

**REGIONAL GUIDELINES ON
PREPARING VITAL STATISTICS
FROM
CIVIL REGISTRATION SYSTEM**

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1. INTRODUCTION

Vital statistics is defined as a collection of statistics on vital events in a lifetime of a person as well as relevant characteristics of the events themselves and of the person and persons concerned. Vital statistics provide crucial and critical information on the population in a country. For statistical purposes, vital events refer to events concerning life and death of individuals, as well as their family and civil status and include birth, death and fetal death, *dual events* that occur to two persons simultaneously, like marriage, registered partnerships, separation, divorce, , legal dissolutions of registered partnerships and annulment of marriage as well as vertical events concerning descendants such as adoption, legitimization and recognition. The dual events are characterized by the fact that the same event can not again occur with the same two people without a previous change to their status.

Reliable, complete and timely statistics on vital events is an essential and fundamental foundation for policy making, planning, program formulation. A country requires these statistics at national level as well as for various geographic regions and socio-cultural groups. Generally, the main sources for vital statistics are civil registration, population censuses where information on vital events during a reference period are collected and sample surveys.

1.1 Definition of vital events for statistical purposes

The following definitions for vital events have been recommended by United Nations¹ in the Principles and Recommendations for a Vital Statistics System. The use of a standard set of definitions would help easy comparison of the data across the countries without having to make any adjustments for the difference in definitions.

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

All live-born infants must be registered and counted-as such irrespective of gestational age or whether alive or dead at time of registration, and if they die at any time following birth, they must also be registered and counted as a death;

- b) Death: the permanent disappearance of all evidence of life at any time after live birth has taken place (post-natal cessation of vital functions without capability of resuscitation). definition therefore excludes foetal deaths;
- c) Foetal death: death prior to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy. The death is indicated by the fact that after such separation the foetus does not breathe or show any other evidence of Life, such as beating of the heart, pulsation of the umbilical cord, or

1

United Nations (2014) - *Principles and Recommendations for a Vital Statistics System, Rev 3*. Statistical Papers Series M, No 19. para 279.

definite movement of voluntary muscles.

The foetal deaths can be further categorized on the basis of the growth of the foetus. These categorization recommended earlier was based on gestational age of the foetus such as, *early foetal death*, at less than 20 completed weeks of pregnancy; *intermediate foetal death* at 20 but less than 28 weeks of gestation; and *late foetal death*, at 28 completed weeks or more of gestation. However, now it is recommended to replace these classifications on the basis of the growth of the foetus in terms of its weight rather than age². It is recommended that dead fetuses weighing 500 or more grams at birth (or those of 22 completed weeks of gestation or crown-heel body length of 25 or more centimetres if weight is not known) be registered. In addition, for statistical purposes, it is recommended that such terminology as “abortion”, “early foetal death”, and “late foetal death” be replaced by the use of weight-specific measures, e.g., the foetal death rate for fetuses of 1,000 or more grams or the foetal death rate for fetuses weighing between 500 and 1,000 grams etc.)

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Ibid. page 10 (footnote)

- d) Marriage: the act, ceremony or process by which the legal relationship of husband and wife is constituted; The legality of the union may be established by civil., religious or other means as recognized by the laws of each country;
- e) Divorce : the final dissolution of a marriage, that is, the separation of husband and wife which confers; on the parties the right to remarriage under civil, religious and or other provisions., according to the laws of each country;
- f) Annulment: the invalidation or voiding of a- marriage. by a competent authority, according to the laws of each country, which confers on the parties the status of never having been married to each other;
- g) Judicial separation: the disunion of married persons, according to the laws of each country, without conferring on the parties the right to remarry;
- h) Adoption: the legal and voluntary taking and treating of, the child of other parents as one's own, in so far as provided by the laws of each country;
- i) Legitimation: the formal investing of a person with the status and rights of legitimacy, according to the laws of each country;
- j) Recognition : the legal acknowledgment, either voluntarily or compulsorily, of the maternity or paternity of an illegitimate child.

The civil registration law in many countries of the region does not provide for registration of all vital events listed above. The law in many countries does not provide a definition of the vital events. In most cases the law provides for registration of births and deaths only. In some cases it also includes marriages.

Statistics on vital events enables a country to know about changes in the size and structure of the population, excluding such changes through migration. Analysis of vital statistics provides information for setting socio-economic plans and monitoring of health intervention programs. It also provides important measurements of indicator of levels of living or quality of life such as expectation of life at birth and infant mortality rate.

The main sources of vital statistics are civil registration system, population census (with question on occurrence of vital events in the reference period or indirect estimates based on the data collected), household sample surveys, sample registrations. It is necessary to use the same set of definitions in all data collection exercises to ensure comparability of data.

One of the main advantages of vital statistics generated from civil registration system is that it would be based on all events and hence would not be affected by sampling errors that estimates from surveys are subjected to. Hence it would be possible to generate the statistics at local area level where they are sought to be used. The population census is a large operation through which data on several aspects of the population are collected. In almost all countries, the data on vital events collected through retrospective inquiry in a census suffers seriously from recall lapse and reference period errors. The application of indirect estimation procedures for estimating fertility and mortality are dependent on several assumptions and may not provide reliable estimates at sub-national levels or for various socio-economic groups.

Civil registration is defined as the “*continuous, permanent, compulsory recording of occurrence and characteristics of vital events, as provided through decree of regulations in accordance*

with the legal requirements in each country". The continuity, permanency and compulsory nature of the civil registration helps a fully functional civil registration system to be used to generate useful and reliable vital statistics. The advantages of civil registration and vital statistics systems for providing legal documentation of the vital events that are useful for many purposes and for generating vital statistics are not well appreciated by decision makers and this is one of the main reasons for the lack of development of civil registration as a source of vital statistics in the developing world and Africa is no exception to this. This lack of appreciation has resulted in under investment and lack of political commitment to improve the Civil Registration and Vital Statistics (CRVS) system that is essential for recording of vital events, compilation, analysis and dissemination of VS information. In the absence of regular and reliable vital statistics of uniformly good quality, national governments are compelled to rely on alternate sources, some of which may not be of adequately good quality even at national level and not available at all for regions and various socio-economic groups.

The status of vital statistics in the region has been the subject of serious concern among national governments and international agencies for some time. Though civil registration in some form existed in several countries of Africa for some time, they could not be used to generate vital statistics due to their incomplete coverage of the vital events in the country. Most countries lacked the necessary legal framework for compulsory registration of vital events. It was only after the countries became independent, the need for a CRVS system was given a serious consideration. After independence, many African countries made amendments to the procedures, coverage and contents of registration forms. This did not bring major structural improvement in making the laws effective and more relevant to the realities of the countries. There were also set backs in some countries due to civil war and other internal disturbances where the level of registration of the events came down substantially wiping off all the gains that were made.

A series of conferences and workshops were organized in the region in the past. As a result of the discussions and recommendations of these conferences, it has become possible to generate awareness of the importance of CRVS system at various levels within the national governments. With the support of several international organizations, the African Countries have embarked upon the implementation of an *African Programme for Accelerated Improvement in Civil Registration and Vital Statistics (APAI-CRVS)*.

Usually, the first step in the establishment of a CRVS system is the enactment of legal provisions that compel, direct and strengthen the activities of CRVS system. One of the major properties of legislation is to set rules and regulations that compel the public to report the occurrence of vital events within a specified period of time. However, most African countries do not have such strong and functional legal provisions. It is important to note that making changes in the legal framework is difficult and time consuming. Hence, until the legal provisions are reviewed and amended, where necessary, it is necessary to build the vital statistics system on the existing legal system.

The purpose of the Guideline is to enable the national offices entrusted with generation of vital statistics to have a critical review of their activities and identify areas for improvements. Considering that civil registration system itself is in nascent stages of development in many countries, it is better to take the CRVS system together for improvement. This is a companion volume to the publication on improving national civil registration systems, but focusing on civil registration systems. In many countries, the vital statistics and civil registration are dealt by different organizations controlled by different ministries. Hence it was felt necessary that these guidelines on vital statistics can be a

separate volume as it would include discussion on several issues that are of no concern to civil registration organization. Hence many issues discussed therein are not repeated unless necessary for better understanding in a specific context. These guidelines are to serve as a supplement to the handbooks on civil registration brought out by the United Nations³.

Chapter 2 provides an overview of the legal framework for civil registration systems focusing on vital statistics generation and related issues. It discusses the various possibilities in ensuring collection of desired information within the provisions of the existing law.

Chapter 3 discusses organizational structure and related issues. As there are different systems for integrating the work of civil registration and vital statistics, various issues in such scenarios are discussed here. It also discusses the organizational structure for processing of vital statistics data collected through civil registration.

Processing of data including its editing, corrections and related issues are discussed in chapter 4. Computerization of data of vital statistics information in relation to the organization of the civil registration data and various issues are discussed in chapter 5.

Tabulation of data from vital statistics and preparation of reports are dealt with in Chapter 6. Preparation of tabulation plans and prioritizing the tabulations are also discussed here. Chapter 7 discusses evaluation of vital statistics systems for coverage and content. Chapter 8 with causes of death and processing of the data therefrom.

Chapter 9 summarizes the way forward based on the discussions.

2. LEGAL BASIS FOR VITAL STATISTICS COMPILATION

Collection of vital statistics involves collection of information on vital events and characteristics of individuals concerned. Some of these information may be personal and people may not provide them in the normal course unless there is a legal compulsion to provide and also a legal responsibility on the part of the organization to keep such information confidential. The civil registration law that normally form the basis for vital statistics generation should have these elements built into that. Civil registration is defined as “*continuous, permanent, compulsory recording of occurrence and characteristics of vital events, as provided through decree of regulations in accordance with the legal requirements in each country*”⁴. Hence the *compulsory* nature is built into the civil registration system as far as registration is concerned. The protection of confidentiality of personal and sensitive information is also key to the successful implementation of any data collection activity. This chapter discusses the various legal provisions that are desirable and the practices followed in some countries.

Most of the countries of the regions have some legal provisions regarding compulsory registration. Some of them also have provisions regarding a report containing statistics of the vital events to be prepared annually. The scope and contents of the reports are not elaborated in the law and is left to those preparing the reports. In some countries, there are provisions on copies or extracts from civil registration documents to be provided for preparation of vital statistics. In many countries nothing is mentioned in the law about vital statistics directly or indirectly. The following paragraphs discuss various scenarios and possibilities. The possible inclusion of legal provisions regarding vital statistics have been discussed in the volume on civil registration system so as to give a comprehensive view on legal framework.

In general, the civil registration law for a country should provide for the following:

- a) Setting up an organization to manage the civil registration related activities
- b) Appointment of and duties/responsibilities of the registrar of vital events and other officials in the hierarchy. Also specify the jurisdiction of the various officials
- c) Specify who are the informants, i.e., the persons responsible to inform the occurrence of vital events to the registrar
- d) Specify the time period within which the events have to be reported for registrations
- e) Procedures for registration of events reported after the period but within a grace period, i.e., late registration
- f) Procedures for registration of events reported after the grace period
- g) Penalties for not reporting vital events for registration
- h) Procedures for correction of errors and cancellation of events erroneously/fraudulently registered
- i) Items of information to be provided to the registrar for registration
- j) Making regulations for operation of the law and providing detailed procedures
- k) Issue of certificates of registration to the individual concerned

4 United Nations (2014) - *Principles and Recommendations for a Vital Statistics System*, Rev 3. Statistical Papers Series M, No 19. para 279.

- l) Use of registration documents in evidence of the facts concerning the events
- m) Coordination among multiple organization of the government
- n) Compilation and publication of vital statistics

The civil registration laws of many countries of the region are deficient in many areas in including provisions for generation of vital statistics or preparation and publication of annual reports. A detailed discussion on various provisions that are required in the law is presented in the Guidelines on Improving Civil Registration Systems. The United Nations *Handbook on Civil Registration and Vital Statistics Systems – Preparation of a Legal Framework* (Studies in methods No. F.71) provides more detailed presentation on various issues related to the legal framework.

2.1. Legal provisions on vital statistics

The main advantage of having legal provisions regarding compilation of vital statistics is that it would compel the CRVS organization to generate vital statistics. This is important when the organization is under the control of a ministry that does not have much to do with statistics, like ministry of Interior , Justice, etc. When civil registration and vital statistics are handled by different organizations the legal positions can compel the civil registration organization to provide necessary support and cooperation for compilation of vital statistics.

Some countries may have legal provisions regarding the top level structure of the civil registration organization without having any provisions regarding vital statistics organization. Here, it is necessary for the Civil Registration Organization, NSO or the government to provide due attention to the compilation of vital statistics and set up a system for vital statistics. It may run parallel to the civil registration organization to some extent, but not necessarily, down to the lowest administrative level in the country to which the civil registration organization extends. The NSO or vital statistics organization may not require to reach to that level in its other functions and providing it for compilation of vital statistics alone would not be economic.

If there are no provisions regarding vital statistics, the NSO/civil registration authorities should take up the matter at the appropriate forum within the government (the CRVS coordination mechanism, if already established) to include this aspect when the law is amended next time. They should also impress the authorities to issue necessary regulations for this purpose so that they can take up the work with sufficient authority in the meantime. In general, if vital statistics is not dealt by the civil registration organization, the National Statistical Office (NSO) should take up the matter for setting up the following through regulations immediately and to get necessary legal support for that later.

- a) The need to generate vital statistics based on civil registration data should be recognized and the law/regulations should specifically require generation of vital statistics
- b) The responsibility to generate vital statistics should be clearly specified as that of either NSO, the CRVS organization (i.e., vital statistics and civil registration are part of the same organization) or a third organization (like Bureau of health statistics).
- c) Where the vital statistics and civil registration functions are handled by different organizations it is necessary for the civil registration organization to hand over a copy of the registration records or establish some other mechanism so that the information relating to individual events reach the VS organization for compiling the statistics. While the law can mention this requirement in broad terms, the details would be better mentioned through regulations. This

would help making changes in the process easily, when necessary. Changes may be required depending on technological changes for data processing and civil registration.

- d) It may also be better to include some provisions in the regulations regarding the form and content of the reports to be prepared on vital statistics.

If vital statistics and civil registration are dealt by the same organization, then the NSO should impress the government that the need to generate vital statistics report should be part of the civil registration law itself. This would be useful to ensure that the the civil registration organization does not neglect this aspect.

2.2. Information collected

Compilation of useful vital statistics depends also on the availability of information in the documents. In most of the countries the law does not specify the information to be collected during registration. It also does not prevent the national CRVS organizations from collecting information in addition to what is required to register a particular event and satisfy the legal requirement of registration. However, it may be necessary to provide a legal support to the collection of specific information at the time of registration. These can be achieved through regulations in most countries. Irrespective of whether the vital statistics is handled by the civil registration organization or not, NSOs should get involved in the decisions regarding the information to be collected and ensure that all information that are relevant for generating useful statistics are included in the reporting forms.

The definitions of the items are also important to ensure that the statistics are comparable internationally. Some of the definitions, like that of the vital events, are sometimes mentioned in the law or regulations. It is to be seen that they are aligned to the definitions recommended by United Nations (See chapter 1 for the definitions of vital events). If any other items are defined in the law or regulations, it is to be seen that they are consistent with international recommendations.

2.3. Process of compilation of vital statistics

Another area where legal provisions would be of immense help is in establishing the process of compilation. In some countries the law provides for preparation of a copy of the report of vital events for the use of the vital statistics compilation. In the current level of technological development in many countries in the region, this may be a good option. However, having this as a mandatory requirement in the law needs review as and when the country develops enough facilities so that such physical copying can be done away with. It may also be possible to do away with such physical copying if the CRVS law or some other law in the country provides that a copy in electronic form would be deemed to be a copy for all purposes where a copy of the document is required. In any case access to the civil registration records in some form by vital statistics organization is necessary for the generation of vital statistics. It is better that the process of such access is detailed through regulations. Possible options are,

- a) Additional copy(ies) of the report of vital event is/are prepared with one copy exclusively for use by the vital statistics organization.
- b) Registrar to make an extract of the information from vital events reports/registers and the same are channeled to the VS organization.
- c) The basic compilation work is got done manually through the registrar. The basic tables are

then sent to VS organization. (This process, however, severely restricts the capacity for tabulation as the registrars can not do too many tabulations and compiling the the results from all registrars would also be a cumbersome process).

- d) Reporting forms to have a detachable portion containing information of statistical importance that need not go into the register as well as some information to be included in the register. After registration is complete and ensuring that this part of the form is complete, it can be detached and sent for compiling vital statistics.
- e) The basic registers are provided for vital statistics compilation for their use for a short period after closing the register at the end of the year. This should be resorted to only if vital statistics is handled by CRVS organization. The safety of the documents and confidentiality of information have to be taken care of.
- f) Where the civil registration documents are computerized:
 - i) If the information are put on a computer network then the vital statistics organization can be given access to the network for the purpose of generating tables from the database without having access to individual information.
 - ii) Alternatively, the data required for vital statistics generation can be extracted and provided to the vital statistics organization. The identity of individual events can be masked in such cases to keep confidentiality.

Whichever option is appropriate for the country, it is better that these are indicated through regulations rather than through the law.

2.4 Confidentiality

As mentioned earlier, confidentiality of individual information is key to getting correct and complete information during the registration process. The law should specifically assure confidentiality of individual information. Many countries developed their legal framework for civil registration without keeping in view the use of civil registration documents for collecting additional information for statistical purposes and compilation of vital statistics therefrom. So the law does not mention anything about confidential nature of the information collected. It is necessary that confidentiality conditions are built into the legal framework.

Including confidentiality provisions in the legal systems would be a time consuming process. In the meantime, regulations can be issued to specify that certain items of information collected during civil registration process are for statistical purposes and would be used only for such purposes and no such personal information would be released to a third party without the individual's consent.

2.5 Reports

Preparation of periodic, preferably annual, reports of vital statistics should be one of the essential functions of the vital statistics organization. It is possible that the law specifies the periodicity and broad contents of the reports. In some countries the responsibility for preparing such reports have been given to the head of the civil registration organization. If the vital statistics is handled by another organization then it may be necessary to reassign this responsibility to the head of the vital statistics organization. This can done through the law or through regulations. Apart from vital statistics the reports should include an analysis of completeness of registration, trends in coverage levels,

geographical variation in coverage, etc., that would help the civil registration organization and the government to plan for further activities to improve coverage. The essential items to be included in the reports may be mentioned through regulations if not already specified by the law.

2.6. Other laws relating to statistics

Some of the countries of the region have laws regarding statistics. Though these may be general in nature, the organizational responsibility of various for specific types of statistics are indicated in some of these laws. The CRVS law has to be consistent with such laws wherever available. It is also possible that the confidentiality clauses in such general statistics laws are more detailed. In some countries such conditions mentioned in the statistical law may be applicable to all statistical activities. If nothing is mentioned about the confidentiality in the CRVS laws, it may be possible to say that such conditions as indicated in the statistics laws would apply to all statistical activities connected with CRVS.

3. ORGANIZATIONAL SET UP AND RELATED ISSUES

The set up of the organizations in charge of vital statistics and civil registration and their interaction are important components of the CRVS system. Unless they function like a single unit, the efficiency of the system to generate useful vital statistics in a timely manner would be seriously affected.

Normally the civil registration organization would have a nationwide organizational set up as it would be reaching down to the lowest possible administrative levels. On the other hand the vital statistics organization, whether it is part of the CRVS organization or NSO, would be reaching down to at most sub regional level only. Another important difference in the organization is that while most of the lower level functionaries in the civil registration system would be doing the civil registration related activities on a part time basis, the NSO or VS organization would be having full time statistical staff. Even if the VS organization is part of a single CRVS organization, this should normally be the case. Coordination between both is essential in the development of several aspects of CRVS system. The civil registration organization may be nationally or sub-nationally organized. In the latter case, the functions of the organization would be divided between the national organization and regional organizations, with the national organization charged with the responsibility to coordination, standardization, etc.. On the other hand in most countries of the region the NSO is centrally organized with its own branch offices handling the work.

The important issues that need to be looked into when deciding on the organizational set up for vital statistics compilation are:

- a) flow of records from registration centers to the vital registration agency
- b) points of interaction between civil registration and vital statistics agencies
- c) involvement of staff of vital statistics organization in efforts for improving quality of data

As the lower level staff actually involved in registration may be from a different government organization compared to those in the higher echelons of the civil registration hierarchy, the transfer of records may involve officials from a third organization as well, though they carry out functions under the civil registration law. If vital statistics organization does not have offices at low levels, then it may not be possible for the office(s) at higher geographic levels to monitor receipt of the documents and correspond with so many registration centers spread over a large area. Hence one or more levels of consolidation may be necessary before the required records are handed over to the vital statistics agency. The work of compilation would start from the point at which the records are received in the vital statistics organization. Hence the organization should be set up in such a way that it can handle the work efficiently. The following paragraphs discuss some of the possibilities and related options in detail.

3.1. Headquarters of the National VS organization

In most countries the national VS organization would either be a part of the CRVS organization or a part of the National Statistics Office (NSO). A third option is to have a National office of population statistics that includes both vital statistics, demographic sample surveys and well as

population census. In all cases the vital statistics organization needs to be well organized with sufficient expertise to handle the statistical activities relating to vital statistics compilation and tackle all related technical issues. It should also have personnel to handle data processing activities. This may be a division of the NSO to cater to all data processing for the NSO or a separate unit for handling vital statistics. Since the vital statistics related data processing would be a regular activity it needs to have sufficient capacity to handle the VS related work without affecting other activities.

The national office, either on its own or in conjunction with office of population statistics, needs:

- a) Expertise in civil registration law and procedures
- b) Expertise in demographic analysis of vital statistics data.
- c) Data processing expertise and facilities - should be able plan data processing and should be able to keep abreast of technological changes
- d) Ability to manage transfer of information/records from civil registration organization and control the entire process
- e) Coordination with other ministries and organizations that use vital statistics data
- f) Coordination with civil registration organization
- g) Expertise in evaluation methods

The vision of the office should be to bring out statistics in an accurate, reliable and timely manner. If the VS organization is part of the CRVS organization that is headed by a general civil service person, then the head of the VS organization should be a statistician.

The national VS organization should ensure that the staff engaged by it has exposure to the latest techniques of evaluation of civil registration, general issues in statistics and data processing. They should also be able to do simple data processing tasks themselves so as to generate tables and prepare and run simple edit checks on the data. This would make them less dependent on the data processing experts.

Where there are no lower level offices of the VS organization, then the headquarters should also be taking care of all the functions listed for the regional/sub-regional offices.

3.2 Regional and sub-regional level office of VS organization

Regional or sub-regional level offices of the VS organization, where they exist, need to be more of operational centers rather than those who decide on policies for data processing or dissemination. Depending on the workload the data processing activities can be distributed to either the regional offices or to sub-regional offices. If the overall workload is low, this activity can be done at the national headquarters itself. However, this activity is different from the activities mentioned earlier to be handled at the headquarters organization.

The offices would have the following functions with regard to vital statistics:

- a) Coordination with designated offices of civil registration for collection of vital statistics documents
- b) Organize the documents and store them

- c) Verify the documents for completeness and correspond with the civil registration office where necessary
- d) Check the documents for correctness of contents and in case of errors that can not be corrected, take up the matter with the CR organization. The matter may also be taken up with headquarters to ensure that the other CR and VS offices are also sensitized about the possibility of same error occurring there.
- e) Organize coding if necessary and data entry of documents
- f) Run computer edit checks and identify errors if any that needs to be taken up with CR organization.
- g) Finalize the data
- h) Either transfer the data to headquarters or tabulate the data and send the results
- i) If tabulation is done in regional offices, then organize checking of the tables before sending them to headquarters
- j) Inspect registration work to identify source of errors in the information collected.
- k) Provide support to training programs organized by civil registration organization for the registration staff
- l) After specified period, dispose of the paper documents received from CR office.

The processing of civil registration data would require computer facilities. The computerization of civil registration data can be handled in different ways depending on the availability of facilities and volume of data.

Even if VS organization is a part of the CRVS setup in the country, and it has regional offices which collect and compile data, most of the discussions above would still apply, except that the coordinations would be with other units within the same organization.

3.3 Data Processing set up

The VS organization would get data from the civil registration system. It may come in one or more forms - as computer files, copies of registration documents or as tabulated data or they may be given access to the data in the servers of the civil registration organization. These would have to be put together and processed for compiling vital statistics. The organizational structure required for this depends on the method of data transfer from civil registration organization to vital statistics organization.

If entire civil registration data are computerized in a fully or partially automated system then the data would be transferred as formatted computer files. The format of the data files would be mutually agreed between the organizations. In this case the VS organization would only need a few data processing professionals, the number of professionals depending on the number of offices of civil registration that would be sending data rather than the volume of data itself. Their job would include;

- a) checking of the data for completeness,
- b) performing edit checks and sending the error lists to technical staff of VS organization
- c) perform imputations, examine statistics of imputations and finalize the data in consultation with

subject matter specialist of VS organization

- d) prepare tabulations and help specialists of VS organization to perform analysis

The personnel should be trained in basic issues relating to civil registration and vital statistics as the the CRVS system is different from censuses and surveys of which the staff may have some experience.

If the copies of civil registration records are being sent to VS organization for processing, then the requirements would be different as the work would involve manual editing, coding, data entry, computer editing, imputations and tabulations as well as to manage records. Staff would be required for manual editing, coding and data entry. This would be a manpower intensive work. The organization should estimate the number of persons required for this work carefully taking into consideration the expected number of events to be registered. However, the actual number of persons used would also depend on the completeness of the registration. The number of personnel required would depend on the volume of data and time period within which the work has to be completed for timely preparation of the reports. The data processing professional would be required to do all the functions as in a fully automated system and also to prepare and maintain software for data entry / verification.

In case the data are coming to VS organization as prepared tables, it may be in paper form. It would necessitate some data entry personnel depending on the number of tables to be handled, rather than the number of registrations. There would be very little amount of work for data processing professionals in this case.

The entire civil registration data may be maintained by the civil registration organization on its servers. If the VS organization is given access to the database for extracting necessary data, then the requirement of data processing staff would be as in the case of a fully automated system.

3.4 Coordination

Generation of vital statistics involves coordination between vital statistics office and the civil registration office. As the civil registration functionaries may have been drawn from various arms of the government, this means coordination with all such organizations involved. Coordination mechanisms for effective coordination among various government organizations at national and regional level where required, has to be established. This mechanism is a broad based one that would look into all aspects of the civil registration system. Either the same committee or a sub-committee or a different committee needs to be established for effective coordination between the civil registration functionaries and vital statistics officials. This committee needs to look into and take decisions on the following when there are no clear legal provisions:

- a) The form of providing information for vital statistics compilation
- b) Periodicity of providing the documents to VS organization. This should be decided in such a manner that there are enough documents to transfer and also that all documents are not handed together at the end of the year.
- c) The level at which the civil registration agency should collate the information and transfer to the VS organization
- d) If there are different geographic jurisdictions for offices of CR and VS organizations at the same level, designate offices that would correspond each other
- e) Inspections that VS organization staff can make on the CR work. If necessary and feasible,

designate them under the CR law for this purpose

- f) If the responsibility to prepare the report is that of the head of the CR organization, then the modalities to be followed.
- g) The issues of timeliness and procedure for all concerned to comply with the timing are also to be decided. Responsibilities should be specified for various officials
- h) Tables to be generated
- i) Form and content of the reports
- j) Consider the annual report before its submission to government or publication
- k) The VS organization should bring out the frequent errors that have been noticed in the data and the possible corrective measures to improve the situation should be arrived at for implementation.

It is necessary to ensure that both civil registration and vital statistics organizations work together as one organization for the purpose of generating vital statistics in an accurate and timely manner.

4. PROCESSING VITAL STATISTICS DATA

Generation of vital statistics would involve processing of data collected during the registration process. It is necessary to collect information about a number of characteristics of the event and the persons involved for this purpose. With detailed information relating to the individual actors relating to specific events being available, it would be possible to generate useful statistics for several population groups. However, it would also bring in the necessity for computerization of data so that all tables can be brought out easily and accurately. This puts a restriction on the method of compilation.

If only a few simple tables only are to be generated, then it can be done through a manual process. The registrar can be asked to generate the same at the end of the year and provide those tables to the next higher level for consolidation. This would not require much computing facilities at various levels and can even be done manually. However, the scope of such tabulations are highly restricted. The process is error prone as many of the people involved may not take interest in the work and may not even have a clear understanding of the procedures for tabulation. It is also possible that several classification errors take place during tabulations. Hence such a process is not recommended, except at initial stages of development of the civil registration system when enough computing facilities are not available in the vital statistics organization.

Alternate methods of compiling vital statistics involve computerization of the entire data that were collected. The method and place of computerization depends on the structure of the CRVS organization, type and design of reporting forms, number of copies made and availability of infrastructure for computerization.

4.1 Fully automated system

In a fully automated system all actions after the receipt of report on a vital event is done over a computerized system. Such a system would require certain infrastructure and other facilities including those below.

- a) A national network of computers that connects all registration centers, the intermediate and national level civil registration and vital statistics offices.
- b) Legal provisions in the country, not necessarily in the civil registration law, should support keeping registers and other documents in electronic form. In many countries of the region the law in the current form requires the registrars/ informants to make multiple copies of the register/report. These would become unnecessary if entire work is computerized. Hence for copies also the provisions should support use of electronic versions.
- c) All forms designed for easy computerization
- d) If institutions are informants under the law, those like hospitals that have large number of events should also be included in the computer network so that they can report events directly through the network.
- e) All registration centers have computers, printers, scanners and uninterrupted power supply.

- f) Though all the data in a decentralized system would be entered through the same computer network, it is not necessary that they are all going into the same database. It can also be stored as separate databases for each region in a decentralized system. However, it is recommended that everything is kept in one database so that it is easy to ensure safety of the data. It is also to be noted that small regions in a country may not have much data to go into a separate database.

The entire information collected in the reporting forms needs to be transferred onto a database. These include the information collected for statistical purposes also. Actually, there can be two databases, one containing information that are part of the registers and another one for all statistical information. Apart from identification particulars, some information like dates of occurrence and registration, age of parents for birth, age of the deceased for death, etc., would be common to both the databases. Scanned copies of the reporting forms, certificates from medical practitioners, etc., should form the archive to be created simultaneously. In case of oral reporting, the information can be directly entered into the database and a printout of the same can be got signed by the informant (and witnesses if any). There should be a system of entering the data and its verification by someone else to ensure that the data are correct and also to ensure that there is no foul play. It can later be scanned and added to the archive. For security purposes, it may be ensured that the registration is deemed to be done only when the reporting forms have been archived. This would ensure that no events are registered without a signed reporting form.

If medical institutions and similar informants are provided facility to enter data directly into the database, they should send the original reporting forms to the registrar and the verification be done in his office to complete the registration process. The forms can also be scanned there.

The computer software in this case should have at least the following functionalities with regard to generation of vital statistics.

- a) To acquire data from the network nodes in online and offline mode. The later would be useful in times of connectivity failure, etc., so that the work is not get interrupted.
- b) Facility to make corrections and cancellations as per the legal provisions. Cancellation/ correction should be done in such a way that if necessary the original entries can be recovered. If need arises, it should also be possible to identify the users who made specific entries.
- c) It should be possible to transfer the database with statistical information to the VS organization. Alternatively, the VS organization should be able to use the same network for the purpose of statistical compilation.

As the registration centers would not have enough workload to fully use the equipments full time there should be other computerized activities that use the same equipments. However, when it comes to compilation of vital statistics is concerned, since only a few computers would actually be used to generate the tables such a restriction does not apply.

It would be possible to design the system in this case with different alternative processes for generation of vital statistics. In all cases the edit checks on individual records are done at the time of data entry. The possible options are:

- a) At the end of every year a specified set of tables that go into the annual report on Vital Statistics is automatically generated and provided to the VS organization. In this case it would not be possible to generate new tables as and when the VS organization requires as the software personnel may be busy with other projects.

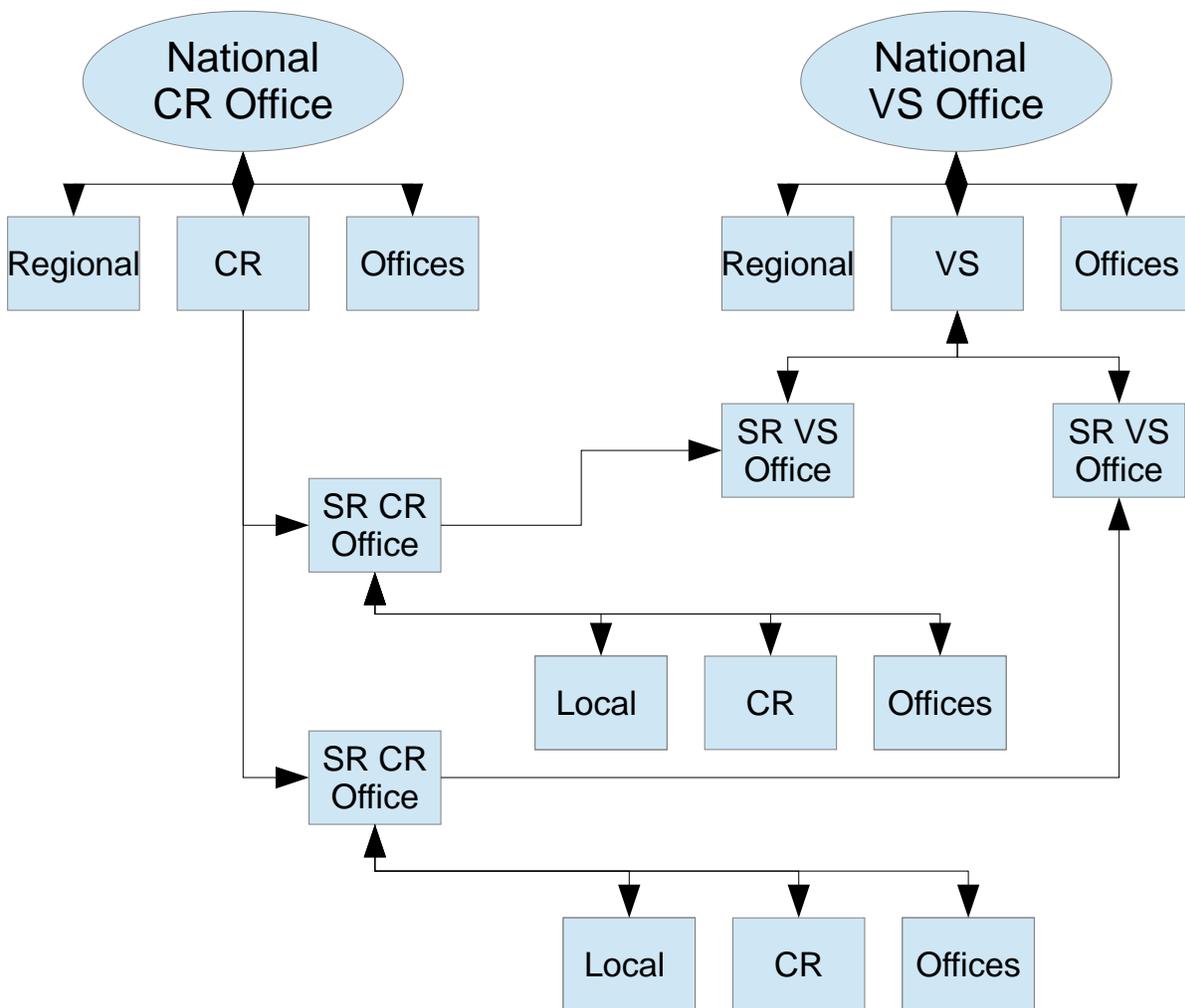
- b) The VS organization has access to the database and can generate whatever tables they would like to include in the annual vital statistics report. This would require expertise on software at the VS organization
- c) The data required for vital statistics compilation is extracted from the database and sent to VS organization for generating the tables. This would also require data processing expertise at the VS organization.

For most of the countries one these should be the objective. However, except in a few countries, it would not be possible to have such systems on a countrywide basis in the immediate future. If some areas of the country, like large urban centers, have a fully computerized system, then the data from such areas have to be handled in one of the ways mentioned above and the VS organization can either merge the data or the results with those for other regions to finalize the results.

4.2 Partially automated system

Unlike in a fully automated system, all the data do not get computerized simultaneously with the registration process in a partially automated system. A partially automated system also involves

Figure 4.1: Illustration of flow of records for generating vital statistics



computerization of the entire data from the registers. The computerization may be partially on line and partially off line. It may not include the data collected specifically for statistical purposes. Such a system can be designed to provide for computerization of vital statistics compilation also.

Computerization is done at some convenient locations. There would be some time lag depending on the process used for computerization. The records used for computerization can be dependent on the legal requirements. In some countries, the law requires multiple copies of the reporting forms to be prepared with one copy being given to the vital statistics organization for compilation of vital statistics. In such places, this requirement can be avoided if the computerization can include the statistical information also. It would also help to reduce expenditure on paper, printing and communications on account of the copy for VS organization. Making the computerization comprehensive would require the VS organization or the NSO taking up the matter in the national coordination mechanism.

In some other countries there may be a detachable portion of the statistical information to be used for data processing. It is designed to be computerized at the VS organization. However, if the civil registration organization is computerizing the information going into the registers, it would be better to include the statistical information also. It would help saving at least the cost of sending all the forms to the VS organization.

In countries where there are no legal provisions as above, it would be difficult to generate vital statistics in time as it would have to be done on the basis of entries in the register that can not be taken away as it would be required at the registrar's office to provide citizen services. An alternative is to use the reporting forms. However, where reporting has been done orally, it may not have been necessary to fill up the reporting forms. Hence the computerization would exclude such events, if the reporting form are used as the reporting forms. An alternative is to use reporting forms for computerization and use the entries from registers only for events reported orally.

In all the above cases if the entered data are stored in servers that are accessible over a network, then the process of getting data for compiling vital statistics can be any of the options discussed for fully automated systems. The main difference is that it may take some time after the end of the year for the computerization to get completed and make the data available for vital statistics generation. Even then computerization in an integrated manner would be more advantageous from a management point of view as it would result in cost reduction while giving better results.

4.3 Manual registration system

If there is no computerization of the registration system at all, then the process has to be different. Since it is likely that such a situation would last for a comparatively short period only, the infrastructure for processing should be carefully planned and developed so that the investment is not lost. There are several options for processing the data depending on the legal system and the registration process. It is necessary to design the process in such a way that it does not interfere with the registration process or the put undue demands on the registrar. It is also possible that in some countries computerization of some kind is possible in some areas. In such cases, for compilation of vital statistics, the processes in different areas need to be integrated well.

The possible alternative processes for generating vital statistics in case of manual registration processes are:

a) Where the law provides for a copy of the vital event reporting form for vital statistics agency, that copy is used for data processing

b) Registrar copies the relevant particulars either on to a form with provision for multiple number of events or to cards with one event per card and these are sent to vital statistics organization

c) At the end of the year, the registrar prepares the tabulations required for the events registered by him and sent it for consolidation.

If the vital statistics agency has computerization facilities then the records received by the agency through options (a) or (b) can be used for computerization. If it does not have sufficient facilities for computerization, then cards mentioned at (b) above can be used to generate tables through manual sorting. This would be a more flexible alternative than the information from multiple records copied to a form. Though the forms obtained at (a) can also be used for sorting, it is possible that sorting may be a cumbersome process due to the size of the form. It may, however, be noted that copying information to cards may make it necessary that coding be done by the registrar and they need to be trained on this aspect. There would also be a need to have quality control of coding by inspections.

If computerization is being done at the VS organization, then the option (a) would be preferable over the others as the copies of the reporting forms would be prepared by the informants and hence are likely to be less error prone. On the other hand, if registrars are to copy the particulars, the chances of errors are higher as they have many other responsibilities and may not devote enough attention to the copying work.

The flow of vital events records to the vital statistics agency from the registrar is also important in this set up. Clear procedures need to be established regarding the frequency of the the dispatch by the registrars and the path the documents need to take. In some countries the law may have specified that the the copies meant for vital statistics agency be handed over at certain level of the vital registration organization. Higher the level of CR organization where the records are given to VS organization, the effort of monitoring at VS organization would be slightly less. However, for the CRVS system as a whole, there would not be much gain as the monitoring work has to be done within the civil registration organization.

When both civil registration and vital statistics organizations are nationally organized, the lower levels are under direct control of the national level organization. In case of civil registration organization, however, personnel from multiple organizations would be involved. Implementation of decisions taken by the coordination mechanism at the national levels is slightly easier as representatives of all concerned organizations are party to the decisions. The ownership of civil registration documents would remain with the national government and the necessary regulations can be issued by the national governments. It can be presumed that the civil registration organization has several levels, like national, regional, sub-regional and local. The vital statistics organization on the other hand may have only national, regional and sub-regional levels. In most cases the sub-regional levels of VS organization would combine areas belonging to multiple number of sub-regions of the CR organization. In such cases there is a possibility that in some of the sub-regional offices of CR and VS organizations may have boundaries cutting across each other.

Whatever be the type of records being transferred between the organizations, it would be easier to manage the transfer at sub-regional level. The number of registration centers being handled would be the smallest at that level. The Civil registration organization can direct the functionary at subregional level to collect the records from the registrars and segregate the those meant for other levels of CR organization and those meant for VS organization and transfer the records to the appropriate office. If the boundaries of the sub-regional office of VS organization cuts across that of the CR organization, there should be a mapping of the VS office to which each CR office should transfer the records. The records may be transferred to a higher level office of VS organization for further processing.

In general, the flow of records for generation of vital statistics may be as indicated in Figure 4.1. In this illustration the level up to which the records travel within the Vital Statistics organization would depend on the availability of facilities for data processing. If facilities are available at a lower level then the data can be processed there. This would help avoiding unnecessary communication expenses and need for large storage facilities at places where the higher level offices are located. Even when the civil registration is regionally organized with the regional offices having some amount of autonomy, the system as indicated in figure 4.1 will not change. In the rare cases where the VS organization also is regionally organized, the processing would be done within the regions and only final results would be transferred to the national level organization.

4.4: Data processing infrastructure

The institutional structure for data processing has been discussed earlier as part of the organizational set up. The data processing activities would also require data processing facilities. As indicated earlier tabulation of data can also be handled manually, if only a few tables are required. However, with modern technology, it would be economical to use computers for processing the civil registration data. Computerization of data processing is not as complex an issue like computerization of civil registration functions.

The requirement of data processing facilities to handle vital statistics would depend on the number of vital events and the level of registration. Even if the country is large, if the level of registration of vital events is low, then the number of records to be processed would not be high. So if the country is embarking on revamping the civil registration system and setting up data processing infrastructure, it should consider the possibility that, in spite of all the efforts the country may make, it would take some time to achieve high levels of registration. Hence it is better to set up minimum facilities at the beginning and then increase it as the level of registration increases.

As the facilities required with the Vital Statistics organization in the event of fully/partially automated registration system is very low, the plans for setting up infrastructure to process civil registration records, should be integrated with the plans for computerization of the civil registration operations itself. This would ensure optimum utilization of the processing capacity. If the vital statistics organization is part of the NSO, then it is possible that any excess capacity can be utilized for other activities of the NSO. In such a case the computerization of vital statistics processing activities should go hand in hand with with computerization of other data processing activities of the NSO. Otherwise there is the danger of some urgent activity being given priority over others and delays occurring in the results.

There may be areas, like large urban centers, where the system is fully or partially automated while everything is done manually in the rural areas. In such cases the computerization of data would

also be a combination of procedures. The data from fully/partially automated system would be merged with data computerized manually at the data processing centers of the vital statistics organization. The VS organization should get involved in any initiative for computerization of civil registration, be it from the civil registration organization or from regional or local governments.

The facilities required would depend on the structure of the organization handling vital statistics. If it has regional/sub-regional offices handling the work, then one option is to have a system of networked computers and centralized databases. However, if the offices cannot be networked due to technical reasons, then data can be computerized and cleaned at the regional/sub-regional offices and send over to the higher level office that has access to the computer network.

In countries where the civil registration system is organized regionally with the regional governments having full authority over the operations, it may be necessary to have the vital statistics generation being done at regional level. This would help the regional governments take advantage of the improvement they bring in the civil registration system. The availability of good quality data in some regions would also help to sensitize other regions on the need to improve their own systems. It may also be noted that in the absence of any law to the contrary, the ownership of civil registration data in regionally organized systems would be that of the regional governments.

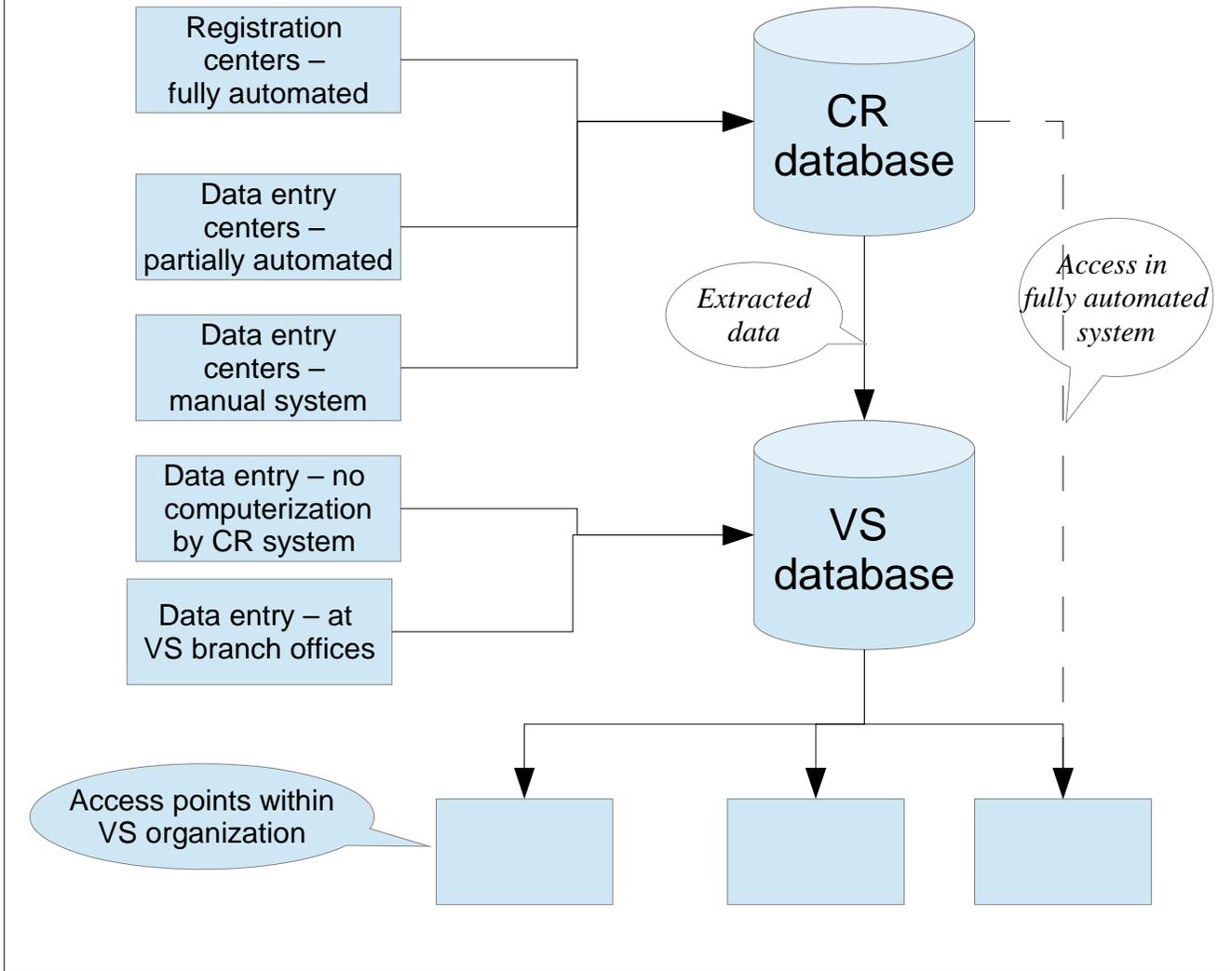
At the national office (regional office if the civil registration system is regionally organized), it is better to keep the data in databases that can be accessed by the concerned staff. If there is a network of computers at the national office, then it is easy to provide access to authorized staff to the database, without giving them access to the database server or giving them copies of the data. This would also help ensuring security of the data. As many of the national governments have financial constraints, it is strongly recommended that open sources database softwares be used for various operations. Figure 3.2 provides an illustration of a data processing system.

4.5: Confidentiality

Maintaining confidentiality of data is a fundamental issue in official statistics and vital statistics data is no exception to that. Unlike many other data collection systems, the civil registration system has some data that are public. For example, the fact that a child has been born to a particular woman on a specific date would be known to many people. Similar is the case with deaths- the name of deceased, sex, date of death and place of death are public knowledge. However, there are many other information collected during the registration process including age, education, occupation, ethnicity, etc.. These information are of personal nature and many people may not like them to be made public. Hence they have to be kept confidential.

In a fully computerized system, it is easy to keep confidentiality by restricting access to the information with the identification. While the registration officials may need the identity of the individuals concerned, that is not the case with the vital statistics staff. Hence when they are given access to the data or are provided copies of the data, the identity of the individuals can be concealed. Instead, the individual events can be identified by pseudo registration numbers. In addition it can also be stipulated that no tables would be published by the VS organization for a geographic region or for a community or any other sub-division of the population, unless there are a minimum number of events for population in that category.

Figure 3.2: Data processing system for VS



5. COMPUTERIZATION OF DATA

Computerization of data involves several steps – manual editing, coding transcribing data to electronic media, editing and imputations. The data that have been made available for processing may contain errors. These include errors in the responses, errors generated during copying and data entry. If multiple copies of the reporting forms or registers are prescribed by the law, then two types of errors can occur – one due to copying if copying is done manually and the other due to use of carbon paper of any kind. Depending on the number of copies required to be made and the copy provided to VS organization, the legibility of the entries would be an issue. These have to be corrected before processing the data. The data entry errors can be avoided through a verification process being part of the data entry system. The process of editing and corrections depend on the process of registration to some extent.

5.1 Coding and Editing of data

Coding of data involves coding of data items and coding of the location descriptions. If a code structure has not been developed for geographic locations for use by both CR and VS organizations, one need to be developed for VS organization at the earliest. It should be better to consult the CR organization and other participating ministries and organizations so that it is widely accepted. If a geographic code structure has been developed for census, it may be possible to use the same. However, it has to be ensured that the administrative boundaries of the Registrar's jurisdictions are clearly identifiable in terms of codes.

One major issue in coding of geographical areas in many countries is frequent changes in administrative boundaries. Many a times intermediate administrative units like districts are divided further or reorganized. Similarly, lowest units may get merged into adjacent towns. Changes in location codes would make it difficult to locate older records and thus citizen services would be affected. As civil registration system is permanent, the code structure needs to be developed in such a way that it can take care of such changes for significantly long period.

Coding of data items wherever necessary has to be done on the basis of clear instructions and the code structure should follow international standards and classifications issued by WHO, ILO, etc.. It would be advantageous to have a manual editing and coding before computerizing the data. However, in fully computerized systems, coding may have to be done during data entry using carefully prepared drop down lists.

The nature of edit checks depend on the items on which information have been collected during registration. The checks should identify missing values where a value is expected and those values which are out of range. There may be items that are completely independent of other items while there are items that are related. For example the sex of a new born child is independent of other information whereas the method of delivery would be related to whether the birth took place at home or in a medical facility. Some of the data items which are independent of other items, may have only specific values in a geographic region, e.g., certain ethnic groups may be residing in certain regions only. Such information also should be used for editing. It is necessary to cross check as much of the information as possible before finalizing the data. A set of edit checks covering all conceivable relationships among variables and geographic divisions should be prepared in advance, as soon as the

items of data are finalized. This would help integrating it with data entry software or preparing the independent computer software and testing before starting the data entry.

5.1.1 Fully automated System

In a fully automated system, the information contained in the reporting forms are entered directly into the database. The data for vital statistics generation are either extracted from the database or the vital statistics organization accesses the data in the central database maintained by the civil registration organization. There can be two approaches for editing the information in this case. The first is to conduct the edit checks at the time of entering the data and point out the errors to the registrar or data entry operator. Unless he corrects the errors, the data entry for the form can not be completed. The second is where data entry is completed without any consistency checking that are carried out later by the Vital Statistics organization. If the registrar or data entry operator has too many events to enter or have many other duties to perform, then the first method of edit checks appear to be a little time consuming and cumbersome. However its main advantage is that the registrar/data entry operator has the reporting form in original and can ensure that the error is not due to data entry error. However, it may not always be possible to have a verification process whereby the data are entered by another operator and the entered data compared by the computer. This is because such a process may require another official and such support may not be available in the office of the local registrar. Hence the verification has to be done by physically examining the entries made with those on the reporting form. This may slightly delay the process of registration, but the delay can not be avoided. It has also to be noted here that, the entries that goes into the register, excluding those that are included also in the statistical database, are not part of the edit checks. They need to be physically verified before finalizing the registration. So extending the same process to the items included for statistical purposes may not add much to the time required.

Another source of error is in coding of data items used for statistical purposes. In a fully automatic system, the coding is easily done on computer using drop down lists to select the appropriate choice instead of doing it in the form before data entry. In many cases the response from the informant may not be sufficiently clear to select the correct choice. One way out is to provide as many items in the list as possible, using lists and sublists. This is a better alternative than providing lists in the reporting form from which the informant can select the appropriate choice and can be easily implemented in a computerized coding system. Due to constraints of space in the form, the list has to be short and this restricts the choices and there can be errors in identifying the correct responses. It would also be possible to provide detailed explanations and clarifications on the computer screen during data entry to help selection of the appropriate choice from the list. This would require the software to be prepared accordingly.

The vital statistics organization should work in collaboration with the civil registration organization to develop the edit checks and with IT specialists in ensuring that they are correctly programmed and integrated with the software.

5.1.2 Partially automated and manual systems

While the components of the partially automated system, where the entire registration process is fully automated, the process may be slightly different where the information from reporting forms/ registers are computerized after registration. There are two possibilities; (a) all information in the reporting forms being entered in an integrated manner and (b) data entry of information required for

registration and those for statistical information being done through separate operations.

In the first case the process has to be similar to the case of a fully automated system. However, it is possible to code the data items in advance using specially trained coders and this may help speeding up the data entry a little bit as the operator does not have to search for the codes

In the later case, only the statistical information needs to be entered. The data items requiring coding may be coded in advance as above and data entry can be done using entry/verification procedure where a second person enters the data again for verification. The verification can be done on the entire data or on a sample basis. In the latter the data are divided into convenient batches and samples of batches are selected for verification. If any of the batch has more errors than a preset limit, the data entry for the entire batch should be redone. In this case the items where the entries made by the data entry operator and verifier are different would need to be confirmed again by the verifier before they are accepted and the data entry allowed to proceed. This would reduce the data entry errors substantially. (It is difficult to have such a procedure at the time of data entry for registration as several data items are alphanumeric and may not be in any fixed formats. Even an inadvertent use of a 'space' character can bring in a non match resulting in loss of time.)

In cases where data entry of statistical information is done independent of that of the registration documents, it would be advantageous to do the edit checks through a batch process rather than at the time of data entry as this would speed up data entry. Coding of data items can also be got done on the documents. Once the edit checks have been done and an error list prepared, it can be checked with the documents. In case the document available with the VS organization is a copy or an extract of the original, then the original can also be consulted, if necessary. However, it may be noted that this may be time consuming as it involves communication with the civil registration organization.

5.2 Corrections and Imputations

Corrections for errors can be based on the original records. If missing entries are due to illegibility of entries in the carbon copies, the best solution to arrive at the correct entry is to refer to the original entries. However, this may involve correspondence with the civil registration authorities. Such correspondence may help sensitizing the registrar on the need for carefully filling up the registration documents and may improve the quality in subsequent batches of records.

The corrections carried out in the records following the due process of law may include corrections on items included for statistical purposes. However, such corrections being carried out after the tabulation of data may be very few in number and would not have any significant impact on the vital statistics. Hence there is no need to correct the statistics for such corrections. Similarly, there is a possibility that the data items remain in error or inconsistent with other items even after reference has been made to the original records. There has to be a cut of point in terms of time from the first initiation of first correspondence to stop further correspondence with the civil registration organization. Getting into protracted correspondence would unnecessarily delay the processing of data without resulting in corresponding improvement in quality of data.. Instead such errors and inconsistencies may be removed through imputations.

Imputation of missing and erroneous data items should be done to have complete records. The principles of imputation should be carefully prepared and should take into consideration the possible reasons for the error and the specific conditions that may point to a particular answer. When imputation is done, the frequency of imputations need to be monitored to see the fields where imputation is taking place and whether there are too many imputations. It would be better to analyze

these at lowest geographic levels as possible. This would help identifying patterns of errors that may help in reducing them through training etc. It is important to not that no imputation is to be done on the civil registration records as they have legal validity and have to be the same as those reported by the informant.

It is recommended that the frequency of error by type of errors and their geographic distribution be discussed in the coordination committee of CR and VS systems to arrive at possible solutions. Though the errors would have been referred to the civil registration organization, the gravity of the situation would be clear only when such an analysis is prepared and discussed.

5.3 Creating databases

As indicated in chapter 3, the data from civil registration documents can come to the VS organization in different forms, like,

- a) extracts from data entered in fully or partially automated systems;
- b) copies of reporting forms filed by informants; and
- c) detachable portion of reporting form containing statistical information.

In addition, there is also the data that would reside in a common server for CRVS system that is accessed by the VS organization, in case of fully automated systems. As data are already in a database in this case, it does not pose any problems once the VS organization gets access to this data. However, there are issues relating to such common databases that the VS organization should get involved in. These are discussed later.

The VS organization needs all data pertaining to a particular event to be in the same format for easy processing and dissemination. This means that the data coming to VS organization from the databases in electronic form and those keyed in by the VS organization have to be converted into the same structure. This would involve coordination with the civil registration organization. The VS organization should work in collaboration with the civil registration organization and decide on the data structure for the files to be transferred to the VS organization. This needs to be done even if there is no immediate plan for computerization of civil registration documents. As and when computerization is taken up, the organization would have ready made formats for data items.

If all the data are coming to the VS organization through paper documents in the form of (b) or (c) above, then, the entire work of computerization is done at VS organization. It is restricted to those of the information relating collected for statistical purposes and a few items that go into the register. If the documents have been designed for automated data capture, like scanning, then extra care need to be taken during the handling of the forms prior to scanning. This may be difficult to some extent in operations like civil registration where regular dispatch of forms are required from a large number of registration centers. The volume of records being dispatched would be small in most cases and this would affect the safety of the documents as they may get crumpled and unsuitable for scanning unless expensive methods of packing are used. A cost benefit analysis of the scanning technology should be done as the volume of data may not justify the investment, unless the equipments are to be used for other works as well.

The choice of software to be used for computerization and database is important as it would have implications on the functionalities and the cost. There are software like CSPro(Census and Survey data Processing) from US Bureau of census that have facilities for data entry, editing and tabulation. This software is suitable for many applications like computerization of vital statistics data.

However, at the end of the year, it may like to convert the data into a database, like Redatam⁵, that allows easy preparation of tables and dissemination. It would also allow remotely connected users to generate tables within the restrictions imposed for keeping confidentiality of individual information. As mentioned earlier, in case of a fully automated system, the VS organization does not have to make efforts to put the data into a structured database as the database is created and updated on line. However conversion of data to databases like Redatam would involve some efforts and necessary software needs to be prepared to do such conversion automatically.

5.4 Access to databases and confidentiality

The data for generation of vital statistics includes several sensitive information relating to the individuals concerned. Unlike some of the essential facts about the event itself, these may not be public knowledge and the individual may not like such information being made available to others. Hence the access to database containing identity of individuals have to be restricted. One or more of the following can be used to prevent individual information being revealed directly or indirectly.

- a) Remove identity related information like address or identity number of the individual from the records
- b) Once the data are finalized, replace the registration numbers with pseudo registration numbers
- c) Re-organize the data by place of usual residence and allot new serial numbers in place of registration numbers
- d) Do not allow any tabulations that may result in less than a minimum number of events (say 5) in a cell.

If data are being given for research purposes, unless it is necessary for the purpose of the research to have the information relating to individuals in a local area, the data may be given after merging those of several local areas and reassigning serial numbers so as not to reveal the identity. If data are given for research purposes with identity of individuals then the researchers should be bound by agreements not to reveal any information relating to any individual without permission of the individual and the VS organization.

The confidentiality conditions should be binding on all employees of the VS organization who handle the information. As they would be handling originals, copies or extracts of the information that form part of the reporting forms, they should clearly understand and exercise utmost care in handling information.

For a detailed discussion on confidentiality issues the *Handbook on Civil Registration and Vital Statistics Systems - Policies and Protocols for the Release and Archiving of Individual Records*⁶ may be referred.

5 Redatam (acronym from REtrieval of DATa for small Areas by Microcomputer) is a database designed for handling population/demographic data

6 United Nations Department of Economic and Social Affairs, Statistics Division(1998) : Handbook on Civil Registration and Vital Statistics Systems - Policies and Protocols for the Release and Archiving of Individual Records, Studies in Methods Series F, No. 70; Sales No. ST/ESA/STAT/SER.F/70

5.5 Outsourcing

In some countries some of the data processing activities are outsourced. The following needs to be taken care of in this case:

- a) confidentiality: the firm should be responsible to ensure confidentiality and liable for its breach
- b) completeness of coverage: tendencies like excluding data received late from processing to adhere to time schedule should not be allowed unless efforts to get the data have been made
- c) collection of reports: if the firm is required to collect reports from all geographical areas, it should be ensured that they collect reports from all far flung areas though the efforts may be expensive
- d) computing facilities: though external computing facilities can be used, in the interests of data security and confidentiality, the data should reside in government owned computers.

The contract with the firm(s) for the work should be carefully drawn up and should be giving a clear idea of the functions and responsibilities of the organization and the firm.

6. TABULATIONS AND REPORTS

The vital statistics tabulations and reports have to serve the purpose of understanding the levels of registration and its regional variations as well as variations across socio-economic and cultural groups, especially when the registration levels are low. This would help evaluating the strategies and reorienting them, if necessary, to achieve universal registration of all vital events. When registration levels have reached near universal levels (90 per cent or more), the vital statistics may also be useful for program and policy formulation as well understanding the population dynamics. This chapter discusses important issues relating to tabulations and reports.

6.1 Tabulations

As the levels of registration in terms of the proportion vital events registered is low in most countries, the statistics on vital events derived from civil registration is not expected to be immediately useful at national level. However, it is likely that in many countries there may be regions in the country where registration is almost complete for some of the vital events, especially births. Generating vital statistics from civil registration in this scenario has two uses:

- a) to provide basic tabulations that may be produced annually that meet minimum national data needs and enhance international comparability,
- b) to present tabulations for administrative purposes that are used to evaluate the level of registration completeness and to promote the comparison of current results with those obtained in previous years in order to identify changes in levels and patterns, errors due to incomplete receipt of records from the registration office, delayed transmissions, etc..

It is important to note that the second use will be the primary one in most countries of the region for sometime to come as sustained improvement in coverage of vital events by CRVS system is not easy and would be time consuming.

There are several data items on which information may be collected during the registration process. However, when registration levels are low, tabulations including all the variables may not be useful. As the level of registration increases to high levels tabulations of those data items and their cross classifications with other variables can be prepared.

One major issue relating to tables based on registration relates to the geographical classifications. Most of the countries require the events to be registered at place of occurrence. This would mean that events like births and deaths are likely to be registered more at registration centers having medical facilities in its jurisdiction. If there are large hospitals, in the jurisdiction of a registration center, the number of events registered in that center would be very high. This happens in urban areas also as people from rural areas go there for availing of medical facilities. The number of events registered in such centers may be disproportionately higher compared to the population living in the jurisdiction of such centers.

For all practical purposes, it is necessary to have tabulations based on place of usual or current residence of the concerned individuals. This brings in the necessity of recording the the usual/current address correctly and in such a manner that they can be easily coded. In many large developing

countries the names of villages and localities in one area may not be known to people of another area and it is very easy for the coders to make errors if the address details are incomplete. Hence, it is necessary that, during the registration process, steps are taken to get correct addresses of the individuals' usual place of residence.

The main principles of preparing tabulations are given below. Detailed discussion of the tabulation principles can be seen in the *Principles and Recommendations for a Vital Statistics System - Revision 3*⁷

It is stipulated in the law that each vital event occurring within the geographical area concerned must be registered once and only once within the time period. Therefore, statistical tabulations should encompass the entire geographic area and include events for all population groups within the area occurring during the specified time period .

Universality: Tabulation of data for a country should generally relate only to events occurring within its boundaries. Events occurring outside the boundaries need to be included only where these relate to persons included in the population denominator for potential national rates, such as deaths to tourists or armed forces occurring outside the country. For countries that wish to implement this principle, provision should be made for international or bilateral exchange of records so that events occurring to residents of other countries can be excluded from occurrence data.

In the event that the registration area is limited to one part of the country, the tabulation program and geographic detail shown needs to be limited to that part of the country.

Tabulation by date of occurrence: Although preliminary tabulations may be presented by date of registration in order to prepare them as quickly as possible, final tabulations for the calendar period should be based on events that actually occurred during the period, regardless of their date of registration.

Every year there may be some events that were registered after the due date either during a grace period or following delayed registration process. It is impossible to keep the tables as provisional to take care of such delayed registrations. A cut of point, after the end of the year, may be decided so that the registrations made that date of events that took place during the year would not be included in the tabulations. For example, if the period for reporting the events is one month and the grace period for delayed registration is three months, then the cut of point may be kept as 3 months from the end of the year, i.e., 31st March if the country follows calendar year for the reporting of vital statistics. However, if the law or regulations require the report to be prepared early, then the date may have to be earlier, excluding all or part of the events registered during the grace period.

Tabulations by place of occurrence and place of residence: Final annual tabulations should be made by place of residence. For tabulations of events for the country as a whole, there is generally relatively little difference between place of occurrence and place of residence. Final tabulations for geographic areas less than the total national territory, major civil divisions, minor civil divisions and cities should, for analytic purposes, be made according to place of usual residence. However, place of occurrence tabulations required for administrative purposes or evaluation of registration coverage need to be prepared.

Tabulations by place of residence requires that the addresses of the concerned persons are

7 United Nations (2014): *Principles and Recommendations for a Vital Statistics System -Revision 3*

correctly recorded in the reporting forms and are correctly coded. If the instructions are incomplete or not clearly understood by the informant, there can be errors in the address. For example, a woman who came from a rural area to a town for getting medical help during delivery of the child and living with some relative may report the address of the relative, which is a communication address at that time, instead of her address at the village. Incomplete addresses also make it difficult to identify the location so that correct geographic code can be given.

A list of essential tables to be produced are provided in Annex. The country should carefully decide on the additional tables that may be useful for its objectives keeping in view the level of registration and the items on which data are collected during registration process. In countries where a comprehensive registration system does not exist, it may limit the tabulations to a smaller number of tables. It may also have detailed tables in areas where it is known that registration completeness is at a much higher level.

6.2 Reports

Preparing tabulations alone would not be sufficient as carefully drawn interpretations are necessary to understand the implications of the results are required for planners and policy makers to use the vital statistics data for policy planning and programme formulation. This has been recognized by some countries and the need to prepare reports have been included in the civil registration law itself. Requirements such as “*within three months after the close of the calendar year the Director of birth and death registration shall compile a report of the births and deaths of such year, and a report on the increase or decrease of the population and on any special causes appearing to affect the same*” are present in the civil registration laws of some countries. Notwithstanding the presence of such clauses, reports prepared without understanding the issues and with incomplete data can be misleading. The Vital Statistics organizations need to be vigilant about this possibility and the reports should reflect the actual positions and its implications. It is nevertheless important to tabulate statistics and evaluate coverage on an annual basis.

In some countries where such legal provisions exist, they cast responsibility to prepare such reports on the head of the civil registration organization. In countries where vital statistics compilation is handled by a different organization, it is necessary to have coordination between both the bodies to ensure preparation of the reports in time.

The annual report on vital statistics should contain the tables and relevant rates and ratios. It may be noted that ratios that has population in the denominator is difficult to be prepared in the vital statistics report as population figures are not available from civil registration. One can use census population for the census year or projected population for giving an approximate set of rates in such cases.

7. QUALITY ASSURANCE AND EVALUATION

Completeness in coverage of all vital events, accuracy of the information, availability of data in a user friendly manner to users and timeliness of registration are the key elements of the quality of a vital statistics system based on civil registration. Quality assurance and assessment or evaluation should be an integral part of the civil registration and vital statistics system. While quality assurance refers to the steps taken at every stage to ensure complete coverage of vital events without any duplication, accuracy of information recorded, compilation of vital statistics based on all registered events accurately and timely. Evaluation, also referred to quality assessment refers to specific studies aimed at answering specific questions on quality in relation to civil registration and vital statistics systems.

7.1 Quality assurance

Quality assurance involves all aspects of a CRVS system. Unless it can be assured that the system is designed to ensure registration of all events without duplication, collect accurate information, process all the data that are collected to produce vital statistics in an accurate and timely manner, it is not possible to expect the vital statistics to be of good quality. Thus every step in the entire process need to be designed carefully and reviewed periodically to see whether any changes in the system are required.

The civil registration system should take steps to ensure that;

- a) all geographical divisions of the country are covered by the registration system;
- b) all local registrars have carried out their duties as per the established procedures;
- c) every vital event occurring in the area have been recorded in the system. However, if law demands that events be registered at the place of residence, then the system should ensure that every vital event occurring to persons residing therein are recorded in the system)
- d) all local offices transmit the records to the higher level office as per the established procedure within the prescribed time. As far as quality and timeliness of vital statistics generation are concerned it is important that all local registrars report the events in time. Failure to send reports would mean that even in cases of complete registration the vital statistics are incomplete.

In addition to the steps take by the civil registration organization, the vital statistics organization needs to ensure that,

- a) statistical reports from the registration areas are received on a timely basis. The VS organization should be vigilant about the receipt of the reports in time in routine manner. It should not happen that the registrars send the report much after the prescribed time is over.
- b) every registration area has reported their data. Non receipt of reports from a center may indicate a breakdown of the system and should be investigated. As this would involve the civil registration organization, in case of shortcomings that does not get resolved in a sustained manner, the matter should be taken up in the coordination committee.

- c) frequencies of each type of vital events are close to the expected values for the period (in comparison to the previous period)
- d) coding of data items are correctly done. In a computerized coding system, the VS organization should involve closely in the software preparation and implementation of quality control systems
- e) compilation of vital statistics is done in time
- f) vital statistics data are available to users in a user friendly manner. This would involve making policies for data dissemination that are consistent with national laws or guiding principles, if any. While user friendly manner does not mean that data have to be provided free of cost, it should not be priced too high for the researchers from the country.

7.2 Evaluation

While quality assurance is the steps taken to ensure coverage and accuracy of the registrations, evaluation or quality assessment refers to the assessment of the final outcome with reference to the objectives of complete registration of all vital events accurately and in a timely manner. If vital statistics are produced from such a system, then it should be accurate. Evaluation tries to assess the completeness and accuracy of civil registration using vital statistics data. It may give some indications on the future course of action for improvement of the system. So, the results would primarily be useful for the civil registration organization. There are direct and indirect methods of evaluation. Evaluation of the registration process is also important to know about people's knowledge attitude and practice and reasons for non registration. As it involves collection of data, it is better handled by the vital statistics organization rather than civil registration organization, especially if it is part of NSO. The civil registration organization may not have enough expertise and manpower to carry out surveys and analysis of data.

Evaluation may also involve the assessment of the impact of the actions taken to improve the registration coverage. For example, if lack of public awareness about the need to register vital events has been an impediment to increasing registration coverage, then the IEC activities should result in increased awareness. Similarly, the impact of structural and procedural changes should make it easier for public to register the events and get certificates. So whether public perception of the changes would make a difference in their attitude to registration of vital events. So it is necessary to assess whether the importance of the changes are reaching to public through the IEC activities, etc. These would involve field surveys using carefully designed questionnaires. While it may not be necessary to conduct exclusive surveys on this subject, it would be advantageous to conduct such surveys periodically so that the changes can be easily assessed.

7.2.1 Methods of evaluation of coverage

There are several methods for evaluating coverage of the registration system. Some of them are direct methods while some of them are indirect. In the direct methods the registration status of individual events from various sources are ascertained to arrive at the proportion of events registered. Some sources would provide more complete and unbiased lists of events against which the list of registered events can be compared. Properly designed tests of registration completeness using direct methods would be able to point out the reasons for under-reporting. The indirect methods try to compare the number of events registered with the number obtained from other sources. The following

paragraphs provide a glimpse of the methods. A more detailed discussion of the methods can be seen in the publication *Principles and Recommendations for a Vital Statistics System, Rev 3*.

(a) Use of civil registration records

Theoretically birth and death registers can be used to validate each other as all persons who were born alive would die some day. However, this is not practical due to,

- i) the time period between births and deaths – knowing that the birth of an old person, who died recently was not registered, does not help in any way; and
- ii) Migration – people may die at places away from where their births were registered. In such cases matching of the records would be extremely difficult.

However, in case infant deaths and births, the matching can be more useful and give a better picture. There can be births with corresponding death not registered and vice versa. In case of infant deaths, it is necessary to try to establish a match with the birth records and if it has been registered, then the fact that the child has died needs to be recorded in the birth register so that the birth record is not used to establish a fake identity.

It may be noted that in countries where both the birth and death registrations are deficient, it is likely that the birth and death of a new born child who died shortly after death was not registered. This is likely to happen if the time available for registration is too long and infant death rates are high.

(b) Use of administrative and social records

Baptism and burial records provide a source against which birth and death records can be matched. However, this would only be applicable to events relating to specific communities. Similarly school enrollment lists, hospital records, etc., can also be used to match with birth/death registers. However, such comparisons pose some problems due to,

- i) incompleteness of such lists resulting in the coverage estimates being applicable only to certain categories of births/deaths;
- ii) involvement of officials from several agencies in the matching process making it extremely difficult to administer; and
- iii) as the lists may be from the place of current residence with the event occurring in a different place. As the registration should have been done at the place of occurrence, it becomes difficult to locate events to establish a match, even if they were registered.

In view of the complexities and resulting cost in matching with such lists, this type of evaluation should not be a regular practice.

(c) Use of lists obtained from censuses and surveys

Lists of births and deaths are collected during censuses and many surveys. These can be used to match with registration records to arrive at registration completeness. However, this may also have similar practical difficulties regarding place of occurrence and hence registration being different from place of enumeration in census/survey. It may still be possible to carry out such matching on a sample basis or for specific local areas. In areas from where people do not travel far for medical facilities during delivery or death may be ideally suited for this purpose. In many countries, the primary health workers have list of all births and deaths in their area. This is likely to be more complete and accurate than many survey records and can provide a basis for estimating registration completeness.

(d) Dual records system

In direct matching techniques, the events found in the reference list that are not found in the civil registration records are considered to be unregistered. There can also be a set of events missing from the reference list itself.

In dual record system, if the reference source is independent of the register of vital events, an attempt is made to estimate the number of events missing from both lists and thus arrive at a more accurate estimate of registration completeness. It uses the Chandraseharan-Deming formula⁸ to estimate the events missed by both the sources.

(e) Comparison of trends

In normal circumstances the number of vital events in one period (year, half year, quarter or month) may not vary much from the previous period of same duration. There may be exceptions, like marriages occurring more in certain months more than in other months. In such cases the number of events in the corresponding period of the previous year should be compared. Significant differences between the numbers of two successive periods or similar periods of successive years may occur only due to,

- i) epidemics, natural calamities or war affecting the number of deaths; and
- ii) significant efforts to boost registration levels bearing fruit

Hence, in the absence of any important events that occurred during the current or the previous period, the number of events registered has to be similar. This type of comparisons by place of registration should form the first set of assessment. This method should be applied by the local registrars to satisfy themselves that the work is not getting affected by extraneous reasons. At a later time, the number of events by place of occurrence should be compared to get a more comprehensive picture of the trends.

(f) Delayed registration and delayed receipt of statistical returns

Though there may be substantial proportion of delayed registrations at the initial stages of implementation of the registration law, the proportion may come down over time as people become aware of the advantages of registering on time. Hence monitoring of the proportion of delayed registrations may give important information about completeness of registration and timeliness of statistics. As delayed registrations are registration of events that should have been registered in an earlier period it gives a rough indication of the completeness of registration. Depending on the length of delay and the cut of date for inclusion of the information in statistical compilations, the quality of statistics may also be affected

Even if delayed registrations form only an insignificant proportion, there may be delays in transmission of statistical information causing delay in compilation of vital statistics. This would also cause delays in compilation of vital statistics and analysis of completeness. Delays may be caused due to several factors including lack of cooperation of officials from various organizations given responsibility relating to civil registration, postal delays, non receipt of reports from a few units and the wait for them, etc.. An analysis of the causes of delay would help in planning improving the situation by developing alternative methods or modifying the existing instructions regarding transmission of information.

⁸ C. Chandrasekharan and W. E. Deming (1949), *On a method of estimating birth and death rates and extent of registration*, Journal of American Statistical Association, vol 44, No. 245

(g) Comparison with census data

If reliable estimates of migration are available, the *balancing equation* can be used to compare intercensal population growth difference between registered births and deaths. However, in most developing countries of the region, the data on migration may not be reliable enough for such comparison. In countries where net migration is negligible at national level the method may yield reasonable results. Even if migration data are reasonably reliable at national level, it would rarely be so at subnational levels and hence any assessment would have to be restricted to national level.

The census data on children under one year of age can be compared with the number of births that occurred in the previous year adjusted for deaths among them. However, it should be noted that the estimate of under registration so obtained would be only a rough measure. If infant death registration is incomplete, then the number of surviving children would be over estimated resulting in lower figures of under-registration. Another source of error is the under-reporting of children and age mis-reporting that occurs in census in many developing countries.

(h) Internal consistency of data

Qualitative assessment of data would reveal inconsistencies resulting from under registration of certain groups. For example, abnormal sex ratio of registered deaths may indicate sex selective under-registration. Similarly, comparison of early infant deaths and foetal deaths may indicate a misunderstanding of the definition of live birth. Age distribution of deaths can be analyzed for age heaping using demographic techniques.

It is necessary that the appropriate method should be selected taking into consideration the availability of secondary sources or data for comparison, their reliability, funding, etc..

7.2.2 Assessing effectiveness of activities for improving registration system

As indicated earlier, it is necessary to evaluate the impact of the IEC activities and the actions taken to streamline the registration processes. The knowledge of the public about need for registration, the processes involved and their attitude to registration system as such would be important indicators as these are direct results of the IEC activities. In addition public opinion about the processes and difficulties faced by them also should be part of the assessment.

Data can be collected through household surveys on these aspects. It is not necessary to conduct exclusive surveys for this purpose. Instead appropriate questions can be included in the questionnaires for socio-demographic surveys conducted by NSOs periodically. The UNICEF Multi Indicator Cluster Surveys and the Demographic and Health Surveys include some questions relating to registration status. However, it should be noted that since all registrations may not get covered in the vital statistics, the questions can only indicate whether the event has been registered. Questions on knowledge of the process and citizen's opinion can be included as a module in other surveys household as well, without unduly affecting those surveys.

8. CAUSE OF DEATH

Statistics on cause of death is an important ingredient for public health planning. Knowledge about the distribution of deaths by geographic areas as well as socio cultural groups can give very useful insights that are useful for planning specific intervention programs. However, unless the data are carefully collected and handled, it can easily be misunderstood resulting in wrong conclusions.

World Health Organization (WHO) has identified the underlying cause of death as the one on which data are to be collected and analyzed as it helps in planning and programming in the area of public health. Underlying cause of death is defined by the WHO as *the disease or injury that initiated the train of events leading directly to death, or the circumstances of the accident or violence which produced the fatal injury*. The selection of a specific condition from a number of reported conditions as the underlying cause of a death facilitates categorizing deaths and enables development of statistical information on cause of death. This permits measuring the rate of death in a particular population, monitoring trends or comparing causes of death across geographic regions.

Getting to the underlying cause of death is not an easy process. In developing countries, there are no medical records for most of the population and majority of deaths occur outside the medical facilities. People go to a medical facility only when they feel it absolutely necessary. Many medical facilities does not have enough infrastructure and diagnostics depends a lot o the experience of the medical professionals. Several deaths occur before a proper diagnosis is completed. In a number of cases, because of the lack of information about the antecedent conditions, the diagnosis is incomplete and many a times point to the immediate cause of death or the conditions that precipitated the immediate cause of death.

Most of the times medical professionals are compelled to write the immediate cause of death as the cause of death in the absence of any other information. Thus *cardiac arrest, multiple organ failure, etc.*, appear in the medical certificates as causes of death in a large number of cases, while these conditions that caused death itself would have been the result of other causes. There are two reasons for this situation:

- (a) Incomplete diagnosis due to lack of information, facilities, etc.
- (b) Medical practitioners being unaware of the need to report the underlying cause of death.

If death occurred outside the medical facility, the cause of death information may not be available, or if available, it is only to rule out the possibility of death being caused by external causes leading to medico-legal cases.

8.1. Determining cause of death

A death record is designed to allow the certifying physician to record multiple causes of death for a decedent and to arrange them so that the causal relationship of the medical conditions that finally lead to the death are recorded. The cause of death that initiated all other causes or conditions, as recorded by the physician, is the underlying cause of death for most deaths.

Complex rules, that can require selecting a different cause of death from the death certificate than the one inferred by the physician, are followed to identify the underlying cause of death.

Sometimes a medical term is selected that was not specifically reported by the physician. Sometimes, the initiating cause as reported might not be the underlying cause as the initiating cause could not cause the subsequent condition. For example, if the certifier recorded that the decedent had chronic hypertension which led to lung cancer that led, in turn, to widespread metastatic cancer, the rules for underlying cause determination would not allow concluding that hypertensive disease caused lung cancer. In an example like this, the condition selected as the underlying cause would be lung cancer.

Some medical conditions are never considered to be an underlying cause of death. Conditions such as a broken neck would not be an underlying cause. Such terms describe the nature of injury but not the cause of the injury. The reason the decedent's neck came to be broken would be the underlying cause.

Medical terms that describe the physical condition of the decedent are only selected as an underlying cause if there are no other conditions reported. Medical conditions that are classified as ill-defined conditions fall into this category. These are medical terms that do not adequately describe the true cause of death. Examples would be terms such as cardio respiratory failure or liver failure. These terms do not describe what caused the condition.

Underlying cause of death determination requires specialized training. The systematic classification of causes of death is known as nosology and a person trained in the coding of cause of death is known as a nosologist. Due to the complexity of cause of death coding and the determination of underlying cause of death, this is a specialized occupation. Very few of the developing countries have persons trained in nosology. If identification of underlying cause of death and its coding are done without trained nosologists, it is likely to lead to erroneous coding and statistics.

8.2. Certification process

In many countries a medical certificate of death is mandatory for issuing a burial permit so that the family can proceed with the funeral. However, the purpose of this certificate not collection of statistics on cause of death. Its purpose is only to rule out possibility of foul play in the death which would have required an autopsy. Hence this certificate should not be confused with a properly issued certificate of cause of death that satisfies the WHO recommendations.

If the decedent, before death, was not attended by a medical professional practicing modern medicine, it would be difficult to identify the underlying cause of death. In such cases, it may be necessary to use *verbal autopsy* techniques to arrive at the cause of death. The accuracy of the cause of death arrived through verbal autopsy depends on the availability of information on events that preceded death and symptoms of specific diseases.

Where the death occurred due to external causes and injuries, it may be necessary to have an autopsy to identify the cause of death. It is mandatory in most cases of medico-legal situations. In such case the surgeon conducting autopsy would try to pinpoint the cause of death and issue a certificate.

If the decedent, before death, was attended by a medical professional practicing modern medicine, the medical practitioner issues a certificate of cause of death that contains complete details relating to cause of death, i.e., the immediate cause of death, all other causes and conditions that lead to the death of the persons and indicate the underlying cause that lead to the death of the persons. This

would be used by the nosologist for coding the underlying cause of death. The cause of death certificate should accompany the death report filed by the informant with the registrar. As it is inconceivable that all informants or registrars would have access to nosologists, the coding has to be done at a later date.

In practice it may be easier to start with proper medical certification in larger cities/towns with significant number of medical facilities and practitioners. In such a case it would be possible to train the professional about cause of death certification. It is also necessary to sensitize the medical fraternity about the need for data on cause of death and the requirement to prepare the certificate in the standard format. It has been observed that in general the medical professionals in developing countries tend to indicate only the immediate cause of death like *cardiac arrest* and *multiple organ failure*. Such recording would necessitate further inquiries through verbal autopsy to arrive at the exact nature of the underlying cause. As facilities become available in other areas it can be made mandatory in other areas.

8.3. Processing data on cause of death

For preparing useful data, it is necessary to tabulate the data on cause of death along with other data collected during registration process. From data processing point of view, the best solution is to have the code for cause of death entered in the death report. However, there may be constraints to this solution. Coding of cause of death may take some time and it may not always be possible to retain the death reports by the informant (even when it is a medical institution). One alternative is design the cause of death form with provision to enter the registration number and such identification particulars as required to uniquely identify the death record. Then after the registration is completed, these particulars can be entered in the form and it can be separated from the death report and sent for coding. In such a case the coding can be done in selected locations in the country reducing the number of persons required for coding. Once the cause profile of mortality is available for a few years, it may be possible identify the important causes that need to be focused on and procedures can be developed for easier coding by training officials in the registration offices when there is no confusion in the certificates. The nosologists can do sample checking to ensure quality of coding. They can send to the nosologists those forms that they are not able to code. This would reduce the time required for coding

The data need to be edited before tabulation as there may be coding and data entry errors. If the coding has been done in a separate operation as per the latter option mentioned above, then the coded data needs to be linked with the registration data that contains other information. Data entry or copying errors (while copying the registration ids to the cause of death form) can prevent perfect linking. These needs to be resolved. Some cause of death codes inconsistent with age and sex can be easily identified. As far as possible these should be corrected with reference to the cause of death certificate and death report.

Tabulations should include cause profile by gender for all deaths. Tabulations for important causes by age, sex and geographic regions would be very useful. It is not necessary make such tabulations for causes that are reported rarely or only in smaller frequencies. Education, cultural practices, etc.. may have impact on cause of death and these can also be analyzed through appropriate tabulations.

It may be noted that if verbal autopsy has been used to identify the cause of death, then the coding of cause of death can not be as detailed as in the case of medically certified causes. This is because it is impossible in most cases to arrive at the exact cause of death in a post death verbal

autopsy. Hence it is recommended that tabulations may be done separately for cause of death based on verbal autopsy and that based on medical certification.

9. THE WAY FORWARD

The countries in the region are in various stages of development of their CRVS systems. The process to develop the vital statistics systems needs to be integrated with that of the civil registration system and should follow it so that once the registration records become available it is possible to start processing vital statistics data. The following are the important steps to be taken. While some of the actions are to be undertaken simultaneously with similar action relating to civil registration system, some are specific to vital statistics system. It is assumed that civil registration and vital statistics are handled by separate organizations. If they are under one organization, it would be easier to take some of the steps.

1. Situation analysis: If the country has some sort of civil registration system then it should analyze the situation regarding vital statistics. On the other hand, if the country is in the process of establishing a CRVS system, then it should include vital statistics related activities in its action plans. This analysis should include the following:

- a) The organization responsible for vital statistics and its relationship with civil registration organization.
- b) Legal provisions regarding vital statistics and possibility of bringing in regulations for filling in the gaps in legal provisions. If there is a plan to review the legal framework for civil registration with the objective of framing new laws or amending the existing ones, then the vital statistics organization or NSO should get involved and ensure that appropriate provisions regarding vital statistics are included in the law.
- c) The existing/proposed modalities for getting the data for vital statistics compilation. The points of contact between the organizations
- d) The powers granted to field staff of vital statistics organization under the law enabling them to inspect the work, demand the reports and engage in training and quality control activities
- e) The division of responsibility between the two organizations to enable the vital statistics organization to prepare the reports in a timely manner
- f) Effectiveness of vital statistics organization in enforcing technical decisions in the CRVS system
- g) Organizational structure of the vital statistics organization and availability of manpower
- h) Data processing infrastructure - capability and manpower
- i) Technical expertise in analysis of civil registration data
- j) system of coordination between civil registration organization and vital statistics organization on the one hand and between civil registration organization and other ministries/organizations of the government that would be using vital statistics data.
- k) Data dissemination including mechanism to ensure confidentiality of information and release of micro data.

2. Action plan and budgeting: Based on the situational analysis, the organization may prepare a detailed action plan with clear time lines that are consistent with the development of civil registration

system. The overall objective should be to be able to start processing the data within 3 months of registration.

The action plan should also have estimated budget for each and every activity. As many countries have difficult financial situations, the budget should be carefully prepared with justifications for each item of expenditure. There is a tendency to overestimate the requirements and not being able to spend the allotted funds in time. This would create a situation where the government would not provide enough funds as it loses confidence in the estimates of funds required prepared by the organization. This would help convincing the government of the need for the expenditure arrived at. Without the government itself being convinced it is impossible to seek assistance from other development partners, if need be.

3. Changes in the law : The vital statistics organization has to work with the civil registration organization to ensure that enough legal provisions for activities relating to vital statistics exist in the civil registration law.

4. Establishing coordination mechanism: Wherever CR and VS organizations are different it is necessary to institutionalize the coordination mechanism. This coordination is more intense compared to the coordination required from various organizations in the running of the civil registration system. In many technical areas the civil registration organization needs to be guided by the vital statistics organization. There has to be perfect synchronization between the organizations to ensure that the data for vital statistics preparation are provided in time and that the reports are prepared in time.

Even if the civil registration and vital statistics functions are handled by the same organization there would be need to ensure that the personnel handling these functions work in a unified manner. While the civil registration division would be engaged in managerial functions, the vital statistics division would look after all technical aspects.

It is also necessary to establish coordination with other organizations that use civil registration data. This would include the ministries or organization dealing with health, family planning, education, child welfare, population census, etc. As the vital statistics data would be based on highly incomplete civil registration system at the initial stages, this coordination mechanism need to be established only when the registration system is able to cover a large proportion of events.

5. Capacity building: Capacity building activities include those for the staff in the vital statistics organization as well as those in the civil registration organization. The vital statistics organization should plan for such activities for its own staff in a phased manner and should also get involved in similar activities for the staff in the civil registration hierarchy. This is necessary to ensure that all technical concerns about data quality are properly addressed.

6. Data processing infrastructure: Establishing data processing infrastructure should be taken up in a phased manner so that as and when the amount of data increases, the infrastructure has capacity to handle the same. Depending on the size of the country in terms of area and population as well as spread of the vital statistics organization, appropriate system needs to be established. Adequate attention should be given to human resources, software and training. The possibility of the data entry jobs within vital statistics organization becoming redundant on full computerization of the civil registration system sometime in the future should be given due consideration.

In case all or part of the data processing related activities are to be outsourced, adequate safeguards should be built in to ensure complete coverage and confidentiality.

7. Tabulations and reports: Tabulations required should be planned well in advance. When the levels

of registration are low, the tables can be few in number. However as the coverage increases and when some areas have such coverage that the data can be very useful, tabulation plans should be tailored to that situation. These may also be finalized in consultation with the data users.

8. Budget and funding: Prepare the fund requirements in the medium term. Ensure that funds are available from government and developing partners to ensure that the work can be go on smoothly. In case of shortage of funds, the activities need to prioritized with most important activities being taken up first.

9. Monitoring and evaluation : Set up the monitoring and and evaluation system and provide necessary training to staff.

Some of the above needs to be taken up simultaneously while others need completion of certain activities in the domain of either vital statistics or the civil registration organization.

Proposed list of core tables

A. Live Births (LB)

- LB-1. Live births by place of occurrence and sex of child
- LB-2. Live births by place of occurrence and place of usual residence of mother
- LB-3. Live births by place of registration, month of occurrence and month of registration
- LB-4. Live births by month, place of occurrence and place of usual residence of mother
- LB-5. Live births by age, place of usual residence and marital status of mother
- LB-6. Live births by age of father
- LB-7. Live births by place of usual residence, age and educational attainment of mother
- LB-8. Live births by educational attainment and age of mother and live-birth order
- LB-9. Live births by place of usual residence and age of mother, sex of child and live-birth order
- LB-10. Live births by live-birth order and interval between last and previous live-births to mother
- LB-11. Live births by ethnic and/or national group and place of usual residence and age of mother
- LB-12. Live births by place of usual residence and age of mother and legitimacy status
- LB-13. Live births by place of occurrence, site of delivery and attendant at birth
- LB-14. Live births by site of delivery, attendant at birth and birth weight
- LB-15. Live births by birth weight and place of usual residence and educational attainment of mother
- LB-16. Live births by gestational age and birth weight
- LB-17. Live births by birth weight, place of usual residence of mother and month in which prenatal care began
- LB-18. Live births by age and place of usual residence of mother and month in which prenatal care began
- LB-19. Live births by live-birth order, place of usual residence of mother and month in which prenatal care began
- LB-20. Live births by place of usual residence of mother and duration of residence at the current usual residence

B. Deaths (DE)

- DE-1. Deaths by place of usual residence and sex of decedent
- DE-2. Deaths by place of occurrence and place of usual residence and sex of decedent
- DE-3. Deaths by month and place of occurrence and place of usual residence of decedent
- DE-4. Deaths by place of registration, month of occurrence and month of registration
- DE-5. Deaths by place of occurrence and site of occurrence
- DE-6. Deaths by place of usual residence, age and sex of decedent
- DE-7. Deaths by age, sex, place of usual residence and marital status of decedent
- DE-8. Deaths by place of usual residence, age, sex and educational attainment of decedent

- DE-9. Deaths by sex, cause of death, place of usual residence and age of decedent
- DE-10. Deaths by month of occurrence and cause of death
- DE-11. Deaths by place of occurrence, sex of decedent and type of certification
- DE-12. Maternal deaths by cause of death and age of woman
- DE-13. Deaths by age and type of usual activity of decedent

C. Infant Deaths (ID)

- ID-1. Infant deaths by place of occurrence and place of usual residence of mother
- ID-2. Infant deaths by month of occurrence and sex and age of child
- ID-3. Infant deaths by place of usual residence of mother and age and sex of child
- ID-4. Infant deaths by cause of death, place of residence of mother and sex and age of child
- ID-5. Infant deaths by place of usual residence of mother and incidence of birth registration