INTERNATIONAL WORK IN HEALTH STATISTICS

1948-1958

H. S. GEAR, Y. BIRAUD & S. SWAROOP

WORLD HEALTH ORGANIZATION
PALAIS DES NATIONS
GENEVA
1961
The World Health Organization (WHO) is one of the specialized agencies of the United Nations. Through this organization, which came into being in 1948, the public health and medical professions of more than 100 countries exchange their knowledge and experience, and collaborate in an effort to achieve the highest possible level of health throughout the world. WHO is not concerned with problems which individual countries or territories can solve with their own resources. It deals, rather, with problems which can only be satisfactorily solved through the co-operation of all, or certain groups of, countries—the eradication of diseases such as malaria, the control of cholera, plague, yellow fever, smallpox and rickettsiosis. Progress towards better health throughout the world also demands international co-operation in many other activities: for example, setting up standards for biological substances, for insecticides and insecticide spraying equipment; compiling an international pharmacopoeia; drawing up international sanitary regulations; revising the international lists of diseases and causes of death; assembling and disseminating epidemiological information; recommending non-proprietary names for drugs; and promoting the exchange of scientific knowledge. In many parts of the world, there is need for improvement in maternal and child health, nutrition, nursing, mental health, environmental sanitation, public health administration, professional education and training, and health education of the public. Thus a very large share of the Organization's resources is devoted to giving assistance and advice in these fields to countries and territories whose health services are in an early state of development and which are therefore weak points in the common front against disease.
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**NOTE**

*Authors alone are responsible for views expressed in this publication.*
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HISTORICAL INTRODUCTION

The general principles of the science of health statistics, as of most others, were foreshadowed by the ancient Greeks, who carefully observed, recorded and analysed natural phenomena, and applied the inductive method of reasoning in a search for natural rather than supernatural causes, treating the unproven with scepticism. Nevertheless, the proper understanding of the behaviour of disease—how and why disease in a human (or animal) population spreads, waxes and wanes, or alters its character in response to the ceaseless changes that take place in its host and environment—had to await the techniques of study and experiment provided by modern epidemiology, statistics, microbiology, and biochemistry.

It is a curious fact that the use of statistical techniques in this field began, not with doctors, but with the work of John Graunt, a London draper, in the middle of the seventeenth century. Graunt carried out an examination of the London Bills of Mortality, which were records of births and deaths based on the parish registers. His findings, first published in 1662, marked the beginning of a science which has shown that human life conforms to broad and predictable patterns. Epidemiology, vital statistics, demography, and even life insurance are greatly indebted to this small volume.

Parish registers—which provided the basic material for Graunt's book—had been in existence for a century or so, not only in England but also in a number of other European countries, and in their colonial possessions from the Philippines to Mexico and Peru. In France, the keeping of parish registers was made compulsory in 1539, and from 1670 on they were used by Colbert as a source of statistics for Paris. The Breslau registers enabled Halley, the astronomer, to construct his famous mortality table in 1692. From 1749 the Swedish registers, which had been made compulsory in 1686, were used for the preparation of annual statistics.

This statistical material supplemented, or even served as a substitute for, censuses. In France in 1788 Necker estimated the population by multiplying recorded births by 25.75, and Laplace, the mathematician, after making an early use of sampling methods, did the same in 1802 on the basis of a ratio of 28.35 births to 1000 population.

During the eighteenth century considerable interest developed in the numerical aspects of all matters of concern to the state, and in Germany, under the name of Staatenkunde, they became a regular subject for teaching in the universities. Achenwall, a professor at Göttingen, probably did most to spread the use of the word "statistics" to designate the new science, but Süßmilch's book played an important part in making it internationally known.

Statecraft had long recognized that knowledge of the numerical size of the population was essential to efficient administration. Censuses were taken in the earliest civilizations—for example, among the Sumerians, Egyptians and Romans and in the Chinese and Inca Empires. Only many centuries after the fall of the Roman Empire, however, were population counts again made in western Europe. These new censuses, such as those of 1328 in France and of 1594 in Spain, were little better than estimates, based upon the number of hearths in each parish and the rough proportion of inhabitants to each hearth.

The first modern census listing each inhabitant by name was probably that carried out in Canada (Quebec) in 1665. The same method was used in other French overseas possessions during the following century.
long before a proper census was taken in France itself. Fairly accurate censuses were carried out in Sweden and Finland in 1749, in Connecticut in 1756, in Massachusetts in 1764, in Denmark and Norway in 1769, and in the United States as a whole in 1790. In England proposals for a census were rejected in 1753 and 1778, and the first census was not carried out until 1801, which was also the year of France's first census. Prussia followed suit in 1810 and Austria in 1818. During the period 1830-1850, there were so many people recording statistics and theorizing on statistical method that Westergaard justly called it "the era of enthusiasm for vital statistics".

In England the Royal Statistical Society was founded in 1834, and the General Register Office in 1836. A physician, William Farr (1807-1883), who held the post of examiner and compiler of abstracts in the General Register Office, was largely responsible for the publication, from 1837 on, of yearly statistics of causes of death, and for the regular computation, from 1841 on, of mortality tables for the whole population. In the opinion of Pearl, present-day procedures in official vital statistics owe more to Farr than to any other person, and the memorial volume of selections from his reports and writings, which shows the stress he laid, inter alia, upon the use of death rates as a measure of local or national health, the importance of population density, the dangers of overcrowding, and the value of uniform nomenclatures of disease, gives some idea both of his influence and of his pioneering spirit.

About the same time as Farr entered the General Register Office, much study was being devoted in Europe to the theory of probability, which is of fundamental importance in statistics. Laplace had published an important work on the subject (1814), and he was followed by Poisson (1836-37) and Cournot (1843). In France, Demonferrand published essays on population and on mortality in 1838 and 1839, and Gavarret a work on general principles of medical statistics in 1840. In Germany, Casper published a study on the probable duration of human life (1835), Moser one on the laws of the duration of life (1839), and Christian Bernoulli a statistical handbook on population (1840). Quetelet published a book on social physics in 1835, and did a great deal towards adapting the theory of probability for use in statistics. From 1851 onwards Quetelet, together with Farr and Babbage, began more and more to impart an international slant to vital and health statistics by organizing international statistical congresses.

The first international statistical congress was held in Brussels in 1853, and the need for uniform nomenclature and classification of diseases as a prerequisite for the international comparability of medical statistics was quickly realized. In the second congress, held in 1855, Farr put forward for international adoption the classification into five classes that was in use in the General Register Office. D'Espine, from Geneva, put forward another list in which diseases were grouped according to their clinical or (as far as was then known) their etiological and pathological characteristics. After some discussion, the congress reached a compromise, adopting a classification which made use of both systems.

Later developments would seem to confirm that the decision taken by the congress was a wise one. International classifications of causes of death have been subjected to much critical scrutiny and revision since 1855, and of the many proposed lists, based on a single classification, whether anatomical, etiological, chronological or otherwise, none has proved any more practicable than the empirical grouping adopted in 1855.

International statistical congresses continued to meet in various capitals at two- or three-year intervals up to 1876, two years after Quetelet's death, when disagreement between some governments and the permanent commission of the congresses brought them to an end. Their place was taken by the International Institute of Statistics, which was created in London in...
At its meeting in Vienna in 1891 the Institute set up a committee to deal with the international list of diseases, with Dr Jacques Bertillon, Head of the Statistical Services of the City of Paris, as its chairman.

In 1893, on the suggestion of Guillaume, Director of the Federal Bureau of Statistics, Switzerland, the basic international classification was maintained, but three lists were drawn up for its application: a detailed list, an intermediate list, and an abridged list, containing 161, 99, and 44 titles respectively. The purpose of these lists was to maintain comparability between the statistics of countries in which facilities for the recording of diagnoses and for statistical processing differed widely.

In 1898 the American Public Health Association, meeting in Ottawa, recommended that the international lists be brought up to date by decennial revisions, and this principle was endorsed by the International Institute of Statistics in 1899 in Christiania. Decennial revision conferences were accordingly held in 1900, 1910 and 1920, and, through Bertillon's influence, they were held in Paris.

When Bertillon died, the 1920 revised international lists were left in abeyance, and it was not until 1924 that the Health Organisation of the League of Nations took up the question of continuing the work and completing their publication. It established a joint committee with the International Institute of Statistics for the preparation of the 1929 revision, which included extensive studies on morbidity and its classification. The same procedure was adopted for the 1938 revision.

In 1945, WHO took over the work of preparing the sixth revision from the United States Government, and completed preparations for the Sixth Revision Conference, which took place in Paris in 1948, under the joint auspices of WHO and the French Government. The international lists of causes of disease and death then adopted were endorsed by the First World Health Assembly as an annex to WHO Regulations No. 1.

Continuous efforts have thus been made for more than a hundred years to bring about international uniformity in disease nomenclature and classification. Even if the related subjects of uniform certification of causes of death and selection of joint causes for the tabulation of both morbidity and mortality statistics are taken into account, the progress made in this field forms only a small part of the developments in health statistics that have taken place during the same period.

One of the great advances has been the publication by an increasing number of countries of annual returns of births and deaths, the latter classified according to the international lists and rules. Another is the production of census returns of increasing detail and precision, the result of the growing realization that numerical data are necessary for administration of any kind. In health, precise data on both mortality and morbidity have been more and more widely accepted as being the basis for any assessment of public health requirements and of the efficacy of action taken.

John Simon, medical officer, first to the English Board of Health, which was created in 1855, later to the Local Government Board of 1871, was one of the first health administrators to stress the value to sanitary science and practice of the statistics issued by the General Register Office. Florence Nightingale, more widely known for her work in nursing, was also a pioneer in the use of statistics, properly collected and inter-

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1 Dr Yves Biraud, who had been Assistant Secretary-General of the Fifth Revision Conference and had edited its official report.


preted, as a means of gauging health conditions in the army as well as in hospitals.

Later in the nineteenth century, Francis Galton played an important part in the movement which sought to apply mathematical procedures to biological phenomena. He founded the tradition of applying statistics to the study of human and biological problems, which in time led to the scientific epidemiological disciplines of to-day, and he was followed in this by Karl Pearson, Greenwood and Fisher in England and by Pearl in the United States of America. Another famous pioneer in the Americas in the use of quantitative methods in epidemiology was W. H. Frost. The experimental epidemiology undertaken by Greenwood and Topley in England, and by Webster in the United States of America, was a fascinating and instructive phase in this movement.¹

The early work of the Health Organisation of the League of Nations in combating the entry into central and western Europe of the epidemics of typhus, relapsing fever and smallpox which raged in eastern Europe from 1921 to 1923 showed the urgent need for improving epidemiological intelligence and health statistical services in most European countries. An attempt was made to remedy this state of affairs from 1924 onwards, by exchange study tours, by expert studies of a series of problems concerning the international comparability of statistics (such as the definition of stillbirth, the selection of joint causes of death, and nomenclatures of causes of morbidity as distinct from those of mortality), and by the preparation of the fourth revision of the international lists of causes of death.

The international definition of stillbirth proposed in 1927 ² was applied widely, but not universally in view of its legal implications. The comparative lists of causes of morbidity prepared by Roesle ³ stimulated the improvement of national morbidity statistics, but these were not then sufficiently developed for international comparability.

The League of Nations made other useful contributions in the field of medical and health statistics. It issued a series of handbooks giving statistical data, including medical and vital statistics, from a number of countries, and outlining the statistical organization of these countries.⁴ The Health Organisation of the League also issued a long series of epidemiological and statistical tables and commentaries which appeared from 1922 onwards in its annual and monthly Epidemiological Reports and Weekly Epidemiological Record, and from 1925 onwards in the Weekly Fasciculus of its Eastern Bureau (Singapore). Statistical data on health conditions and activities in a number of countries were also published in the successive issues of the League's International Health Year-Book, and on population and vital statistics in its Annual Epidemiological Reports. A number of studies of epidemiological and statistical significance appeared in the Bulletin of the Health Organisation.⁵

In the century which ended with the Second World War much progress was made in vital and health statistics by governmental services, intergovernmental institutions, and scientific societies, both national and international. Little by little the value of official mortality records, morbidity data collected by social insurance organizations, and hospital statistics as sources of information on the health of the population, and as a basis for planning health policies, began to be realized by an increasing number of health administrators and statesmen. By their efforts, health statistics improved in quality and increased in quantity until by the end of the Second World War they had grown to formidable proportions.

Progress had not been uniform, however. Mortality statistics recorded according to international rules of classification were available for highly developed countries, but

for very few others, so that there were enormous gaps in the coverage of the world as a whole. Morbidity statistics were available for a large number of territories, but lacked uniformity and therefore comparability. This was the situation when WHO took over the functions of the League of Nations Health Organisation. Subsequent sections will show what it has so far done in the field of international health statistics.

NATURE AND EXTENT OF THE PROBLEM

In the post-war years progress in international statistics received fresh momentum with the creation of the United Nations and of WHO, its specialized agency for health, and it has been further accelerated by the desire of many developing countries to raise their living standards. Before reviewing current developments in vital and health statistics, it is well to consider the nature and extent of the problem, which has two aspects, national and international.

National and international needs in health statistics

By and large, the purpose of vital and health statistics is to contribute to social and economic progress. Existing levels of health and demographic problems have to be studied in relation to the conditions and factors that influence them. For this—and for the study of trends and changes in health conditions—factual knowledge is essential. The more advanced a country, the more precise and penetrating are the studies it has to undertake. On the other hand, a country only just beginning to organize its public health services may do so without waiting for extensive data to be gathered and analysed. For instance, such basic steps as the improvement of environmental sanitation, the establishment of maternal and child health services, and health education—to name only a few—may well precede a full statistical scrutiny of the situation. Nevertheless, even simple kinds of vital and health statistics, such as those which help in locating areas of high mortality and indicating the major preventable diseases, would be helpful. These can be produced relatively easily, either by means of sample surveys or by the establishment of a national health statistics system. But once public health services have been successful in reducing epidemic diseases and death rates, the need arises for precise data on the relative importance of various residual causes of sickness and death. Indeed, it is on the basis of such careful scrutiny that the importance of accidents in childhood and of degenerative diseases in adult life and old age in advanced countries is now being brought out.

It has been truly said that health is indivisible. This is especially apparent when epidemics sweep from one country to another and cover more than one continent: recent examples are the spread of cholera as far west as Egypt in 1947, the world-wide epidemic of influenza in 1957, and the occasional outbreaks of smallpox generated by infection imported into countries of the west. Each country has, therefore, to be constantly on the lookout for what is happening epidemiologically throughout the world. International health statistics provide the necessary world information system. They are also made use of by various countries to compare their progress in health with that achieved by similar health action elsewhere. Because of these national requirements, international agencies have the unique responsibility of collecting and promptly disseminating statistical information on a world-wide basis.

However, from the international point of view, while the special needs of individual nations are still paramount, the problem is not confined merely to collection and dissemination of information. International cooperation has to be secured so that national health statistical services will produce data in a form that is useful not only to themselves...
but to the world at large. Moreover, certain health problems affecting groups of countries have to be studied statistically from an international standpoint. Statistics are also important in connexion with the help given by WHO to various countries in the implementation of their health programmes and the introduction of modern techniques in health work. For instance, with the assistance of UNICEF, and in collaboration with other bilateral and international co-operation agencies, WHO has undertaken large-scale campaigns against several communicable diseases—malaria, yaws, trachoma, etc. The treatment of millions of individuals and the spraying of millions of houses by residual insecticides entail the study of the relevant statistics and their proper interpretation. With the assistance of WHO and UNICEF, various other national activities, such as maternal and child health services, school health work, and dental health, are being expanded. The value of this work can be demonstrated only if reliable statistics are maintained, and systems for the collection and analysis of the relevant data must be devised.

In 1946, when the Interim Commission of the World Health Organization assumed the functions of its predecessors, it became responsible for continuing previous work in international health statistics. The work of the Health Organisation of the League of Nations, the Office International d’Hygiène Publique (OIHP), and the Pan American Sanitary Bureau (PASB) had been designed to meet then existing needs in the collection of vital and health statistics, the diffusion of knowledge on quarantinable diseases, and the preparation of studies on factors determining the prevalence of disease.

The responsibility for continuing previous work, and the constitutional obligation to undertake additional work in the above-mentioned fields, had an important influence on the preparation of early WHO programmes. The framers of the WHO Constitution had expressed their realization of the shortcomings of the international facilities then existing for the collection of vital and health statistics, and for the investigation of hazards to national, regional, and international health. Hence the appearance in the Constitution of such functions as: the maintenance of epidemiological and statistical services; the control and eradication of communicable diseases; the conduct of research in the field of health; and the establishment of international nomenclatures of diseases and causes of death.

**Basic data**

There are three main categories of basic data in health statistics:

1. Data on population: size, composition, distribution and growth.

2. Vital statistics, i.e., statistics on live births, foetal deaths, marriages and divorces, deaths, etc. Of these, the statistics relating to live births, deaths, and foetal deaths are of particular interest to WHO.

3. Health statistics, i.e., numerical information required and produced for and by health agencies.

The Statistical Office of the United Nations has assumed responsibility for seeing that vital statistics and data on population are obtained in sufficient detail and in internationally comparable form from an increasing number of areas. In the light of the above needs, the nature and extent of what WHO is called upon to do in health statistics can be summed up as follows: 1

To consolidate basic data received from countries, or extracted from various national statistical or epidemiological publications, by: the routine collection of data on diseases, health service facilities, health personnel, and major activities of health services, e.g., vaccination; the collection, elaboration and analysis of vital and health statistics; the keeping of up-to-date records of such statistics, published in the monthly *Epidemiological and Vital Statistics Report* and in an annual volume;

To assist countries in the organization and development of their national health statistical services;

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To conduct a general survey of the present situation of vital and health statistics in the world in order to plan a long-term programme of assistance to countries;

To assist national administrations through expert advice by the statistical officers of the Organization or by special consultants;

To assist in improving the collection of national data so as to achieve better international comparability of such data;

To encourage the broader utilization of national committees on vital and health statistics through meetings of representatives of such committees;

To ensure the sound application of statistical methodology indispensable for an adequate evaluation of the work performed and the results achieved;

To process and analyse the statistical data produced in connexion with studies conducted by various units of WHO;

To establish a classification of diseases, injuries, and causes of death, and its application to the compilation of morbidity and mortality statistics.

It is generally admitted that the number of countries producing reliable and adequate basic data is very small. The extent of the problem will be clear from the pages that follow.

**Population data**

In such a basic matter as the enumeration of human population, the position was far from satisfactory in the ten years preceding the end of the Second World War. The United Nations has reported that during that decade only 44 sovereign countries undertook population censuses. These were distributed as follows: 3 in Africa; 9 in North America; 6 in South America; 9 in Asia and Oceania; and 17 in Europe.¹

This situation could not fail to have an adverse effect on health work, for no public health programme can be adequately planned or maintained in the absence of such fundamental data as the size of human populations, their age and sex constitution, and their rate of change.

In the ten years since the end of the war, which approximately cover the first phase of WHO’s work, there has been a considerable improvement in knowledge of the human population of the world, much of it due to the continuous efforts of the United Nations in this field. In its *Demographic Yearbook* for 1957 the United Nations estimates the population of the world in 1956 as 2737 million, with a margin of error of 5%:² An increasing proportion of the world’s population is being enumerated by censuses but certain reservations are necessary concerning the completeness and accuracy of the results recorded in many countries which lack experience in census work. The United Nations *Demographic Yearbook* states that population estimates in the majority of countries are still subject to error because of the lack of recent adequate censuses, especially in South-East Asia, the Eastern Mediterranean and Africa: “...it is shown that estimates for 78 per cent of the world’s population in 1955 were based on census counts made since 1945, while 9 per cent originated in partial censuses, surveys, or older enumerations, and 12 per cent had conjectural estimates for a base...only 25 per cent of the countries of the world used the natural increase method in 1955. The situation varies, of course, from region to region and it changes also with time. With the taking of more censuses, estimates will have firmer bases.”³

**Vital statistics**

Statistics on births and deaths are in general much less adequate than those on population. It is estimated by the United Nations that, while roughly 80% of the world’s population has been enumerated in the last decade, only about 42% of births and some 33% of deaths are currently being registered.

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The reason for this disparity is "that censuses are primarily dependent on the resources and efficiency of the statistical administrations, as well as on the collaboration of the population, while availability of vital statistics depends to a larger degree on the participation of the whole population, which is responsible for the registration of births, deaths, marriages and other vital events".\textsuperscript{1} Africa and Asia are the continents most deficient in such statistics. In 1956, out of a total of 214 countries or territories, only 4 in Africa, 18 in the Americas, and 7 in Asia forwarded comprehensive birth and death statistics to the United Nations, though it is necessary to qualify this statement with the remark that comprehensiveness is not necessarily always allied to accuracy. Difficulties in obtaining adequate vital statistics are rarely due to any single direct cause. Even in a single country there may be much variety in the extent to which registration of vital events is carried out. In almost all countries the degree of efficiency in collecting such material varies from possibly very high in cities and towns to very low in rural areas.

This deficiency in knowledge of the occurrence of births and deaths in the world is a barrier to the full discussion, let alone the planning and execution, of programmes for improving health. Its nature is such that many international and national health programmes can be based only on guesswork about what is needed.

Health statistics

It is axiomatic that sound health statistical and epidemiological systems cannot be expected in a country lacking the usual fundamental administrative and social services. As a country improves its local government and provides its people with a gradually widening series of social services, it reaches a stage when it is possible for it to obtain the essential facts for a study of its social, economic and health problems. At the present time, there are serious gaps in the collection of data on such matters as causes of death and disease by age, sex and season, or even causes of death alone. This is confirmed by the fact that in 1958 only the following returns were available to WHO in this connexion:

<table>
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<th>Subject</th>
<th>Number of countries and territories</th>
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<tr>
<td>(i) causes of death</td>
<td>93</td>
</tr>
<tr>
<td>(ii) causes of death by age and sex</td>
<td>77</td>
</tr>
<tr>
<td>(iii) incidence of communicable diseases by season</td>
<td>176</td>
</tr>
<tr>
<td>(iv) incidence of other diseases</td>
<td>7</td>
</tr>
</tbody>
</table>

It is estimated that about a further 100 countries and territories would need to submit returns before even a simple picture of world mortality and morbidity can emerge.

In 1953 WHO sent a questionnaire to its Member States to elicit information on the types of health statistics and related vital statistics available in different countries, on how they were obtained, and to what extent they were being transmitted to international organizations.\textsuperscript{2} A certain number of countries answered fully; others did not answer at all, or gave very incomplete answers, since comprehensive answers would have involved them in months of patient research. The replies received show that in advanced countries, even though health statistics are numerous, they are varied and scattered among many government departments other than the health department, for example, the social welfare administration (social insurance returns, hospital statistics), the defence department (statistics of the army, navy and air force), and the education department (school medical inspection returns, numbers of graduates in medicine and allied professions). In many countries the provincial or municipal authorities are responsible for health, and do not necessarily supply statistics to the central government; and where statistics are supplied, they are not necessarily uniform from province to province. In some countries there is decentralization of government, with consequent


\textsuperscript{2}Data on causes of death from some 50 countries only are considered by WHO as sufficiently reliable for publication in its Annual Epidemiological and Vital Statistics.

\textsuperscript{3}Bull. Wid H/th Org., 1954, 11, 201.
decentralization of health statistics; or the organization is federal, with a like result. Nor is the terminology used uniform: medical schools differ greatly in background and methods of training, and diagnoses are couched in terms that vary not only from country to country but also within the same country. Again, a "bed" in a remote jungle hospital can hardly be placed on a par with a "bed" in a large teaching hospital in an advanced country, although both are called "beds". Similarly, the meaning of "doctor", "nurse", etc. will differ from country to country, or even within one and the same country.

Statistics on causes of death

The statistics available to WHO on causes of death suffer from further defects. In many countries, there are not enough physicians to attend every dying patient and certify the cause of death. If it is recorded at all, it will be by a lay registrar who may be merely guessing from crude information provided by relatives. Only a few countries have medical services with sufficient staff trained to give an accurate medical certificate of death. Indeed, the countries giving satisfactory information, both on the actual occurrence of death and on its causes, could be numbered on the fingers of one hand. The usefulness of material collected on a world-wide basis for regional or world analysis is therefore exceedingly limited. To its inherent defects of inaccuracy and incompleteness there must be added the serious difficulty of determining comparability between one country and another.

Quarantinable disease statistics

As soon as international health co-operation began to develop, the need for statistical and epidemiological data on the so-called quarantinable diseases became apparent. Hence such information is available in some detail right back to the beginnings of such predecessors of WHO as the Pan American Sanitary Bureau, the Office International d'Hygiène Publique, the League of Nations Health Organisation, and UNRRA. The information collected by all these organizations had a dual purpose.

Primarily it was collected with the intention of guiding countries in any administrative action they wished to take against the threat of invasion by quarantinable diseases from other countries. Indeed, this was the major purpose of the comprehensive network of stations established for the collection and diffusion of data on quarantinable diseases. The second purpose was the scientific determination of some of the circumstances governing the behaviour of these diseases, particularly when they took an epidemic or pandemic form. The statistics obtained had a certain value in showing the historical trends and geographical diffusion of each disease during a period of fifty years or more.

WHO inherited a complete system for the collection and reporting of quarantine information; this involved dealing annually with some 7000 routine reports from health and statistical authorities. In addition to ad hoc telegraphic notifications, the diffusion of the information was ensured by systematic broadcasting through a wide network of stations with occasional telegrams and routine airmailing of weekly periodicals from four focal points.

This system of collection and diffusion, valuable though it has been in dealing with the threat of the international spread of quarantinable diseases, could have only a restricted scientific value, owing to the probable incompleteness of many of the basic notifications from areas without physicians or health administrations.

Morbidity statistics

In proportion as the campaigns against the great killing scourges have met with success, interest has grown in causes of diseases which are widespread, but not in themselves immediately fatal. This type of morbidity has figured with increasing prominence in the discussions of international councils of statisticians and epidemiologists in the last two or three decades, and its statistical and epidemiological definition and analysis have proved particularly difficult. Whatever the causes of this morbidity—whether they
were acute, communicable, chronic, neoplastic, or accidental—they raised basic questions of terminology, classification, and measurement by suitable indices. Until these were answered, epidemiologists and statisticians could scarcely employ any refinement of analysis in defining the significance of the various causative and correlative factors. In turn these raised other difficulties, as for example, that of bringing uniformity into the collection of morbidity data from different regions where methods of diagnosis and nomenclatures varied in efficiency, completeness and form.

One particularly troublesome statistical problem has been that of the hospital record. Even though case records have accumulated in hospitals for generations, no simple means has yet been evolved for the international use of what superficially appears to be an invaluable source of clinical and pathological material for epidemiological purposes. This general statement does not belittle the valuable contributions which have been made, not only to clinical medicine and pathology, but also to epidemiology and public health, by numbers of individual studies based on morbidity records from hospitals in many countries. It is only in the present decade that international studies have been undertaken to develop their comparability, an important facet of the more general problem of comparability in morbidity statistics.

Statistical methodology

By the end of the Second World War, considerable developments had taken place in the theory of probability, sampling methods, and techniques for field trials, surveys, and controlled laboratory experiments. These techniques were obviously urgently needed, and the fact that this methodology had first appeared in countries with well-organized social, medical, and statistical services was no argument for delaying the application of some of the newer techniques in countries lacking them. Indeed, many of these techniques were admirably suited to epidemiological and statistical enquiry in almost any community, however primitive its condition or however awkward its physical environment. Above all, the method of sampling had been so improved that it could be operated at relatively small cost, provide up-to-date data, and give a reasonably accurate picture of the health situation.

A technique of some value in epidemiological and statistical work is that of the survey. Early surveys of such matters as the incidence of disease, based on hospital populations, out-patient records, or general practitioners’ returns, omitted many of the checks and adjustments required to remove distortions caused by such factors as differing age and sex composition. By the middle of the present century, however, the limits and fallacies, as well as the advantages and potentialities, of surveys had become much clearer. The technique of the survey had been so developed as to make it suitable for regions of the world from which no records of diseases had been previously available. The hazards of surveying such highly selected populations as hospital patients or industrial communities were known, and frequently could be overcome. It had therefore become possible for experienced people to use surveys profitably in the service of international health statistics.

At the same time a fuller appreciation was being gained of the application of statistical analysis to recorded results of clinical trials, field observations, and similar investigations. This showed the place that these techniques should have in the training of health workers destined for work in under-developed countries.

When WHO launched its programmes it was thus accepted that it had a duty to make health statistical techniques available to administrations, educational institutions, and research workers in countries co-operating in international health programmes. This was an urgent task, as failure to use such techniques in planning or executing large programmes in diverse communities could be wasteful of money and seriously delay achievement of aims, besides perpetuating wrong technical theories to the disadvantage of other plans or programmes.
International statistical classification of diseases

In the earlier revisions of the International Lists of Causes of Death, some doubt had been expressed as to their suitability for use in countries with few or poor health and social services. In 1938, the Conference for the Fifth Revision of the International Lists had particularly mentioned the need to prepare simpler lists, the application of which would be guided by suitable rules for use in countries not having a full vital statistical registration. Furthermore, statisticians in Africa and Asia had become aware of the unsuitability of the full detailed list even before the Second World War. Therefore, when preparations were launched, after the Second World War, for the sixth revision of the Lists, proposals had already been submitted for a study of this problem. An allied problem was the dependence of the International Lists of Causes of Death on medical certification. Earlier assumptions to the effect that only returns submitted by medical practitioners were of value had to be discarded, and the hard fact accepted that in most regions of the world full and accurate medical certification could not be achieved within the foreseeable future. This called for the study of methods of collecting records of causes of death in cases where the attendance of a fully qualified medical practitioner could not be taken for granted. Methods had to be simple, efficient, and economical.

Co-operation and co-ordination

It is thus clear that, at the time of WHO’s foundation, there was a considerable lack of even the basic facts required for the elaboration of international health programmes. The situation was bad enough with respect to the fundamental matter of enumerating population, but was even worse as regards the collection of important items concerning the causes of death and disease. The resources for gathering such facts were almost non-existent in some areas. This was the challenge. It could be met, theoretically, with a certain degree of optimism, in that much experience had been gained in methods and techniques suitable for application in any type of country for which data were required for the conduct of health programmes.

To meet the needs and apply the newer measures meant collaboration with national administrations and with many other organizations and agencies. It was important that governments, and their technical departments and teaching institutions, should give their full support. Medical, nursing, and allied professions had to be persuaded to plan health programmes in such a way as to give due place to the study of health problems and the collection of essential health statistics. A large programme had therefore to be undertaken to gain the support and goodwill of these various agencies and individuals, and, as will be seen in due course, it included, inter alia, the creation of an important system of national committees on vital and health statistics.

Internationally, too, much preparation was necessary to secure adequate liaison with all inter-governmental and governmental bodies concerned in health programmes. Naturally, the first to be considered among these was the United Nations itself, which had the responsibility of collecting such basic data as the numbers of populations, their age and sex composition, and vital statistics. It was encouraging that WHO would have the powerful support of the United Nations in appeals to countries and institutions for improved statistical services.

In that many health problems have facets to be examined by such other agencies as FAO, ILO, and UNESCO, the need for liaison with these agencies was accepted by WHO. The co-operation of individuals and of the non-governmental agencies had also to be obtained; in fact, no agency had been more helpful in the earlier history of international statistics than the International Statistics Institute.

The importance attached by WHO at the outset to co-operation and co-ordination in its international programmes has undoubtedly been responsible for much of their success.
SECURING INTERNATIONAL COMPARABILITY

Efforts to secure international comparability in health statistics began as early as 1851 on the initiative of certain intergovernmental and voluntary organizations. Attention was then focused primarily on developing a uniform nomenclature and classification of diseases and causes of death. This in turn brought out the need for establishing uniform rules for the selection and certification of the cause to which a particular death was to be ascribed in case there were several contributory causes, occurring jointly or successively. It was soon found that a number of complex technical and administrative procedures, ranging from the certification of the cause of death to the final tabulation of the mass of data on mortality by age, sex, locality, cause, etc., required standardization. Many of the problems involved have been successfully resolved, thus greatly contributing to the value and international comparability of health statistics, and particularly mortality statistics.

During the last half-century, the widening in scope of public health activity from control of preventable diseases and improvement of environmental sanitation to the promotion of health has created an increasing demand for comparable data on factors and conditions affecting the public health, e.g., on such subjects as maternal and child health, school health services, mental health, etc. Scientific advances in medicine and statistical methodology have further emphasized the importance of detailed and comparable statistical information. While many old problems still remain unsolved, new ones are appearing—for example, in connexion with the recently developed practice of measuring and comparing general morbidity levels of populations by sample surveys, many of which are planned on a national scale.

The role of WHO

While the responsibility for operating national health statistical services rests with the country concerned, it has fallen to WHO to take steps to develop uniform terminology, definitions, recording procedures, classification schemes and, at the same time, to devise uniform programmes for the tabulation and interpretation of data by means of uniformly computed health statistics indices. Each of these tasks requires, in the first instance, a world-wide study of the nature and causes of variations in statistical procedure. Some of these variations are bound up with the special needs of the country concerned, some exist because of long-standing legal and administrative provisions, and some are related to the country's stage of development. But the keen desire of each country to compare its statistical indices on health with those of others has been fully demonstrated by the co-operation that WHO has received in its exploratory work and the willingness of the various countries to adopt international recommendations.

WHO has been particularly concerned to improve definitions of terms used in vital and health statistics and to make them comparable—tasks which are clearly inter-related. Through the expert committees set up by the Organization, steady advances have been and are being made towards greater uniformity in this field. These committees deal on the one hand with specific diseases, such as tuberculosis, malaria, treponematoses, cancer and heart disease, to name only a few, and on the other with general services, such as public health administration, environmental sanitation, maternal and child health, nutrition and mental health.

The recommendations of these committees appear in the various reports in the WHO Technical Report Series and cannot be described in this brief review, though mention should be made of the reports of the WHO Expert Committee on Health Statistics, which are of particular interest to those seeking guidance on special definitions and the classification of disease.
Some special definitions

Health authorities are becoming increasingly concerned with the prevention of avoidable deaths in the period of gestation and during infancy, especially where the major preventable diseases have already been brought under control. In the absence of proper definitions, work in this field is hampered on both the national and international levels. In respect of stillbirths or foetal deaths, for example, it is obviously essential that there should be uniform agreement among those responsible for the notification of deaths in each country on the criteria for deciding whether a baby is born dead or has died after birth. This distinction is important for the recording of vital statistics which will be affected according to whether entries are made under births and deaths in general, or in a special category for foetal deaths. Moreover, it is necessary in order that public health authorities may assess the nature and extent of the problem and take appropriate measures for dealing with it.

The importance of a universally accepted definition of stillbirth was recognized by the League of Nations Health Organisation, and its Committee of Expert Statisticians adopted the following definition in 1927:

"A dead-birth is the birth of a foetus, after at least twenty-eight weeks’ pregnancy, in which pulmonary respiration does not occur; such a foetus may die either (a) before, (b) during or (c) after birth, but before it has breathed.”

This definition does not provide uniform and definite criteria for differentiating between a stillbirth and a live birth. At the end of the Second World War, a wide variety of definitions were still in use throughout the world, and this created many difficulties in the analysis of statistics by public health offices. In certain countries, e.g., Spain and some of its former South American colonies, a child had to survive 24 hours to be registered as a live birth. In others, including France, the case of a child born alive but dying before registration was counted as a stillbirth; and in yet others it was counted as a death, but not as a live birth. Such differences in classification might, in some cases, mean a reduction in the general death-rate of the order of 1.2%.

The Second World Health Assembly called for the establishment of a subcommittee to study the question of the definition of stillbirth and allied matters. It asked for:

“ (a) special studies on live births and foetal deaths in relation to various factors (gestation period, birth weight, single or multiple birth, etc.) to obtain a statistical basis for a satisfactory definition of immaturity;

(b) classification of foetal deaths when more than one cause is stated;

(c) magnitude of loss of foetal lives at various periods of pregnancy;

(d) better utilization of records of maternity and children’s hospitals for medical-statistical research into the causes of foetal and infant death.”

A WHO Subcommittee on the Definition of Stillbirth and Abortion met in 1950. After due consideration, it proposed the definitions given below, which were approved by the Expert Committee on Health Statistics and subsequently adopted by the Third World Health Assembly. The universal use of these definitions would clearly go far to provide comparable data on perinatal mortality.

The definitions are:

“Live birth is the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy, which, after such separation, breathes or shows any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta...

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is attached; each product of such a birth is considered live born.”

“Foetal death is death prior to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy; the death is indicated by the fact that after such separation the foetus does not breathe or show any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles.”

“All live-born infants should be registered and counted as such, irrespective of the period of gestation, and if they die at any time following birth, they should also be registered and counted as deaths.” 1

The International Statistical Classification of Diseases, Injuries and Causes of Death

The first part of this account carried the history of this significant international instrument as far as the fifth revision of the International Lists of Diseases and Causes of Death, which took place in 1938.

The sixth decennial revision, for which WHO became responsible, was largely prepared before the Organization was created. Following the fifth revision, a United States Committee on Joint Causes of Death, commencing work in 1945, had prepared a Proposed Statistical Classification of Diseases, Injuries and Causes of Death. This Committee included representatives of Canada, the United Kingdom and the Health Organisation of the League of Nations. Its proposed classification was indeed the first successful effort to bring both mortality and morbidity statistics into one list and had been evolved after trials in the United States, Canada and the United Kingdom. The Expert Committee on Health Statistics, set up by the WHO Interim Commission in 1947, submitted this classification to various national health and statistical authorities and presented it to the International Conference for the Sixth Revision convened by the French Government in April 1948 in Paris. Having been endorsed by the Conference, it was finally adopted by the First World Health Assembly in July 1948. This Assembly also adopted the WHO Nomenclature Regulations. 2

These Regulations were significant, making use for the first time of the important provision in the WHO Constitution whereby regulations adopted by the Assembly would automatically come into force in all those Member States which had not formally rejected them or entered reservations against them. In the past, the revision conferences had merely made recommendations to countries to adopt the revised lists, frequently an ineffectual procedure. The Regulations were thus the first application of the principle of “contracting out” in international health.

The regulations cover a comprehensive programme of international co-operation in statistics, requiring Member States to publish statistics of causes of death for: (a) the territory as a whole; (b) principal towns; (c) national aggregates of urban areas (districts); and (d) national aggregates of rural areas (districts). There are additional responsibilities accepted by countries observing the Regulations such as undertakings to publish statistics of causes of death by prescribed age and sex groupings, and in accordance with the classification, nomenclature, and numbering of the International Classification of Diseases, Injuries and Causes of Death.

Perhaps the most important feature of the Nomenclature Regulations is the requirement that each Member State must adopt a form of medical certificate that provides for the statement of the disease or condition directly leading to death, together with such antecedent morbid conditions as may exist, so that the underlying cause of death will be clearly indicated, together with any other significant conditions contributing to death which are not, however, related to the disease or condition causing death.

The action of the First World Health Assembly in adopting the WHO Nomenclature Regulations and the associated lists


of the sixth revision was indeed a landmark in international health statistics. Among the features which make it outstanding are: the agreement on a single list of terms applicable to both mortality and morbidity statistics; the comprehensiveness of the Classification; the degree of uniformity achieved; the agreement on a form of medical certificate based on the selection of the main cause of death to be tabulated; and the guidance given in a set of rules to national compilers using the lists.

In 1948 WHO implemented one of the decisions of the First World Health Assembly by publishing in two volumes the Manual of the International Statistical Classification of Diseases, Injuries and Causes of Death, which was issued in English, French and Spanish. A shortened form in Latin was produced in 1955 at the request of a number of countries, mainly of central and northern Europe, which still use medical terminology in this language. This Index Alphabeticus does not provide for a classification of violent causes of death or illness according to the external agent involved, since there is no generally accepted nomenclature in Latin for describing external causes of death and their action (vehicles, firearms, etc.).

The sixth revision, as adopted in 1948, also includes a detailed, an intermediate, and an abridged list, thus maintaining the tradition of the earlier revisions. The detailed list contains three-digit categories in seventeen main sections, covering, inter alia, the chief infectious diseases, neoplasms, allergies, and metabolic and nutritional diseases. Other diseases are grouped mainly according to their principal anatomical sites, but there are special sections for mental diseases, complications of pregnancy and childbirth, early infancy, senility, and ill-defined diseases. Injuries are placed in a dual classification, firstly according to the external cause, secondly according to the nature of the injury.

The introduction of the decimal classification in the detailed list has the advantage of making changes in the numbers given to items unnecessary when alterations from previous revisions are made. The first two digits of the three-digit number in many instances designate important groups of diseases, while the third divides each group into categories which represent a specific disease or its classification according to some significant feature, such as the anatomical site. Certain numbers have been omitted to provide for future additions. The intermediate list includes 150 causes for tabulation of morbidity and mortality; the abbreviated list 50 causes for tabulation of mortality. A special list contains 50 causes for tabulation of morbidity for social security purposes.

The Manual also contains certain supplementary classifications, a model medical certificate of the cause of death, and an alphabetical index of diagnostic terms coded to the appropriate categories. A part of the Manual includes sub-divisions of many of the three-digit categories into four-digit categories. These are intended for use by countries or services which wish to make more comprehensive studies of causes of illness, disability, or death.

Although no serious objection has been made to the general structure of the Classification, an important section of the introduction to the Manual deals with certain of its features which have been questioned. Some of the shortcomings of the Classification reflect the persistent division of opinion between those using the anatomical and those favouring the etiological approach. The position given to such diseases as rheumatic fever, pneumonia and influenza has also been criticized, since opinions differ as to the emphasis to be given to the conditions themselves or their complications and sequelae. Language is the source of serious problems. As the introduction puts it: "It is evident that versions of the Classification in languages other than English cannot be mere literal translations of the original text but must be adapted to the medical terminology in actual use. Efforts have already been made by the World Health Organization to compile French and Spanish versions from the basic English text, employing medical terms in actual use while at

the same time preserving as much as possible the original meaning and intent. Further improvement can be brought about by the users of the Classification in communicating such differences in local usage to the World Health Organization and by the physicians themselves in stating the meaning and the prevalent usage of a medical term.”  

Seventh decennial revision of the Classification

In accordance with the decision to revise the Classification every ten years, preparations were made for the seventh revision shortly after the publication of the Manual. A series of meetings of expert groups was arranged as for the sixth revision, the results of the experience gleaned from the use of the Manual throughout the world were collated, and governments were consulted for their views on how the Classification could best be improved. WHO’s health statistical services had by now been established, and provided an international clearing-house for the co-ordination of statistics, as well as promoting their international comparability. The WHO Expert Committee on Health Statistics furnished advice and assistance and special technical questions were considered by its subcommittees: as, for example, the Subcommittee on Definition of Stillbirth—which dealt with the problem of enlarging and improving the relevant categories in the Classification, which had proved in practice to be too few or insufficiently specific—and the Subcommittee on the Registration of Cases of Cancer as well as their Statistical Presentation. A Conference on Morbidity Statistics was held in 1951 to discuss the problems involved in the compilation, presentation and analysis of statistics of disease.

An important additional source of advice and experiment in the use of the Classification was the WHO Centre for Problems arising in the Application of the International Classification of Diseases, Injuries and Causes of Death. This had been set up by the Third World Health Assembly 2 in 1951 on the recommendation of the Expert Committee on Health Statistics, and had been established in the General Register Office of England and Wales; not inappropriately, for this was the office from which William Farr had issued the annual reports which did so much to set health and vital statistics on a firm foundation.

In the role of technical adviser and “laboratory” the Centre has dealt with a variety of practical problems encountered by countries in applying the Classification. It has helped in the interpretation of obscurities; advised on tabulation; listed ambiguities, defects and errors; studied the problems arising in practice from the utilization and coding of death certificates; advised on training in the use of the Classification; conducted research into national records on certification of causes of death, reporting of morbidity in hospitals and sickness surveys; and drawn up practical instructions on how to collect, record, code and classify data in accordance with the Classification.

The Centre was responsible for the compilation of booklets of instructions, 3 some of which will be considered later; and it assessed changes in comparability of statistics due to the passage of time, 4 basing itself on the constant flow of reports and queries from governments.

The mass of information accumulated from these various sources was considered by an advisory group which met in London in 1954 and proposed certain amendments to the Classification. These amendments were in turn considered by the Expert Committee on Health Statistics and later by the International Conference for the Seventh Decennial Revision, which met in 1955 in Paris.

This Conference made recommendations regarding the certification of death; suggested deferring the problem of the classification of stillbirth until more experience had been gained from the use of the existing classifi-
cation; and advised less stringency in the application of certain of the WHO Nomenclature Regulations because the obligations they imposed upon countries sometimes exceeded national resources and even needs. It paid special attention to the major problem of obtaining information on health conditions in areas without doctors, where causes of death could not be based on a proper medical diagnosis so that there could be no question of applying the International Classification. There was general agreement in the Conference that information was obtainable from such areas, both on diseases and on causes of death, by means of simple lists of causes stated in terms of obvious symptoms or, broadly, in terms of anatomical sites or systems. The Conference accordingly recommended that WHO consider ways and means of obtaining information in these areas, and co-ordinate national or regional studies on the subject.

The Ninth World Health Assembly adopted the seventh revision and the additional regulations giving effect to the various recommendations. As experience had shown that the WHO Nomenclature Regulations were difficult to apply in many countries, they were amended so as to allow greater freedom and flexibility in the reporting and recording of deaths and provide more convenient lists and age-groupings for particular types of disease. There was no sacrifice of the fundamental principles of statistical uniformity and comparability.

The seventh revision, and the attendant regulations, came into force on 1 January 1958. It conformed to its predecessor in most respects, incorporating such advances in the diagnosis of disease and causes of death as had been made since the sixth revision.

Basically, the Classification as evolved by the sixth and seventh revisions is a compromise, as it must be if it is to be accepted internationally. It is designed to be used by doctors educated at different medical schools in different countries with different backgrounds over a period of more than fifty years of rapid progress in medicine, and to meet the varying requirements of hospitals, vital statistics offices, medical services of the armed forces, social insurance organizations, sickness surveys, and a host of other agencies, as well as of the relatively or absolutely unqualified person who will apply it (in simplified form) in areas where there are no doctors. Attempts to provide a statistical classification based on a strictly logical arrangement of morbid conditions have hitherto failed, and the Classification has accordingly had to effect a compromise between classifications based on etiology, anatomical site, age, and circumstances of onset. As Farr observed: "The medical practitioner may found his main divisions of diseases on their treatment as medical or surgical; the pathologist, on the nature of the morbid action or product; the anatomist or the physiologist on the tissues and organs involved; the medical jurist on the suddenness or the slowness of death; and all these points will deserve attention in a statistical classification."

The Classification has not only had to pay attention to these points, but also to take the quality of the information available in medical reports into consideration. It is therefore not surprising that there has been criticism of some categories, usually based upon disagreement regarding the etiology of some disease or its place in a certain group. With improved knowledge it is to be expected that in due course each disease or group of diseases will be classified in a way that commands international support.

**Medical certificates of death: application of the Classification to causes of death**

Early records of death usually mentioned only one cause but in the course of time it became recognized that two or more causes were often involved and that it was important to decide carefully which was the main one. Certain principles were laid down in the first revision of the International List of Causes of Death, and these were applied by the United States Bureau of the Census in a *Manual of Joint Causes of Death*, first published in 1914 and afterwards revised to
conform with successive revisions of the List. This manual was used by other countries as well. Rather more flexible rules concerning the cause or causes of death were applied by the General Register Office of England and Wales. The Fifth Decennial Revision Conference requested the United States Government to continue its investigations into the problem of multiple causes of death, in co-operation with other governments and organizations, and these investigations and the suggestions made led in due course to the approval by the Sixth Revision Conference of an International Form of Medical Certificate of Cause of Death and Rules for Classification, which included a definition of the underlying cause of death.

The Rules for Classification observe that, for the purpose of introducing public health measures to prevent the precipitating cause of death from operating, "the most useful single statistic is that relating to the underlying cause of death, which may be defined as (a) the disease or injury which initiated the train of morbid events leading directly to death, or (b) the circumstances of the accident or violence which produced the fatal injury". The recommended form provides for:

I. (a) Direct Cause, (due to)
    (b) Intervening antecedent cause, (due to)
    (c) Underlying antecedent cause;

II. Other significant conditions contributing to the death but not related to the disease or conditions causing it."

These Rules for Classification give examples of how the certificate is completed, as well as of improbable sequences in the train of morbid events, and other errors; and provide notes for the interpretation of entries of causes of death. Member States of WHO pledge themselves under the WHO Nomenclature Regulations to adopt this death certificate, and to ensure as far as possible that it is completed by an attending physician. The Regulations also stress the need for protecting the confidential nature of the certificate during any administrative procedures. This is an important point, and great stress was laid on it in papers read at the First International Conference of National Committees on Vital and Health Statistics in 1954, by Aubenque and Neurdenburg, the latter remarking that if there is no guarantee that confidentiality will be respected, medical practitioners may be reluctant to make a precise and full report.

As already noted, the WHO Centre for Classification for Diseases, after consultation with several national statistical offices and after experimental trials, drew up additional rules—the Supplementary Interpretations and Instructions for Coding Causes of Death, and Medical Certification of Causes of Death—which were incorporated into the Rules for Classification in the 1955 revision of the Manual.

While specifying uniform and efficient methods of recording medical opinion, as given in certificates of causes of death, the 1955 Revision Conference formally recognized the difficulty that many national administrations would have in applying the relevant rules. One serious difficulty in many countries is the lack of medical practitioners to attend the sick and sign certificates. The Conference therefore recommended that WHO undertake a study of methods which could be used temporarily in specific areas as a substitute for the classical methods, but would still furnish health administrations with useful information on the frequency and severity of specific diseases or groups of diseases. A series of regional statistical seminars have since initiated the search for, and the experimental application of, such methods.

Another important step towards increasing international comparability was taken in April 1955 by the establishment in Caracas, 1

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in the Ministry of Health and Welfare, Venezuela, of the Latin American Centre for the Classification of Diseases. The specific tasks of this Centre are to promote completeness, accuracy and comparability of mortality statistics in Latin America, by means of training courses and by serving as the clearing-house for problems arising in the application of the Spanish edition of the Manual of the International Statistical Classification of Diseases, Injuries and Causes of Death. By a decision of the WHO Regional Committee for South-East Asia in 1958, another Centre with similar objectives is to be established in New Delhi.

Geographical limitations in international comparability

To ensure comparability of health statistics, it is necessary not only to have an efficient administrative machinery for recording vital events, and statistical services to compute and tabulate them, but also an adequate number of competent physicians to diagnose causes of illnesses and deaths. But estimates made by the United Nations Statistical Office\(^1\) show that only 33% of the deaths occurring annually in the world are recorded and included in statistics, the proportion by continent ranging from 100% in Europe and North America to 39% in South America, 18.2% in Asia, and 13% in Africa. The proportion is as low as 8% in tropical and southern Africa, and 7% in eastern Asia. The number of physicians available for certifying causes of death is even less than the number of lay registrars. It is not surprising therefore that the population covered by adequate statistics of causes of death is smaller still than that covered by crude mortality data.

Statistics of causes of death deemed worthy of reproduction in the latest issue of WHO’s Annual Epidemiological and Vital Statistics cover a population of 682 millions in 50 countries or territories, representing roughly 25% of the world’s population.

The practical impossibility of applying standard statistical methods to most under-developed areas has been increasingly realized by WHO. The Expert Committee on Health Statistics has accordingly recommended that WHO concentrate its statistical activities in the coming years on the search for substitute methods capable of meeting the needs of territories in various stages of development. The possibility of securing comparable data has been explored at a series of international seminars and training centres in vital and health statistics organized in collaboration with the United Nations. Regional advisers in health statistics have further pursued this task by assisting national governments.

Co-operation with the United Nations

The definitions of live birth and foetal death adopted by the Third World Health Assembly, as well as the International Classification, have been included in the Principles for a Vital Statistics System, adopted by the United Nations.\(^2\) The United Nations is concerned with problems of demography, and these Principles, after adoption by the Statistical Commission of the United Nations Economic and Social Council, were approved by the Council and forwarded to governments with the request that “they review and appraise their procedures for registering vital events and compiling vital statistics, taking into consideration the principles for a vital statistics system, and introduce such changes as are feasible to improve national statistics and their national comparability in this field...”. The Principles cover the registration of vital events, the recording, reporting and collecting of data for statistical purposes, and the compilation of vital statistics, and were based on a survey of procedures in 58 countries. In their preparation the comments of the WHO Expert Committee on Health Statistics were taken into consideration. As a result, the recommendations relating to the responsibility for medical certification of cause of death, the use of the International Form of Medical Certificate of Cause of Death, and the definition and classification

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of cause of death are in accordance with the WHO Nomenclature Regulations; and the definitions of live birth and foetal death are those given above. There is thus close co-operation between WHO and the United Nations in the effort to introduce uniformity of definition and international comparability into vital and health statistics.

IMPROVEMENT OF NATIONAL STATISTICS

It is one thing for a heterogeneous collection of countries, ranging from the highly to the poorly developed, to agree on international regulations or recommendations in vital and health statistics; it is quite another for these countries to set their statistical houses in order by improving their existing systems or by creating new statistical services. WHO has sought to help countries in developing their statistical services by a programme of advice, by co-operative action on a national, regional or international scale, and by promoting education and training. Advisers in statistics have been appointed to WHO's regional offices; the establishment of national committees on vital and health statistics has been encouraged; WHO centres for the classification of diseases have been created; fellowships in health statistics have been awarded; and seminars and training centres on vital and health statistics have been conducted, in conjunction with the United Nations and the governments of the countries concerned. WHO has also endeavoured to co-operate with other bodies, international, national, governmental or non-governmental, interested in furthering health statistics.

National committees on vital and health statistics

The idea of national committees was mooted at the International Conference for the Sixth Decennial Revision of the International Lists of Diseases and Causes of Death in 1948. The Conference recommended that governments should set them up, in order to co-ordinate statistical activities within each country and to serve as a link between national statistical organizations and WHO. Such committees, it was considered, could also study statistical problems of public health importance and make the results of their investigations available to WHO, thus providing it with valuable information on national points of view. Where national co-ordinating bodies already existed, as they did in a few countries, they could take over these functions as an addition to those they already had.

By 1958, 35 national committees had been created, while others were in the process of being created. WHO Headquarters in Geneva keeps in close touch with them, both to facilitate the exchange of information between them and to bring a variety of material to their attention, and, through them, to the attention of other interested organizations. The WHO Expert Committee on Health Statistics has referred specific problems to them—such as the development of a statistical classification of operations and anaesthetic procedures, the classification of foetal deaths when more than one cause is stated on the death certificate, the terms and definitions used in connexion with morbidity statistics, and the study of the accuracy of diagnoses on death certificates, with special reference to cancer.

The idea behind these national committees was that they should bring together in each country representatives of the administrative services interested in vital and health statistics. Duplication of activities sometimes occurs among different government agencies, or there is uncertainty of responsibility, to the detriment of the country's statistics as a whole. It was felt that if representatives met periodically a spirit of co-operation would be generated and statistics would come to be seen, not as the exclusive preserve of one or other department, but as a subject in which
all were interested and to which all could make a contribution. There were no hard and fast rules laid down about composition or meetings; some committees meet regularly, some not, and the numbers attending depend on conditions in the country. Some committees have been very active and have done a great deal of work both within the country and internationally. They provide a very convenient forum for the discussion of technical problems and for the exchange of information, and they transmit to WHO information and reports on their proceedings and studies. These reports often have a stimulating effect on national committees in other countries, which are naturally interested in seeing how the same statistical problems are dealt with elsewhere; and indeed they may be expected to help, to however small an extent, in standardizing statistical procedures internationally.

The international aspect of national committees on vital and health statistics was summarized as follows by one of the originators of the idea: “To be comparable from country to country, to be useful at the international level, part of the statistical product in each country should be the same in all countries... But this means international requirements—and there’s the rub! For international requirements have a way of creating difficult procedural problems back in the countries, States, and localities where the data must be collected in the first place. In some instances the effort to collect data needed internationally may interfere with local ways of doing things, or entail effort that the locality or nation would rather spend on data more acutely needed at home. All this we know, and we also know the effect—that international recommendations are sometimes ignored, and the international data series represent not all but only some of the countries...”

“As an essential part of the mechanics of reaching international agreement on statistical matters, direct participation of national technicians should be sought and obtained at the planning stage. This is a fundamental principle of the national committee concept... The creation of a national committee is in itself no guarantee that this national objective will be accomplished. But it is difficult to visualize how it can be accomplished at all in the absence of a national committee.”

In 1953 the First International Conference of National Committees on Vital and Health Statistics was convened in London under the auspices of WHO and in close collaboration with the United Nations. Delegates of 28 Member States were present, as well as representatives of the International Labour Office and the International Statistical Institute. The Conference laid down the objectives that national committees should aim at, and recommended that any government that had not done so should “review, having regard to the particular circumstances of its country, the practicability of setting up such a committee”. The functions of a national committee would, the Conference felt, normally be advisory and consultative, but it should be free also to consider any other matters within the general scope of its terms of reference and, in appropriate circumstances, stimulate the undertaking of analysis, research and special studies. Its membership should include administrative, professional and lay persons concerned with the collection and analysis of health and vital statistics both at the national and at the regional or local levels, and it should be able to invite competent persons in special subjects to participate in its work. Its reports should not only go to the government, but should also be forwarded periodically to WHO and, when appropriate, to the United Nations. WHO should circulate such reports, summarize information wherever possible and desirable, and point to significant developments in the field and to analogous activities in the different countries. Finally, WHO might consider the possibility of aiding the national committees to carry out their work more effectively, by providing assistance for particular purposes, or by fellowships enabling visits to be made to other committees carrying out joint investigations. WHO might also periodically consider, on the basis of the information

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received from the committees, whether any action was required on its part; and it might keep in mind the desirability of convening other similar conferences.

Fellowships

The need for better statistical and epidemiological information has led to a demand for more trained statisticians, of whom there is a serious shortage throughout the world. In 1951 the Expert Committee on Health Statistics recommended that special consideration be given in WHO training programmes to the training of statistical staff and the granting of fellowships for this purpose.

The figures for fellowships awarded in health statistics are as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of WHO fellowships in health statistics</th>
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</thead>
<tbody>
<tr>
<td>1947</td>
<td>4</td>
</tr>
<tr>
<td>1948</td>
<td>1</td>
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<tr>
<td>1949</td>
<td>-</td>
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<tr>
<td>1950</td>
<td>7</td>
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<td>1951</td>
<td>59</td>
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<tr>
<td>1955</td>
<td>49</td>
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<tr>
<td>1956</td>
<td>39</td>
</tr>
<tr>
<td>1957</td>
<td>61</td>
</tr>
<tr>
<td>1958</td>
<td>60</td>
</tr>
</tbody>
</table>

From 1952 to 1958 the figures for individual regions were as shown in the table below.

WHO FELLOWSHIPS IN HEALTH STATISTICS BY REGION, 1952-1958

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Africa</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>3</td>
</tr>
<tr>
<td>America</td>
<td>10</td>
<td>27</td>
<td>25</td>
<td>28</td>
<td>47</td>
<td>35</td>
<td>172</td>
<td></td>
</tr>
<tr>
<td>Eastern Mediterranean</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>8</td>
<td>6</td>
<td>6</td>
<td>15</td>
<td>44</td>
</tr>
<tr>
<td>South-East Asia</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Europe</td>
<td>6</td>
<td>2</td>
<td>9</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>8</td>
<td>31</td>
</tr>
<tr>
<td>Western Pacific</td>
<td>14</td>
<td>2</td>
<td>1</td>
<td>11</td>
<td>2</td>
<td>1</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>22</td>
<td>21</td>
<td>42</td>
<td>49</td>
<td>39</td>
<td>61</td>
<td>60</td>
<td>294</td>
</tr>
</tbody>
</table>

Fellowships are given to selected individuals to spend a period of study at a university, or of observation and practical training in the statistical offices of a country more advanced than, or otherwise different from, their own. The award of these fellowships is a recognition that each country, whatever its development, must have at least a nucleus of health workers who have acquired the necessary statistical skills and knowledge to impart to their colleagues and students. As a method of promoting technical instruction, it is felt to be an investment which gives returns out of all proportion to the original outlay, and to be a valuable stimulus of national efforts to improve statistical services. To meet the training needs of a broader group, other training opportunities have been devised, such as seminars or training centres.

Seminars and training centres

The chief objective of seminars and training centres is to bring responsible statistical workers of various countries in one or more regions together to take part in a programme designed to improve national vital and health statistical services and, as a corollary, international statistics. There is training in organizational, methodological and analytical
techniques of vital and health statistics; instruction in the aims and working programmes of international agencies in that field; dissemination of information on international standards and recommendations for the improvement of national statistics and for the attainment of international comparability; and development of close working relationships and co-ordination of effort among the national agencies concerned. Exchange of information and ideas is encouraged, and professional contacts are made. This type of training provides practical, but more summary and more specialized, instruction than is the rule in academic institutions. The seminar makes it available, however, to a larger number of persons than could take advantage of the fellowship programme; provides it as far as possible within a region, using the language, materials and problems of the region as the basis of the training; and does so at the minimum cost to the countries and sponsoring organizations.

In accordance with WHO's policy of co-operation, most of these seminars and training centres have been sponsored jointly with UN, the host government, and whatever other organizations are interested. For example, in the case of the twelve-week Inter-American Seminar for Biostatistics held in 1950 with 49 participants, the sponsors were the Government of Chile, the United Nations, the Pan American Sanitary Bureau (which acts as the WHO Regional Office for the Americas), the Inter-American Statistical Institute, and the National Office of Vital Statistics of the United States Public Health Service. Other training centres or seminars have been: a twelve-week International Training Centre on Vital Statistics and Health Statistics for South-East Asia in Ceylon in 1951, with 32 participants; a Training Centre on Vital Statistics and Health Statistics for the Eastern Mediterranean in Cairo in 1951 with 35 participants; one in Tokyo in 1952 with 33 participants; and one in Afghanistan in 1954 with 38 participants. Yet others have been held in Africa in 1956, with 20 participants, and in South-East Asia in 1958, with 18 participants. The participants in these seminars and training centres are heterogeneous: some medical, some not; some highly trained in statistical theory, others with only the basic training but engaged in the collection and publication of statistics and therefore with practical experience; and they represent a variety of statistical interests, official and non-official. The result is that the seminars provide a broad conspectus of statistical activities, and give sharper relief to the problems of co-ordination between these various interests. In some of them heads of services discuss their problems with experts; in others training is by group discussions following lectures; and much stress is laid on practical work. In some seminars teaching material is provided by lecture notes, reprints of professional articles, pamphlets, textbooks, reports and year-books of both national and international agencies, material which in itself forms the basis of a useful reference library for each participant. In others the participants take home their own notes and the various reports issued.

The discussions at these regional seminars brought out the need for holding similar reunions in the local languages in individual countries, and these have in fact taken place. In 1952 a significant advance in the training of statisticians was made by the establishment of an Inter-American Center of Biostatistics in Santiago, Chile, which was jointly sponsored by WHO, the United Nations, and the Chilean Government. This Center offers courses of some length, covering a variety of special fields in vital and health statistics, to statistical personnel in Central and South America; and it arranges practical training in the countries of that region. Its first class completed a nine-month course in 1953; six months of the course were devoted to academic studies, and three to practical training in various programmes in the field. It was attended by 31 students from 15 different countries. In 1956 responsibility for the course was accepted by the University of Chile. By 1958 about 200 students from 19 Spanish-speaking countries in South and Central America had been trained in the annual and supplementary courses given by the Center, with WHO assistance.
In 1951, WHO held a training course in Geneva for those engaged in coding in connexion with the application of the International Statistical Classification of Diseases, Injuries, and Causes of Death, 1948 Revision. It was attended by 20 participants, from 16 different countries in the European region.

These activities have received full recognition from governments, and the publicity given to them, the participation in them of statistical staff from various countries, and the stress laid on the importance of international comparability and of national committees on vital and health statistics have created in the regions and in their constituent countries an awareness of the valuable part that improved statistical services can play in national development, as well as internationally. The emphasis is on the applied side of statistics, so that more efficient use is made of existing staff and resources; WHO does not attempt to duplicate the training to be obtained in academic institutions, where the necessary foundations in statistical training are, and should be, laid.

Consultants in statistics

Apart from fellowships and seminars, WHO has sent consultants to advise countries on their statistical services. A senior consultant in statistics has visited a large number of countries, and, in association with the respective regional offices, given advice on the institution of new, or improvement of existing, services. Most of the regional offices now have advisers to help in the development of adequate statistics throughout the region and in the co-ordination of work done in the various countries. Progress is especially noteworthy in the Americas, where PASB and its zone offices have their own statistical advisers.

A useful medium for imparting knowledge on epidemiology and statistics has been the medical teaching missions sent by WHO to a number of countries, especially in the Regions of the Eastern Mediterranean and South-East Asia. An example is to be found in the group which went to Israel in 1951.

In 1952 WHO established the principle of participation by statistical consultants in the work of project teams and field missions, so that epidemiology and statistics might receive due consideration in the planning and execution of programmes. There has been an inevitable increase in the desire for guidance in these aspects as a result of the gradual shift from emergency or ‘ad hoc’ programmes to longer-term programmes, which synchronizes with a growing interest internationally in co-ordinated research. This policy is doing much to extend knowledge of these sciences into many fields of medicine in most countries of the world.

The increase in the number of internationally co-ordinated research programmes has meant, too, that growing attention is being paid to such epidemiological and statistical techniques as surveys and controlled field experiments. Inevitably this has called for the application of modern knowledge to the design of such investigations.

Health statistical methods suitable for developing areas

The standard statistical methods for collecting data are not uniformly applicable throughout the world. Apart from purely local differences in methods, there are regional differences which embody cumulative experience and common traditions; these indeed are of major significance in explaining existing systems and in pointing the way to improvement. Thus, for instance, any improvement in the statistical system will require consideration of Islamic culture in countries of the Eastern Mediterranean, of Hispanic traditions in Central and South America, and of animist beliefs and tribal organization in tropical Africa.

Detailed knowledge of the local conditions in which diseases and deaths are recorded, of the availability of medical care, of local usage in registration, and of the degree of education of registrars in various types of communities, not to mention the social and educational level of the population itself, are all essential to the intelligent use of statistics and to plans for their improvement. A number of partial solutions may be needed.
Sampling methods have been used, and pilot registration areas established. In this connexion, semi-skilled medical personnel and even lay personnel have had to be employed to record vital events and their causation. Staff like this cannot provide accurate diagnoses, but they can record symptoms roughly, and their records, taken in conjunction with an approximate age grouping, may reveal to health authorities an abnormal frequency of maternal or infant deaths, for example, or of chest complaints, or diarrhoeal diseases.

Keeping apart data of various degrees of technical accuracy and completeness, instead of pooling them and arriving at meaningless "national aggregates", in itself brings an improvement: not only because the grading of data is an incentive to raising the standard of inferior data, but because fairly reliable data relating to some urban areas are often available, and can be separated from less trustworthy material.

Teaching of statistics

With a view to improving the recording, analysis, interpretation, and presentation of statistics of health and disease, the WHO Expert Committee on Health Statistics \(^1\) has emphasized the importance of teaching elementary statistical methodology to all medical students, preferably in the second and third years of their training. Emphasis has also been laid on teaching more advanced statistical methodology and vital statistics to medical and other graduates who are trained for public health posts, and the groundwork of medical statistics to non-medical personnel engaged in medical coding, keeping records and preparing statistics in public health offices, hospitals, social security institutions, and government departments.

The fifth report of the Committee recognized three main types of statistical workers: \(^2\)

1. Statisticians with comprehensive university training, including special training in health statistics;

2. "intermediate staff", such as record keepers, local registrars, heads of small vital and health statistical units, hospital statisticians, etc.; and

3. Clerical staff.

A careful balance has to be sought between these three types, and the needs of particular areas ascertained by survey before appropriate plans for training are made. While the training of personnel of type 1 might be pursued by the granting of fellowships and of type 2 by the organization of international regional training courses, personnel of type 3 could be trained within the country. National administrations, sometimes under the technical guidance of national committees on vital and health statistics, normally provide the training of the last category of staff.

The teaching of health statistics in medical schools is of special value, not only because it contributes to the development of the scientific attitude, but also because it instructs the future physician on the collection and analysis of data, and makes him aware of his responsibility as the primary source of certain important information. The physician's role in issuing death and birth certificates, in notifying disease, and in preparing clinical reports on patients under his care is indeed of prime importance. Many of the defects in health statistics are essentially the result of deficient instruction on the physician's part in their production, as well as of his ignorance of their importance and uses.

There is, however, an increasing recognition of the value of statistics to the medical profession. An important step was taken in July 1958 by the Pan American Health Organization and the Faculty of Hygiene and Public Health of the University of São Paulo, in convening a conference on the teaching of medical statistics. It was attended by professors of medicine and public health from six South American countries. Suitable teaching courses were outlined, emphasis being placed on the careful selection of practical examples directly associated with the students' medical studies.

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INTERNATIONAL COLLECTION AND PUBLICATION OF DATA

The Fourth World Health Assembly decided that one of the main aims of the Organization should be gradually to build up a body of sound statistical information and advice, covering all parts of the world, by which the policy of the Organization could be guided and its operations and their results measured. Another aim was to encourage the various branches and regions of the Organization to make the fullest use of the statistical data and facilities available at WHO Headquarters.

This was a formal confirmation of the function of collection, analysis and publication of statistical and epidemiological data which, as already noted, has been one of those undertaken by international health agencies since their inception. By Articles 63 and 64 of WHO's Constitution each Member State must communicate promptly to the Organization important laws, regulations, official reports, and statistics pertaining to health which have been published in the State concerned, and provide statistical and epidemiological reports in a manner to be determined by the World Health Assembly. Something has already been said about the action taken by WHO both to continue and extend systems of collecting and publishing medical and health statistical data and to undertake or report epidemiological studies. Certain further features of this basic work require noting, as in one sense there is no more important work, initially, in the field of epidemiology and statistics than that of persuading, encouraging, and assisting countries to make their own arrangements for recording morbidity and mortality, and for ensuring the widest use of the statistics for public health and research purposes.

General epidemiological and statistical data

WHO inherited the statutory rights and obligations of the OIHP and of the Health Division of the United Nations Relief and Rehabilitation Administration (UNRRA) (which had assumed responsibility for OIHP's duties in January 1945) in respect of international quarantine; and the machinery of the Health Organisation of the League of Nations for the collection of general epidemiological and statistical information. Under the International Sanitary Regulations (WHO Regulations No. 2) the health administrations of a large number of countries throughout the world have the responsibility of reporting by cable and airmail the appearance of quarantinable diseases—cholera, plague, epidemic (louse-borne) typhus, relapsing fever, smallpox and yellow fever—to WHO. In its turn, WHO has the responsibility of sending this information to all health administrations and this it does by a daily broadcast over an international radio network and by publication in the *Weekly Epidemiological Record*, which is a legacy from the League of Nations and has been in existence for more than thirty years. The Record also contains notes, based on current statistical data, on incidence of certain non-quarantinable diseases, such as influenza and poliomyelitis, whenever their spread becomes of international importance.

A vast amount of statistical material is received by WHO in weekly, 10-day, fortnightly, monthly, quarterly and annual reports, which are furnished by the health and statistical departments of most countries in the world and by many local statistical offices. They include national and local statistical reports and tables from over 250 countries and territories. These reports form a heterogeneous mass, varying, despite WHO's efforts at standardization, in form, accuracy, completeness, definition and classification, and in the type of data supplied. While many countries and territories do not provide health statistics, mainly because of lack of physicians and of registration.

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officials and machinery, in general it may be stated that such vital and health statistics as are available to governments of Member States are sent to WHO. Also under Article 61 of WHO's Constitution each Member State is required to “report annually to the Organization on the action taken and progress achieved in improving the health of its people”, and these annual reports contain a proportion of statistical information.

The statistical data collected are classified and extracted at WHO headquarters in Geneva, and form the basis of the Epidemiological and Vital Statistics Report, a compilation which has been published by WHO monthly since June 1947 and which contains statistics on disease, general mortality, infant mortality, and birth rates in certain countries, and statistical tables on epidemiological and demographic topics. It has, for example, included tables showing specific death rates for selected countries from cancer (of various types), certain communicable diseases, alcoholism, arteriosclerosis, accidents, etc. It is a lineal descendant of the Monthly Epidemiological Report issued by the League of Nations from 1922 on. A year-book is published, Annual Epidemiological and Vital Statistics, with a time lag of about two years as detailed figures are not as a rule supplied immediately by local administrations. This annual volume contains tables of population, general vital statistics and causes of death according to age and sex, and cases of, and deaths from, notifiable diseases. In addition, it provides tables of death rates from selected causes by age and by sex; the seasonal distribution of notifiable diseases; and numbers of health personnel, hospitals, and vaccinations in many countries. The tables on vital statistics owe much to the United Nations and its Statistical Office in New York.

Responsibility of UN and WHO

It is pertinent here to outline the relative responsibilities for the collection of statistical data of the United Nations and WHO. In order to avoid duplication of effort and overlapping in the collection of information, the various fields of vital and health statistics are covered as follows:

(a) Population data—aggregates, and by age and sex:
    collected by the UN;
    published by both agencies, WHO reproducing the UN figures exclusively.

(b) Births—numbers and rates:
    data collected by the UN;
    published by both agencies, WHO reproducing the UN figures exclusively.

(c) Stillbirths—numbers and rates:
    data collected by the UN;
    published by both agencies, WHO reproducing the UN figures exclusively.

(d) Fertility data:
    collected and published by the UN;
    material supplied by the UN to WHO as and when required for particular purposes or publications.

(e) Marriages:
    data collected and published by the UN.

(f) Life table functions:
    data collected and published by the UN;
    material supplied by the UN to WHO as and when required for particular purposes or publications.

(g) Deaths by age and sex:
    data collected by the UN and published by both agencies;
    data on infant deaths collected by the UN with the sub-classifications requested by WHO.

(h) Deaths by cause, subdivided by age and sex:
    data according to the Abridged International List collected by the UN, and supplied by the UN to WHO;
    additional data according to the Detailed International List collected by WHO, when desired, the UN being informed of each such collection;

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1 In view of the special interest and competence of WHO in the International Classification of Diseases, Injuries, and Causes of Death, and the methods of implementing this Classification, WHO, when necessary, corresponds with national authorities with a view to the adaptation of their statistical material to the Classification, particularly if the classification in use in their countries does not conform with the Abridged International List used in the UN questionnaires. Copies of such requests are sent systematically to the Statistical Office of the UN.
publication by the UN of aggregates by each cause of the Abridged List; publication by WHO of such aggregates and of details by age and sex for each cause of the Abridged List and for such additional detailed causes as may be deemed desirable.

(i) Communicable diseases: data collected and published by WHO.

(j) Morbidity: data collected and published by WHO.

(k) Medical institutions and public health measures: data collected and published by WHO, and communicated to the UN in the form of final tables for publication purposes, together with technical notes on qualifications attaching to the data.

(l) Medical and sanitary personnel and institutions: data collected and published by WHO and communicated to the UN in the form of final tables for publication purposes, together with technical notes on qualifications attaching to the data.

(m) Population, vital and health statistics of cities: in the case of cities adjacent to ports and airports, and also of aggregates of cities, WHO collects data on population, births, deaths and diseases, as required for such cities to meet their special epidemiological requirements; the UN collects and publishes population and vital statistics on cities as part of its programme coverage of communities according to size.

Special health data

Continuing a practice begun by the League of Nations, WHO has maintained records of the numbers of physicians, dentists, midwives, nurses, pharmacists, and veterinarians as notified by countries. These records now cover a period of 25 years, and since 1950 details have been published for about 180 countries and territories. The data are difficult to report in a uniform way because of the differences in professional qualifications, and because reports vary in completeness and accuracy.

Data on national hospital establishments are also recorded, with the numbers of hospitals and hospital beds by categories, i.e., general, maternity, sanatoria, leprosaria, etc.

In 1955, a supplement to the WHO Library News \(^1\) was published giving a list of public health reports (annual and occasional) and of official reports containing health statistics that were available in Geneva at the libraries of WHO, the United Nations and the International Labour Office. In some countries, e.g., Canada and the United States of America, where important health functions are decentralized, available provincial or state reports are included; but reports from smaller administrative units, such as local authorities or cities are not. From this list it appears that certain countries do not publish annual reports on public health, and that some others publish such reports only at irregular intervals. An effort is therefore being made, especially by the statistical advisers of the regional offices, to assist countries in improving them, since they are of immediate value administratively to the national health services, as well as being helpful to workers both at the local and the international level.

Through such official and other collections the WHO library and reference system is coming to play a more direct role in the collation of published statistical and epidemiological material. It is helping, in combination with the other statistical services, both headquarters and regional, to make WHO a major, if not the chief, repository of essential world and regional data, statistical and epidemiological.

Other publications

Apart from its periodical statistical publications, WHO publishes the Bulletin of the World Health Organization, its principal scientific organ, which prints articles of international significance falling within the scope of WHO's interest and activities. Statistical and epidemiological articles appear

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\(^1\) WHO Library News, 1955, 8, Supp. 2.
in it periodically. One whole issue of the Bulletin in 1954 was devoted to health statistics, and one in 1956 to epidemiology, each covering a wide range of subjects. In the case of the statistical number these included the use of sampling for vital registration and statistics, the securing of appreciation of health statistics, needs in vital and health statistics in the less developed countries, and future objectives of national committees on vital and health statistics. The epidemiological number included such subjects as cancer of the breast, poliomyelitis, accident mortality amongst children, protein malnutrition, and endemic goitre. Numbers of the Bulletin on such subjects as bilharziasis, endemic goitre, virus diseases, the treponematoses, and malaria, have dealt with various epidemiological and statistical aspects of these subjects.

5 Bull. Wid Hlth Org., 1957, 17, 865.
6 Bull. Wid Hlth Org., 1956, 15, 863.

INTERNATIONAL MORTALITY STATISTICS

General mortality

A general survey of the vast quantity of material stored in the annual and monthly statistical publications of WHO is certainly beyond the scope of the present review. It is also doubtful whether it would be fruitful, as the data clearly vary widely in completeness, accuracy and comparability. Nevertheless, there is a use for such data in studies with a specific purpose, e.g., on variations of and trends in mortality in selected countries or regions, or on mortality by cause.

Mortality statistics from various countries and territories are received by WHO directly or through the United Nations Statistical Office. This material is regularly tabulated and published in the Annual Epidemiological and Vital Statistics and the monthly Epidemiological and Vital Statistics Report.

In its earlier years the WHO Epidemiological and Vital Statistics Report contained statistical studies on such subjects as the evolution of mortality in Europe during the twentieth century, recent birth-rate trends, the present state of population growth, and the influence of the decline in mortality on growth of population.

The reports of the Expert Committee on Health Statistics are of great value in the study of international statistics. They appear in the WHO Technical Report Series, and cover a wide range of international statistics.

All these publications reflect the increasing application of statistical and epidemiological methods to WHO programmes. But while the quality of the statistics published by WHO continues to be dependent upon the reliability, completeness, and comprehensiveness of the information collected at the source, which fall far short of what they might be, it cannot be said that there is any ground for complacency about them.

The annual volumes have generally contained some 60 tables, but there were 74 tables in the 1958 volume, which gave data for 1955. The tables in these volumes are grouped as follows: general vital statistics of selected countries and certain large cities; causes of death according to age and sex for 30 to 40 countries; deaths and death rates from selected causes by age and sex; cases of, and deaths from, notifiable diseases for countries and territories, with seasonal distribution.

Though limited in scope, these annual volumes are growing in importance as sources of basic data extending over many years. They provide demographers, statisticians, epidemiologists, sociologists and public health workers with reference material for enquiries into world or regional mortality phenomena. They also serve as a stimulus to many administrations to remedy lacunae,
irregularities and inaccuracies in their own statistics.

The monthly *Epidemiological and Vital Statistics Report* contains current data on general mortality, infant mortality, notifiable diseases, and also special tables on the occurrence of diseases in certain selected countries and large cities.

The contents of these reports may be illustrated by a tabulation of general mortality in the *Epidemiological and Vital Statistics Report*.¹ It gives available death rates per 1000 population for countries throughout the world for which statistics are available, noting where the data are incomplete or approximate; and provides figures for the years 1936-38, 1947-49, 1950-52, 1953-55, 1956, 1957, and the quarters of 1956, 1957 and 1958. Other tables show the total number of deaths and death rates per 1 000 000 population, by sex, since 1950; the number of deaths by sex and age-group since 1950; the 1954-1956 average of specific death rates per 1 000 000 population, by sex and age-group; the number of deaths, by sex and by age, in 1954-1956; and the distribution of deaths from various causes in 1954-1956, using the International Classification.

The mortality statistics available in the most complete form for the largest population and longest time are those for Europe. In Europe, the period since 1900 has, however, been characterized by two world wars which in addition to causing a loss of population, and migrations, brought about important changes in territorial boundaries and under-registration of deaths. Moreover, the national censuses have also differed in value. The administration of statistics services has varied in efficiency from country to country; in some, the basic accuracy of population data may even have changed between one census and the next. For all these reasons an analytical study of the mortality data has sometimes been extremely difficult. Certain general trends in mortality have been evident, however.²

There were periods when the number of registered deaths increased to an abnormal extent: such were the years 1904-1908, and again 1924-1927. Except for these periods the death rate declined during the century, being almost halved in some countries. This trend was masked in places by the aging of the population; for the greatest improvement was in infant and child mortality, though there was a marked decline also in the death rates for some middle-aged groups. The result was a higher proportion of people of 60 years of age and over. It became evident that unless new and effective therapeutic agents were discovered and new methods of treatment evolved to combat or retard diseases of old age, there was no possibility of a substantial permanent decrease in the general death rates for the countries which already had a large proportion of old people in their populations.

The expectation of life was increased, the gains made being chiefly concentrated in childhood and early adulthood, and being smaller in countries such as England, France and Sweden where the expectation of life was already high. The maximum gains were at birth, reflecting the great strides made in reducing infant mortality in all the countries of Europe.

The fall in the mortality of pre-school children was also spectacular, the rates in 1950 being less than 30% of the corresponding rates at the beginning of the century. The specific death rates for the other age-groups up to 45 or 50 years were reduced in most countries by roughly half or more. But only small gains were registered for older age-groups. The minimum specific death rates recorded in all countries were for the age-group 10-14 years. The ratio of male to female mortality almost universally exceeded unity for all ages combined (Sweden being the one exception), male babies being more liable to die than female babies. By about 1947, in 13 Western European countries with a total population of about 203 million, there were more than 1 750 000 fewer deaths per year among persons of all ages than would have been expected if the 1900 level of the death rate had remained unchanged.

Mortality could be viewed during the half-century in terms of a selected group of infectious diseases: the typhoid and paratyphoid fevers, scarlet fever, whooping cough, diphtheria, measles, malaria, smallpox and typhus. Mortality from typhoid and paratyphoid fevers declined in practically all European countries; on the whole in a pronounced and steady fashion in one group, which included Belgium, England and Wales, the Netherlands, Sweden and Switzerland; far less markedly in a second group, which included Italy and Spain. The decline was generally attributed to improvements in sanitary conditions through better water supplies, the installation of sewerage systems, greater attention to the hygiene of milk and other foods, and better plumbing and housing. Other factors were better medical care, more hospital facilities, earlier notification of suspected cases, prompter measures by public health authorities on receiving notifications, improvement in the education of the public, greater awareness of the dangers of infection, and, perhaps, antityphoid inoculations (though the part played by inoculation is difficult to assess).

With scarlet fever there was no definite decline in mortality until about 1920. Thereafter it became appreciable, although there were marked fluctuations in some countries; and at the end of the half-century mortality was of the order of between 0.1 and 0.2 per 100,000 inhabitants, having been more than 5 per 100,000 for most European countries at the beginning of the period. The two explanations most frequently advanced for the uniform decline were a change in the virulence of the causative organism and a shift in the incidence of the disease, which now tended to attack older children and adults rather than the younger children among whom it had previously been most frequent.

Whooping cough mortality also declined with remarkable uniformity throughout the period. Except for better medical and nursing care generally, and the use of modern therapeutic agents in combating respiratory complications, nothing specific had been done from a public health point of view to account significantly for this considerable decrease.

Mortality from diphtheria decreased substantially during the half-century. While the introduction of antitoxin could be held to be partially responsible for the decrease in the earlier part of the period, it was difficult to ascribe full responsibility to it. Preventive immunization had reduced mortality to practically nil wherever it was practised on a sufficiently high proportion of children of pre-school and school age.

There was a conspicuous reduction in the mortality from measles. There does not seem to have been any great change in morbidity, but the pattern of distribution may have shifted so that more older children and fewer babies and younger children were affected. Less overcrowding, through improved housing, may have helped. Administration of convalescent or adult serum and the use of gamma globulin were not carried out on a sufficient scale to have had any considerable effect; but this did not apply to the use of sulfa drugs and antibiotics which controlled mortality from the more fatal complications.

Malaria declined also, as the result of improved malaria prophylaxis and of progress in the treatment of patients. DDT and other residual insecticides helped bring about a striking decrease in mortality from this disease towards the end of the period. Widespread and sustained vaccination stimulated by the two world wars was probably responsible for the great decline in smallpox mortality.

Typhus is a disease closely associated with war, famine, overcrowding and insanitary conditions in general. Not surprisingly, therefore, there were major epidemics during and immediately after the First World War in Poland, Romania, Russia and Serbia; the number of cases in the European part of the USSR from 1918 to 1921 was estimated at no less than 25 million.1 Typhus mortality went up again, during the Second World War, in central and eastern Europe: but not on any comparable scale. The advent of DDT obviously affected its incidence during the closing months and the aftermath of the conflict.

Mortality from all the diseases considered has thus greatly decreased, in some cases very substantially. It is interesting to observe that the rate of decrease in the mortality from several of these diseases has been remarkably similar in various western European countries which differ, and have differed, a great deal in some of the public health and medical practices usually considered as influencing the behaviour of infectious diseases.

Special studies

Many tables and studies have been based in recent years on the mortality data collected internationally. However, we shall deal here with only two subjects which exemplify the development of international statistics and their utilization, i.e., infant mortality and accident mortality.

Infant mortality


Infant mortality had started to decline in Europe by about the turn of the century, and in most other countries of the world a little later:³ in 1876-1880, except in the British Isles and Scandinavia, infant mortality rates in European countries were over 150 per 1000 live births, being 250 or more per 1000 in Austria-Hungary, southern Germany and Russia. In 1912, when there were rates below 100 per 1000 in the British Isles, the Netherlands, Scandinavia and Switzerland, they were still over 180 in Austria-Hungary, Romania and Russia. In 1932 the area of excessive infant mortality in Europe was confined to Hungary and Romania. In 1946, on the other hand, among countries throughout the world which published statistics on the subject, only four had rates of 160 or over, while none had rates over 185.

Just before the Second World War infant mortality rates of under 50 per 1000 live births were to be found in Australia, Scandinavia, Switzerland, the Netherlands and New Zealand. This group of countries with a very low infant mortality rate was joined immediately after the war by Canada, the United Kingdom and the United States, while in Australia, New Zealand and Sweden the rate had by then fallen to below 30 per 1000.

The immediate effect of the Second World War on infant mortality varied from country to country. In Scandinavia and the United Kingdom it was practically nil; indeed, Sweden, the United Kingdom and the United States experienced their most spectacular fall in infant mortality after 1941. In spite of the hardships it suffered, Finland had a rate above its pre-war level only in 1940, while Iceland and Norway remained below 40 per 1000 except for one year. In France, on the other hand, the rate rose from 65 per 1000 live births in 1937-1939 to 91 in 1940 and 108 in 1945. In Germany, where the rate had fallen from 145 per 1000 in 1919 to 60 in 1938-1939, it rose slowly throughout the war, and in the British Zone of Occupation it was 105 per 1000 in 1946. In Austria, where it had been 70 per 1000 in 1941, it was 162 per 1000 in 1945; but it was back to 81 in 1946.

A general downward trend in infant mortality, in some cases momentarily interrupted by the war, was also observable elsewhere. In Egypt, the rate, which had been 224 per 1000 in 1921-1925, fell to 198 in 1939, rose to 215 in 1943, but fell again to 185 per 1000 in 1946. In Ceylon, the 1931-1935 rate of 182 per 1000 fell to 140 per 1000 in 1945. In India, the rate was 182 per 1000 in 1921-1925, 156 in 1939, 169 in 1944. In Venezuela, it had been over 150 in most years up to 1934, but it fell to 99 in 1945; and in Argentina, where it had been 99 in 1935-1939, it was 81 in 1943-1945.

In most countries immediately after the war, therefore, the infant mortality rate in

spite of the ravages of the war became as low as it had ever been, representing constantly increasing control over the hazards surrounding infant life.

Studies appearing in the *Epidemiological and Vital Statistics Report* in 1950,\(^1\) 1951,\(^2\) and 1952\(^3\) showed that in most European countries the limits to which the more easily preventable infant deaths could be reduced were being reached with rates falling to 30 deaths and less per 1000 live births. This was also the position in certain other countries, particularly Australia, Canada, New Zealand and the United States. Other countries which made returns also generally showed descending rates.

For reasons of brevity, reference has been made only to total infant mortality. Data on the age distribution of infant deaths, however, provide a valuable field of study, and have shown that the reduction of neonatal mortality depends mainly on prenatal care and good obstetrics, and goes hand in hand with reduction of maternal mortality. The reduction of later infant mortality (over one month) depends largely on the control of environmental factors and correct feeding. The institution of health centres and improvement in general public health work have contributed to a more rapid decrease in later infant mortality than in mortality in the first month of life.

*Accident mortality*

Article 2 of WHO's Constitution stipulates that, in order to achieve WHO's objectives, one of the functions of the Organization shall be "to promote, in co-operation with other specialized agencies where necessary, the prevention of accidental injuries".

The importance of accident mortality has increased in recent years. Whereas general mortality has steadily decreased in many parts of the world, the death rate due to accidents remains high, and for many types of accident has gone up. In some countries, accidents among certain groups have become the chief cause of death in childhood and adolescence, killing greater numbers than all other causes combined. The first WHO International Conference of National Committees on Vital and Health Statistics in 1953 accordingly recommended that WHO continue or initiate statistical studies on the problem.

International interest in the subject, in fact, dates back to 1934, when the League of Nations asked governments whether they kept statistics on road accidents and their causes and, if so, on what basis they did so. A Committee for the Unification of Statistics Relating to Road Traffic Accidents was established in 1935, and met in 1936 and 1937; it recommended compilation of statistics in a uniform manner, and the adoption of the International List of Causes of Death for the purpose. After the war, the United Nations Economic Commission for Europe, through its Subcommittee on Road Transport, revived interest in the subject by setting up a Working Party on the Prevention of Road Accidents. The Economic Commission for Asia and the Far East also set up a working party in 1950 to consider, *inter alia*, the problem of accident statistics. WHO's interest has been in accidental deaths of all kinds, the most important of which include those due to motor-vehicle accidents, drowning, poisoning and falls.

The International Statistical Classification of Diseases, Injuries, and Causes of Death gives a dual classification of accidents: according to the external cause, and according to the nature of the resulting injury. In the former classification, which comprises 124 categories, the main division lies between transport accidents and accidents from other causes. The WHO *Epidemiological and Vital Statistics Report* has included statistics of both these kinds of injury\(^4\) for 18 countries throughout the world, using figures based on the Intermediate List of the 1948 International Classification, and adopting the classification by external cause only. These statistics cover deaths from all accidents and—published in separate tables—from transport accidents, with their relationship numerically and pro-

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\(^4\) *Epidem. vital Statist. Rep.*, 1956, 9, 1; 1953, 6, 259.
portionately to general mortality; on deaths from accidents, both generally and by categories, according to sex and age; as well as detailed data concerning, for example, deaths from the various kinds of accidental fall and from poisoning, and infant mortality from certain accidental causes.

Accidents are the leading cause of death between the ages of 1 and 19 in most of a group of selected countries throughout the world. In the Netherlands in 1954 they were responsible for 30-40% of all deaths. In childhood, mortality from accidents is highest at the pre-school age; it then falls for school-children, but increases again somewhat in adolescence. Since the beginning of the century, it has decreased in Europe for the pre-school group, in spite of a growing traffic-accident toll, because deaths from drowning and burns and scalds have diminished. It has remained almost level for school-age and adolescent groups, where increasing deaths from traffic accidents have cancelled out the decrease in deaths from other accidental causes.

For countries outside Europe, accidents also constitute an important problem. The highest accident rate of all for girls, in the years 1951-53, was in Ceylon. The rate for both sexes was high in Australia, Canada, Ceylon and the United States. In Canada and the United States about a quarter of all deaths every year among pre-school children, and a third of those among elementary schoolchildren result from accidents of one kind or another. Accidents kill more than twice as many pre-school children as do measles, scarlet fever, whooping cough, diphtheria, dysentery, tuberculosis and polio-myalitis together. Statistical studies of “total life” or “working life” lost through death from various causes show the great economic effect of accident mortality on a nation’s productivity: in 1945 in the United States, for example, accidents replaced heart diseases as the cause of death responsible for the greatest number of working years lost.

In all of 12 selected countries throughout the world, except Ceylon, the accident death rate between the ages of 1 and 19 in 1951-53 was at least twice as much for males as for females, and in Australia, Germany and Sweden it was about three times as much. In the majority of these countries, motor-vehicle accidents were responsible for the largest share of the deaths; but in France and Japan accidental drowning occupied the first position. Deaths from fire and explosion and deaths caused by hot substances occurred much more frequently among females, particularly in Ceylon.

In 8 of the 12 countries, a study of trends in mortality revealed that the specific death rate between the ages of 1 and 19, while remaining practically unchanged in Australia between 1931 and 1951, decreased during the same period in other countries—by about 15% in Switzerland and by between 25% and 30% in Italy, the Netherlands and the United States. If the relative importance of accidental deaths in relation to total deaths is studied, however, there is a noticeable increase, which can be ascribed largely to the more rapid reduction in deaths from other causes. A clear trend towards an increase in deaths from motor-vehicle accidents is discernible, especially in Australia, Canada and Sweden. The decline in the death rate from all accidents is due to the fact that the increasing death rate from motor-vehicle accidents is more than compensated for by the decline in the death rate from other accidental causes.

A WHO Advisory Group on Prevention of Accidents in Childhood met in 1956, and devoted much of its agenda to the statistical aspects of accidents for, as its report said: “Fact-finding is basic to the development of accident-prevention programmes.”

The Group held the view that data on accidents should contain more information regarding age, cause and sex, and should be made available quickly, as they lost much of their value for the preparation of programmes for prevention and for community education when out of date. In other words, routine

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production of current figures, inaccurate as they might be in detail, helped greatly in prevention. "As in the case of diseases affecting a community, the occurrence of accidents in a given population involves important, but at present ill-understood, relationships between the host, the agent and the environment. In the opinion of the Advisory Group, the epidemiological method offers a scientific approach to the study of accidents and accident prevention. An explanation of causes can be sought in each case through the interaction of the host—the child at risk, the agent—the effective cause of the event, and the environment—the chain of external circumstances culminating in the event. Whereas from the strictly medical point of view the injured child is the primary concern, the epidemiological standpoint requires careful determination not only of the number of events of a certain character which occur in a given category or group of the population, but of the time, the manner, and the place of occurrence, and the relation of these events to the population at risk."

Hence the importance of careful statistical data on accidents. The Advisory Group considered, however, that the international use of mortality figures was limited and that the figures were of greater value locally.

The work of the Group was pursued in a more representative seminar convened by the WHO Regional Office for Europe at Spa, Belgium, in July 1958. Before the seminar a consultant visited a number of countries in Europe, securing further information by means of a questionnaire on the status and extent of accident prevention work. Although the main topics discussed were education and publicity, administrative and legal aspects and medical considerations, fact-finding was an important feature.

Other studies

WHO has taken part in many other mortality studies in connexion with epidemiological investigations of cancer, tuberculosis, quarantinable diseases, etc.

The material on mortality collected and disseminated by WHO constitutes an important world service over and above any particular analyses undertaken by the Organization itself. It ensures continuity in mortality records going back to the early days of the League of Nations. In conjunction with the demographic series published by the United Nations, it also provides an increasingly more complete survey of data essential both for administrators and investigators.

In the annual and monthly reports on epidemiology and health statistics, WHO has managed to issue a number of tables over and above those on general mortality and those forming the subject of special study described in this paper. These tables have presented available world mortality data on such subjects as syphilis, diabetes, gastric and duodenal ulcers, alcoholism, cirrhosis of the liver, congenital malformations, arteriosclerosis, infective and parasitic conditions, pneumonia and bronchitis, suicide, trachoma, leukaemia, leprosy, epilepsy, and malignant tumours of various sites.

INTERNATIONAL MORBIDITY STATISTICS

Death is a clear-cut event, and the number of such events can be counted. Disease, on the other hand, is infinitely varied, including everything from a minor departure from normal health which does not interfere with a person's activities to a chronic condition condemning a person to bed for a prolonged period. The person afflicted with a disease may experience only one period of illness during a selected period of observation, or he may have repeated illnesses from the same disease. Moreover, during the same period of illness he may suffer from two or more distinct diseases. The basic problem of what is to be counted is thus an exceedingly complex one, and morbidity statistics there-
fore require a broader approach than that required for mortality statistics. Important consideration has been given by WHO to developing the field of morbidity statistics. In 1950, the WHO Expert Committee on Health Statistics suggested that, in view of the magnitude and complexity of statistical procedures in morbidity, a conference of experts in morbidity statistics be convened with the object of obtaining an orientation, evaluation, and selection of the projects requiring international action in this field. WHO was also asked to request national committees on vital and health statistics, and other appropriate national and international agencies, for reports on their activities in, and plans for, statistics of disease, and for their views on what could be done by WHO to improve them.

The Conference on Morbidity Statistics held in November 1951 pointed out that morbidity statistics were required to amplify the information given by mortality statistics, and were useful, not only to public health and hospital administrators, but also to those concerned with social security programmes, to industrial undertakings, and to workers engaged in medical and social research. Morbidity statistics, it felt, should not be defined in any narrow way, but should cover all statistics relating to departure from health. Such statistics would be of value for the control of communicable diseases; for planning the development of therapeutic and preventive services; for an assessment of the economic importance of disease, and its relationship to social factors; for research into the etiology and pathogenesis of diseases, as well as into the efficacy of preventive and therapeutic measures; and for the national and international study of distribution of diseases.

The Conference felt that it would be useful to classify morbidity statistics in such a way that countries, whatever their stage of development, could make some use of the list; and it drew up a list (see p. 41), which it did not regard as exhaustive, but as illustrative of the wide range and uses of morbidity data. Many of the types of statistics listed were by-products of organizations set up for other purposes, not primarily in order to ascertain morbidity.

The Morbidity Conference also discussed the various types and sources of morbidity statistics. The sickness or population survey was widely applicable, both in the less and in the more developed countries. In the former, the possibility of obtaining morbidity data from the existing registration or record services was extremely limited, but the organization which was responsible for the planning of the health services could carry out a sample survey, which was relatively inexpensive and could be utilized to answer a variety of questions. However, experts in sampling theory were required to plan and supervise the surveys and analyse the data collected. The WHO Expert Committee on Health Statistics accordingly recommended in 1951 that national health administrations establish groups of such experts, and that national committees on vital and health statistics explore the possibilities of the survey, particularly its applicability in the less-developed countries, and study the statistical methodology involved. It asked certain countries which had experience of surveys to report to WHO on their use, so that information could be conveyed to national committees on vital and health statistics or their equivalents elsewhere.

Other sources of morbidity statistics of importance were records of hospital in-patients and out-patients, and those kept by general practitioners, health welfare centres, educational institutions, the armed forces, and industrial, civil service and other occupational groups (in respect of absence on account of sickness). Many of those records manifestly suffered from defects—those from hospitals, for example, were of a highly selective character and contained an unknown amount and direction of bias—but clearly their use as a source of statistics on disease could be greatly developed with the collaboration of national committees on vital and health statistics.

Two fundamental problems faced by WHO were those of definitions of terms

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**Explanation of figures and letters**

W. Whole population of country (or representative sample of it)
X. Population of selected locality (or sample of it)
Y. Selected types of persons in whole population (or samples of them)
Z. Persons applying to selected health services
1. All sicknesses at a point of time
2. All sicknesses during a period of time
3. Selected diseases or impairments at a point of time
4. Selected diseases or impairments during a period of time
a. Control of communicable diseases
b. Planning for development of preventive services
c. Ascertainment of relationship to social factors
d. Planning for provision of adequate treatment services
e. Estimation of economic importance of sickness
f. Research into etiology and pathogenesis
g. Research on efficacy of preventive and therapeutic measures
h. National and international study of distribution of diseases and impairments
A. Countries with no complete enumeration of population and lacking, or with only slightly developed, public health and vital registration systems
B. Countries with an over-all or partial census and with a well-developed public health and vital registration system for parts of the population (e.g., for large towns) but not for all
C. Countries with an over-all census and well-developed facilities for obtaining morbidity statistics
used in morbidity statistics, and measurement of morbidity. There were terms descriptive of ill health, of a particular episode of ill health, of severity, of duration of an episode or of its location in time; as well as special terms used in hospital statistics, and terms referring to medical consultation. Furthermore, diseases could be classified according to type, severity, duration or the kind of medical care involved, or the usual prognosis, or the degree or likelihood of (permanent) incapacity or invalidity; or according to the probable period of invalidity, or the prospects of effective therapy or cure, or a rough scale of health ranging from the state of complete health to extreme ill health. On none of these points was there any standardization of definition; nor was there any on methods of measuring morbidity and the terms by which they should be described. The measurements appeared to be concerned primarily with the frequency of illness in the population, and with the results of treatment carried out on all or a part of it. They therefore depended on information about the illness in a given period of time (which might be expressed in days, weeks, or years), or at a single point in time. Discussing the comparability of the statistical units involved in the compilation of morbidity statistics, the WHO Expert Committee on Health Statistics agreed that these units would generally be “persons”, “illnesses” or “spells (‘episodes’, ‘periods’) of illness”. In any given period, say a year, a patient might suffer from illness A twice and from illness B three times, at different periods. He would then have contributed one unit of statistics to “persons”, two to “illness”, and five to “spells of illness”. The Committee regarded it as essential that it should be made clear to which of these three concepts of morbidity the statistics actually related. Furthermore, whatever the class of unit, the illness would either begin within the period of observation, end within it, be current at any time within it, or be current at some particular point within it. Alternatively, the statistics might relate to the duration of sickness current or ending during the period.

In its sixth report the Expert Committee considered that for many purposes morbidity could best be measured in terms of: (1) periods (spells) of illness, or alternatively, persons with illness, commencing during a defined period; (2) illness current, or persons ill, during a defined period; (3) illness current, or persons ill, at a particular point of time within the period, or at an average point of time within the period; and (4) the duration of these illnesses. The term “incidence” was recommended for use in describing the measurement of frequency of illnesses commencing during a defined period, the term “period prevalence” in connexion with illnesses in existence at any time during a defined period, and the term “point prevalence” for illness in existence at any particular point of time.

The WHO Expert Committee on Health Statistics has also reviewed morbidity studies carried out by national committees on vital and health statistics, and the progress made in a number of subjects relating to morbidity statistics. Realizing that many problems in health statistics could best be dealt with on a regional basis, the Committee recommended that regional and inter-regional conferences of specialists from countries presenting comparable conditions should be held periodically, with WHO co-operation and the participation of national committees on vital and health statistics, to discuss such problems in the light of local conditions.

Noting the stress laid by the Seventh Revision Conference on the desirability of exploring methods of vital and health statistics registration suited to the needs of countries at various stages of development, the Expert Committee expressed its satisfaction at what was being done in that respect. The African seminar on vital and health statistics, held at Brazzaville in November 1956, under the joint auspices of the WHO Regional Office for Africa and the Commission for Technical Co-operation
in Africa South of the Sahara (CCTA), had gone into the problem at great length, discussing existing statistical organizations and procedures, methods of obtaining statistics, training of staff and the interpretation of the data collected. The Latin American Centre for the Classification of Diseases, established in Caracas in 1955 under the joint auspices of the Government of Venezuela and the Pan American Sanitary Bureau, had published booklets of instructions, pamphlets, and special studies, and established a training programme for coders. The Expert Committee, after listening to reports by the statistical advisers attached to the Regional Offices for the Eastern Mediterranean and the Americas, noted their usefulness, but observed that in many countries statistical information of varying degrees of accuracy was being mixed, with the result that the value of the data as a whole was diminished. It recommended, therefore, that the data in those countries be sorted into homogeneous groups, and that, if published, each set of data be accompanied by a formal statement of their degree of reliability and a clear indication of the population groups to which they referred.

Hospital statistics

The WHO Expert Committee on Health Statistics has from the outset paid attention to hospital statistics, as an obvious, if frequently untrustworthy, source of information on disease, even in the least developed countries. A Sub-Committee on Hospital Statistics met in Geneva in 1950.1 It discussed, among other topics, the limitations placed upon the utilization of hospital experience by the fact that the selective character of hospital admissions generally precluded the drawing of conclusions regarding the prevalence and distribution of disease in the community as a whole. It considered that the International Statistical Classification of Diseases would generally serve the needs of hospitals better than any other classification for the compilation of statistics of illness, and recommended its use, both for the benefit of hospitals themselves and as a step towards international comparability.

The Sub-Committee felt that certain selected countries and areas with a definable population at risk, as well as selected hospitals, should be encouraged to compile hospital morbidity statistics as a matter of routine. For such statistics, individual reports should be prepared, the part on diagnosis to be completed by the physician himself or under his direction in accordance with the grouping given below:

I. Principal disease, injury or other condition which led to the admission.
II. Principal complication(s) of I (stating the most important one first and whether present at admission).
III. Principal accessory acute condition (stating whether present at admission).
IV. Principal accessory chronic condition.

The Sub-Committee made several other recommendations regarding the form of the report and what it should contain, and emphasized that the preparation of reports of that kind did not mean that there should be no numbering of individuals in terms of admissions or discharges, or of principal diagnoses. Certain special problems relating to statistics in mental, maternity and tuberculosis hospitals, to a diagnostic cross-index (using the International Classification), to the preparation of a code for anaesthetics and operations, and to multiple admissions were suggested for further study either by national committees on vital and health statistics, or by the Expert Committee on Health Statistics.

Noting the Sub-Committee’s reference to the selective character of hospitalized illness, the Expert Committee afterwards stressed the need for investigating ways and means of bridging the gap between hospital statistics and statistics of the community from which the hospital patients were drawn. This might be done by the family type of survey, or by the complete coverage of medical care services.

The Expert Committee in its fifth report 2 considered that it was still not in a position

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to make recommendations on the type of form needed to ensure international comparability of hospital statistics of morbidity. It accordingly recommended that WHO study the systems at present in use throughout the world, as a preliminary step to a future and thorough examination of the subject. In the collection of hospital statistics a distinction should be made between residents and non-residents of an area, so as to link the data more closely with the population at risk. The Committee also expressed the view that the one-day census of hospital patients that was used in Japan was an economic way of getting useful information on the medical and other characteristics of the population receiving medical care.

In its sixth report the WHO Expert Committee on Health Statistics reviewed a series of terms commonly used in connexion with hospital statistics—for example: admission, first admission, re-admission, discharge, in-patient, patient-day, duration of stay—and noted that there seemed to be a high measure of agreement on the definitions of these terms. It considered that the general definitions of measurements of morbidity were applicable to hospital in-patient morbidity statistics, but with a number of changes in terminology, e.g., "admission rate" would correspond to "incidence rate", and "daily bed occupancy" to "prevalence rate".

Another step towards international standardization of hospital statistics was taken by WHO with the convening in November 1958 of a European Conference on Hospital Statistics and their Application in Health Administration. The Conference considered that the International Classification of Diseases (Detailed List of three digits, or the extended list with four-digit sub-categories) was suitable for the diagnostic coding of hospital records. For special types of hospitals or for special groups of diseases, a local ad hoc extension of the classification by means of five- or six-digit sub-categories might sometimes be necessary. For the presentation of hospital statistics, a much shorter list was required and WHO was urged to prepare such a standard list. Mention was made of certain short-cut methods such as hospital censuses, sampling, periodic surveys and ad hoc enquiries to collect the necessary data. The need for ensuring medical secrecy was emphasized. The Conference also considered the value of hospital records for hospital planning, study of disease, and in particular research. It concluded that if additional data could be secured by means of special enquiries, the material could well be used in studies on human genetics, birth weight in relation to the duration of gestation, maternal age and parity, etc.

**Notifiable communicable diseases**

Notifiable communicable diseases represent only a small part of the total morbidity but, owing to their preventible nature, they are of considerable importance in public health. The problems involved in securing prompt and reliable information on these diseases were studied by the WHO Conference on Morbidity Statistics in 1951.

The Conference recommended that the fullest co-operation be sought from the medical profession and health institutions to improve completeness of notification, that uniform procedures for ensuring correction of diagnosis be adopted, and that it be made clear for each disease whether it was intended that notification be based on clinical findings alone, or laboratory and other evidence, or both. The national committees on vital and health statistics were asked to study special problems, and WHO was requested to undertake a critical appraisal of the uses of statistics on epidemic diseases and of their value to the epidemiologist, the quarantine official, and the health statistician.

A seminar on reporting of communicable diseases held in Chile in 1955 developed basic procedures for the reporting of communicable diseases (Scientific Publications, No. 9), Washington, D.C.
veloped. The recommendations made have been used in the revision of the Guide for the Reporting of Communicable Diseases in the Americas.¹

The problem of notification of disease was considered by the WHO Expert Committee on Health Statistics in its sixth report.² The Committee emphasized the desirability of distinguishing in tabulations between “provisional notifications” and “corrected notifications” and asked that indication be given of the estimated degree of error to which these statistics are subject as a result of incompleteness of notification. In respect of certain notifiable diseases, such as tuberculosis, distinction was to be made, if possible, between “new cases” and “newly detected pre-existing cases.”

Accuracy and completeness of notifiable disease statistics are linked with legal provisions and their implementation. WHO has published a survey of the existing legislation on the notification of communicable diseases.³

Sickness surveys

The sickness survey is a good statistical tool if properly handled by trained persons. Its advantages have been succinctly expressed in the third report of the Expert Committee on Health Statistics:

“(a) it provides the possibility of linking morbidity data to a variety of social and economic conditions;
(b) the population covered is automatically defined;
(c) it offers a means of linking the data in existing medical records to that obtained from the general population;
(d) if probability sampling methods are employed, the desired information can be obtained with specified precision at the smallest possible expense;
(e) the method is flexible and can be utilized to provide answers to a wide variety of specific questions of practical administrative as well as scientific importance; and
(f) if the objectives of the investigation are not continuous, once the specific objective has been accomplished the survey can be easily stopped and the personnel utilized for investigations of other problems.”⁴

The survey raises all the problems common to all medical statistical inquiries, such as the standardization of nomenclatures, definitions and classifications; and one peculiar to itself, the problem of sampling. Here are involved the questions of whom to include in the survey, how to train the field teams, and what methods to use; and the answer to these questions in turn depends on the statistical theory of sampling adopted. It is rarely practicable or even desirable to survey a whole community. The First International Conference of National Committees on Vital and Health Statistics in London in 1953 drew attention to the value of modern sampling methods in all statistical practice, and recommended the use of such methods for the study of morbidity.⁵

Special problems of under-developed areas

In various proposals for remedying the lack of vital and medical statistics in the world, account has been taken of the special needs of under-developed areas. In the United Nations Principles for a Vital Statistics System,⁶ for example, the importance of special arrangements for the counting of the population (census) and the registration of vital events is indicated, and methods suitable for various types of country are recommended. Health and medical authorities are concerned in these matters, especially as the evaluation of mortality and morbidity is difficult in the absence of such denominators as size of population and general birth and death rates. The same general problems which face the vital statistician also frustrate

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¹Pan American Sanitary Bureau (1955) Guide for the reporting of communicable diseases in the Americas (Miscellaneous Publications, No. 6 (Rev.)), Washington, D.C.
³Int. Dig. Hlth Legis., 1958, 9, 606.
the medical and health investigator. These include: absence of a comprehensive national health administration with local officers; lack of communications; the existence of social and economic barriers to the acceptance of such essential matters as censuses, and notification of diseases; lack of medical and nursing services; illiteracy of the population; difficulties, both social and economic, in the introduction of special techniques such as demonstration areas and mobile teams to collect essential data. Inevitably, the lack of essential data from large parts of the world and the recognized difficulties in obtaining early comprehensive information from such areas have presented the various international statistical groups with serious problems.

As early as 1949, the Expert Committee on Health Statistics recommended that special studies be carried out in under-developed areas on methods suitable for measuring the state of health and the prevalence of disease. It called for an early report on these methods so as to make such knowledge available to similar areas.

Similarly, the Conference on Morbidity Statistics, held in Geneva in November 1951, noted that the International Statistical Classification is difficult to apply in countries with few qualified physicians and where morbidity statistics are based largely on imperfect diagnoses or symptomatic descriptions. It therefore suggested that the World Health Organization ask such countries to design lists of selected diseases based on the Intermediate Lists of the International Statistical Classification.

The first International Conference of National Committees on Vital and Health Statistics, held in London in October 1953, examined the question of areas with under-developed health and statistical services. It agreed that every effort should be made in such areas to maintain full records and to produce summarized figures of the diseases treated in medical institutions, even though such summaries sometimes gave a misleading picture. It proposed that, in areas where full information could not be readily obtained by the usual administrative means, medical surveys should be organized, possibly by using mobile teams. It urged that when any health programme was introduced into such areas statistics should be made an integral part of the programme. It also drew attention to the value of sampling methods, either in the form of sample registration districts or of special inquiries, as an important device for determining the essential facts.

Aware of the importance of providing a simple list, the Conference for the Seventh Revision of the International Classification, recommended an amendment to the WHO Nomenclature Regulations. This amendment gives greater flexibility by providing for the use of special lists of diseases easily recognizable by subordinate medical personnel yet following the general structure of the International Classification.

In keeping with the need for continuing study of local difficulties in this field, the seminar on vital and health statistics held in Africa in November 1956 gave consideration to: hospital statistics, returns from outpatient dispensaries, records from mobile medical units, data on notifiable diseases, and crude causes of death in certain countries as collected by non-medical personnel.

The report of this seminar, together with other material on the subject, was studied by the WHO Expert Committee on Health Statistics and commented on in its fifth report.

Morbidity statistics published by WHO

The WHO Epidemiological and Vital Statistics Report, since the beginning of 1957, has produced morbidity statistics for diphtheria, meningococcal infections, tuberculosis in certain non-European countries, illiteracy of the population; difficulties, both social and economic, in the introduction of special techniques such as demonstration areas and mobile teams to collect essential data. Inevitably, the lack of essential data from large parts of the world and the recognized difficulties in obtaining early comprehensive information from such areas have presented the various international statistical groups with serious problems.

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acute poliomyelitis, smallpox in Europe, acute infectious encephalitis, tuberculosis in Europe since 1950, brucellosis, endemic typhus and other rickettsial diseases, typhoid and paratyphoid fevers, dysentery, influenza, venereal diseases in Europe, and whooping cough. The statistics on diphtheria,\(^1\) to take an example, cover cases of the disease from 1950 to 1955 in 15 African, 21 American, 17 Asian, and 24 European countries and in Australia and New Zealand. Data are given on the seasonal distribution of cases, their sex and age distribution, and the number of vaccinations carried out in various countries.


**Statistical Studies on Cancer**

Cancer research is taking place on an impressive scale in a number of countries. Many institutions and organizations, especially in North America and Europe, are investigating the causation, prevention and therapy of the disease, and all possibly relevant factors. Research has been stimulated in turn into the very fabric of life and its processes, as revealed in the physiology, chemistry and physics of cell growth.

The conduct of cancer research is generally costly and complex, and so limited to well-endowed and highly organized institutions. Realizing that WHO could not materially add to the volume of laboratory and clinical research being carried out in this field, even if it devoted a large share of its budget to such work, the Interim Commission, and later the First World Health Assembly, decided to concentrate on cancer statistics, where WHO’s position as an international organization could be made use of in the standardization of the nomenclature and classification of tumours and in the development of ways of assessing incidence and prevalence.

Following a suggestion made by the WHO Expert Committee on Health Statistics in 1949,\(^2\) the Second World Health Assembly established a Subcommittee on the Registration of Cases of Cancer as well as their Statistical Presentation. Meeting in March 1950,\(^3\) this Subcommittee discussed the difficulties of defining cancer in terms of the International Classification of Diseases, Injuries, and Causes of Death; of tabulating multiple causes of death where cancer was one; and of obtaining an accurate diagnosis of the disease. National committees on vital and health statistics should, the Subcommittee felt, be encouraged to sponsor the study of these problems, and also geographical variations in mortality from cancer of specific anatomical sites, as well as to determine the total incidence of cancer in populations of sample areas over selected periods, and where feasible to institute a follow-up system so as to arrive at a true survival rate. In the absence of any agreed method of calculating survival and apparent recovery (“cure”) rates, the Subcommittee made certain recommendations and proposed certain definitions and rules that were designed to produce standard returns.

Another Subcommittee on the Registration of Cases of Cancer met in September 1951,\(^4\) and, after discussion of the general principles that should govern the statistical classification of neoplasms, agreed that such a classification should distinguish between the anatomical site, the histological type, and the degree of malignancy. To provide adequate flexibility and ease in coding, a separate classification in respect of each of these three aspects was required. The Subcommittee accordingly drew up a classification of neoplasms according to anatomical location, for general use in cancer registration and morbidity statistics. This classification was based upon the International Classification of Diseases, Injuries, and Causes of Death, but contained modifications to provide for a strictly anatomical


classification where grouping on a histological basis was found in the International Classification.

The Subcommittee did not embark upon any classification of cancer according to histological type or degree of malignancy. In the former case there was lack of uniformity in histological terminology, and in the latter there was considerable disagreement concerning the concept of pre-malignancy. Nevertheless, the American Cancer Society's *Manual of Tumor Nomenclature and Coding*,¹ which the Subcommittee regarded as the first serious attempt to prepare a histological code for statistical studies, was recognized as an important advance towards the development of a standard histological classification of neoplasms. The Subcommittee therefore recommended that it be distributed to national organizations for study, and, if possible, for trial, with or without modifications. Their experience in its use and their views on its applicability would materially assist WHO in its preparation of a standard classification according to histological type and to degree of malignancy.

Various international and national organizations had made attempts to classify cancer according to stage. The Subcommittee reviewed their work, and briefly outlined the principles that should govern any such classification. While recommending the system for staging of cervical cancer adopted at the International and Fourth American Congress on Obstetrics and Gynecology, it expressed the view that any future revision of that system should bring it into conformity with those principles.

In 1956, the Expert Committee on Health Statistics returned to the subject of classification of neoplasms by site, histological type, and stage.² It recommended that WHO expand the publication of statistical studies on the various types of cancer, increase the distribution of information on the statistical methodology applicable in the field, and continue its efforts to improve the classification of cancer, in co-operation with the appropriate professional organizations. In order to assess the results of treatment, the maintenance of cancer registers was essential; WHO should therefore keep the different systems and methods of cancer registration constantly under review, so as to ascertain how that could best be done. Since a Subcommittee on Cancer Statistics had last met a number of cancer registers had been set up throughout the world. International co-operation, under the auspices of the International Union against Cancer, had been achieved in the compilation of a statistical code of neoplasms, classified histologically. Progress had been made in the classification of cancer according to degree of malignancy. Various techniques had been developed for the assessment of the incidence and prevalence of cancer. And more statistical studies on the etiology of cancer were being carried out.

A Sub-Committee on Cancer Statistics met in December 1957.³ It had before it a resolution of the Tenth World Health Assembly on the epidemiology of cancer, which requested the Director-General of WHO to pursue the collection and publication of the relevant mortality and morbidity statistics; to continue to seek acceptable international definitions and an agreed statistical classification; to provide a centre to give advice on the objectives and methods of cancer registration; and to consider the desirability and urgency of co-ordinating and expanding work on cancer epidemiology and statistics, in order to contribute more effectively to national needs through improved international liaison.

The Sub-Committee agreed to define "incidence" as the number of new cases occurring during a stated period of time in a given population, and "prevalence" as the number of cases current in a given population, either at a given point of time—e.g., on a given day ("point prevalence")—or during a stated period ("period prevalence"). The statistical unit should be indicated: either "persons" diagnosed as having cancer, regardless of whether they have more than one primary cancer; or "cases", in which each primary site is counted separately. The proportionate

distribution of cancer, i.e., the relation of different forms to the total number of cancer cases, is occasionally useful, particularly when no population denominator is available, and often too as a supplement to rates based on populations.

The Sub-Committee discussed the value of statistics of incidence and prevalence in the organization of medical care, in cancer control and in epidemiological research. Mortality statistics cannot provide differential survival rates for the various kinds of cancer, but are nevertheless a useful source of information. Compulsory notification, on the pattern of that for communicable diseases, has the disadvantage that the minimum amount of useful information required about each cancer case is considerably more than that normally obtained about a communicable disease; but it does provide information which, because of its confidential nature, might not otherwise be obtainable. National cancer registration could only be effective in small countries; in large ones it is doubtful whether the amount of work needed to keep track of all cases is justifiable merely to obtain incidence and prevalence statistics. Surveys of the ad hoc type carried out in the United States and in France, or as a by-product of general morbidity surveys, are a distinct possibility. Other sources, such as social security statistics, records of absenteeism, and general practitioners' records, are usually inadequate. On the whole, the Sub-Committee concluded, any investigation not specifically adapted to cancer does not supply the information required.

Linked with the difficulty of obtaining reliable statistics is the question of when cancer actually starts. In most morbidity studies a case of cancer dates from its first diagnosis, but this is not wholly satisfactory from the standpoint of statistics of incidence. The Sub-Committee accordingly recommended that countries recording the date of onset of the first symptoms in their registrations should carry out experimental studies to determine whether the adoption of the onset of symptoms as the starting point of the disease would offer any advantage in such statistics.

Unusual incidence, taken with dietary and other habits and environmental conditions in under-developed communities, might shed light on the etiology of malignant neoplasms. In such regions, therefore, joint schemes of cancer diagnosis and of registration of population and vital statistics might be established in selected areas.

The Sub-Committee then discussed cancer registration as a system of maintaining a centralized register covering patients from a whole country, state or other well-defined large area. This system has begun to be instituted widely throughout the world as a means of providing valuable statistical information on cancer. A cancer register affords a means of assessing the results of treatment, comparing the effectiveness of various forms of treatment, computing rates of survival, studying the etiological and pathogenetic aspects of cancer, and indicating methods of control and medical care. There are several ways of starting a register, depending on the purpose it is meant to fulfil. Points that deserve note either in starting or in maintaining such a register are its scope, the anatomical sites to be covered, the sources of the data, the items of information to be collected, who should be in charge of the register, how the data should be utilized, the register's role in general cancer research, and the use of the register in under-developed countries.

Next, the Sub-Committee discussed the epidemiology of cancer, laying stress upon the value of statistical methods in the study of cancer etiology. It ended its session with a group of recommendations: that WHO continue publication of reports on cancer mortality, publishing rates by sex and age and examining the question whether some form of standardization could be applied as regards rates for all ages; that it investigate as far as possible the major apparent differences in mortality between countries; that it publish a study on the epidemiology of cancer and cancer registration systems; that it co-operate with interested organizations on field studies of cancer; that it again draw the attention of countries to the definitions and rates the Sub-Committee had earlier recommended; that a preliminary study be undertaken of prob-
lems of classification of neoplasms, which would take into account current developments in their histological classification, and that studies continue on the extent to which diagnoses of malignant tumours upon death certificates can be accepted as reliable.

Special studies

A number of special statistical studies of cancer have been made by WHO. In 1952 the evolution of cancer mortality in Europe during the twentieth century was described in the *Epidemiological and Vital Statistics Report*. Stress was laid on the degree of caution needed in examining international statistics of cancer mortality, and a strong appeal was made for fuller statistics, especially through extension of the cancer registration system, to help in the elucidation of many obscure points in the epidemiology of cancer.

This study revealed inexplicable differences in the mortality from malignant tumours in various countries: differences which inevitably suggest that more accurate recording and more careful inquiry into the relevant factors are required. It showed, however, a distinct rise in cancer mortality among the older age-groups in all countries, particularly from neoplasms of the respiratory system. It also showed that, although mortality from cancer of the uterus had on the whole been stationary, there was a definite increase in deaths registered as due to cancer of the breast in females.

The interest in the marked increase of respiratory neoplasms and in the possible causative or correlative relationship of such factors as smoking led in 1955 to the publication by WHO of available international data in tabular form, and to a further mortality study in the *Bulletin of the World Health Organization*. In view of the heterogeneous character of the data, the study was guarded in its conclusions, but it found an increase in mortality from lung disease in all the countries reviewed, attributable mainly to the increased number of tumours of the trachea, bronchi and lungs. Although it is not entirely clear what proportion of the recorded increase should be attributed to improved diagnosis, there is nevertheless no doubt that in a significant number of countries of the world today cancer of the lung has become an important medical problem requiring intensive epidemiological research.

In response to current interest in mortality from Hodgkin's disease and leukaemia, WHO, also in 1955, compiled tables from the available records.

Another statistical cancer study in the *Bulletin of the World Health Organization* in 1956 reviewed the trends of female mortality from cancer of the breast and genital organs, as shown by the data available to WHO. Here again, marked differences in the rate of mortality were found to occur in the countries included in the survey. These uncertainties confirm the need for fuller statistical research into the exact prevalence of the different neoplasms country by country and area by area, and into possible correlative and causative circumstances.

Pathological reference centres

The question of the classification of neoplasms was raised again by a WHO consultant group in 1955. It suggested that WHO convene groups of specialists on the various types of cancer in which the histological picture and nomenclature were still in dispute. These specialists would seek to define the types of cancer in terms of actual pathological specimens, which would be kept in special pathological reference centres, which would be kept in special pathological reference centres and placed at the disposal of interested workers throughout the world. The first centre of this kind was opened in 1958.

Non-governmental contributions

It is particularly in the field of the statistics and epidemiology of cancer that some of the

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3 *Bull. Wid Hth Org.*, 1955, 12, 687.
most active international co-operation of non-governmental organizations is taking place. The chief of these organizations is the well-known International Union Against Cancer, with which WHO has established official relationship, and which has lent its full authority to the recommendations on nomenclature, definition and classification. In many of the registration systems outlined above, much support has been given by the national branches of this organization.

One feature of the international study of these conditions which has been specially developed by the International Union Against Cancer in recent years is the examination of geographical variation in the occurrence of different types of cancer. For this purpose, the Union has a Committee on Geographical Pathology which met in 1956 in Kampala and in Leopoldville to discuss the problems of primary cancer of the liver in countries south of the Sahara and the general problems involved in the study of the epidemiology of cancer in this region. A further meeting of the Committee in Leopoldville in October 1959 showed that remarkable progress had been made and was continuing in the ascertainment of the frequency of cancer in several areas of Africa. WHO participated in these meetings with a view to providing assistance in statistical methodology.

There are a variety of other international medical and related bodies which are involved in the international study of cancer. There is, for example, the International Committee on Stage-Grouping in Cancer for the Presentation of the Results of Treatment of Cancer, appointed by the International Congress of Radiology. The work of this Committee was reviewed by a WHO Expert Committee on Health Statistics which considered "that cases of cancer of accessible sites might profitably be grouped under four stages to be more precisely defined for each site:

Stage 1—Tumour strictly confined to the organ and of relatively small size

Stage 2—Tumour limited to the organ of origin but of relatively large size or with limited extension beyond the original organ

Stage 3—Tumour with wide infiltration reaching neighbouring organs

Stage 4—Tumour with considerable involvement of adjacent tissues or having spread to neighbouring organs."

An important contribution was made by the Council for the Co-ordination of International Congresses of Medical Sciences, a special body set up under the joint sponsorship of UNESCO and WHO, in its Symposium on the Geographical Pathology and Demography of Cancer held in Oxford in 1950. This meeting recommended, inter alia, that facilities be made available for the exchange of knowledge by workers on similar programmes. Among problems offering useful opportunities for international collaboration were those concerning primary cancer of the liver and cancer of the cervix uteri. The Symposium came out strongly in favour of securing the comparability of published results by the provision in all studies on the frequency of malignant diseases of information concerning the total number of new cases, the population in the area, the percentage of cases, the proportion diagnosed in hospital and the percentage verified by histological or autopsy examination.

The importance of the various non-governmental international organizations to statistical work in the field of cancer cannot be over-emphasized. The ultimate value of international statistical and epidemiological studies of cancer is dependent upon the use by practising physicians, surgeons, radiologists and pathologists of an accepted nomenclature, accepted definitions and an accepted classification in diagnosis, staging and therapy.

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2. Council for the Co-ordination of International Congresses of Medical Sciences (1951) Symposium on Geographical Pathology and Demography of Cancer (Paris).
LEVELS OF LIVING

In 1952 the United Nations General Assembly requested its Economic and Social Council to "provide for the working out of adequate statistical methods and techniques so as best to facilitate the gathering and use of pertinent data in order to enable the Secretary-General to publish regular annual reports showing changes in absolute levels of living conditions in all countries". The Secretary-General convened a committee of experts to report on the definition and measurement of standards of living. This committee, which preferred the use of the term "levels of living" for actual living conditions, leaving the term "standards of living" to cover "future aspirations", was unable to formulate a single index of the level of living, but concluded that "the most satisfactory approach to international measurement of levels of living would be through the measurement of clearly delineated aspects or parts of the total life situation that are amenable to quantification and reflect international aims". Statistical measurements were to be sought, therefore, for twelve components of levels of living which, the committee considered, would form a satisfactory international catalogue of such aspects. Of these twelve components, "health, including demographic conditions" was placed first.

The United Nations Statistical Commission discussed the committee's report, and recommended that the specialized agencies, each in its own field, examine the adequacy of the indicators proposed by the committee, as well as the availability and accuracy of the statistics relating to such indicators. In pursuance of this recommendation a WHO Expert Committee on Health Statistics examined the indicators proposed by the United Nations committee for the component "health, including demographic conditions". These indicators are: (a) expectation of life at birth, (b) infant mortality rate, (c) crude annual death rate, (d) number of hospital beds in relation to the population, and (e) number of physicians in relation to the population. Each of these indicators, in the Expert Committee's opinion, has its disadvantages. The expectation of life at birth is affected significantly by the infant mortality rate, the accuracy and reliability of which are questionable in many territories of the world because of incomplete registration. Moreover, indices of expectation of life are themselves not available in many countries, especially in under-developed ones. The crude death rate is of limited value because of the influence of the sex and age structure of the population. There is no international comparability of quality of medical care facilities, so that the number of hospital beds and of physicians would not show how well equipped the hospitals are, nor how competent the physicians. In any case, hospitals and physicians tend to be concentrated in urban areas in some countries so that urban levels of medical care are higher, rural levels correspondingly lower. The Expert Committee reviewed other possible indicators, such as the number of deaths from infectious diseases in relation to all deaths, the number of deaths under five years of age in relation to deaths at all ages, and the use of morbidity statistics. However, it felt that, in view of the complex nature of the issues involved, further studies of these were required.

In October 1955 WHO convened a Study Group on the Measurement of Levels of Health, which included among its members statisticians, public health experts, a social scientist, and an anthropologist.

The Group was confronted with two questions: what can be done with available health statistics as indicators (perhaps suitably refined); and can any new indicators be suggested?

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In the opinion of the Group, health indicators might be classified in three categories: (a) those associated with the health status of persons and populations in a given area (vital statistics, nutrition, etc.); (b) those related to physical environmental conditions having a more or less direct bearing on the health status of the area under review; and (c) those concerned with health services and activities directed to the improvement of health conditions (availability and use of hospitals, physicians and other health personnel).

The Group reviewed the sources available to the health administrator for measuring levels of health, such as vital and health statistics, epidemiological information, and data from surveys. None contains satisfactory specific indicators of health from the threefold aspect of physical, mental and social well-being. Nor are the techniques for measuring the level of morbidity sufficiently advanced to provide a satisfactory indicator. Mortality statistics, however, for all their limitations, have the merit of availability both from one period to another and from one country to another.

The Study Group discussed the concept of health and possible indicators of health. These might be roughly divided into those based on available statistics and such new ones as might be devised. Among the former, there are comprehensive indicators, such as the expectation of life and the crude death rate, and specific indicators, such as infant mortality, deaths from communicable diseases per 100,000 population, and indicators of health services and activities. Among the latter might be considered the percentage of population receiving a protected water supply, or the percentage having facilities for proper disposal of excreta, or indicators measuring the status of mental health, nutrition and housing (as seen from its health aspect). The group weighed up the merits and demerits of each of these indicators, and concluded that further information was required. It accordingly recommended that special sampling surveys be undertaken of morbidity, nutrition, mental health, environmental factors, health services, and social and economic conditions.

In its discussions the Study Group considered the proportional mortality ratio (the number of deaths at ages 50 years and over as a percentage of total deaths) as a possible comprehensive indicator of health. In the view of the Study Group, this indicator—which was devised by WHO—was a promising one, because the primary data are comparatively easy to collect and the method of construction is straightforward. It felt, however, as did the authors themselves, that further critical studies would be necessary before it could be definitely accepted. The proportional mortality ratio has now been further tested by its authors, who have produced statistical evidence to show that it satisfies certain essential conditions. These are: records should be available from as large a number of countries and territories as possible; the indicator should be related as far as possible to the country as a whole, not just to a selected area or population group; the records needed for its estimation should not be unduly affected by such defects as under-registration or differences in terminology; and the indicator should be of a comprehensive character, simple enough to command acceptance internationally, and sufficiently discriminating to distinguish between countries at various levels of health. In spite of some weaknesses, they therefore concluded that it is the most suitable indicator of "health, including demographic conditions".

The fifth 2 and sixth 3 reports of the WHO Expert Committee on Health Statistics briefly reviewed contributions to the development of indicators of health levels. They reiterated the opinion that theoretically the expectation of life at birth, at 1 year, or at any other age is the best indicator of all; but admitted that it is available for only a small number of countries, and even then at infrequent intervals. The best practical comprehensive health indicator suggested hitherto is the proportional mortality ratio, and the Expert Committee accordingly recommended that it be explored on an experimental basis until its usefulness can be judged in the light of

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1 Bull. Wid Hlth Org., 1957, 17, 439.
experience. Referring to specific indicators, the Committee emphasized the value of the infant mortality rate, and in particular the late infant mortality rate (from 1 to 11 months), because the latter is less influenced by pre-natal and intrapartum causes of death. The total death rate in the 1-4 age group was also suggested for trial as a specific indicator where accuracy of age-recording justifies its use. A choice has to be made between a series of indicators which fulfill to different degrees the criteria of statistical significance, and of availability. It is to be hoped that the work initiated by ILO and WHO on family living studies and family health surveys will provide valuable data which in future can be used for the measurement of levels and trends in health.

SOME GENERAL TRENDS

A brief mention has already been made of the statistical work initiated by the Health Organisation of the League of Nations, which greatly encouraged countries to introduce or to expand systems for the collection and publication of health statistics. It published a series of handbooks on the statistics of a number of countries, and sponsored much statistical work on such matters as nomenclature, classification, field studies, and the collection and publication of the results of surveys, all of which are dominant features of present-day health programmes.

When WHO took the place of the Health Organisation of the League of Nations, governments and a number of non-governmental organizations pressed for previous international work to be continued and expanded. It was recognized that sound international health policies and programmes were dependent upon countries providing adequate statistical and other data, and upon the application of sound statistical methodology. It has been the purpose of the present review to show how WHO has attempted to meet the demand made on it for services in these technical fields.

At first, quite understandably, the emergency conditions immediately following the Second World War gave considerable prominence to communicable diseases, malnutrition and dislocation of local health services. Even these emergencies could not be met without the guidance given by health statistics. When this phase passed, the role of health statistics became even more important. In most WHO activities during the past ten years planning has come to be seen as dependent upon adequate statistical data and upon a better understanding of the epidemiological factors operating in each country and region. Conversely, the marked gaps in the completeness and accuracy of health statistics in many regions and the incomplete understanding of the epidemiological circumstances of many causes of ill health and disease resulting from this situation have been seen to be a serious obstacle to the efficiency of the health services provided by individual countries.

In the early days of WHO the study of the communicable diseases (such as cholera, malaria, and tuberculosis) was predominant. Latterly, although epidemiological problems in communicable disease have continued to be exceedingly important, greater attention has begun to be paid to the study of non-communicable conditions, such as cancer. The work of the League in achieving greater comparability of statistics of incidence and prevalence of cancer from country to country has been continued and expanded by WHO, with the help of the national committees on vital and health statistics. Other non-communicable conditions of interest have been circulatory conditions, malnutrition and accidents.

Any proposal made to WHO for an international health programme has usually followed the same pattern. It has been recognized that any assistance to governments is administratively and technically faulty unless its full extent and implications are known. Invariably, therefore, the technical groups
called together by WHO to advise on programmes have requested improved statistical information from countries, and asked WHO to arrange for this to be collected and analysed.

Again and again in the period described in the present review the priority to be given to the improvement of national statistical systems has been emphasized. WHO has played a large part in encouraging countries to recognize their responsibility for collecting adequate data on their health conditions, and to use the procedures and technical methods recommended by the various WHO expert groups. Statistical services in countries are being improved through seminars (conducted usually in co-operation with the United Nations), the visits of consultants, and the training of local staff through WHO fellowships. This basic work has been furthered by the appointment of statistical officers to the staffs of four of the WHO regional offices. These experts have helped local administrations to understand the role of epidemiology and statistics in the development of their own national health services.

Much of the work in statistics undertaken by countries individually or in combination would be haphazard or self-defeating but for the procedures, nomenclatures and classifications devised by the WHO Expert Committees on Health Statistics and the International Conference of National Committees on Vital and Health Statistics. Under the auspices of WHO the exceedingly important seventh revision of the International Lists of Diseases and Causes of Death has been prepared and made available to countries through a manual published in several languages.

Another noticeable trend has been the increased willingness of countries to use statistical methods for the more accurate determination of the causes of mortality and morbidity. The detailed lists of the earlier decennial revisions of the International Lists had been recognized as suitable for countries with well-organized statistical systems. In recent years, however, it has been accepted that these detailed lists are of less use to countries lacking proper statistical services. Valuable contributions to the solution of the statistical problems of such countries have been made by the WHO expert committees; they have devised, for example, short lists and sampling procedures, and shown how the analysis of hospital statistics and other morbidity returns could be put to use in obtaining data of value.

This more intensive study of morbidity data is another tendency now noticeable. In the last decade health administrations have found it increasingly necessary to base their policies on indices of morbidity as well as of mortality, if not more so on the former. The difficulties of morbidity statistics have consequently become the subject of study. Recent Expert Committees on Health Statistics have attempted to give some guidance, but have recognized that the nature of the subject makes international study of morbidity returns inevitably more complex than the study of mortality returns. Nevertheless, several principles have been defined. Some of the conditions have been laid down which must precede the use of morbidity data, whether taken from hospital returns or general practitioner records, or collected in pilot schemes or experimental areas. Much research work, however, especially under field conditions, is required. Here again, the national committees are giving much assistance. Modern statistical methodology is of great value in dealing with the problems arising in the use of morbidity statistics, and is being made more widely available through training courses (developed by WHO) in the use and limits of small samples, in the control of clinical and field experimental studies, and in the general techniques of analysing numerical data.

WHO has inherited from the League the obligation to publish the data it receives on mortality and morbidity from a number of important conditions. During the decade, these returns have been under constant review, and every occasion has been seized to persuade countries to send in more complete and accurate returns, based wherever possible on one of the lists given in the latest decennial revision of the International Classification. A further obligation has been to make these data available to all those who may be
interested in it. WHO has maintained the regular publication of these reports, incomplete and inaccurate though many returns from countries have been. The very publication of obviously incomplete returns is arguably a stimulus to better returns being prepared. World data, available through WHO publications or, in the case of vital statistics, in the companion publications of the United Nations, are essential for international organizations assisting countries to organize their health services, as well as for institutions and individuals undertaking research into epidemiological and statistical matters of world or regional concern.

Numerical data are not the only contributions WHO has been able to make in this field. Equally important is the information collected in specific epidemiological studies or surveys. Epidemiological inquiry, it will be recalled from the examples given elsewhere in the present study, has increased in prominence in WHO programmes. Many projects launched by WHO in response to requests by governments for assistance now have an epidemiological component: for example, those dealing with malaria, brucellosis, rabies, trachoma, tuberculosis, and such conditions as diarrhoeal diseases, malnutrition and mental diseases.

Data from such projects, apart from their use in guiding local programmes, are increasingly being added to medical knowledge by publication in WHO technical journals or, on occasion, in national journals. As the phase of direct assistance to countries in establishing their own basic health services decreases in relative importance, this tendency is likely to become more marked. International scientific data will be gathered and published increasingly continuously and regularly for use by technical and administrative groups everywhere.

The modern world depends more and more on a complexity of organization which sets a premium on statistics, and there is little likelihood of any decrease in the demand made on WHO for its services in epidemiology and health statistics. The growing complication of modern industrial and urban life must also make health programmes increasingly dependent upon epidemiological guidance. It is perhaps not going too far to see in many present-day circumstances an indication of the future importance of epidemiology and statistics. Populations, whether of humans, insects, parasites or micro-organisms, are living, changing groups which are continually interacting with each other and, in turn, being influenced by any variation in their general environment. This being so, no description or analysis of disease in a human population serves for all time: there are too many variable factors existing in the circumstances of any particular disease in a human community ever to justify complacency. Man’s conquest of so many of the diseases that mystified and appalled his ancestors has, paradoxically, presented him with new problems. The reduction in the plagues of the past has unleashed forces the extent of which has still to be revealed. A world contracted in space and made one by technology, industrialization and urbanization is bound to produce new and unpredictable disease patterns. Even if the traditional hazards of such diseases as cholera, plague and smallpox are avoided, there is a distinct possibility of new infections and new hazards, radiation and other, emerging. The future role of virus infections is also difficult to predict. Whatever form, therefore, human communities of the future may take, it is unlikely that they will be able to dispense with international health statistics if they desire efficient health services.
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