POTENTIALS OF RECORDS AND STATISTICS FROM CIVIL REGISTRATION SYSTEMS FOR HEALTH ADMINISTRATION AND RESEARCH[1]

Iwao M. Moriyama

For many years, the only recognized way of producing vital statistics was from birth and death records filed for legal purposes. This was true despite the fact that the statistics derived from these documents in developing countries were generally so incomplete as to be of limited usefulness. Shortly after World War II, a demand arose in developing countries for birth and death statistics for planning, administration and evaluation of health programs; for measurement of population growth for family planning programs; and for national social and economic development planning purposes. Because the then current civil registration systems were incapable of providing the needed statistics, other ways and means were sought to estimate birth, death and population growth data. This led to the application of retrospective survey methodology and the development of indirect methods of estimating fertility and mortality rates. The availability of such methods for estimating birth and death statistics naturally raises questions about the value of civil registration data for statistical purposes. The purpose of this paper is to discuss the advantages and disadvantages of the current continuous death registration system as a source of data for differential mortality analysis and other uses of mortality data.

Some Aspects of the Death Registration Process[2]

The legal base for death registration is some kind of civil law on registration which establishes the compulsory nature of and the requirements for registration of deaths. The law designates the person responsible for and the place of registration and prescribes the time allowed for the registration of the event, the fees required, if any, and the penalty for failure to register.

In most countries, the responsibility for the registration of a death rests with a relative or the head of the family or household. Data concerning the decedent are obtained from the informant prior to or at the time of registration. These data usually include the time and place of death, the personal particulars about the decedent, and characteristics of the parents, attendant at death, informant, witnesses and the registrar, and the method of interment. Another important datum is provided by the medical attendant, if any, or by the medico-legal authority, on the cause of death. The legal record, in the form of books of actas, is usually brief. For statistical purposes, additional information is collected from the informant at the time of registration. The legal record is placed in a permanent repository while the statistical transcript is transmitted to the government agency responsible for vital statistics.

In some countries, the legal and the statistical forms are combined into a single death certificate. The original death certificates are bound into books and filed permanently for legal purposes. Provisions safeguarding the confidentiality of information in these documents vary by country. However, certified copies of the record are generally issued to individuals upon request.

Uses of Death Statistics

Official mortality statistics derived from death records are used extensively for demographic studies and in public health programs. These studies may deal with mortality differentials by age, sex, occupation, socioeconomic characteristics, etc., or they may deal with the demographic characteristics of the decedent to eliminate the effects of age, sex, and ethnicity for studies of mortality risk factors. For public health purposes, the statistics on causes of death figure prominently. Death statistics have long been used as indicators of health, as measures of the magnitude of health problems, and for the evaluation of health programs, despite certain limitations of mortality data for this purpose. The availability of mortality statistics on a routine basis for the various political subdivisions of a country is of central importance to the utilization of death statistics for these manifold purposes.

An important use of mortality statistics is in the study of determinants of disease. For example, Pool and Chan (2) observed the differential decline in the tuberculosis mortality rate for the Maoris and attributed the decline to the disadvantageous position of the Maoris in New Zealand society until the 1940s. Elsewhere, nationwide malaria control programs were carried out in a number of countries after World War II, and significant reductions in the general mortality rate occurred. Pampana (3) presented data for six countries where such programs had been in operation for at least 5 years and for which adequate data were available. The decline in mortality was found to be most striking in Ceylon, but there was no general agreement as to the cause of the reduction. Meegama (4) attributed part of the decrease to malaria control and the rest to the establishment and provision of health and medical services. Fredriksen (5) found similar mortality reductions in nonmalarious areas not protected by pesticides and concluded that the decline in mortality was associated with economic development and the consequent rise in the level of living. Newman (6), on the other hand, took the position that it was not possible to disentangle the effects of the various factors that were operating at that period.

There are many other examples of epidemiologic studies based on official mortality statistics. Hoover and Fraumeni (7) studied cancer mortality in counties where certain industries were located and found excessively high death rates for bladder, lung, liver and certain other cancer sites in 139 counties where the chemical industry was centered. Blot and Fraumeni (8) compared data on lung cancer mortality for counties in the United States where paper, chemical, petroleum and transportation industries were located with data for adjacent counties where there were no such industries.

In the studies cited thus far, observed changes and differentials resulted in inferences leading to hypotheses about disease causation. Other studies start with a hypothesis about a disease and accumulate data to test it. For example, Fears (9), in an effort to ascertain whether naturally occurring asbestos resulted in increased risk of cancer mortality, identified the various counties in the United States with asbestos deposits, matched them with two nearby counties that did not have known asbestos deposits, and compared cancer mortality rates for the two sets of counties. He found no evidence that naturally occurring asbestos is a hazard to the general population.

All of the studies cited have one characteristic in common, namely, that the investigations are based on traditional or official mortality impinging on the general population as well as the special risk factors. Therefore, it is not possible to determine the effect of any particular factor. However, descriptive epidemiology is valuable in suggesting hypotheses or leads for further investigation.

For the testing of epidemiologic hypotheses, it is necessary to include measures of specific risk factors in the study. This is the basis of the case control or the retrospective epidemiologic study and the prospective epidemiologic study which will be discussed later in connection with the uses of death records.

Uses of Death Records

The death record provides a proof of death for burial or other means of disposition of the remains, for the settlement of life insurance and social insurance claims, and for the adjudication of property ownership and inheritance claims. It also provides legal evidence for the right of a surviving spouse to remarry. The death record has also been used for clearing various kinds of files such as social security records, disease case registers, electoral lists, bank accounts, missing persons files, etc.

The death certificate or death reports have been used extensively in public health and medical studies. The death record has been useful for program purposes in public health, for linkages to other records, for follow-back investigations, and for retrospective and prospective epidemiologic studies. Following is a brief description of each of these uses.

Public health program uses

A common use of vital records in public health is the referral of certain problems to specific program units for follow-up or investigative purposes. For example, in many local health departments, death records involving individuals who died from certain infective diseases are routinely referred to the communicable disease unit. This makes possible the spotting of epidemics or, in the case of virulent epidemic diseases, an investigation to examine contacts in attempts to contain the spread of the disease.

Other program uses may be mentioned. Birth records of immaturely born children may be referred to the maternal and child program for follow-up purposes to advise on the proper neonatal care for the baby. In the event that the child was born with a malformation, the crippled children's program may provide assistance or make the parents aware of the available services. None of these community and personal services can be provided without the identity of individuals involved.

For many service programs, it is important to update the registers by removing on a current basis those that dropped out of the program through death. This can be done by matching the death records with the registry file. Vital records serve various administrative and scientific purposes, such as the surveillance of certain disease problems. In establishing a registry for incidence or prevalence studies, the death record plays an important role. For example, the cancer registry attempts to record every known case of cancer. Deaths from cancer, if reported to cancer registries, will serve to supplement the known cases. In the poorer registries, more than half of the registry cases are those that were identified by the death certificate. Even in the better cancer registries, more than 10 percent of the total cancer cases come to the attention of the registry from the death record. Other surveillance systems also benefit from a routine flow of information from the vital records. Cates et al. (10) found that surveillance techniques identified more deaths as abortion-related than the death records did. When death records were combined with surveillance records, there was a significant improvement in the identification of abortion-related deaths.

An important use of cancer registries is to make a systematic follow-up of cancer patients in order to schedule periodic examinations. For this purpose, it is essential that the registry clear all cancer patients who die by matching death records to the register cases. This also makes possible the determination of survival rates for the various groups of cases. The survival rate is one means of assessing the effectiveness of different kinds of cancer therapy.

Record linkage

The value of mortality statistics *per se*, that is, official mortality statistics, is limited for epidemiologic and evaluation purposes. This is because mortality data are not generally classified according to the factors that need to be studied. One needs to go beyond the usually available demographic characteristics such as age, sex, ethnicity, etc. To break out of the limiting bounds of mortality statistics, one could link the death record with other pertinent information. An example of this may be found in the study of infant deaths. Conventional infant mortality statistics include rates by age, sex, and cause of death. Although immaturity is tabulated as a cause of death, there is no way to obtain death rates for low birth weight infants using the death record alone. However, birth certificates in many countries contain information on birth weight. Therefore, if the infant death record were to be matched to the birth record, it would be possible to utilize the birth weight data recorded on the birth certificates for the numerator as well as the denominator of the rate. Similarly, it would be possible to obtain infant death rates by age of mother, parity, and other information concerning the mother or child which may not be recorded on the death certificate.[3]

Follow-back studies

To go beyond the limitations of traditional mortality statistics, it has been suggested that supplemental data be collected by going back to the informants named on the death record. By obtaining the same information for a sample of the living population, it would be possible to present death rates on items not covered in the death record. Also, by going back to the medical attendant at death, it should be possible to obtain additional diagnostic information and make an evaluation of the quality of diagnostic data.

Epidemiologic studies

One of the significant developments in the postwar period was the burgeoning of public health interest in environmental problems which gave rise to many studies in chronic disease epidemiology. In these efforts, mortality statistics proved to be an inadequate source of data. It remained for the death record to serve this new need by providing a starting point in retrospective studies and an end point in prospective epidemiologic studies.

In the retrospective, or the case control, study approach, the death record is employed to identify the cases for retrospective epidemiologic study, one group of cases being related to the disease under study and the other to a matched control or comparison group. A follow-back is then made to a data source for information on the etiologic factor, and a comparison is made between these two groups to establish whether the factor is associated with one group and not with the other.

Stewart et al. (13), MacMahon (14) and others have made studies of childhood cancer utilizing the death certificate as the starting point. In the former study, more mothers of children who died of leukemia and other malignant diseases remembered having an abdominal or pelvic X-ray during the related pregnancy than did the mothers of a sample of children who did not die of cancer. In MacMahon's research, children born in a study population who subsequently died of cancer were identified in a review of death and birth certificates. Records of pregnancy and

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[3]Other studies based on linked records are available. For example, see Newcombe et al. (11) and Acheson et al. (12).

delivery of these children were also reviewed. It was found that cancer mortality was much higher in the X-rayed than in the unirradiated children in the study population.[4]

The prospective study starts with a hypothesis about a disease, and data are collected for two defined populations, the "experimental" group and the comparative or "control" group. These two population cohorts are then followed until an event (i.e., death in the case of mortality studies) occurs. The use of matched controls, that is, two populations similar in all respects except for the factor being tested, provides a stronger basis for showing association between variables than the mentioned retrospective approach.

In a prospective study of mortality from lung cancer among asbestos workers, Doll (16) and Knox et al. (17) found lung cancer to be a specific environmental hazard of certain asbestos workers. The average risk among men employed for 20 years or more was in the order of 10 times that of the general population. The risk lessened as duration of employment under old dusty conditions decreased.

Among the more significant epidemiological findings of recent years are those demonstrating the association between smoking and lung cancer. For example, Doll and Hill (18) followed the smoking habits and mortality of 40,000 men and women in the United Kingdom for a period of time, and Dorn (19) analyzed smoking habits and mortality of 200,000 U.S. war veterans. Both studies found a significant association between smoking and lung cancer.

Shortly after the end of World War II, the Atomic Bomb Casualty Commission was established to study the delayed effects of ionizing radiation from the A-bombs. A life span study reported by Beebe et al. (20) followed about 110,000 A-bomb survivors and controls who were alive on October 1, 1950. Dose estimation was made for each survivor from information regarding their physical location and the shielding configuration at the time of the bomb. Deaths occurring to the members of this cohort were ascertained periodically from checks of the family register, and copies of death certificates secured. The unique Japanese system of family registration made possible the ascertainment of virtually all deaths in the sample regardless of the place of death in Japan.[5]

Advantages of a Continuous Registration System

A major advantage of a continuous registration system is that, once the system has been established on an adequate basis, there will be a continuous flow of death records from the local registration units to a permanent repository to serve legal purposes. This makes possible the transcription and/or transmission of copies of death records to a central agency for data processing and statistical compilations.

Registration data deal with the whole universe of events. Therefore, not all of the data may have been tabulated routinely, but much of the needed statistics are usually readily available annually. This is an invaluable feature of registration statistics in providing detailed all-purpose reference tables for various segments of the population that can be tapped for specific studies. It makes possible the conduct of analytical studies on numerous topics either on a cross-sectional

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[4]More recently, Blot et al. (15) undertook a case control study to identify the factors associated with the unusually high lung cancer death rate among male residents of coastal Georgia. The findings suggested that asbestos and possibly other exposures during wartime employment accounted for part of the excess mortality from lung cancer in the southeastern coastal areas of the United States.

[5]For another study of mortality associated with A-bomb radiation exposure, see Moriyama (21).

basis or over a period of time. The availability of trend data is an important advantage of a continuous registration system.

The general availability of mortality data by various personal characteristics of the decedent such as age, sex and ethnicity for the country as a whole and for the different geographic divisions down to the smallest political subdivision makes possible their utilization for many purposes, as already illustrated. Shapiro (22) points out that for local health planning purposes the availability of data for the past and present, and likely availability for the foreseeable future, for geographically disaggregated levels down to subdivisions of a city, make up for many of the defects that may be present in mortality statistics. The question posed to the user of mortality data for planning purposes is how to maximize the utility of this resource even though conceptual and technical issues still remain.

The compiled data are, at least for countries with well-established systems, generally comparable from place to place within a country and from one time period to another. Such internal consistency is one of the remarkable characteristics of registration data. Also, because the definitions and classifications used in vital statistics are usually international in nature, there is a considerable amount of comparability among the data for various countries.

The availability of statistics on causes of death and the possibility of obtaining other medical information through the follow-back procedure make registration statistics virtually indispensable for public health and medical programs. Even developing countries may be able to generate useful cause-of-death data through a system of lay reporting. This is not as far fetched as it may seem because in developing countries a large proportion of all deaths occur in the childhood years. The common diseases of childhood may frequently be recognized by the mother. These cases, plus accidental causes, do not require medical training for an adequate description of the cause of death.

It is difficult to ascertain the cost of registration statistics because a large part of the collection cost is borne by the legal registration process. However, it is probably fair to say that the unit cost of registration data is considerably less than that of data obtained from interview surveys.

The continuous flow of data on a permanent basis obviates the necessity of mounting periodic surveys with attendant high costs and possible changes in survey personnel, objectives, procedures and definitions. In addition to statistics, a death registration system provides death records which make possible the identification of deaths of individuals for use in communicable disease control and in other public health programs such as those on maternal and child health. It also makes death records available for retrospective and prospective epidemiologic studies. The General Register Office of England and Wales gives invaluable assistance in notifying epidemiologists of deaths occurring to members of a study cohort. The U.S. National Center for Health Statistics is now establishing a national death index to provide similar services to those engaged in scientific investigations. These services made possible the conduct of epidemiologic studies which would otherwise be impossible to carry out, except at exorbitant cost.

Disadvantages of a Continuous Registration System

The monolithic nature of the registration system dealing with the total population of a country is a definite disadvantage in any effort to make changes or otherwise improve the system. Changes come slowly. The United States, an industrialized country with a literate population, took over 30 years to qualify all the States for the national death registration area.

Another disadvantage of a continuous registration system is the lack of flexibility in making changes in the content of statistical reports. In interview surveys, it is possible to make changes in the questionnaire forms and to include probing questions if needed. In a registration form,

especially if it is part of a legal document, there are definite constraints on the kind of topics that can be included and how detailed the questions are. There may be a little more freedom with the statistical report form independent of the legal registration document, but registration officials are generally conservative about making substantial changes in the content of the statistical report form.

The disadvantages of a continuous registration system are relatively few, but a number of improvements need to be made before civil registration and vital statistics systems are capable of producing useful statistics on a continuous basis. The most serious problem in developing countries is incompleteness of coverage. In most developing countries, access to the local registration offices is difficult in the rural areas. In many countries, special problems are posed by nomadic and indigenous populations. To complicate matters still further, there is little incentive to register vital events even if there is awareness of the need to register deaths. As noted by IIVRS (23), the absence of need for death certificates and the lack of awareness on the part of the public of the necessity to register deaths have been cited by civil registration authorities as the biggest obstacles to registration improvement. Incomplete death registration, particularly outside the major cities, is a major impediment to the use of data for mortality analysis. Another major factor is the quality of the local registration personnel in developing countries. Sometimes they are scarcely literate; almost always they are inadequately compensated and untrained. As a result, the completeness and quality of the collected data are adversely affected. In addition, dealing with an illiterate population presents special problems in eliciting seemingly simple information such as the age of the decedent, and the poor quality of information concerning the characteristics of the decedent represents a further complication in the use of data for mortality studies.

In view of these problems, virtually all developing countries find themselves without adequate death statistics in their period of greatest need for data for social and economic planning, and for health planning and administration of health programs. Some countries are adopting other means of collecting data to fill the gap, but a large majority of countries are still struggling with registration of vital events.

Discussion

The continuous registration system offers data possibilities that cannot be achieved in any other way. Mauldin (24) and Brass (25) observe that single-round and even multi-round surveys have notably not been successful in obtaining adequate counts of deaths. Lunde (26), in his discussion of the limitations of single-round surveys, points out that mortality data for Uganda, Niger, Algeria, and Tanzania were never published because of obvious defects in the information on deaths obtained from single-visit retrospective surveys. Basically, it is extremely difficult to identify retrospectively persons who are no longer present. For example, deaths occurring in single-person households are not identifiable in retrospective surveys. Dissolution of a family or household may also occur on the death of the head of the family or household, or of one of the spouses. In addition, there may be taboos and/or general reluctance about revealing the facts of death, especially to strangers. In all countries, it is difficult to obtain information on deaths of infants who die soon after birth. Social surveys also have other nonsampling problems such as inadequate recall, erroneous dating of events and misreporting of age.

Indirect estimation methods are based on characteristics of the living population obtained in a census or survey. Data such as those relating to surviving children of mothers at various ages or persons at various ages who were orphaned are transformed into mortality estimates of children and adults. The results of indirect estimation techniques are subject to errors from the

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already mentioned nonsampling problems arising in census and social survey interviews. The validity of the estimates also depends on the assumptions underlying the analytical development of the methods. In some cases, it is clear that the conditions were not met while in others it is difficult to judge the validity of the assumptions.

For countries with no data at all or inadequate mortality statistics, even the limited mortality measures provided by the combination of surveys and indirect estimation techniques are valuable for certain purposes. Also, estimates of death reporting completeness provided by indirect methods developed by, among others, Preston et al. (27) are useful approximations for assessment purposes. On the other hand, it seems apparent that the limitations of the survey and indirect methods of estimation are such that they cannot ever provide the kind and amount of statistical data which are obtainable from death registration data. The advantages of a continuous registration process as a source of records and statistics are so substantial that other methods cannot be regarded as adequate long-term substitutes for death registration data, though in the short run, such other methods may represent the only feasible source of mortality data for some countries.

If there are no satisfactory alternatives to the continuous registration process, what are the possibilities of developing registration data within a reasonable time frame? This is not an easy question to answer because there have been no outstanding developments in civil registration parallel to those in survey methodology and indirect estimation methods over the past 15 to 20 years. Perhaps this is because changes and improvements cannot be obtained quickly in a continuous registration system. To try to establish and improve a nationwide registration system is simply too large a task for the usual staff and budget. Also, there are problems amenable and not amenable to solution depending on the state of social and economic development of a country. Linder (28) has classified problems of civil registration under the following heads:

- Relatively intractable problems. These can be solved within the framework of long-range social and economic development, but can hardly be solved by short-range actions taken within the civil registration system itself.

- Problems soluble but requiring national or outside technical assistance funds.

- Soluble problems. These can be solved within the national domain with relatively small financial requirements.

Instead of tackling all the problems at once, Linder suggests that certain tasks should be deferred. One approach to improving the data along this line is the adoption of the registration area concept. For example, the death registration area was established in the United States in 1900 starting with 10 States (out of 48) and the District of Columbia. As the States qualified by the adoption of a standard death certificate form and by demonstrating that 90 percent or more of deaths were registered, they were included in the registration area. By 1933, the registration area covered all the population in the country.

For developing countries, a start might be made with the capital city and major efforts devoted to the establishment of a satisfactory death registration system. After the registration system in the capital city is deemed operational, efforts should then be transferred, one by one, to the other major cities, leaving the difficult and sparsely settled rural areas to the last. A problem with this approach is that until coverage has been fairly extensive, the data will be limited to urban experience.

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Another possible approach is that suggested by Hauser (29). He proposed that a national sample vital statistics system be established comprising a sample of complete primary registration units or combinations thereof. This makes possible the focusing of energy and funds on a limited number of primary registration units instead of dealing with all the units in the country at once. Data from a representative sample are certainly more desirable than data limited to urban areas, but it would be more complicated administratively to work on a number of noncontiguous primary registration units simultaneously. In addition, Linder (30), in reviewing the experiences of a number of countries undertaking sample registration projects, observed that most of the recent sample registration schemes have departed from the original concept and have established a sample system independent of the existing legal system. This is an unfortunate departure in that it defeats the original purpose of obtaining continuous improvement in the registration system.

As a strategy to improve civil registration in a country, it would seem sensible to concentrate activities on problems most amenable to solution in geographic areas with the greatest population where government services are more likely to be available to the public. However, because of the nature of registration problems, a fully operational system cannot be expected overnight. Patience and persistence are needed.

The development of a death registration system requires a satisfactory legal base and an administrative organization of local offices. It requires the understanding and cooperation of the public, of medical attendants and others in the healing arts, of hospitals and clinics, of undertakers, and of those in charge of burial places and crematoria. An active and innovative program is needed—not a passive waiting for death certificates to be filed. It is a long road to success, but the reward at the end is worthwhile in terms of an invaluable data source to serve the health and demographic needs of the country.

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