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**DIFFERENT APPROACHES FOR EVALUATING
CIVIL REGISTRATION COVERAGE**

BY

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I. Introduction

The principal aim of a civil registration system is to register all vital events occurring in a country on a continuing basis. Indeed, the system has been defined as "the continuous, permanent, compulsory recording of the occurrence and characteristics of vital events". The functioning of the system in line with its continuing nature can best be ensured through a legislation which makes the registration compulsory.

In this regard, it clearly constitutes a major on-going data collection system. Its features include:-

- a. Use of the "registration method" in contradistinction to the "enumeration method" as used in other data collection systems such as censuses and surveys;
- b. Legal provisions which make the exercise compulsory;
- c. Confidentiality of the registration records;
- d. Designation of agency (ies) responsible for all aspect of the system with clear indication of duties and responsibilities together with arrangements for coordination of the registration and statistical aspects;
- e. Designation of legally responsible informant(s);
- f. Organizational structure which ensures administrative efficiency;
- g. Primary registration units of manageable size and established in locations which would ensure easy accessibility to the public;
- h. Efficient registration personnel;
- i. Registration documents together with definition of topics; and
- j. Public enlightenment and motivation programme together with incentives to promote compliance with the registration law.

The need for the establishment of an efficient civil registration system in a country cannot be overemphasized but the system is in an unsatisfactory state in almost all African countries. A number of the countries in the region, however, have initiated programmes at some point in the past two decades for the improvement of their registration systems but, generally, there has been little or no progress in most of the countries, if not all, which have made the attempt. The poor outcome of the attempts

made so far in the region demonstrates that sustained commitment and efforts are needed to make the exercise worthwhile. On the other hand, the recognized uses of civil registration system underscore the need to ensure its steady development and improvement to maximize the benefits.

Indeed, the vital records from the registration system have legal, administrative and statistical uses. A few examples may serve to illustrate the varied advantages of vital records. With respect to the individual, registration records of birth provide, inter-alia, legal proof of identity, age and nationality while death records provide legal evidence required for some insurance claims relating to deceased persons. In the area of government administration, the records constitute a basis for public health programmes such as those for post-natal care of mothers and children, immunization and control measures against infectious diseases. Further, the records are a major source of vital statistics which are used in demographic analysis and as essential tool in socio-economic development planning.

The vital events which are covered in a civil registration system are: live birth, death, foetal death, marriage, divorce, annulment of marriage, judicial separation, adoption, legitimation of birth and recognition of parenthood.

It is, however, recommended that in any programme for the establishment or improvement of a civil registration system, particularly in developing countries, first priority should be given to setting up procedures for the registration and collection of information on live births and deaths. The paper, therefore, focuses on the coverage of these two priority vital events in civil registration systems.

II. Evaluation of data collection coverage

It is now generally acknowledged that a civil registration system, like other statistical data collection systems, such as censuses and surveys are affected by errors of various types. Thus, it is recognized that there is the need to determine the extent, types and sources of errors in the data that are produced. In line with this recognition, statistical programmes, have involved not only the collection and compilation of the required statistics but also the measurement of their reliability for various uses. Hence, an evaluation programme is considered an essential aspect of any sizeable statistical enquiry; and in this regard, evaluation of a civil registration system is generally carried out in countries with well developed statistical systems. The indications, however, appear to be that no serious systematic evaluation of most, if not all, of the registration systems in the African region have been attempted.

III. Objectives of civil registration evaluation programme

A programme for the evaluation of a civil registration system attempts to measure achievements of the system against the goals relating to the legal, administrative and statistical uses of the registration records. Thus, evaluation exercises mainly measure the accuracy of the statistical data derived from the registration records as well as the completeness of the registration in terms of the different geographic areas and population groups in a country. Other aspects of civil registration evaluation programme include determination of the degree of compliance with procedures including their efficiency and identification of sources of error. Further, evaluation exercises provide a basis for proper use of the registration data as well as lessons/guidance for the improvement of the system.

Thus, civil registration evaluation programmes involve investigation of both the quantitative and qualitative aspects of the registration system. The former relates to the coverage of vital events while the latter refers to the other characteristics of the registration system, notably the responses in respect of the registered events and the persons concerned.

IV. Types and Sources of Errors

The errors measured in an evaluation programme may, be classified into two major groups: coverage and content errors.

Coverage errors are those relating to the completeness of the registration of vital events and they occur because of omissions or duplications. The omissions may be due to the failure of informants to report events or loss of records after events have been duly reported, perhaps during transcription for statistical purposes or transmission of records from local registration centres to the central registry. On the other hand, duplications may arise when the same event is reported more than once for registration purposes or when duplicates of statistical reports are inadvertently included in the count of the registered events. For example, an event may be reported at the primary registration unit at the place where the event occurred as well as at the unit at the place of usual residence of the person concerned. Also, duplications may occur particularly in respect of late registrations without adequate checking by the registration personnel. Generally, however, there are more omissions than duplications in births and deaths registration systems; and this is particularly the case in the African region.

Content errors are errors in respect of the registered event and/or the characteristics of the person involved. They include misreporting of items such as sex, age, place and date of occurrence of the event, cause of death, etc and they may be attributable to the informant's ignorance of the facts or his/her failure to understand the question concerned or inadequate definition of a topic or failure of a registrar to ask the

proper question or record the answer accurately. Other content errors may occur at the data processing stage, particularly during coding.

Both types of errors, coverage and content errors, need to be given due attention in the evaluation of civil registration systems. In this paper, however, a review of only the approaches for the evaluation of the coverage of births and deaths registration system is attempted.

V. Evaluation techniques

The approaches which have been followed in evaluating births and deaths registration which, by and large, are applicable to other vital events, may be classified into two major groups. These are referred to as the direct and indirect methods.

Direct method: This approach is essentially a comparison of the records of different events in a registration system or a matching of records from different sources. Thus, it involves examination of the registration records themselves to determine degree of consistency/divergency as well as the checking of individual records of vital events against corresponding listings or records from an independent source. The latter method is similar to the use of a post-enumeration survey to evaluate the coverage of a population census.

In this respect, the sources of information for the evaluation of the coverage of births and deaths registration systems include civil registration and other administrative and social records as well as completed census and survey questionnaires.

With regard to civil registration records, the register of deaths can be used to verify the completeness of birth registration of infant deaths. This method provides only a limited check on registration coverage but it can throw some light on the efficiency of the system since it relates to events which have a high degree of not being registered. Other administrative and social records which are potential sources for evaluation of civil registration coverage are school enrolments as well as hospital and baptism records.

It is recognized, though, that such administrative records may not provide complete lists of births and deaths and further, due to their selectivity, they cannot be used to assess the overall completeness of the registration system. However, they can either individually or in combination be used to provide some indication of the completeness of registration of certain types of vital events such as the birth registration of school entrants. It is also reported that in the 1970s, Cuba used information from a variety of sources including death certificates, burial records, lists for food rationing, etc to prepare, a comprehensive list of deaths which was then matched with death registration records to determine the completeness of the latter.

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With respect to the use of censuses and surveys, lists of live births and/or deaths are compiled from a sample of the census/survey returns and these are then matched against the records of vital events to obtain estimates of the degree of completeness of the registration of those events. The list of live births from the census or survey is basically the infant population obtained on the basis of the question on age in the enquiry. Alternatively, a specific question on births and/or deaths during a specified period such as three or 12 months preceding the census or survey may be included in the relevant questionnaire.

An application of the method of direct matching of records of vital events with survey returns is the dual record system which involves the collection of information on vital events by replication of the same procedure successively or use of two different procedures. In the use of this method to evaluate the coverage of births and deaths registration system, a periodic vital events field survey is carried out to constitute the independent source of information. The registration itself may be instituted on a probability area sample basis pending the establishment or attainment of a nationwide system. Examples of the method are the sample registration scheme in India initiated in 1970 as well as the Population Growth Estimation experiment in Pakistan and the Survey of Population Change in Thailand, both carried out in the 1960s. In the African region, the limited attempts in the use of this method were in the 1970s and they included the Liberia Population Growth Survey, the Malawi Population Change Survey and the Ghana Sample Registration Scheme. Lately, Ethiopia has also undertaken a study on Sample Vital Registration Experiment in rural areas. All these attempts, however, appear to have been short lived and, with the exception of the Ghana Sample Registration scheme, were mainly regarded as statistical exercises to obtain vital rates.

The method involves case-by-case matching of records from the registration system with the corresponding survey returns. On the basis of the matching, the vital events (births and deaths) are classified into the following categories: (a) events reported in both the registration system and the survey (matched); (b) events reported in the registration system only; and (c) events reported in the survey only. The values of the three categories are then used to estimate the completeness of the reporting of events in the registration system and the survey (or other independent source of information) through the application of the Chandrasekaran - Deming formula.

An essential element in the direct method for estimation of completeness of registration is independence between the registration system and the other administrative records and/or census/survey returns with which the records of vital events are compared. In the case of the dual record system, a condition for valid application of the Chandrasekaran - Deming formula is complete statistical independence of the two data sources.

The direct method is regarded as a powerful tool for the evaluation of completeness of registration since it can provide accurate estimates. Further, its use will

enable the sources of under- or over-registration to be determined and thus facilitate the adoption of remedial measures for the improvement of the registration system.

The method, however, has a number of limitations. The lack of independence between the two sources of data can affect the accuracy of the estimate and in the case of the dual record system it will make the application of the formula invalid. In many instances, it is difficult to achieve complete independence between the two sources.

On the other hand, administrative records are often incomplete and vital events are generally under-reported in censuses and surveys so their use for evaluation purposes may tend to over-estimate the completeness of the registration of those events.

Another major limitation of the direct method is the difficulties relating to the matching procedure. The exercise is laborious and expensive. Further, in countries where children are not named immediately after birth or where multiple names are common or residential addresses are deficient, matching becomes very problematic, if not impossible.

Indirect method: This approach for detecting errors in civil registration involves the monitoring of the operational control and related reporting systems of the registration of vital events particularly with respect to the transmission of reports/records from local registration centres to the central registry and/or the statistical agency concerned as well as comparison of aggregates and rates of different data sets relating to vital events and the application of demographic analytical techniques to check the consistency of the statistical outputs of the registration system.

Generally, therefore, the various techniques of the indirect method for evaluation of civil registration coverage entail scrutiny of progress reports to ascertain their regularity and availability; comparison of trends in the registration of events over time and geographical areas to detect compatibility; analysis of the data from the registration records and the related demographic relationships to determine their reasonableness, consistency and extent of departure from established patterns; and examination of the quantitative relationship between the vital rates derived from the registration system and those from an independent source.

Thus, the application of the indirect method for measuring completeness of births and deaths registration include:

- a. Checking of the preparation of statistical reports and administrative inspection of returns at the different administrative levels of the registration system to determine the efficiency of the reporting system and the level of registration. In this respect, absence of reports for a certain period and/or a registration unit is regarded as a signal of deficiency in the reporting system and/or the coverage of events. Also, the monitoring

of the registration rate, which is the percentage of births/deaths registered out of the number "expected", in each registration unit helps to follow-up any under-registration and to take remedial and/or preventive measures. This technique was used for control of coverage in the Kenya Civil Registration Demonstration Project (1981 to 1984);

- b. Comparison of the number of events registered or crude birth and death rates derived from registration records in two different periods or similar populations or geographic areas. Also, seasonal patterns of registration of events can be compared with corresponding data from previous years to detect divergences.

The rationale of this method for evaluation of births and deaths registration coverage is that any important differences between the two data sets or fluctuations observed through such comparisons give indication of possible coverage errors which need further investigation to identify the sources;

- c. Determination of extent of delayed registration through analysis of the data relating to date of occurrence of the vital events and date of their registration. The proportion of delayed registration out of the total number of the relevant events registered in a specified period provides a rough estimate of under-coverage of the events in previous periods. Hence, if the interval between date of occurrence and date of registration is continuously monitored, an indication of improvement or deterioration of the registration system could be obtained;
- d. Derivation of sex ratio at birth from the registration records and its use as a tool for measuring completeness of birth registration. In this respect, unless the known characteristics of the population of a country or parts of it suggest anything to the contrary, then patterns in sex ratio at birth of 105 to 106 boys per 100 girls indicate reasonable level of completeness of birth registration or the same level of coverage error in the registration of both sexes; and
- e. Comparison of total number of live births or vital rates obtained from registration records with corresponding aggregates and rates from results of a single population census or two successive censuses. This includes the use of indirect techniques developed for estimation of demographic parameters from incomplete or deficient data. In this case, the appropriate technique may be applied directly to estimate the level of under registration of births and deaths; or vital rates estimated from population census data, through the application of the technique, are compared with corresponding rates derived from the registration system

to estimate the extent of registration coverage error. Further, the demographic relationships used in the indirect techniques for estimating demographic measures could be adapted to assess the quality of civil registration data.

With respect to the use of data from a single census, the number of live births registered in the 12 months preceding the census is compared with the number of children under one year enumerated in the census with allowance for deaths among these children during the period.

This method provides only a rough measure of completeness of registration since the difference between the two sets of data may be due to one or more of the following: incomplete registration, age misstatements or under-coverage of infants in the census. In many African censuses, however, errors due to age misstatements and under-enumeration are known to be significant so the applicability of this method for measurement of civil registration is greatly limited and therefore may be used with caution.

Where data from two successive population censuses are available, intercensal population increase can be compared with intercensal total number of occurrences of births, deaths and net migration on the basis of the "balancing equation" for the study of population growth:

$$P_1 = P_0 + (B-D) + (M_1 - M_0) \text{ Where}$$

P_1 = Population at the second census

P_0 = Population at the first census

B = Births during the intercensal period

(ie. interval between P_0 and P_1)

D = Deaths during the intercensal period

M_1 = Immigration during the intercensal period

M_0 = Emigration during the intercensal period

On the assumption that all the data sources (the two censuses as well as the vital and migration records) are reliable, the intercensal population increase (ie $P_1 - P_0$) should be equal to the sum of intercensal births and number of immigrants minus intercensal deaths and number of emigrants [ie. $(B + M_1) - (D + M_0)$]. Differences between this sum and intercensal population increase will be due to under registration of births and/or deaths.

The problem with the use of this method is that in many developing countries, migration statistics are rarely accurate, if available. However, if migration in a country is known to be negligible, then the method can provide reasonable measure of coverage error although separate estimates for completeness of births and deaths registration cannot be obtained.

It should also be recognized that, in practice, there would be errors in all the components of the balancing equation so definite conclusions regarding registration coverage error cannot be made until all the components have been separately evaluated in view of the possibility of compensating errors.

The indirect techniques for estimation of demographic measures from incomplete or deficient data which have been applied to evaluate completeness of vital registration comprise those which are based on the assumption of a stable population and those which relax the assumption of population stability.

The techniques based on the stable population theory include the growth balance equation developed by Brass (1975) and the Preston-Coale technique (1983). Both techniques are used for estimation of completeness of death registration.

The "growth balance equation" compares distribution of registered deaths for ages 5 years and above to the distribution of population, both by 5-year age groups. Ratios of cumulated deaths to the population, by age, and ratios of population at exact age X to the cumulated population at the same age x and over are calculated. These ratios are then plotted and a straight line fitted to the points. The degree of completeness of death registration is provided by the reciprocal of the slope of the line.

The underlying assumptions of the technique, other than the stability of the population are that, there is no age differential in the completeness of death registration and also no age misstatements in the two data sources.

The technique developed by Preston and Coale involves comparisons of age distribution of the population with age distribution of registered deaths. Estimate of the population by 5-year age group is calculated by adjusting registered deaths by 5-year age groups on the basis of the stable population theory and then cumulating the results. The ratio of the estimated population to the actual population provides an estimate of the completeness of death registration. The use of the technique requires information on a census population and registered deaths by 5-year age groups and the stable growth rate of the population.

The techniques which do not assume population stability include the P/F ratio method for fertility estimation developed by Brass, the reverse survival ratio method, the technique of forward projection, the modified growth balance equation developed by Martin (1980) and the technique by Bennett and Horiuchi (1981).

The first two techniques have been used for the estimation of completeness of birth registration and the remaining three for completeness of death registration. Although the techniques are not based on stable population analysis, more information is needed for their application for estimation of degree of death registration completeness. The additional information required are population distribution by 5 year age groups from

two censuses which have the same degree of coverage error and age misreporting. Other assumptions are that there is no differential coverage of registration of deaths aged 5 years and over and there has not been any intercensal migration.

The use of the P/F ratio method to evaluate vital registration coverage is based on the premiss that complete birth registration provides accurate measure of fertility and thus the ratio of age-specific parity data to age - specific current fertility rates from vital registration should approach unity at younger ages if fertility rate has remained constant in the recent past. Under such conditions, deviations of the ratio from unity would be due to incomplete birth registration. Variants of this method applicable to situations where constant fertility cannot be assumed have been developed using cohort analysis.

Reverse survival ratio method has also been used to estimate intercensal births by backward projection of census population aged 0-4 years and the results compared with the number of registered births to determine approximate level of birth registration on the assumption that age reporting is accurate and child mortality estimates are reliable. Such assumptions, however, cannot be made in respect of the relevant data in many developing countries and so the method may be inappropriate for use in such countries.

The technique of forward projection involves the construction of a life table from registered deaths and person-years lived during two successive censuses and use of the life table to project the first census to the time of the second census. The projected population figure is then related to the observed second census population and then the relative under-enumeration between the two censuses and completeness of death registration estimated through regression analysis.

The modified growth balance equation relaxes the assumption of population stability by estimating age segment growth rates from two successive censuses. Deaths by age cohorts from registration records are then compared with the same cohorts derived from intercensal change in cohort size. The comparison provides estimates of completeness of death registration.

The Bennet - Horiuchi technique estimates death registration completeness for ages 5 years and over during an intercensal period. Registered deaths and population growth rates for each age group are used to estimate the expected population by age which is then compared with the enumerated population to determine the extent of death registration completeness.

The various techniques which constitute the indirect method for evaluation of registration coverage have the advantage that their use would enable the extent of completeness of registration to be readily determined as soon as the statistical information of the registration becomes available. Further, the ease of their applications makes them appropriate tools for continuous monitoring of the level of registration completeness and

they can be used at the various levels of the administrative machinery of the registration system to facilitate identification of problem areas for timely redress.

On the other hand, the applications of most of the techniques are limited by the various assumptions, namely, population stability, closed population, accurate age reporting and uniform level of coverage of enumeration in two successive censuses. These assumptions, particularly those relating to population stability, may limit the applications of the techniques for evaluation of African registration systems. However, since many African countries have now conducted at least two national population censuses, greater use could be made of the techniques which do not assume population stability.

VI. Conclusions

The development of a civil registration system is a long-term process and when well developed, it constitutes a major source of vital statistics besides its benefits for legal and administrative purposes. In this respect, it is a major data collection system which should include an evaluation programme as an integral part of the system.

The evaluation programme needs to have clear objectives with indication of types of events to be studied, errors (coverage and/or content) to be measured, time frame for the various evaluation activities as well as the degree of precision and resources required.

As in the case of other aspects of the registration system, responsibility for the evaluation should be properly assigned. The various approaches and techniques which have been developed over the years make it clear that such responsibility could be shared between the civil registration agency and the national statistical authority but with close collaboration between the two bodies and also with other relevant population data producers.

A number of the techniques under the indirect method approach for evaluation which involve comparison of number of registered events with the "expected" number obtained through demographic analytical techniques could be easily applied at the level of the primary registration unit and higher administrative levels to constitute a monitoring mechanism. Thus, the performance of the registration system in terms of coverage of events could be continuously assessed. In this respect, it is also clear that where quick assessment of registration completeness is needed, the approach of the indirect method is most appropriate. The more elaborate techniques under the direct method approach involving matching of records could then be carried out periodically by the national statistical authority.

Finally, the types of data required for the evaluation of civil registration coverage, namely, population censuses, household surveys and administrative records, clearly underscore the need for development of an integrated data collection system involving the different sources of population data to ensure standardization of relevant concepts, definitions and classifications. Such strategy will facilitate the use of the different data sources for evaluation of the coverage of the civil registration system and vice versa.

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