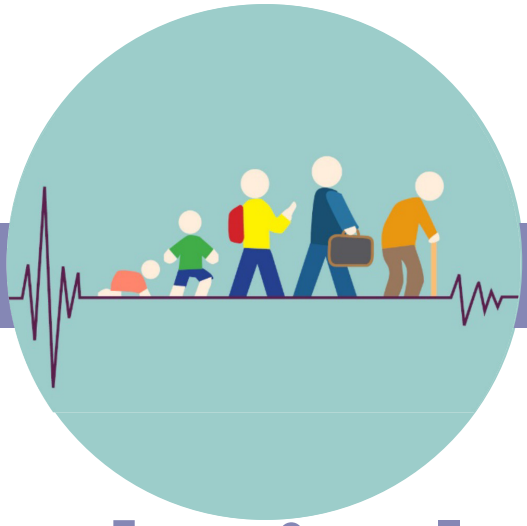

MODULE 9:

Civil Registration and Vital Statistics System

9B: Certification of Cause of Death

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MEASURE Evaluation

This module is one of 12 HIS data source modules in *Health Information System Strengthening: Standards and Best Practices for Data Sources*. The full series of modules (available at https://www.measureevaluation.org/resources/publications/tr-17-225) is intended to provide health authorities and other health information stakeholders with a reference guide that, along with other sources, can help align the HIS data sources with international standards and best practices.

Type of Data Generated: Causes of Death from Communicable Diseases, Chronic Conditions, and Fatal Injuries

Description

Vital statistics derived from civil registration constitute the only nationally representative source of information on mortality by cause of death, provided that civil registration services are universal, continuous, and permanent (UN, 2014b). The description, standards, and best practices for cause of death data in the civil registration and vital statistics (CRVS) system are addressed in this section because a different national agency, namely the MOH, manages the collection of these data. The MOH authorizes medical personnel to certify and record causes of death on the international medical certificate of cause of death form.

When notifying the civil registration authority of the death event, the MOH may provide the underlying cause of death at the same time so that it is immediately part of the death registration record. Often, however, the causes of death diagnoses are coded in batches at a later time and the underlying cause of death must be linked to the death registration record at a later time. The successful incorporation of the ICD-coded underlying cause of death in the legal record in the civil registration system will allow the CRVS data source to provide the complete, minimally recommended data elements needed to compute cause of death indicators (UN, 2014b).

Types of Indicators

- CRVS cause of death data can be used to derive cause-specific mortality rates resulting from infectious diseases, noncommunicable diseases, and accidents and injuries, including several Sustainable Development Goal indicators (see, Module 9a: Civil Registration and Vital Statistics System – Registration of Events, Table 12).

Alternative Data Sources

In the absence of physician-certified deaths in a CRVS system or sample registration system, a country can obtain probable cause of death information from verbal autopsies. In the CRVS database, these or other cause of death data should be clearly distinguished from physician-certified cause of death data because the methods are not strictly comparable.

Standards

1. **Cause of death certification and coding.** The international standard rules and instructions for classifying and coding deaths are defined in the WHO *International Statistical Classification of Diseases and Related Health Problems* (ICD) (WHO, 2010a). The current version is the tenth revision (ICD-10). The next revision, ICD-11, will be released in 2018.

"In compiling and publishing mortality and morbidity statistics, WHO member countries agree to comply as far as possible with recommendations made by the World Health Assembly as to

International Classification of Diseases

Since 1948, the WHO ICD is the single internationally endorsed standard for generating comparable statistics pertaining to morbidity and cause of death trends. It provides evidence for monitoring and evaluation, epidemiological research, and provider reimbursements and resource allocation. ICD is used by more than 115 countries for diagnosing and coding causes of death.

ICD-10 consists of three volumes: Volume 1 is a tabular list of the classification of diseases in three- and four-character levels; Volume 2 is an instruction manual and guidance on using ICD; and Volume 3 is an alphabetical index to diseases and nature of injury.

classification, coding procedure, age-grouping, territorial areas to be identified, and other relevant definitions and standards." (WHO, 1967)

2. **International medical certificate of cause of death form.** This form ensures the proper recording of the immediate, antecedent, and underlying causes of death (Figure 3). The form may be translated, but the standard format and wording must stay intact. It may be embedded in the official death notification form where other facts surrounding the death are recorded. This form provides information for identifying the underlying cause of death, which should be linked to the official registration record in the CRVS database.

Figure 3. International form of medical certificate of death

INTERNATIONAL FORM OF MEDICAL CERTIFICATE OF CAUSE OF DEATH

	Cause of death	Approximate interval between onset and death
I Disease or condition directly leading to death*	(a)	.....
	due to (or as a consequence of)	
Antecedent causes Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last	(b)	.....
	due to (or as a consequence of)	
	(c)	.....
	due to (or as a consequence of)	
	(d)	.....
II Other significant conditions contributing to the death, but not related to the disease or condition causing it	.....	.....
	.....	.....

**This does not mean the mode of dying, e.g. heart failure, respiratory failure. It means the disease, injury, or complication that caused death.*

Source: WHO ICD-10 Volume 2, Section 4.1.3 (WHO, 2010a)

3. **ICD-10 training.** WHO provides an interactive self-learning tool structured to provide a full ICD-10 training or training on specific modules (WHO, 2010b). It can be used for self-learning, in a classroom setting, or on the web, allowing for interaction with specialists. The tool also has translation capabilities. It can be used online or downloaded and installed on a computer. The basic training on ICD-10 coding is about two hours, the training on completing the medical certificate of cause of death is less than an hour, and the full training is about 40 hours. A brief overview of ICD-10 can be obtained through reviewing the chapter summaries (about five hours).

In addition, since 2010, the WHO Family of International Classifications Network Education & Implementation Committee, the international body responsible for ensuring standardized coding of mortality and morbidity data in WHO member states, develops ICD implementation, curriculum, training, and certification materials. The Centers for Disease Control and Prevention National Center for Health Statistics publishes these documents on its website (Centers for Disease Control and Prevention National Center for Health Statistics & Education & Implementation Committee, 2016).

4. **ICD-10 automated software.** This software provides for automated coding of causes of death and selecting the underlying cause of death. It is developed and maintained by the Iris Institute, an international cooperation between six countries (Germany, France, Hungary, Italy, Sweden, and the United States). The software can be downloaded for free from the German Institute of Medical Documentation and Information website (German Institute of Medical Documentation and Information, 2016).

Iris software for automating cause of death information

The Iris software is based on the international medical certificate of cause of death form. There are two ways that Iris software can be used. First, in the "code entry" mode, an officer enters information about a death, including each of the physician-certified diagnoses and the corresponding ICD-10 code. Iris will then automatically apply the ICD-10 rules to the sequence of coded causes and use an algorithm to select the underlying cause.

Second, in the "text entry" mode, an officer (or physician) enters the cause of death diagnoses in free text, and a country-specific dictionary of medical terms will automatically translate the diagnosis into an ICD-10 code. IRIS has an English dictionary of medical terms, and dictionaries with terms in other languages are being developed. After the dictionary is enhanced with local terms, text entry becomes the most efficient mode to produce consistent data.

Most countries in Europe have used Iris for several years. Australia implemented it fully in 2013, and the United States is transitioning from the Mortality Medical Data System to Iris. Iris software presents an excellent opportunity for any country planning to use an automated system.

5. **Verbal autopsy.** For countries that do not have the capacity for full ICD-10 implementation verbal autopsy tools, WHO and the Institute for Health Metrics and Evaluation have developed standard questionnaire instruments and analysis applications (WHO, 2017; Institute for Health Metrics and Evaluation, n.d.). These verbal autopsy instruments are suitable for routine use in capturing information on the circumstances surrounding deaths for all age groups, including on circumstances related to maternal and perinatal deaths and deaths caused by injuries. The WHO recommends that results recorded in the verbal autopsy instruments are reviewed independently by two or more physicians. If the probable cause of death is the same for both, then this is the final cause recorded; if the cause of death is different from the two physicians, then a third physician will decide on the final cause to record. Publicly available software that automates cause of death diagnoses also exists, such as open-source tariff method, InterVA-4, and others, but although these methods have shown some success in replicating cause-specific mortality fractions in the population, they have replicated physician-assigned cause of death at the individual level only about half the time (Desai, et al., 2014).

6. **ICD-10 Startup Mortality List.** WHO has developed a Startup Mortality List (SMoL) (ICD-10-SMoL) of 115 categories of causes based on the full ICD-10 general mortality list. Countries that do not have the resources to code causes with ICD 3- or 4-digits can start with the SMoL as a first step toward standardized reporting of causes of death. An electronic module (DHIS 2) has been developed to collect and tabulate information on deaths, and the underlying cause of death must be selected manually according to the SMoL rules (WHO, 2014a). This is especially relevant for hospital deaths.

Best Practices

Verbal autopsies

What are they? In low- and middle-income countries, deaths in the community are least likely to be certified by a physician. To address this discrepancy, WHO and other partners have developed standard verbal autopsy instruments. Verbal autopsy is a method that helps determine probable causes of death at the population level, for deaths that could not get a medical certification of cause of death.

How to administer them? To obtain nationally representative results on causes of death, the verbal autopsy instrument can be employed as part of a Sample Vital Registration with Verbal Autopsy or included as a module in a larger population-based survey. To administer the verbal autopsy, interviewers are trained to conduct an interview with a household member and record information on signs and symptoms of a recently deceased person. The probable cause of death can be either derived manually by physicians reviewing the questionnaires and assigning a cause or derived automatically from a computer algorithm.

Caveats—Probable causes of death provided by verbal autopsies can fill a gap in mortality data, but this should be regarded as a temporary measure. Although the probable cause of death from the verbal autopsy is attributed an ICD-10 code, the causes of death are not physician certified per the required medical certificate of cause of death form and according to ICD rules and instructions. Therefore, although studies suggest that verbal autopsy can provide cause of death information, that at the population level is similar to physician-certified deaths in high-quality hospitals, the data from the two sources are not strictly comparable and should be distinguishable at the time of analysis. (Note that the WHO Mortality Data Base contains only data from medical certificate of cause of death forms.)

Most low- and middle-income countries only generate ICD-10 physician-certified cause of death information for deaths that occur in some hospitals (WHO, n.d.). Some steps toward obtaining more complete and reliable mortality data in the long-term are as follows:

- Establish a permanent **ICD-10 reference body** to oversee ICD-10 implementation and quality assurance.
- Update and institutionalize the **International Medical Cause of Death** form, in paper or electronic format. Train physicians on how to properly complete the form following the WHO guidelines on sequencing of events leading to death. The WHO quick reference guide provides instructions for properly completing the international medical certificate of death form. It gives step-by-step instructions to certifiers on how to correctly complete the form, and indicates frequently used ill-defined causes of death that certifiers should avoid. The form can be easily translated, printed on two pages, and folded into a small booklet for easy dissemination (see Standard #2).
- Develop and roll out **physician training,** refresher courses, and continued professional development on ICD-10 certification. Institute ICD-10 training in medical school curriculums (see Standard #3).
- Train and engage a small number of **dedicated ICD-10 coders** who are not practicing physicians, who all receive the same training, and who code deaths daily or at least on a regular basis. This will help ensure consistent coding practices between individual coders that will minimize bias and provide experience with a sufficient number of deaths so that skills are continuously exercised and sharpened (see Standard #3).
- Because all hospitals have physicians on staff and the completion of a medical certificate of cause of death is a routine aspect of medical care, ICD-10 certification and coding should be implemented for all **deaths in hospitals,** with the expectation of rolling out the procedures for deaths in the community. For countries that intend to apply ICD-10 to deaths in hospitals but do not yet have the capacity to code those deaths in

standard format of ICD-10 3 or 4 characters, WHO developed the ICD-10 SML (see Standard #6) that can be used as a first step toward standardized reporting of causes of death.

- The underlying cause of death is considered to be the most informative data element related to cause of death from a public health point of view, and thus is used for tabulation and comparisons. It is "the disease or injury that initiated the train of morbid events leading directly to death, or the circumstances of the accident or violence that produced the injury" (WHO, 2010a, Section 4.1.2). To **properly select the underlying cause of death,** coders are taught to apply the ICD rules and instructions to the sequence of causes. Automated software developed by the Iris Institute is available to facilitate coding of multiple causes of death and selection of the correct underlying cause (see Standards #3 and #4).
- WHO has produced two useful tools for **processing ICD-10 codes.** First, the Microsoft Access-based CoDEdit tool improves data quality by checking the validity of each ICD-10 death record and flagging records in which a correction needs to be made (WHO, 2014b). Second, the Microsoft Excel-based ANACoD application performs a comprehensive analysis of ICD-10 data on mortality levels and causes of death (WHO, 2013b; AbouZahr, et al., 2010).
- For communities where deaths are not certified by a physician, cause of death information may be captured through a standard **verbal autopsy instrument,** in which the probable cause of death may be assigned either through review by trained physicians or using computer algorithms (see Standard #5).

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