of statistical information and they should stimulate and support any necessary research to this end. It has to be remembered that statistics are not an end in themselves but a means to an end—the provision of better health care for the population. This is the central objective to the attainment of which all disciplines and skills must be directed.

The role of the committees in helping to meet needs is to provide leadership, spread knowledge, and encourage interdisciplinary cooperation, and it will be an obvious advantage for each national committee or its equivalent to include prestigious members from different disciplines ; it would also be an advantage if each member from whatever discipline had an appreciation of the use of statistics and of the future statistical needs.

The national committee should be able to identify areas for which statistics are needed and to recommend specific ways to meet the needs. The committee should periodically review the statistical system for its effectiveness and efficiency, and should recommend changes and improvements when these are needed. It should recommend areas where *ad hoc* investigations as distinct from routine statistics are needed and also where special surveillance registers need to be instituted. It should also ensure adequate publication of statistics and research findings.

The national committee should be a focus for national and international cooperation and efforts to improve health statistics. WHO should consider making use of national committee members for its expert committees. At fairly frequent intervals WHO should convene an assembly of representatives of national committees to review world health statistics problems. Such

meetings would enable WHO to identify the problems that are most common in Member States and for which action is needed. The necessary action could then be undertaken either by WHO or by international health statistical centres. Such centres should be created to promote health statistical activities among countries, namely by exchanging views and ideas on problems of the organization of health statistical services, and in providing assistance in the fields where such assistance is needed.

In developing countries, national committees are as important as in developed countries. However, considering the very limited resources and the lack of data in some countries, the Conference appreciated the great problems faced by those countries in creating such a body and setting up a statistical system.

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Romania

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Sierra Leone

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Singapore

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Spain

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Switzerland

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Syria

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Thailand

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Dr Y. Suksamiti, Director, Division of Health Planning, Ministry of Health, Bangkok

Turkey

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Uganda

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Union of Soviet Socialist Republics

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(*Vice-Chairman*)
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Advanced Medical Training, Moscow

United Kingdom of Great Britain and Northern Ireland

- Dr A. M. Adelstein, Chief Medical Statistician, Office of Population Censuses and Surveys, London
- Professor M. R. Alderson, Hon. Director, Wessex Medical Information Unit, Wessex Regional Hospital Board, Winchester
- Professor B. Benjamin, Professor of Actuarial Science, City University, London
- Dr M. A. Heasman, Director, Health Services Research and Intelligence Unit, Scottish Home and Health Department, Edinburgh
- Mr R. W. Howell, Epidemiologist, British Steel Corporation, London
- Mr R. S. Matthews, Assistant Secretary, Central Planning Services Branch, Department of Health and Social Security, London
- Mr G. Paine, Director, Office of Population Censuses and Surveys, and Registrar General, London
- Mr W. Rudoe, Director of Statistics and Research, Department of Health and Social Security, London

United States of America

- Professor J. R. Abernathy, Department of Biostatistics, School of Public Health, University of North Carolina, Chapel Hill, N.C.
- Professor T. M. Frazier, Assistant Director, Harvard Centre for Community Health and Medical Care, Boston, Mass.
- Mr T. J. Kennedy, Associate Director, National Institutes of Health for Program Planning and Evaluation, US Department of Health Education and Welfare, Bethesda, Md.
- Mr D. E. Krueger, Executive Secretary, US National Committee on Vital and Health Statistics, Health Resources Administration, Department of Health, Education, and Welfare, Rockville, Md.
- Dr I. M. Moriyama, Director, Office of Health Statistics Analysis, National Center for Health Statistics, Health Resources Administration, Department of Health, Education, and Welfare, Rockville, Md.
- Dr E. Perrin, Director, National Center for Health Statistics, Health Resources Administration, Department of Health, Education, and Welfare, Rockville, Md. (*Vice-Chairman*)
- Professor O. L. Peterson, Department of Preventive Medicine, Harvard Medical School, Boston, Mass.
- Mr T. D. Woolsey, former Director of the National Center for Health Statistics, Rockville, Md.

Venezuela

- Dr J. Avilan, Head of the Vital Statistics Department, Ministry of Health and Social Security, Caracas

Yugoslavia

- Dr J. Čuček, Chief, Health Statistics Department, National Institute of Public Health of Slovenia, Ljubljana
- Dr Z. Kulčar, Head, Department of Chronic Diseases, Institute of Public Health of Croatia, Zagreb
- Professor N. Persić, Professor of Psychiatry, Head of University Psychiatric Clinic, Zagreb
- Professor B. Pirc, Chairman, Yugoslav National Committee on Vital Health Statistics, Ljubljana

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Dr G. Trobozić, Head, Department of Public Health Statistics, Institute of Public Health,
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Dr C. Vukmanović, Director, Federal Institute of Public Health, Belgrade (*Chairman*)

United Nations and related organizations

United Nations

Mrs Lourdes Morton, Statistician, Statistical Office, New York, N.Y., USA

International Labour Office

Mr G. Tamburi, Chief, Social Security Branch, Geneva, Switzerland

Nongovernmental organizations

International Federation for Information Processing

Dr I. S. Väänänen, Chief Administrator, Helsinki University Hospital, Helsinki, Finland

International Federation of Medical Records Organizations

Miss L. Gay, President, Los Angeles, Calif., USA

International Hospital Federation

Dr J. J. Poeisz, Head, Section of Statistics and Planning, National Hospital Institute,
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International Statistical Institute

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Nordic Medico-statistical Institute

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World Medical Association

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World Health Organization

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Dr W. P. D. Logan, Director, Division of Health Statistics, Geneva, Switzerland
Mr F. Sadek, Statistician, Regional Office for the Western Pacific, Manila, Philippines
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International Agency for Research on Cancer

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