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**USES OF CIVIL REGISTRATION  
AND VITAL STATISTICS IN HEALTH  
PROGRAMMES AND SERVICES<sup>1/</sup>**

**BY**

**Dr. Oddile Frank  
World Health Organization**

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**- The view in this paper are those of the author and not necessarily reflect those of the Economic Commission for Africa.**

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Vital registration addresses multiple needs of administration and record-keeping of a society that go beyond the applicability or usefulness of information on individuals at their birth and at their death for health care systems.<sup>1</sup> It is a commonplace to note that birth and death are not only the fundamental biological transitions, but also profoundly social events. Indeed, interest in noting their advent was prompted by the need to regulate society long before the human lifespan became an object of description and study. There existed a civil registration system in China already many hundreds of years before the christian era, a household civil registry in Korea before the 10th century, a population recording system in pre-Columbian Peru, and parish registers were introduced in England and in France in the 16th century and in Northern Europe in the 17th century, but modern secular civil registration of vital events was not implemented as known today until the 19th century (United Nations, 1991:3-11).

It is likely that as the importance of the person evolved in various cultures, so they became societies of laws that, among other things, required accurate identification and situation of each individual, with attribution of rank and property, in order to regulate human affairs. Thus rightful inheritance, for example, became critical to determine, and depended on birth and death registration. It is probable also that the only health gain from early vital registration was with respect to the public health improvement afforded by regard given to disposal of bodies.

Legal provisions for vital registration, however, have not always served the cause of registration well: a need to maintain registers of the population for taxation, labour, or military conscription purposes, for example, has typically led to poor compliance, as has the imposition of fees with or without compulsory registration. Where compliance is now high, vital registration is generally essential to establish identity for civil rights, such as school enrolment, issuance of a passport, voter registration, social entitlements, and so on, as well as responsibilities. It well may be that poor registration of vital events results as much from the absence of any associated benefit in certain societies as from the absence of sufficient social and economic means to support a better system: these may be direct and indirect effects of the same phenomenon, as improvements in the standard of living raise the demand for - as well as the availability of - such benefits.

The applicability of fertility and mortality measurement to the study of health broadly can provide a useful backdrop to

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<sup>1</sup>. For purposes of discussion, registration of only births and deaths will be addressed in this paper: marriage, divorce, adoption, and other subjects of civil registration undoubtedly have some bearing on health, but their relevance is more remote, and they are omitted for the sake of brevity. Accordingly, we will be more often speaking of vital than civil registration.

The applicability of fertility and mortality measurement to the study of health broadly can provide a useful backdrop to situate and discuss the more narrow role of vital registration in health management. Accordingly this brief paper will first review fertility measurement and contributions that are made by civil registration to that end, and then will address similar issues regarding mortality measurement and the role of registration in improving not only measurement, but the base for health programme and service intervention. Finally, the paper will address alternatives to civil registration, and describe one particular alternative that would focus administrative and medical registration efforts on the youngest age group, children up to the age of five years.

### *The measurement of fertility and birth registration*

The first table briefly outlines the options to measure fertility, arranged from those with least to those with most data requirements, the features of each source, and its usefulness in the field of health. It is assumed, for simplicity, that the increasing data requirements more or less follow what emerges from birth information systems of increasing sophistication, and the discussion necessarily ignores problems of coverage and reliability of registration that may occur at all levels of system refinement.

One can note in Table 1 that, broadly, registration of births offers more potential scope for understanding the determinants and health correlates of birth. The first two options do provide some information that is useful to health management, namely the total burden of fertility<sup>2</sup>, and the age pattern of childbearing of women. Moreover, specific measures mentioned in the first two options may be derived from census or survey data, and by indirect methods. This presents distinct advantages: estimates may be easily derived, census data often allow for substantial analysis by subnational region, political subdivision, or other subgroup (ethnic group, for example) because of the size of the data base, and, while sacrificing size, surveys offer the advantage of a wider scope of enquiry, often including in-depth items on social and economic factors. Information from census and survey-based measures that can assist in health management includes gross analysis of fertility trends and differentials - knowledge on where and in what subgroups of women fertility is greatest and most "burdensome" to

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<sup>2</sup> The burden of fertility is an important criterion in assessment of reproductive health. As it concerns pregnancies that result only in live births, however, it leaves aside reproductive health problems of pregnancy wastage - or foetal death - as well as stillbirths. Stillbirths can be captured in registration of late foetal deaths, but there are few good nonclinical sources of information on pregnancy wastage that can be utilized for health management.

reproductive health -and on the age-pattern of fertility - knowledge on the fertility of women of potentially high-risk ages, such as adolescents.

Nevertheless, the disadvantage of small size of surveys remains, and censuses cannot be conducted at short intervals - they are generally carried out every ten years - so they are not ideal instruments to detect change over time. Moreover, whereas one attractive feature of census-based assessment of fertility is the fact that it can capture cumulative and completed fertility, a drawback is that census fertility measures are period-bound, yet give a summary of fertility performance as if women would live their reproductive lives at successive ages in the same way as women of all ages currently report doing so: although these measures are period measures, yet they do not allow precise timing of fertility behaviour, and change in fertility over time can be gauged only approximately (see United Nations, 1991:77-78; Ní Bhrolcháin, 1992). Some timing of fertility is afforded, however, by the measurement of observed fertility over a retrospective period in the case of surveys with maternity histories.

In essence, the survey and the census generally provide enough information to examine the interaction of health and fertility at a demographic level, and they provide opportunities to collect supplementary

**Table 1. Sources of fertility information, features and potential for the health field**

Source of fertility assessment	Features	Use to the study of health
Crude birth rate, child-woman ratio, or general fertility rate	Estimates of overall fertility	Levels indicate relative overall burden of fertility of populations; gross analysis of trends and differentials
Total fertility rate; gross and net reproduction rates	Estimates of fertility of women by age at one period	Age pattern of fertility for women
Registration of live births with time and place	Live birth counts; gives differentials with denominator estimates	Variation in birth rates by time and place; analysis of trends and differentials
Registration of live births with sex	Allows for sex ratios of declared live births	Indication of sex preference and female risk of neglect
Registration of live births with circumstances; multiple or not, birthweight, where and by whom delivered	Allows for estimation of condition of the newborn	Causal analysis of survival chances of newborn
Registration of live births with mother's maternity history	Provides maternal age, parity, and survival of prior live births	Causal analysis of survival chances of newborn; estimates of child mortality using the preceding birth technique
Registration of live births with maternal characteristics	Provides marital status, education, and occupation of mother	Causal analysis of determinants of child survival

Registration of live births with additional medical information	Can provide data such as gestational age, interval since last birth	Causal analysis of biological determinants of child survival
Registration of live births with additional social and economic information	Can provide data on paternal factors, social and economic factors, and so on	Analysis of broad determinants in the social and economic environment of healthy birth and survival

information that can give valuable information on the determinants - and consequences - of reproductive health (see Shryock, Siegel, et al., 1971: 500). They do not, however, allow for discrete determination of fertility over time, nor for analysis of differentials according to characteristics of individual births that cannot be ascertained in retrospect. Birth registration, on the other hand, has far greater potential to assist health management, although it may be a statistician's nightmare from the point of view of data collection.

Some of the uses of birth registration to health programmes are listed in the third column of the table. At the very first level of registration - a mere record of time and place of a birth - and assuming complete and prompt registration as well as speedy processing, changes in the volume of births can be determined at the local level. This could allow programme and service-relevant assessments such as the degree of success of contraceptive introduction, needs for prenatal, postnatal, maternity and vaccine services, and so on.

The addition of the sex of the child on a birth registration can provide information on the sex ratio of declared births. In view of the fact that the sex ratio at birth is generally in a narrow range of about 105-107 male to 100 female newborns, departures can indicate such health concerns as underregistration of female newborns, that may presage female infant risk of neglect (see Das Gupta, 1987; Coale, 1991).

When characteristics of the birth - such as whether a multiple birth was involved, the weight of the newborn, the place of delivery, and by whom the infant was delivered - are available, the registration process begins to serve not only broadly health-related objectives, but medical and clinical ends. The relationship of low birthweight can be determined in relation to numerous possible outcomes - as well as to characteristics of the mother that may be recorded in registered births, that is relevant to defining both prenatal and postnatal health service needs. Distributional patterns of low birthweight can point to cause-, place- and risk group-specific service needs. Finally, the

information about delivery may be essential to determination of the delivery profile for a locality, and of delivery coverage improvements that are required.

When characteristics of the mother, such as her age, and the mother's prior maternity history are also recorded at birth registration, in particular her parity and the survival of her previous births, after analysis, not only can child mortality be estimated, both directly and indirectly on the basis of the preceding birth technique<sup>3</sup>, but better indications can also be derived of the survival chances of newborns in relation to a range of possible determinants. For this purpose, ideally, a reliable linkage of birth and death registration would also be in place. Infants at higher risk can be programmatically identified for closer postnatal care and follow-up.

Further information about the mother, such as her marital status, level of education, and her occupation, in conjunction with reliable death registration and birth-death record linkage, allows for both broad study of social and economic determinants of child survival, and identification of individual newborns who are at risk and require particular health service attention. Similarly, more accurate biological information, such as the presumed gestational age of the newborn, and the interval in months since last birth make it possible to improve our understanding of the determinants of child survival, generally, as well as identify high-risk infants at birth who can be given programmatic attention.

The same may again be said of the inclusion of paternal characteristics that parallel and supplement the information provided regarding the mother. Furthermore, the inclusion of true birth order and of the interval since the last birth (or since marriage for primiparous women) also allows for a more accurate assessment of period fertility to assess trends/changes in childbearing over time (Ní Bhrolcháin, 1992:619), that can serve as a better indicator of changes in the burden of fertility, the degree of contraceptive practice, the success of targets, and of any change in the need for reproductive health services of various types.

In sum, the usefulness to health programmes of birth registration, and of supplemental information provided on a birth record is twofold: the data can serve the needs of scientific

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<sup>3</sup> For a recent review that favours the use of this technique (that was originally proposed by William Brass and Sheila Macrae in 1984 on the basis of Sheila Macrae's 1979 doctoral dissertation), and in other settings than civil registration, see David and Hill, 1992. Utilization of the preceding birth technique also has its detractors (see, for example, Rutstein, 1989). The David and Hill paper offers a substantial bibliography.

analysis that informs health management - and consequently assists health programmes indirectly - and it can serve directly to inform health programmes of health risks for particular newborn infants and their mothers.

### **The measurement of mortality and death registration**

Table 2 presents a synopsis of sources of mortality information, the main characteristics of these sources, and their potential usefulness to health programmes and services.

At the very first level, determination of the crude mortality provides a very useful measure of overall health of a population, and the crude death rate can be derived through indirect techniques from census or survey data which presents the same advantages as described earlier. The crude death rate, while a key summary measure, is, however, highly dependent on the age structure of the population, which makes it difficult to use to compare two populations (or even the same population over time if its age structure is changing because of factors such as declining fertility). In most cases, fortunately, the data needed to provide an estimate of crude mortality also provide estimates of both infant and child mortality - in the form of life table probabilities of survival - so that straightforward comparisons of child mortality can also be made on the basis of censuses (and surveys) and indirect techniques of estimation. Furthermore, there are indirect ways of estimating

1. Most often, data for fertility estimation in conjunction with further information on survival of children born are used to select a model population that best fits, and which then provides the associated intrinsic mortality parameters.



**Table 2. Sources of mortality information, features, and potential for the health field**

Source of mortality assessment	Features	Use to the Study of Health
Crude death rate	Estimate of overall mortality; can be derived by indirect techniques	Levels indicate relative state of health of populations
Estimates of mortality for infants, children, adults	Mortality by age; can be derived by indirect techniques	Provides comparative mortality rates
Registration of deaths with date and place	Death counts; gives differentials with denominator estimates	Concentrations of deaths by time and place; gross epidemiology
Registration of death with age and sex	Mortality by age and sex with denominator estimates	Age and sex patterns of mortality
Medical certification of death	Provides cause-of-death	Cause patterns of mortality; disease-specific epidemiology
Registration with certification and record linkage	Link to birth record; medical/work/social records	Causal analyses
Prompt continuous registration	Uninterrupted, complete and timely	Any deviation immediately flagged; allows for immediate analytic and reactive response to incipient or suspected epidemics
Individual socioeconomic information	Characteristics of potential factors	Analysis of broad determinants of health, disease, death

adult mortality from enquiry on orphanhood and widowhood<sup>5</sup> in

<sup>5</sup>. There are similarly indirect methods to estimate *maternal* mortality on the basis of sisterhood (see Graham et al., 1988).

censuses and surveys. In sum, therefore, surveys and censuses can provide us with rough estimates of the relative health of populations by age than can provide useful information for health management. In addition, the broad base of censuses allows for substantial subnational analysis, and surveys often allow enquiry of potential correlates of mortality that can increase our understanding of its determinants.

As with the options for fertility assessment, however, the possibilities afforded by death registration, assuming once again reliability and satisfactory coverage, are far superior to assist health programmes and services. At the very first level, whereas mortality estimation may be used to show long-term and secular time trends, it necessarily smoothes out local and short-term variation. Registration of deaths by time and place does not smooth out geographical and temporal heapings due to localized or currently evolving epidemics, and can therefore, if well conducted, do much to document the waxing and waning - as well as transmission - of fatal morbidity.

Incremental information further strengthens the value of death registration. Age and sex information allows for the study of age and sex patterns of mortality that can be highly informative and can be used to compare the experience of different populations. Different age and sex patterns of mortality are indicative of different stages of the transition from high to low mortality associated with economic development and improved health infrastructure. Accordingly, a great deal may be said about a population's health needs from observation and analysis of its age and sex pattern of mortality, which provide the well-recognized population pyramid. A probable side-benefit of age and sex registration of deaths also arises from the need to record this information on infants: it is likely that both the health of infants and the reliability and coverage of registration benefit as the improvement in each is nudged by improvement in the other, at least in the initial phases of a registration system.

#### ***Death registration and cause-of-death certification***

No increment of information, however, has as great an influence on potential usefulness to health programmes and services as the determination of causes-of-death on the basis of medical certification at the time of death. The addition of cause-of-death to death registration represents also a remarkable achievement of coordination between the administrative and medical institutions of societies that have introduced it.

Unlike the fact of death, cause-of-death determination had to wait upon the development of medical diagnosis to become useful to health professionals and demographers alike. Cause-of-death classifications were attempted as early as the eighteenth century, and by the mid-nineteenth century the first International

Statistical Congress commissioned the development of a uniform nomenclature of causes-of-death that could be used internationally. A classification originally prepared by William Farr and revised several times between 1855 and 1886, although not universally accepted, eventually became the basis for modern cause-of-death classifications. The first modern classification prepared by Jacques Bertillon for a meeting of the International Statistical Institute in 1893 met with general approval, and was recommended for international adoption in 1899. Known thereafter as the International Classification of Causes of Death, it has been revised 10 times, almost on a decennial basis - first in 1900, then in 1909/1910, in 1920, in 1929, in 1938, in 1948, in 1955, in 1965, in 1975, and most recently in 1985 and 1987: the most recent tenth revision was published in 1992 (United Nations, 1991; World Health Organization 1957, 1967, 1977, and 1992).

From the base of cause-of-death certification, all forms of increased sophistication in the vital registration system allow for substantial and rich quantum improvements in our understanding of the determinants and natural history of health and disease. It then becomes possible to determine cause-specific mortality, by age and sex, at a demographic level, and to study disease patterns, such as in environmental studies and case-control studies. Record linkage to births and other data (medical, employment and social insurance system records, for example) allow for more specific epidemiological study, and any supplemental information on social and economic factors allows for broad analysis of determinants of health and disease.

#### ***Advantages and limitations of universal registration***

Once again, as for fertility, registration is superior to other sources of information on mortality, because it provides a richer base for analysis in the study of health, which in turn provides innumerable indirect benefits through the improvement so health programmes and services. But also, once again, registration is of direct benefit to the management of health interventions, programmes and services. As mentioned earlier, the timing and site of increases in registered deaths can alert health systems to unusual concentrations of deaths: the addition of valid medical certification of cause-of-death allows for good epidemiological follow-up of such concentrations in time and place. If registration can be carried out in an uninterrupted, and prompt manner, and assuming high reliability and coverage, deviations can be also be picked up in a timely way, which allows not only for the necessary epidemiological investigation, but rapid intervention to identify and control epidemic problems. In conjunction with an associated level of morbid diagnosis, good cause-of-death information can lead to sophisticated large-scale epidemiological studies of disease transmission, including etiological and causal

analysis, and so on<sup>6</sup>.

In sum, in the case of mortality as well as fertility, registration is a demographically, epidemiologically and medically/clinically superior source of information for both research purposes - that serve health systems and programmes indirectly - and to address immediate, operational health service provision issues related to interventions, day-to-day service, the deployment of health manpower, and other practical and/or logistical factors related to health strategy development and national health management<sup>7</sup>.

To achieve their maximal usefulness, however, registration systems must meet several criteria; the coverage must be virtually universal (or known to cover fairly completely a subnational population of no known bias, unless the registration is wittingly directed, or targeted at selected populations), the registration must be reliable (dependably free from any systematic voluntary or involuntary error), medical certification of cause-of-death must be valid (should lead to correct inferences regarding the cause, because it is logical and justifiable), no untoward delays in reporting to a central point should occur, linkage between birth and death registries (and possibly other registries) must allow for good correspondence, and a population register must provide denominator information to reduce birth and death events to comparative measures in the intercensal period, or some other source of denominator data of equivalent quality.

The paradox of registration - and readers seasoned in this field will likely find it a commonplace - is that the requirements for an informative registration system are absent or seriously weak specifically where the benefits of registration for both improvement of knowledge about health and its determinants, and of health programmes and services themselves are most needed. Indeed, information forthcoming from civil registration today essentially comes from societies about whose health we know a substantial amount from other sources, and who have a relatively good health infrastructure. In a sense, the need for good vital and civil registration where it is absent begs the question.

***Alternatives to universal registration: vertical and horizontal sample registration***

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<sup>6</sup>. For a review of specific epidemiological milestone studies achieved on the basis of cause-of-death certification and death registration, see Moriyama, 1982.

<sup>7</sup>. Moriyama (1982) presents a very clear elaboration of these two major public health applications of death registration with cause-of-death certification, citing specific examples (see, especially, pages 3-4, 5, and 6-8).

If the establishment of a well functioning system of vital statistics on the basis of universal registration is not possible, however, there are alternatives that are perceived by some as solutions, by other as steps intermediary to such an establishment. They include continuous population registers, longitudinal panel studies, anthropological-style in-depth field work and participant observation of small populations, and population "observatories" or "laboratories". One method stands out, however, as superior generally among these alternatives, and that is the sample registration system (see also the discussion by Moriyama, 1982:10-12).

Sample registration is similar in all respects to national registration, except that it involves application of the conventional registration system to a limited area or areas of a country. Sample registration presents all the training and quality control problems of a national registration system - although on a far smaller scale - but it also introduces new ones, such as the definition and rigorous application of registration area boundaries, logistics and expense of travel between areas. Often selected areas are in both rural and urban zones. If the areas are sampled on a statistical basis, they can be interpreted as representative of the entire population, and conclusions regarding the registration area may be extrapolated or generalized to the entire population. It is necessary, however, to conduct surveys of the same population independently at intervals to improve coverage and quality by estimating the needed "calibration" of the registration system: to estimate over and undercount of events, ideally after matching individual records (see, for example, the discussion of the *Chandra Sekar* and *Deming* formula in Shryock, Siegel et al., pp. 834-836). All things considered, the sample registration system is, nevertheless an attractive alternative to assess a number of demographic and epidemiological parameters. Local differences in the progression of births and deaths, however, and birth and death trends and the local epidemiology of areas that are not covered cannot, of course, be deduced.

One approach to sample registration that has the potential of offering a richer informational base and a more inclusive definition of health problems and service needs is to establish the registration sample on the basis of age rather than geographical area. This requires targeting of a specific - or several specific - age group(s) instead of areas of the country and to organize the registration along a horizontal rather than vertical objective of coverage. One obvious choice would be children under five, who suffer a disproportional amount of morbidity and mortality, in particular in countries that do not have and need a better system of registration. In sum, the sample of the population chosen for registration would be all births and all deaths to children under five years. The bulk of deaths would accordingly be uncovered in such a system, whether it were the first phase of introduction of a larger system, or intended as the

sole objective of registration to begin with. The epidemiology of childhood morbidity and mortality - as well as the measurement of infant and child mortality - could be highly developed, and adult mortality could then be estimated on the basis of very good selection of model life tables. An associated, smaller scale geographically-based vertical sample registration scheme for all ages might still be envisaged to supplement information on adult mortality. Furthermore, the need for a dual system to evaluate the reliability and coverage of the registration scheme, and to help regulate it could be met with possible less than a national, statistically representative survey, as in the case of national registration systems, for example with surveys of national sub-samples, on the basis of geographic, ethnic, socio-economic, and other dimensions. Consequently, the registration would be rather national and the survey subnational, whereas for sample, subnational registration, national surveys are generally required.

Such a registration system would bring with it a number of practical problems, while solving others, and would need to be carefully thought out. But one could imagine a form of national mobilization that included both registrar training and motivation of informants and the population at large to focus on the very youngest human resource - infants and small children. At first, the quality and coverage of such registration would likely be poor. A concerted effort by the entire medical establishment and the statistical authorities could have a strong influence not only on the quality of registration and the extent of coverage, but also on child deaths themselves. In effect, sensitization and awareness/education (akin to information, education and communication outreach efforts that are conducted in connexion with family planning programmes) regarding the importance of registering each child birth and each child death - and consequently the importance of each child - could beneficially influence child survival in the course of improving record keeping.

In essence, the establishment of such a system would represent more than the creation and implementation of civil registration and vital statistics; it could form part of a broader national campaign to foster and to safeguard the health of the very young, as a base for the health of the entire society. In view of the fact that resources for health programmes and services, as well as resources for civil registration are highly constrained, the focus in such a scheme could help also to focus priorities and scarce resources. In the case of the Western Asia region, it is notable that an independent regional activity that focusses on infant and child health - PAPCHILD - that is based in Egypt and sponsored by the League of Arab States demonstrates substantial regional capacity in child health research that could be mobilized to consider the feasibility of a horizontal sample registration of vital events and their correlates in the under-five population.

One practical aspect of such a system that could be

implemented is the broad use of lay reporting<sup>2</sup> of deaths, and reliance on verbal autopsy<sup>2</sup> provided by householders and other informants of dead children, particularly mothers, to obtain information on causes-of-death. The utilization of verbal autopsy and of lay reporting could serve not only the immediate ends of improving registration coverage and cause-of-death reporting of children under five, but also the eventual establishment of a nationwide scheme of civil registration and vital statistics. These approaches would tend to put far larger numbers of people in the picture, and to implicate the population more broadly in the campaign to focus on the healthy survival of the very young. Such an approach might also have a beneficial incidental influence on the adoption of family planning, by emphasizing the role of individual children and contributing to alter attitudes and behaviours with respect to family size desires.

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<sup>2</sup>. For a helpful review of issues raised by lay reporting, and a discussion of other technical issues - such as use of cause-of-death data for comparative analysis, difficulties of time-trend analysis in causes-of-death, and problems of using cause-of-death data to determine progress of health programmes in small populations - see Ruzicka and Lopez (1990), especially page 251.

<sup>3</sup>. For a recent review of verbal autopsy with respect to childhood mortality, see Ross, 1992. An earlier review that contributed to development of the approach is Gray et al., 1990. Shortcomings of the method with respect to non-specific syndromes are discussed in Snow et al., 1992. The bibliographies of all three papers are comprehensive.

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