Needed Improvements in Mortality Data

By IWAO M. MORIYAMA, Ph.D.

In reviewing the 50-year history of national mortality statistics in the United States, one is impressed by the fact that death statistics have not changed basically since 1900. However, this does not mean that progress was not made in the development of mortality statistics. Perhaps the most important of these developments was the growth of the registration area into a federated system of vital records and statistics with a nation-wide coverage. Another major advance was the establishment in 1937 of place-of-residence data on an annual basis for each area in the country.

The availability of data on a routine basis over a relatively long period, for small geographic areas, and in considerable detail as to cause is perhaps the most important factor in the widespread use of mortality statistics. Mortality statistics are frequently utilized as a substitute for morbidity statistics. The validity of this type of use is open to question, particularly when diseases with low fatality rates are under study. For example, one could hardly expect to measure the prevalence of rheumatic fever, or the mental disease problem, or the nutritional status of the population by the use of mortality statistics. On the other hand, mortality data still provide the best available index of incidence of a number of communicable diseases.

The quality of mortality statistics has improved markedly over the past 50 years. The International List of Causes of Death, through its decennial revisions, has kept pace with medical progress, and medical certifications of causes of death have greatly improved. Medical returns are more complete, as indicated by the increase in multiple-cause reporting from 35 percent in 1917 to 55 percent in 1940. It is expected that in 1950 the proportion of multiple-cause reporting will prove to be in the neighborhood of two-thirds of all deaths. The percentage of ill-defined and unknown causes has been declining steadily—an indication of the improvement in the quality of cause-of-death reporting.

Despite the progress made in the development of mortality statistics over the years, there are a number of defects that seriously limit the usefulness of the data. If mortality statistics are to continue to serve as tools in public health programs, there need to be further improvements in the quality of the basic data. The scope of public health problems cannot be precisely defined, nor can programs be planned or evaluated effectively with imperfect tools. It is also important that there be extensions in the use of data that can be obtained from the death registration document. Lastly, there needs to be development of new information using the death certificate as the starting point.

Dr. Moriyama is chief of the mortality analysis branch, National Office of Vital Statistics, Public Health Service. *This paper was presented at the Second Conference on Public Health Statistics at the University of Michigan School of Public Health, Ann Arbor, June 18, 1952.*

Needed Improvements in Quality of Data

Death Registration

One of the basic defects in many geographic areas is the incompleteness of death registration. Although the completeness of death registration has never been precisely measured, there is evidence that many deaths are not regis-

tered. This, despite the fact that the law usually requires the filing of a death certificate in order to secure a burial permit. An examination of the death rates for any number of counties will show crude death rates of much lower magnitude than can be accounted for on the basis of known mortality levels and age distribution of the population. In many instances, it is almost impossible to interpret the death rates for small areas because of incomplete registration. Since public health programs are carried out in the local areas, improvement in death registration is essential if valid data are to be available for program planning and program evaluation.

Place of Residence

In addition to complete registration, there needs to be further study of the problems of residence allocation. Since data by place of residence are generally used as an index of mortality in a community, accurate classification of data is essential. This is not a simple problem because the "usual place of residence" is not as clear cut or definitely determinable as the place of death. A study of this problem is being initiated, and it is hoped that the results will be useful in clarifying the situation with respect to the kind of information being reported as the place of residence, and how accurately such events can be classified.

Intercensal Population Estimates

Population estimates are not a problem in mortality statistics, but they should be mentioned here because the availability of reliable annual estimates of population, particularly for small areas, will extend the usefulness of mortality data. Reliable population data are needed more than once a decade.

Accuracy of Information

There are several items on the death certificate for which more complete and accurate information is needed. Mention has already been made of the usual-place-of-residence item. The others of special interest are the statements of age, marital status, occupation and industry, and the medical certification of causes of death.

Misstatements of age, particularly for those around age 65, are becoming of increasing importance because of their effect on death rates for the older population. Unless the population data contain the same proportionate bias as mortality data, death rates for studies of mortality in the aging population will be misleading.

Statistics on causes of death are used more extensively to define health problems than any other kind of mortality data. For precision in definition, further improvements in medical certification are needed. To close the gap between the needs and the work currently being done in this area, the Public Health Conference on Records and Statistics is recommending to all States that an intensive program be carried on over the next 2 years to secure improvements in medical certification.

The quality of cause-of-death reporting today varies considerably from area to area. For the country as a whole, it is estimated that perhaps 20 percent of the medical returns are not properly made. At the fourth annual meeting of the Public Health Conference on Records and Statistics, in Washington, March 25–28, 1952, Florence Olson reported to the mortality statistics working group that, in a recent survey of State cause-of-death query programs, it was found that the State vital statistics offices were querying, on the average, about 3 percent of the cause-of-death statements.

The classification of causes of death has been put on a sounder basis, but the benefits of this change cannot be fully realized until more reporting physicians assume fully their responsibility. The certifying physician must now be concerned with how the causes of death are reported as well as what should be certified. A number of tools, such as a filmstrip on medical certification of causes of death, and new procedures for querying causes of death, have been developed to bring to physicians the proper method of medical certification. Vital statistics offices should make more effective use of these tools and develop others to secure needed improvements in the quality of cause-of-death statistics. In this connection, it is hoped that more local health officers will become actively engaged in informing the medical practitioners in their areas of the proper method of medical certification. Routine examination of death certificates will indicate local problems. Dis-

cussion of these problems with individual physicians, or before the medical society and hospital staff, has been effective in securing almost immediate improvement in the quality of medical certification.

Accuracy of Diagnoses

The death certificate even under ideal conditions can do no more than register the physician's knowledge and medical opinion regarding causes of death. In interpreting statistics derived from these reports, it is important to know about the reliability of medical diagnoses. This is obviously not a statistical problem but a medical one. Also, it is a problem that will always exist in one degree or another no matter how much medical progress is made. Although the actual numbers of deaths from particular diseases are of interest to public health program directors, the establishment of the "true" numbers of deaths or death rates is not practical, except in rare instances. However, it does seem feasible to make an evaluation of medical diagnoses from a sample of death certificates. If the death occurred in a hospital, a follow-back can be made to the hospital records and to autopsy reports if a necropsy has been performed. In other cases, the follow-back can be made to the certifying physician. In these follow-backs, information would be collected which would permit some evaluation of the accuracy of diagnoses.

Causes of Fetal Deaths

With the great progress made in the saving of infant lives, it is expected that attention will be shifted to a public health problem of great magnitude—fetal deaths. Data are not yet available to measure the size of this problem, but estimates indicate that the annual fetal loss is much greater than that ever caused by infant deaths. The World Health Organization has recommended that statistics be compiled on the fetal death problem.

Little is known about the causes of fetal deaths. Experimental studies are now under way to determine the best method for collecting data on this subject. The problem here is not simple since the fetus cannot be observed clinically. It is hoped that eventually the statistics on fetal deaths will be as useful as general mortality statistics.

Extending Use of Available Data

There are still some opportunities for extension of mortality data from information available on the death certificate but not regularly processed into statistical tables. The most useful data not tabulated regularly are those related to multiple causes of death, mortality statistics by social classes, mortality experience of industrial groups, and statistics from the matching of birth and death records.

Multiple-Cause Tabulations

A good deal of medical information is available on the death certificate. When more than one cause of death is reported and only one cause is tabulated, then only a segment of the reported information is used. Also, single-cause tabulations limit the interpretation of cause-of-death statistics.

Multiple-cause tabulations provide information on the various diseases or conditions contributing to death. A count of diseases or conditions is made without regard to individuals, whereas the single-cause tabulations represent counts of individuals who died as a result of a particular cause that initiated the train of morbid events leading to death. Roughly speaking, multiple-cause tabulations show diseases and conditions present at the time of death or associated with the death; primary mortality tabulations indicate deaths from a particular disease or condition.

The results of a full-scale study of multiple causes of death are not yet available. However, a preliminary report of the study being conducted by the Illinois State Health Department was presented by John H. Vinyard to the mortality working group of the Public Health Conference on Records and Statistics at their meeting in Washington, March 25–28, 1952. In coding death certificates for the period April to June 1951, it was found that of the 22,481 death records involved, 11,616, or 52 percent of the total for the period, reported deaths due to multiple causes. Also, there were 15,910 causes certified in addition to the 22,481 causes which are classified as the underlying cause of death.

The table shows selected causes taken from Vinyard's report. It may be seen that there were 442 deaths assigned to pulmonary tuberculosis as the underlying cause. In addition, 58 cases of pulmonary tuberculosis were involved in the deaths. Syphilis was the underlying cause in 97 deaths, and it was also a contributory cause or mentioned as a cause of death on 53 other occasions. Diabetes was coded as the underlying cause in 399 deaths, but it was a contributory condition in 491 other deaths. From this, it may be presumed that there were at least 890 diabetics that died in this period. Deaths resulting from hypertension without heart disease numbered only 173, but there were 1,565 other instances in which hypertension without heart disease was mentioned on the death certificate. As might be expected, the chronic diseases which might be lost from primary mortality tabulations appear most frequently in multiple-cause tabulations.

The full use of available medical information is becoming increasingly important with the shift in emphasis from the acute to the chronic diseases. In chronic diseases, in which various conditions arise from a number of causes, it is possible to count such conditions without regard to the underlying cause. Tabulations can also be made to indicate the sequence of events or the association of diseases. Multiple-cause tabulations will also answer such questions as how frequently a specific disease is involved—whether as the underlying cause, a complication, or as a contributory cause. They also answer such questions as the number of deaths of diabetic and of tuberculous persons.

The compilation of multiple-cause statistics is not a simple task. There are a number of mechanical problems and analytical approaches to be worked out. However, the possibilities afforded in answering a variety of questions concerning diseases are great.

Statistics by Social Classes

The biggest gap today in mortality statistics is the lack of social and economic data related to mortality; 1950 is the first year for which a nation-wide study on this subject is being made. A number of State health departments are also conducting studies of occupational and industrial mortality for deaths occurring in 1950. It is hoped that revival of interest in this area

Multiple causes of death for selected underlying causes, deaths in Illinois, April–June, 1951

Cause of death	Underlying cause	Other causes										
		Total	001–008	020–029	140–205	260	330–334	420–422	440–443	444–447	450	Residual [1]
All causes	22,481	15,910	58	53	205	491	1,051	1,971	629	1,562	2,994	6,896
Pulmonary tuberculosis (001–008)	442	110	-----	6	4	11	2	22	2	------	4	59
Syphilis and its sequelae (020–029)	97	72	1	-----	1	1	3	15	2	6	22	21
Malignant neoplasms (140–205)	3,588	1,503	11	2	4	48	47	268	36	40	104	943
Diabetes mellitus (260)	399	563	4	1	6	-----	65	175	29	37	113	133
Vascular lesions of central nervous system (330–334)	2,398	2,810	-----	8	27	63	1	129	40	901	1,193	448
Arteriosclerotic and degenerative heart disease (420–422)	7,581	5,121	20	20	87	225	352	553	402	413	1,019	2,030
Hypertensive heart disease (440–443)	1,346	1,026	3	3	9	37	346	18	-----	------	226	384
Hypertension without heart disease (440–447)	173	120	2	-----	4	7	15	5	-----	3	23	61
General arteriosclerosis (450)	435	316	-----	1	6	13	6	23	-----	7	------	260
Residual [1]	6,022	4,269	17	12	57	86	214	763	118	155	290	2,557

[1] Excludes suicide, 963, 970–979; homicide, 964, 980–985; and ill-defined and unassigned causes, 780–785, which are not suitable for multiple-cause tabulations.

will bring useful information into the planning of health programs.

Mortality of Various Industrial Groups

Related to the occupational returns on the death certificate is an item on industry or business. The classification of the industry in which the decedent was employed provides data on the mortality experience of the various industrial groups. Puffer (*1*), in Tennessee, has tabulated mortality data for specific industrial plants, and reported that those tabulations have been utilized to great advantage in the industrial hygiene program.

Although the hazards of certain industries will be reflected in these statistics, they, like the occupational mortality data, do not give a direct measure of the mortality risk in various industries. However, they do provide an important index of mortality of a population group. This information should be extremely valuable in the case-finding activities of health departments.

Matched Birth and Death Records

A number of States match infant and maternal death records with birth certificates as a routine check on birth registration. Some of these States go a step further to prepare statistical tabulations on the basis of these matched records. Recently, the Public Health Conference on Records and Statistics proposed that national tabulations be prepared on matched records involving neonatal deaths. Some 14 States are now contributing to this set of tabulations.

The use of matched birth and death records is a simple extension of currently available data which provide additional information of value to maternal and child health programs. For example, it will be possible to determine the effect of birth weight on the survival of the infant. Birth order of the child is another variable of importance in maternal deaths and possibly in infant mortality. The information on complications of pregnancy and labor which is being developed on the birth record may shed additional light on the infant mortality problem. Possibly, leads from this type of data will help close the chapter on infant and maternal mortality as major public health problems.

Development of New Information

The death certificate is primarily a legal document. As such, it is important that its content not be overburdened with statistical items. There is always a temptation to add more and more medical or statistical items to the death certificate. Although it would be convenient to obtain statistics routinely in this way, it is difficult to justify the use of the death certificate for this purpose.

A slightly less convenient, but a more desirable approach to securing new information, is to use the death certificate as the starting point and follow back for additional information to the physician or the informant named on the death certificate. Collection of data in this manner is in many ways preferable to loading up the death certificate with information which is not pertinent to its legal use.

By use of the follow-back procedure, it is possible to obtain specific medical information from the hospital and/or from the certifying physician. The supplemental data may relate to illness history, verification of the diagnosis, and other facts about medical care and hospitalization. Certain other pertinent social facts, such as economic status, medical costs, education, and number of dependents, may be secured from the family.

A study of this kind would have to be directed at specific diseases or groups of diseases. In many instances, it would be on a sample basis. Included in the study should be factors that will materially broaden the base of interpretation of mortality data for use in program planning.

Other Areas Needing Improvement

Statistical activities may be viewed in two ways. The first aspect, the collection of statistics, has already been discussed. The second, the analytical phase, brings out the meaning in the statistics. All too often the end result of a statistical activity is a voluminous set of tables. While the vital statistics offices have a primary responsibility for providing reference tables for the use of others, a good deal can be done in the reduction, or digesting, of the data. More intensive work along these lines is needed. The removal of the wheat from the chaff not only

eliminates useless tabulations, but also points to needed improvements in the data as well as to new areas for study. More important, data in usable form lead to interpretations which can be utilized in public health programs.

In many areas, vital statistics are an integral part of the activities of the health department. In others, the vital statistics activities appear to be merely housed in the health department. This detachment is helpful in maintaining a strictly objective attitude toward the data, but it does not discharge the responsibilities of the statistical office. Mortality statistics are tools to be used in planning and evaluating public health programs, and statistical findings are of no value if they are modestly hidden. There should also be more knowledge of program needs and anticipation of these needs by statisticians. If the statistical offices can be adequately staffed by competent personnel, sound bases for the planning of health programs can be developed.

Insofar as mortality statistics are concerned, it seems fair to say that they are here to stay, despite the crying need for morbidity statistics. There are many areas in death statistics that need improvement. New statistics should be developed to meet health program needs. There is life in mortality statistics waiting to be brought out by the statistician, and to be used by the administrator and program directors.

REFERENCE

(1) Puffer, Ruth R.: Industrial and occupational environment and health. Milbank Mem. Fund Quart. 26: 22–40 (1948).

A Program of Conservation Irrigation

The headquarters of the newly established water projects section of the Public Health Service Communicable Disease Center has been opened in Salt Lake City, Utah. In the western United States, where the program will operate in 17 States, one of the major health problems and a major goal of the new office is the control of mosquitoes.

The section will cooperate with State health departments and Federal water development agencies in a "conservation irrigation" program to control insects of public health significance associated with the development of national water resources. Application of the principle of "conservation irrigation," a concept of the Soil Conservation Service, can greatly reduce the hazard of mosquito-borne disease.

Irrigation, which has opened some 22 million acres of arid and semiarid land to the production of food, often results in the breeding of mosquitoes and the spreading of the diseases they carry. Studies made in the past have shown that as many as 20,000,000 eggs of one type of mosquito may be present on a single acre of irrigated pasture, and a new brood may be produced following each flooding of the area throughout the irrigation season.