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CRVS technical guide

Medical certification of cause of death: Undergraduate curriculum

November 2018





Resources available from the University of Melbourne, Bloomberg Philanthropies Data for Health Initiative

CRVS course prospectuses

These resources outline the context, training approach, course content and course objectives for the suite of CRVS trainings delivered through the Bloomberg Philanthropies Data for Health Initiative. Each course focuses on a specific CRVS intervention or concept, and is designed to support countries to strengthen their CRVS systems and data.

CRVS Fellowship reports and profiles

The CRVS Fellowship Program aims to build technical capacity in both individuals and institutions to enhance the quality, sustainability and health policy utility of CRVS systems in Fellows' home countries. *Fellowship reports* are written by Fellows as a component of the program, and document, in detail, the research outcomes of their Fellowship. *Fellowship profiles* provide a summary of Fellows' country context in relation to CRVS, an overview of the Fellowship experiences, the research topic and the projected impact of findings.

CRVS analyses and evaluations

These analytical and evaluative resources, generated through the Initiative, form a concise and accessible knowledge-base of outcomes and lessons learnt from CRVS initiatives and interventions. They report on works in progress, particularly for large or complex technical initiatives, and on specific components of projects that may be of more immediate relevance to stakeholders. These resources have a strong empirical focus, and are intended to provide evidence to assist planning and monitoring of in-country CRVS technical initiatives and other projects

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Generated through the Initiative, CRVS best-practice and advocacy resources are based on a combination of technical knowledge, country experiences and scientific literature. These resources are intended to stimulate debate and ideas for in-country CRVS policy, planning, and capacity building, and promote the adoption of best-practice to strengthen CRVS systems worldwide.

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CRVS country reports describe the capacity-building experiences and successes of strengthening CRVS systems in partner countries. These resources describe the state of CRVS systems-improvement and lessons learnt, and provide a baseline for comparison over time and between countries.

CRVS technical guides

Specific, technical and instructive resources in the form of *quick reference guides*, *user guides* and *action guides*. These guides provide a succinct overview and/or instructions for the implementation or operation of a specific CRVS-related intervention or tool.

CRVS tools

Interactive and practical resources designed to influence and align CRVS processes with established international or best-practice standards. These resources, which are used extensively in the Initiative's training courses, aim to change practice and ensure countries benefit from such changes by developing critical CRVS capacity among technical officers and ministries.

Published by the University of Melbourne, Civil Registration and Vital Statistics Improvement, Bloomberg Philanthropies Data for Health Initiative.

Melbourne School of Population and Global Health
Building 379
207 Bouverie Street
Carlton, VIC 3053
Australia

CRVS-info@unimelb.edu.au
www.mspgh.unimelb.edu.au/dataforhealth

Made possible through funding from Bloomberg Philanthropies www.bloomberg.org

Suggested citation

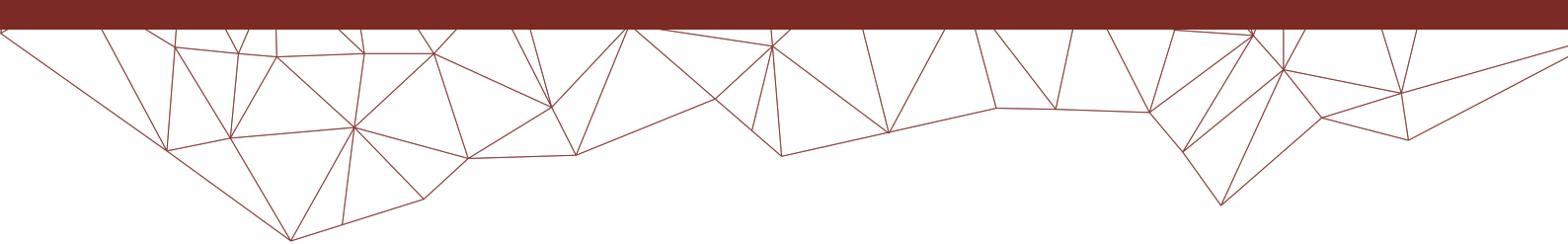
Rampatige R, Gamage S. *Medical certification of cause of death: Undergraduate curriculum*. CRVS resources and tools. Melbourne, Australia: Bloomberg Philanthropies Data for Health Initiative, Civil Registration and Vital Statistics Improvement, University of Melbourne; 2018.

Acknowledgments

The authors wish to acknowledge the members of Working Group Four (Medical Certification of Cause of Death) and the Knowledge Management Centre team for their contribution.

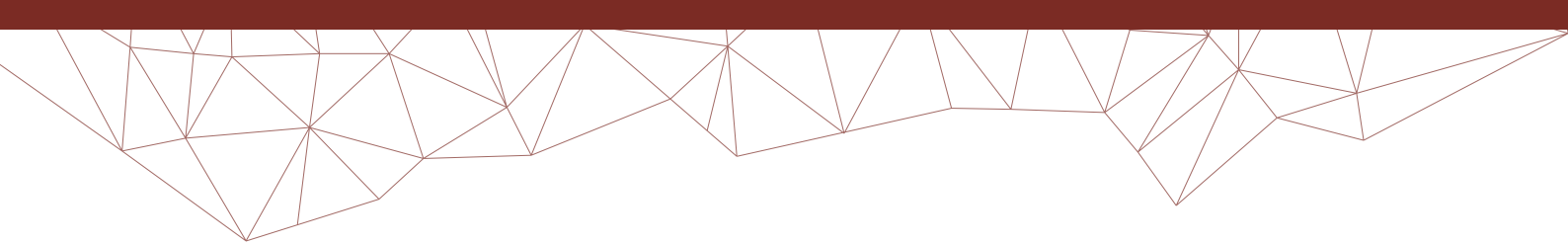
Authors

Dr Rasika Rampatige and Dr Saman Gamage, the University of Melbourne.

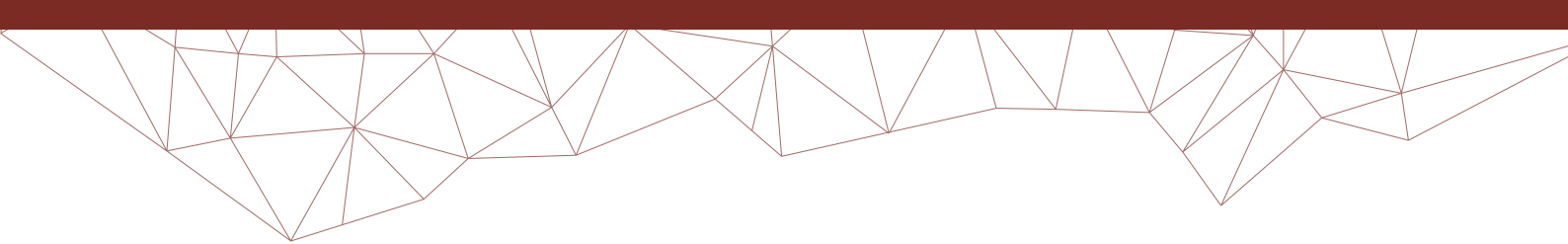


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We owe it to the dead to accurately record their passing



About this curriculum

This resource was developed to help medical schools incorporate medical certification of cause of death into their undergraduate medical curriculum. The content can be further adapted and included in relevant postgraduate curricula as well.

Generally, undergraduate medical curricula are overloaded with many subject areas, and there is always a demand to include more areas of knowledge. This curriculum is intended to be delivered as a module with nine learning areas and 10 to 12 hours of student contact time. However, each learning area can be customised to be delivered in a shorter or longer period.

Each learning area has assessment criteria. As the authority who is administering the module, medical schools can choose whether to make the assessments compulsory. This curriculum should be reviewed by the curriculum development committee or an equivalent body of the medical school before finalisation to ensure that modules on medical certification meet overall curriculum requirements.

The content of this curriculum is based on two key resources, developed by the University of Melbourne as part of the Bloomberg Philanthropies Data for Health Initiative:

1. *Handbook for doctors on cause of death certification*¹
2. *Assessing the quality of death certificates*.²

Country medical certificate of cause of death

This curriculum assumes that the country already uses the International Form of Medical Certificate of Cause of Death (or a very similar version of the standard certificate, with Part 1, Part 2 and a column for reporting time interval). The latest medical certificate of cause of death recommended by the World Health Organization is given in Annex 1.

Placement of the module within the undergraduate medical curriculum

Since this curriculum is intended for medical students and medical postgraduate students, training in medical science is not included. All students must have sufficient medical knowledge to understand the patho-physiology of disease processes leading to death before this module is taught. This module can be embedded in a subject stream that is taught in the fourth or fifth (that is, final) year of the existing undergraduate medical curriculum. Year level can vary from country to country, and from medical school to medical school within the same country. This curriculum may be incorporated into medical postgraduate training curricula of any stream, and into induction training programs conducted for intern medical officers.

Since information on the underlying cause of death is collected and collated for health planning and policy purposes, we recommend that this curriculum be taught in the public health/community medicine stream. However, this curriculum can be easily adapted to be taught in forensic medicine or other subject streams (eg internal medicine, paediatrics).

1 The University of Melbourne. *Handbook for doctors on cause of death certification*. CRVS resources and tools. Melbourne, Australia: Civil Registration and Vital Statistics Improvement, The University of Melbourne, Bloomberg Philanthropies Data for Health Initiative; 2017.

2 Rampatige et al. *Assessing the quality of death certificates: Guidance for the rapid tool*. CRVS resources and tools. Melbourne, Australia: Civil Registration and Vital Statistics Improvement, The University of Melbourne, Bloomberg Philanthropies Data for Health Initiative; 2018.

Learning areas and objectives

This curriculum consists of nine learning areas (Table 1). The choice of learning areas depends on the objectives of the medical school in introducing this module into their curricula.

Table 1: Learning areas and objectives

Learning areas	Learning objectives
	At the successful completion of the module, students will be able to:
1. Concepts and definitions in death certification	1. Demonstrate their understanding of important concepts and definitions in the certification of death
2. Underlying cause of death	2. List the uses of data on underlying cause of death
3. Local mortality statistics	3. Describe the challenges in improving cause of death statistics in their country
4. Legal implications and ethics	4. Discuss the legal and ethical role of physicians in certifying deaths
5. International Form of Medical Certificate of Cause of Death	5. Understand the International Form of Medical Certificate of Cause of Death
6. General instructions for certification	6. Demonstrate an ability to correctly certify deaths
7. Guidelines for recording specific conditions	7. Demonstrate an ability to correctly apply the guidelines related to specific underlying causes of death
8. Assessing the quality of death certification	8. Demonstrate an ability to accurately assess the quality of death certification using the University of Melbourne death certificate assessment tool
9. ICD-10 and mortality coding	9. Provide an overview of the ICD-10 and mortality coding

ICD-10 = International Statistical Classification of Diseases and Related Health Problems, 10th revision

Teaching and learning methods

- Interactive lecture discussions with question-and-answer sessions (theory component of guidelines)
- Tutorials/small-group discussions
- Case scenarios
 - guidelines on certifying different case scenarios will be demonstrated using case-based examples
 - practice in death certification using case scenarios
- Assessment of the quality of death certificates
 - students will be given a sample of incorrectly completed certificates to assess using the death certification assessment tool. This will be an opportunity for the students to understand common certification errors. This will help them to avoid the same errors in the future.

Medium of instruction

This curriculum is designed to be delivered in English. The contents can be translated into other languages to suit the general medium of instruction of the medical school. We suggest that translations be done using a standard process, and then back-translated to ensure the content remains the same. However, local adaptation of the language may be required.

Evaluation

This curriculum contains assessments for learning areas as needed. Medical schools can decide to make some or all of the assessments based on their local requirements.

Duration of teaching

The curriculum is expected to consist of 10 to 12 hours of student contact time plus assessments (Table 2).

Table 2: Learning areas, times allocated and learning methods

Learning area	Time* (hours)	Method
1. Concepts and definitions in death certification	0.5	Interactive presentation
2. Underlying cause of death	0.5	Interactive presentation
3. Local mortality statistics	1.5	Group work and student presentations based on their own assessment of the country situation
4. Legal implications and ethics	0.5	Interactive presentation
5. International Form of Medical Certificate of Cause of Death	1.0	Interactive presentation
6. General instructions for certification	1.0	Interactive presentation and case-based exercises (small-group work/tutorial)
7. Guidelines for recording specific conditions	2.0	Interactive presentation and case-based exercises (small-group work/tutorial)
8. Assessing the quality of death certification	2.0	Death certificate based exercise (small-group work/tutorial)
9. ICD-10 and mortality coding	1.0	Interactive presentation
Total	10.0	

ICD-10 = International Statistical Classification of Diseases and Related Health Problems, 10th revision

* This is given as a guide only. The duration may vary based on curriculum requirements.

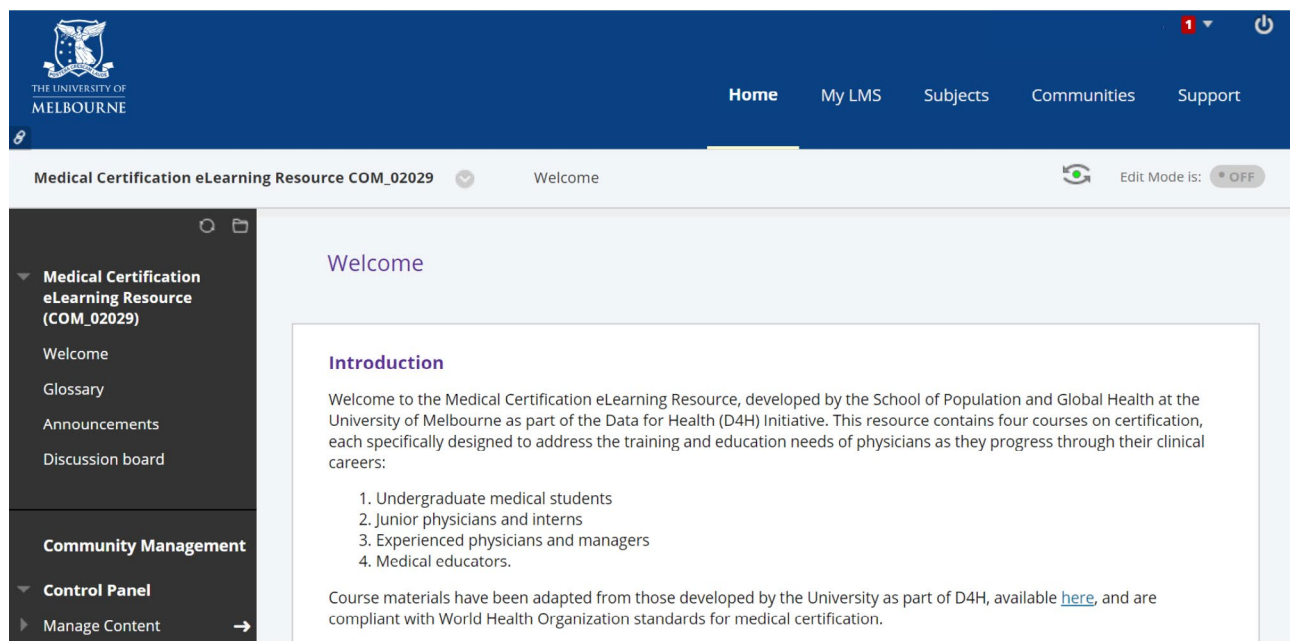
Adapting the curriculum for online delivery

The Melbourne School of Population and Global Health, University of Melbourne, has used the information and guidance provided in this curriculum to develop an online course for undergraduate medical students (Figure 1). Universities and teaching hospitals can use the online course materials in two ways:

1. **Directly**, by enrolling as students and completing the course through the University of Melbourne’s learning management system (LMS), Blackboard. This option has been developed for countries that do not have access to their own university-level LMS platforms, and provides an immediate learning resource. Course content cannot be modified or made country-specific.
2. **Indirectly**, by requesting the raw course materials, so that they can be modified and hosted using a local LMS. Course materials can be provided in a Word document, or through a direct export/import file (depending on the local LMS software). This option allows the course materials to be adapted and localised, and it requires local hosting and management by relevant institutions.

For more information on how to access the online course, please email CRVS-info@unimelb.edu.au and a course coordinator will be in touch.

Figure 1: Welcome screen, online course for undergraduate medical students



Learning areas

1. Concepts and definitions in death certification

This brief introductory section outlines three key concepts:

- Cause of death (COD)
- Underlying cause of death (UCOD)
- Sequence of events leading to death.

Objective	To explain important concepts and definitions used in the medical certification of COD
Duration	30 minutes
Method and resources	Interactive presentation (PowerPoint)
Evaluation activities	1. Define UCOD
	2. Explain the concept of UCOD and how it differs from the concept of COD

Lesson plan

Topic 1	Cause of death
Expected outcome	Students learn the definition of COD and understand its importance
Content	The CODs recorded in the <i>International Form of Medical Certificate of Cause of Death</i> are: 'all those diseases, morbid conditions or injuries which either resulted in or contributed to death and the circumstances of the accident or violence which produced any such injuries'. ³
Topic 2	Underlying cause of death
Expected outcome	Students learn the definition of UCOD and understand its importance
Content	The UCOD is: 'the disease or injury which initiated the train of morbid events leading directly to death, or the circumstances of the accident or violence which produced the fatal injury'. ⁴
Topic 3	Sequence of events leading to death
Expected outcome	Students understand the sequence of events leading to death
Content	Mortality statistics are based on the UCOD, which is the disease or injury that initiated the sequence/chain of events that led directly to death. For example, imagine a person dying of septicaemia following meningococcal meningitis. Septicaemia is the direct (or immediate) COD, but meningococcal meningitis is the UCOD.

3 World Health Organization. Twentieth World Health Assembly, 1967. Available at: apps.who.int/iris/bitstream/10665/85800/1/Official_record160_eng.pdf (accessed 8 November 2018).

4 World Health Organization. Mortality. Available at: who.int/topics/mortality/en/ (accessed 31 October 2018).



2. Underlying cause of death

This is the introductory component of the module. This learning area explains the importance and use of death certification. It should be presented as an interactive presentation, with time for students to ask questions. The use of cause of death (COD) statistics (based on the underlying cause of death, UCOD) to prevent future premature deaths, and the link between what individual physicians write on death certificates and national mortality statistics, should be emphasised.

Objective	To explain the need for high-quality COD statistics, the purposes for which UCOD data are collected, and how the data are used
Duration	30 minutes
Method and resources	Interactive presentation (PowerPoint)
Evaluation activities	1. List four uses of UCOD data
	2. Explain how accurate COD data will help to improve the health situation in your country (200 words)

Lesson plan

Topic 1	Need for high-quality UCOD statistics
Expected outcome	Students understand the need for high-quality COD statistics
Content	<p>Reliable and timely mortality and COD data are essential for monitoring trends in diseases, injuries and risk factors, and critically important for guiding good public policy and prevention. Medical certification of COD by physicians is the basis of mortality statistics in many countries.</p> <p>It is generally assumed that hospitals accurately certify CODs, but this is not always the case. The quality of hospital death certification largely depends on how accurately physicians can diagnose the diseases and conditions present in their patients and how well they understand the concept of the UCOD. How well the patient-related information is documented in medical records will also influence the accuracy of death certification, as physicians almost always need to consult the medical records to determine or confirm the underlying cause and sequence of events that led to death.</p> <p>The collection of COD data and the completion of the medical certificate of COD must be seen as integral parts of patient care.</p> <p>Unfortunately, it is not uncommon for the clinical team to lose interest in the case if the patient dies. Consequently, key information may be omitted from the clinical record. In addition, junior physicians are often asked to complete the medical certificate of COD, yet they may not be the one who attended the patient and may be the most poorly equipped to establish the COD and write the certificate.</p>
Topic 2	Use of UCOD data
Expected outcome	Students understand the specific uses of UCOD data
Content	<p>Statistical outputs: The accurate collection of COD data is an important step towards better population-level data, because many countries rely on hospitals and other health facilities for mortality statistics. Hospitals can also benefit from improved mortality statistics by seeing the CODs in their facility, studying case fatality rates, and analysing data by patient factors such as place of residence.</p> <p>Evidence for health policy: Mortality statistics are used by health planners to plan prevention programs to prevent future premature deaths due to similar causes.</p> <p>Mortality statistics are used to evaluate the effectiveness of training programs and in medical and public health research and clinical education.</p>

3. Local mortality statistics

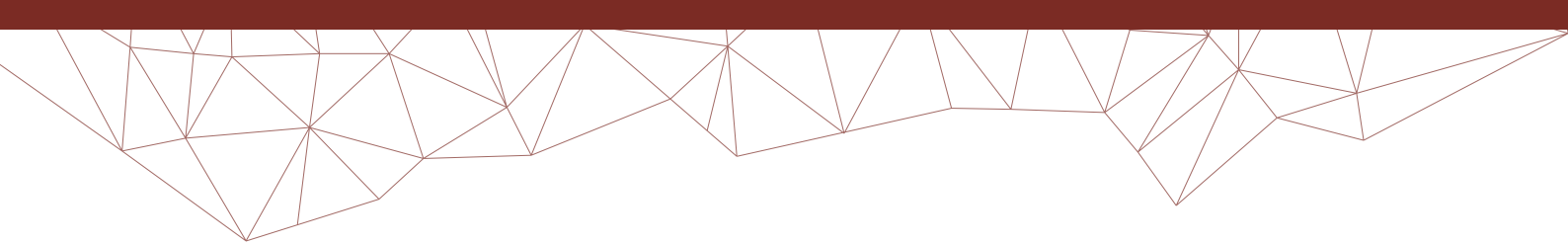
This should be presented as a student-led activity. After completing Learning area 2, students should have a good understanding of the importance and uses of mortality statistics. In this activity, students are asked to research the current challenges in improving the cause of death (COD) information in their country. This can be done as a student-led small-group activity or as a tutorial. Provide students with guidance on where such information may be found (annual reports, statistics websites, hospital websites, etc).

Objective	To promote student understanding of the challenges in improving the death certification in the country
Duration	90 minutes
Method and resources	Group work and student presentations
Evaluation activity	1. Students do a short presentation to the class in groups, or submit a short report on their research findings

Lesson plan

Use the following questions to help guide the students' research:

1. What is the latest year for which COD data are available?
2. Does the country use the International Form of Medical Certificate of Cause of Death?
 - a. If not, what are the major differences between the international standard and local certificates?
3. Does the country use the International Statistical Classification of Diseases and Related Health Problems (ICD) to code COD information?
 - a. If yes, what version of the ICD is used?
4. What are five main challenges physicians face when they certify deaths?
5. Who certifies the deaths that occur within 24 hours of admission to the hospital?
6. How are cases of 'dead on arrival' certified?
7. How are CODs assigned for deaths occurring outside hospitals (ie community deaths)?
8. Under what circumstances are community deaths not certified by a medically qualified person?



4. Legal implications and ethics

The information presented in this section needs to be related to the current law of the country of interest (eg birth and death registration law, coronial acts, police ordinances). Death certification laws differ from country to country, and content should be modified accordingly to give the most correct and up-to-date information to students. We recommend involving a legal medicine expert in modifying this section of the curriculum.

Objective	To introduce the legal requirements and ethical responsibilities of physicians related to cause of death (COD) certification
Duration	30 minutes
Method and resources	Interactive presentation (PowerPoint)
Evaluation activities	1. List two situations in which COD information may be divulged to a third party by a physician
	2. Briefly describe the process of certifying deaths due to unnatural causes (use a flow diagram to explain the process)
	3. Does the country have a coronial system in place?

Lesson plan

Topic 1	Legal requirements in death certification
Expected outcome	Students understand the local legal requirements in certifying a death
Content	<p>A death certificate is a legal document with implications and uses that vary from country to country. Therefore, completing the death certificate accurately is important.</p> <p>Local laws and customs may affect this. Burial or cremation of the body may be necessary to execute the deceased person's will. In countries with a coronial system, a physician may be required to report unnatural deaths for inquest, or for a post-mortem to be held to determine the cause and circumstances of the death. The process of notification will differ between countries, and physicians need to be aware of the correct reporting process.</p> <p>The physician or the hospital must report details of the death to national authorities such as the health department, the civil registrar or the national statistics office. In most countries, details of the death and the circumstances of the deceased person are stored in a database; in some countries, these data are de-identified.</p>
Topic 2	Ethical responsibilities
Expected outcome	Students understand the ethical responsibilities and confidentiality issues in death certification
Content	<p>Within the above limits, the physician has a duty to maintain confidentiality about the COD. This duty is to the family of the deceased person. Information on the death certificate can be used for research purposes, if the deceased is not identifiable by name or other means.</p> <p>The physician should not reveal details of a death certificate to a third party unless they are legally required to do so, or they have obtained prior consent from the next of kin of the deceased.</p>

5. International Form of Medical Certificate of Cause of Death

The International Form of Medical Certificate of Cause of Death (often referred to as the 'medical certificate of COD' or simply 'death certificate') is recommended by the World Health Organization for medical certification of deaths in all countries. The death certificate provides a framework for the organisation of clinical diagnoses used for public health purposes (Figure 2).

Figure 2: International Form of Medical Certificate of Cause of Death (Frame A) (WHO 2016)

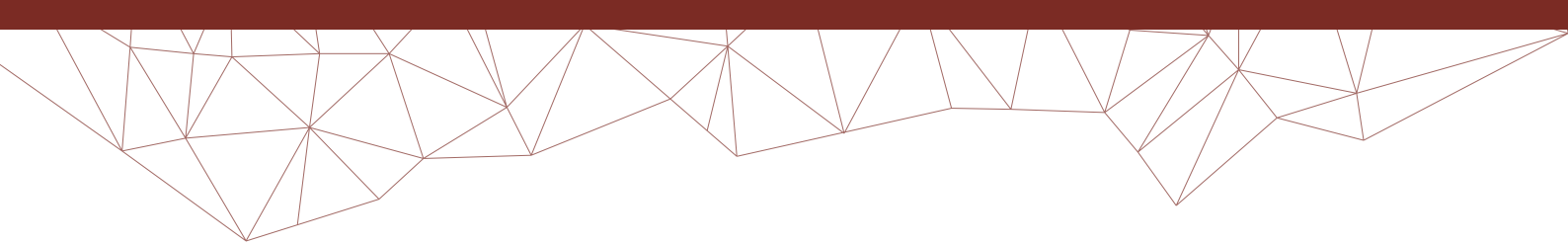
Administrative Data (can be further specified by country)																	
Sex	<input type="checkbox"/> Female				<input type="checkbox"/> Male				<input type="checkbox"/> Unknown								
Date of birth	D	D	M	M	Y	Y	Y	Y	Date of death	D	D	M	M	Y	Y	Y	Y
Frame A: Medical data: Part 1 and 2																	
1 Report disease or condition directly leading to death on line a			Cause of death									Time interval from onset to death					
Report chain of events in due to order (if applicable)		a															
State the underlying cause on the lowest used line		b	Due to:														
		c	Due to:														
	d	Due to:															
2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)		-----															

Death certificates are usually written by the physician who attended the deceased patient or who is sufficiently familiar with the medical history of the patient to be confident of knowing the COD. To fill in a medical certificate correctly, the physician must first identify the disease leading directly to death (immediate cause of death) and then trace the sequence of events back to the underlying cause of death (UCOD). Other diseases contributing to death are entered on a second part of the form.

However, this process is quite different from the logic that the physician uses to make clinical diagnoses, which are the basis for patient management. In addition, few physicians have been trained in medical certification. Because of these factors, there has been extensive misclassification of the UCOD in deaths reported by hospitals in all parts of the world.

Teaching physicians how to certify accurately is not difficult, but making sure they sustain the practice over the longer term can be difficult. The high turnover of junior physicians creates a need for continuous retraining, and the hierarchical nature of clinical hospital practice means that, unless senior physicians can be persuaded to actively support good certification practices, junior physicians will not change their behaviour.

Part of the role of medical professional bodies must be to stress the fundamental importance of UCOD data in determining health policy and the allocation of resources, and to convince physicians of the need for reform.



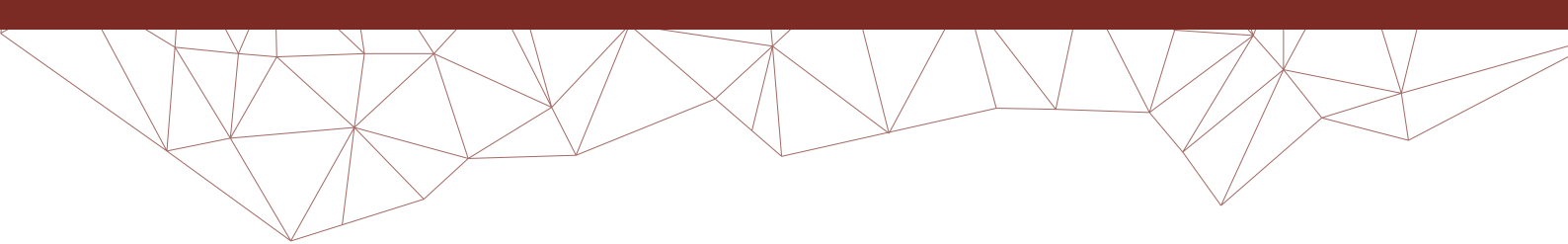
Objective	Introduce the International Form of Medical Certificate of Cause of Death and its structure (Section 4.1.2 and Appendix 7.1 of Volume 2 of the International Statistical Classification of Diseases and Related Health Problems, 10th revision)
Duration	60 minutes
Method and resources	Interactive presentation (PowerPoint), copy of the medical certificate of cause of death used by the country
Evaluation activities	1. Give examples of situations where it is common to make errors in recording identification data for a deceased person
	2. Explain the function of Part 1 of the death certificate
	3. Explain the function of Part 2 of the death certificate
	4. Why is it important to record the time interval between the onset of a condition and death on the death certificate?

Lesson plan

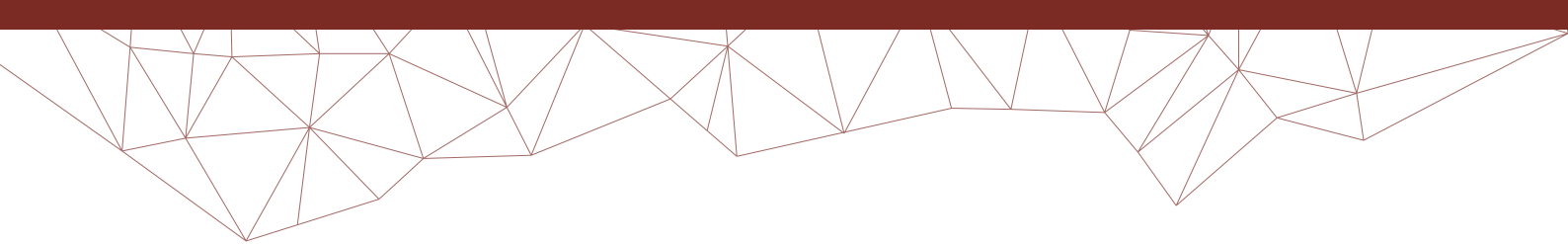
Topic 1	Identification data in the death certificate
Expected outcome	Students are familiarised with the identification data on the country's death certificate
Content	<p>Show a copy of the identification data on the current death certificate used in your country. Discuss why the correct completion of all these items is important.</p> <p>Identification data may include:</p> <ul style="list-style-type: none"> ■ Date and place of death ■ Full name ■ Place of residence ■ Sex ■ Race/ethnicity ■ Age/date of birth ■ Profession or occupation.
Expected outcome	Students understand the importance of correctly recording the identification data of the deceased
Content	<p>This information is critical to correctly identifying the deceased for legal and statistical purposes.</p> <p>Verify details before recording (eg correct legal name, correct spelling and usual residence). Refer to identity documents if available.</p>

Identification data on the death certificate

This information is critical to correctly identifying the deceased for legal and statistical purposes. The details vary from country to country, so the implementing faculty or department must review the current death certificate of the country.



Topic 2	International Form of Medical Certificate of Cause of Death
Expected outcome	Students recognise and understand the function of all parts of the medical certificate of cause of death
Content	<p>Use the death certificate used in the country to demonstrate the correct completion of the certificate. The death certificate is divided into three sections:</p> <p>Part 1 – report the sequence/chain of events leading to death</p> <p>Part 1 of the death certificate has four lines for reporting the sequence/chain of events leading to death; these are labelled 1(a), 1(b), 1(c) and 1(d). The direct COD is entered in line 1(a). If the death was a consequence of another disease or condition, this underlying cause should be entered at 1(b). If there are more events leading to death, write these in order at 1(c) and 1(d).</p> <p>Emphasise the following important points:</p> <ul style="list-style-type: none"> ■ <i>Always use consecutive lines starting at 1(a); never leave blank lines within the sequence.</i> ■ <i>If there is only one COD, it is entered at 1(a).</i> ■ <i>Each condition below 1(a) must be a cause of the condition above it (ie it is an antecedent cause).</i> ■ <i>The initiating cause in the sequence is the underlying cause.</i> <p>Part 2 – other significant conditions contributing to death</p> <p>Part 2 of the death certificate records all other significant or contributory diseases or conditions that were present at the time of death, but did not directly lead to the UCOD listed in Part 1.</p> <p>A column to record the approximate interval between onset of the condition and death</p> <p>The column on the right-hand side of the death certificate is for recording the approximate time interval(s) between the onset of the condition and the date or time of death. The intervals should be entered for all conditions reported on the death certificate, especially for the conditions reported in Part 1. These intervals are usually established by the physician on the basis of available information. In some cases, the interval will have to be estimated. Time periods such as minutes, hours, days, weeks, months or years can be used.</p>



6a. General instructions for certification

Physicians must pay attention to these guidelines, because they will help coders correctly identify and code the death. In most countries, coders are not medically trained, so even a small misinterpretation may result in confusion and the incorrect underlying cause of death (UCOD) being selected. Instructions given in this section comply with the International Statistical Classification of Diseases and Related Health Problems, 10th revision guidelines. Any local variations in general instructions should be taught in this section.

Objective	To describe the general instructions for completing death certificates
Duration	15 minutes
Method and resources	Interactive presentation (PowerPoint)
Evaluation activities	None

Lesson plan

Topic 1	General instructions in death certification
Expected outcome	Students should be able to adhere to general instructions in certifying deaths
Content	<p>The following are some general instructions on certification. Complying with these instructions helps increase the overall accuracy of mortality statistics.</p> <p>Complete each item in order (following any special instructions given in the country). Note:</p> <ul style="list-style-type: none">■ All entries must be legible.■ Use black or blue ink to complete the certificate.■ Do not make alterations or erasures. If any entry needs to be altered, draw a single line through it. Do not use correction fluid.■ Verify the identification details of the deceased person, including the correct spelling of the legal name and place of usual residence.■ Do not use abbreviations.■ Enter only one disease condition and event per line.

6b. General instructions for certification

The causes of death (CODs) recorded on the medical certificate are 'all those diseases, morbid conditions or injuries which either resulted in or contributed to death and the circumstances of the accident or violence which produced any such injuries'.⁵ The underlying cause of death (UCOD) is 'the disease or injury which initiated the train of morbid events leading directly to death, or the circumstances of the accident or violence which produced the fatal injury'.⁶

The importance of best medical opinion should be stressed. Give students access to the available resource materials on medical certification of COD (see Related resources section). Use the following examples to explain and demonstrate how to certify deaths correctly.

Objective	To provide students with detailed instructions (with examples) on how to certify the CODs on the World Health Organization-recommended death certificate
Duration	45 minutes
Method and resources	Interactive presentation (PowerPoint), case studies
Evaluation activities	<ol style="list-style-type: none"> List five common errors that are seen in death certification During a clinical visit to the hospital, look at the death certificate book from a ward and try to identify errors in certification (optional activity)

Lesson plan

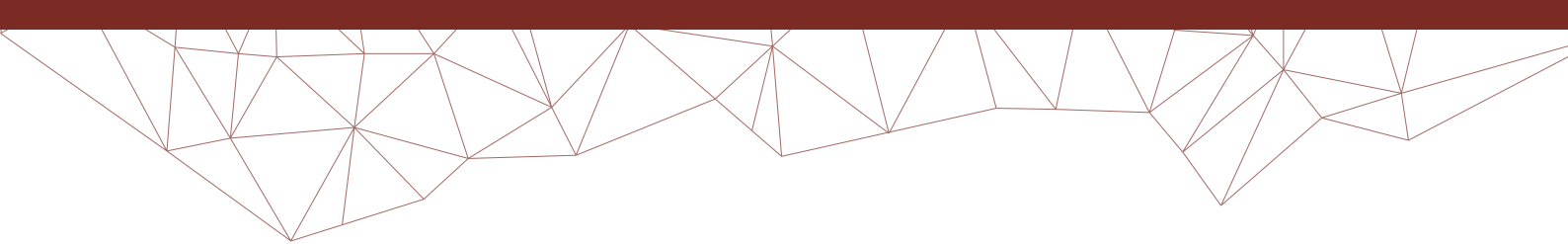
Topic 2	Certification guidelines
Expected outcome	Students understand the sequence of events leading to death, including the concept of UCOD and immediate COD
Content Explain the sequence of events leading to death	<p>Case study 1</p> <p>A 50-year-old woman was admitted to the hospital vomiting blood and was diagnosed as having bleeding oesophageal varices. Investigation revealed portal hypertension. The woman had a history of hepatitis B infection. Three days later, she died. Figure 3 outlines the sequence/chain of events that led to her death.</p> <p>It is extremely important that the underlying cause of each death is correctly determined and accurately recorded. In this case, bleeding oesophageal varices was the immediate COD. Hepatitis B was the UCOD. Knowing this, the public health response is to implement immunisation programs against hepatitis B virus to prevent such deaths in future.</p> <p>Figure 3: The sequence/chain of events leading to death in Case study 1</p> <pre> graph BT HB[Hepatitis B] --> LC[Liver cirrhosis] LC --> PH[Portal hypertension] PH --> BOV[Bleeding oesophageal varices] BOV --> Death[Death] HB --- UCOD[Underlying cause of death] BOV --- ICOD[Immediate cause of death] </pre>

3 World Health Organization. Twentieth World Health Assembly, 1967. Available at: apps.who.int/iris/bitstream/10665/85800/1/Official_record160_eng.pdf (accessed 8 November 2018).

4 World Health Organization. Mortality. Available at: who.int/topics/mortality/en/ (accessed 31 October 2018).



<p>Content</p> <p>Explain the sequence of events leading to death</p> <p>cont...</p>	<p>Case study 2</p> <p>A man dies of cerebral haemorrhage because of secondary hypertension from chronic pyelonephritis. The chronic pyelonephritis was a result of outflow obstruction, which was because of benign prostatic hyperplasia. He also had a history of diabetes mellitus, which had been diagnosed five years before his death. Diabetes mellitus (type II), which is not in the sequence/chain of events leading to death, would have contributed to the death, and therefore should be entered on Part 2 of the death certificate.</p> <p>Figure 4 outlines the sequence/chain of events and the contributory condition that led to his death.</p> <p>Figure 4: The sequence/chain of events leading to death in Case study 2</p> <pre> graph TD A[Diabetes mellitus (type II)] --> B[Benign hypertrophy of prostate] B --> C[Chronic pyelonephritis] C --> D[Secondary hypertension] D --> E[Cerebral haemorrhage] </pre> <p>However, if the certifying physician had additional information about the severity of the outflow obstruction and the control of diabetes mellitus, another possible sequence would be chronic pyelonephritis caused by recurrent urinary infections due to poorly controlled diabetes mellitus. The sequence recorded on the certificate must always be thought of as the best medical opinion of the certifying physician, rather than certain fact, especially in cases where the patient has no or limited medical records.</p>																									
<p>Expected outcome</p>	<p>Students understand the different case scenarios possible when filling in Part 1 of the death certificate</p>																									
<p>Content</p>	<p>Case study 3</p> <p>A 56-year-old man dies from acute myocardial infarction within three hours of its onset. He did not have any other illnesses. His ECG and cardiac enzyme levels confirmed the diagnosis.</p> <p>Although it is rare to only have one event leading to death, it does occur. In these cases, COD would be reported at 1(a) and it would also form the underlying cause of the death, shown in Figure 5. If more information is available in the sequence of events leading to death, these must be reported using the lines provided at 1(b), 1(c) and 1(d).</p> <p>Figure 5: The sequence/chain of events leading to death in Case study 3</p> <table border="1"> <thead> <tr> <th colspan="4">Frame A: Medical data: Part 1 and 2</th> </tr> </thead> <tbody> <tr> <td rowspan="4"> 1 Report disease or condition directly leading to death on line a Report chain of events in due to order (if applicable) State the underlying cause on the lowest used line </td> <td></td> <td>Cause of death</td> <td>Time interval from onset to death</td> </tr> <tr> <td>a</td> <td><i>Acute myocardial infarction</i></td> <td><i>3 hours</i></td> </tr> <tr> <td>b</td> <td>Due to:</td> <td></td> </tr> <tr> <td>c</td> <td>Due to:</td> <td></td> </tr> <tr> <td></td> <td>d</td> <td>Due to:</td> <td></td> </tr> <tr> <td colspan="2"> 2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition) </td> <td colspan="2"></td> </tr> </tbody> </table>	Frame A: Medical data: Part 1 and 2				1 Report disease or condition directly leading to death on line a Report chain of events in due to order (if applicable) State the underlying cause on the lowest used line		Cause of death	Time interval from onset to death	a	<i>Acute myocardial infarction</i>	<i>3 hours</i>	b	Due to:		c	Due to:			d	Due to:		2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)			
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Case study 4

A 56-year old person dies from an abscess of the lung after five days. The abscess resulted from lobar pneumonia of the left lung (two weeks).

When two CODs are reported, these are written in at 1(a) and 1(b), as shown in Figure 6. In this case, UCOD is recorded in line 1(b).

Figure 6: The sequence/chain of events leading to death in Case study 4

<i>Frame A: Medical data: Part 1 and 2</i>				
1 Report disease or condition directly leading to death on line a Report chain of events in due to order (if applicable) State the underlying cause on the lowest used line			Cause of death	Time interval from onset to death
		a	<i>Abscess of lung</i>	<i>5 days</i>
		b	Due to: <i>Lobar pneumonia left lung</i>	<i>2 weeks</i>
		c	Due to:	
	d	Due to:		
2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)				

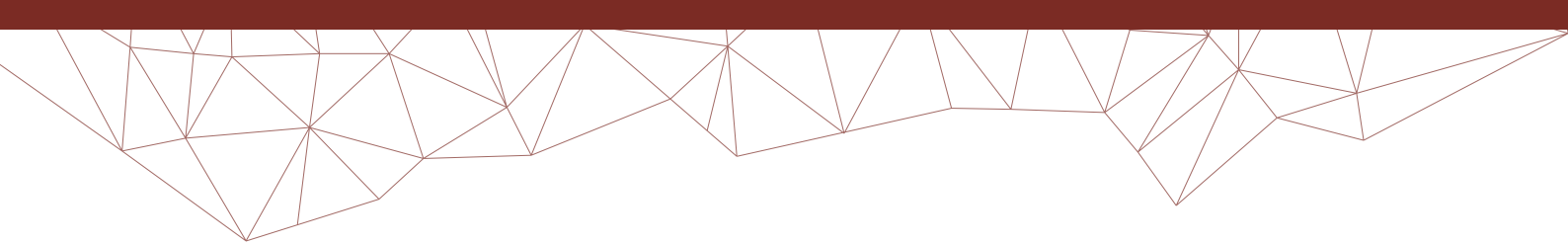
Case study 5

A 23-year-old man died from traumatic shock one hour after sustaining multiple fractures when he was hit by a truck. The accident happened five hours ago.

Figure 7 shows a death certificate that has used three lines. These events are recorded at 1(a), 1(b) and 1(c). In this case, UCOD is recorded in line 1(c).

Figure 7: The sequence/chain of events leading to death in Case study 5

<i>Frame A: Medical data: Part 1 and 2</i>				
1 Report disease or condition directly leading to death on line a Report chain of events in due to order (if applicable) State the underlying cause on the lowest used line			Cause of death	Time interval from onset to death
		a	<i>Traumatic shock</i>	<i>1 hour</i>
		b	Due to: <i>Multiple fractures</i>	<i>5 hours</i>
		c	Due to: <i>Pedestrian hit by truck</i>	<i>5 hours</i>
	d	Due to:		
2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)				



Case study 6

A 36-year-old man with chronic alcoholism for 10 years and a previous history of duodenal ulcers (for three years) was admitted to the hospital with acute abdominal pain and high fever. Initial chest X-rays showed free air under both domes of his diaphragm. He was diagnosed with peritonitis from peptic ulcer perforation. Emergency exploratory laparotomy on his first day of admission showed a 2cm sized duodenal ulcer on the anterior wall of the first part of the duodenum.

Five days later, the patient had high fever with chills, and his abdominal ultrasound revealed a sub-phrenic abscess under the right diaphragm. A revision exploratory laparotomy was planned. However, the patient suddenly showed signs of septic shock that night, had a sudden cardiac arrest, and died within two hours of septic shock.

Figure 8 shows a death certificate that has used four lines. These events are recorded at 1(a), 1(b), 1(c) and 1(d). The UCOD is reported in line 1(d).

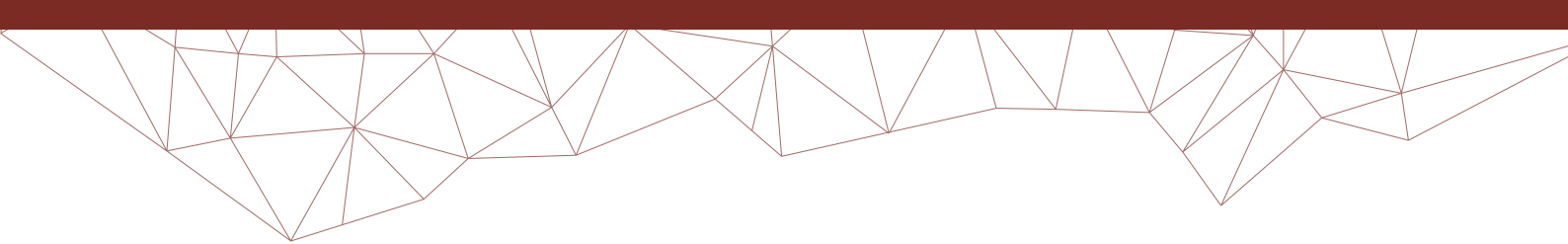
Figure 8: The sequence/chain of events leading to death in Case study 6

Frame A: Medical data: Part 1 and 2			
1 Report disease or condition directly leading to death on line a Report chain of events in due to order (if applicable) State the underlying cause on the lowest used line			Cause of death Time interval from onset to death
	a	Septic shock	2 hours
	b	Due to: Right sub-phrenic abscess	1 day
	c	Due to: Perforated duodenal ulcer	5 days
	d	Due to: Duodenal ulcer	3 years
2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)		Chronic alcoholism (10 years)	

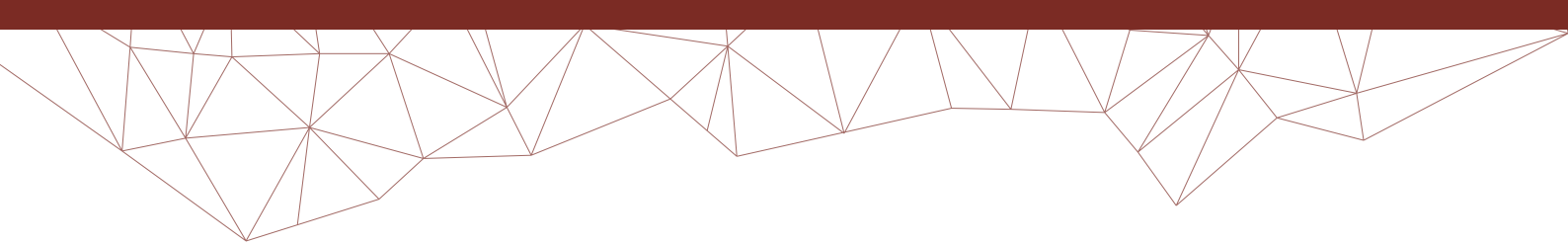
Note: Chronic alcoholism contributed, but did not directly cause the death, and is therefore recorded in Part 2 of the death certificate. The term 'cardiac arrest' is a mode of dying, and should not be written on the certificate.

Important: In all cases, emphasise that the UCOD should be reported in the last-used line in Part 1.

In rare situations, there could be more than four events in the sequence leading to death. In this case, you can add a line 1(e) and record the UCOD on that line. Do not record UCOD in Part 2 of the death certificate.



Expected outcome	Students understand the different case scenarios when completing Part 2 of the death certificate																												
Content	<p>Important: <i>Part 2 of the death certificate records all other significant or contributory diseases or conditions that were present at the time of death, but did not lead directly to the UCOD listed in Part 1.</i></p> <p>Case study 7</p> <p>A 60-year-old hypertensive patient was admitted to the surgical casualty ward with severe abdominal pain and vomiting, which had lasted for one week. She was diagnosed as having a strangulated femoral hernia with a bowel perforation. She underwent surgery to release the hernia and resect the intestine, with an end-to-end anastomosis. Two days after the surgery, she developed signs of peritonitis and she died two days later.</p> <p>In this example, the UCOD is strangulated femoral hernia. Hypertension, which is not in the sequence of events leading to death but would have contributed to the death, should be entered in Part 2 of the death certificate, as shown in Figure 9.</p> <p>Figure 9: A death certificate with a condition listed in Part 2</p> <table border="1" data-bbox="497 898 1410 1240"> <thead> <tr> <th colspan="4"><i>Frame A: Medical data: Part 1 and 2</i></th> </tr> </thead> <tbody> <tr> <td data-bbox="497 927 735 981">1</td> <td data-bbox="735 927 791 981"></td> <td data-bbox="791 927 1233 981">Cause of death</td> <td data-bbox="1233 927 1410 981">Time interval from onset to death</td> </tr> <tr> <td data-bbox="497 981 735 1034">Report disease or condition directly leading to death on line a</td> <td data-bbox="735 981 791 1034">a</td> <td data-bbox="791 981 1233 1034"><i>Peritonitis</i></td> <td data-bbox="1233 981 1410 1034"><i>2 days</i></td> </tr> <tr> <td data-bbox="497 1034 735 1088">Report chain of events in due to order (if applicable)</td> <td data-bbox="735 1034 791 1088">b</td> <td data-bbox="791 1034 1233 1088">Due to: <i>Bowel perforation</i></td> <td data-bbox="1233 1034 1410 1088"><i>1 week</i></td> </tr> <tr> <td data-bbox="497 1088 735 1142">State the underlying cause on the lowest used line</td> <td data-bbox="735 1088 791 1142">c</td> <td data-bbox="791 1088 1233 1142">Due to: <i>Strangulated femoral hernia</i></td> <td data-bbox="1233 1088 1410 1142"><i>1 week</i></td> </tr> <tr> <td data-bbox="497 1142 735 1173"></td> <td data-bbox="735 1142 791 1173">d</td> <td data-bbox="791 1142 1233 1173">Due to:</td> <td data-bbox="1233 1142 1410 1173"></td> </tr> <tr> <td data-bbox="497 1173 882 1240">2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)</td> <td colspan="3" data-bbox="882 1173 1410 1240"><i>Hypertension</i></td> </tr> </tbody> </table>	<i>Frame A: Medical data: Part 1 and 2</i>				1		Cause of death	Time interval from onset to death	Report disease or condition directly leading to death on line a	a	<i>Peritonitis</i>	<i>2 days</i>	Report chain of events in due to order (if applicable)	b	Due to: <i>Bowel perforation</i>	<i>1 week</i>	State the underlying cause on the lowest used line	c	Due to: <i>Strangulated femoral hernia</i>	<i>1 week</i>		d	Due to:		2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)	<i>Hypertension</i>		
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Expected outcome	Students learn to document approximate interval																												
Content	<p>Important: Introduce and explain to the students the importance of the column for recording the approximate interval between onset of the condition and time of death.</p> <p>Approximate time interval between onset and death</p> <p>The column on the right-hand side of the death certificate is for recording the approximate interval between the onset of the condition and the date or time of death. An interval should be entered for each condition reported on the death certificate, especially for the conditions reported in Part 1. These intervals are usually established by the physician on the basis of available information. In some cases, the interval must be estimated. Periods such as minutes, hours, days, weeks, months or years can be used. If the time of onset is unknown or cannot be determined, write 'unknown'. This is very important. Do not leave this column blank. This information is useful for coding certain diseases and provides a check on the accuracy of the reported sequence of conditions. Therefore, filling in these lines is important.</p>																												
	<p>Case study 8</p> <p>A 58-year-old man presented at a clinic with a long history of haemoptysis and weight loss. The diagnosis was advanced pulmonary tuberculosis, reactivation type with cavitation, perhaps of eight years' duration. The patient also suffered from generalised arteriosclerosis, probably of long duration. Directly after the admission, the patient had an acute and massive pulmonary haemorrhage and died about 10 hours later. The patient's death certificate is shown in Figure 10.</p> <p>Figure 10: Sequence/chain of events leading to death in Case study 8</p> <table border="1" data-bbox="499 1099 1409 1440"> <thead> <tr> <th colspan="4"><i>Frame A: Medical data: Part 1 and 2</i></th> </tr> <tr> <th data-bbox="499 1126 735 1178">1</th> <th data-bbox="735 1126 826 1178"></th> <th data-bbox="826 1126 1233 1178">Cause of death</th> <th data-bbox="1233 1126 1409 1178">Time interval from onset to death</th> </tr> </thead> <tbody> <tr> <td data-bbox="499 1178 735 1229">Report disease or condition directly leading to death on line a</td> <td data-bbox="735 1178 826 1229">a</td> <td data-bbox="826 1178 1233 1229"><i>Pulmonary haemorrhage</i></td> <td data-bbox="1233 1178 1409 1229"><i>10 hours</i></td> </tr> <tr> <td data-bbox="499 1229 735 1281">Report chain of events in due to order (if applicable)</td> <td data-bbox="735 1229 826 1281">b</td> <td data-bbox="826 1229 1233 1281">Due to: <i>Advanced pulmonary tuberculosis</i></td> <td data-bbox="1233 1229 1409 1281"><i>8 years</i></td> </tr> <tr> <td data-bbox="499 1281 735 1332">State the underlying cause on the lowest used line</td> <td data-bbox="735 1281 826 1332">c</td> <td data-bbox="826 1281 1233 1332">Due to:</td> <td data-bbox="1233 1281 1409 1332"></td> </tr> <tr> <td data-bbox="499 1332 735 1384"></td> <td data-bbox="735 1332 826 1384">d</td> <td data-bbox="826 1332 1233 1384">Due to:</td> <td data-bbox="1233 1332 1409 1384"></td> </tr> <tr> <td data-bbox="499 1384 882 1440">2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)</td> <td colspan="3" data-bbox="882 1384 1409 1440"><i>Generalised arteriosclerosis (unknown)</i></td> </tr> </tbody> </table>	<i>Frame A: Medical data: Part 1 and 2</i>				1		Cause of death	Time interval from onset to death	Report disease or condition directly leading to death on line a	a	<i>Pulmonary haemorrhage</i>	<i>10 hours</i>	Report chain of events in due to order (if applicable)	b	Due to: <i>Advanced pulmonary tuberculosis</i>	<i>8 years</i>	State the underlying cause on the lowest used line	c	Due to:			d	Due to:		2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)	<i>Generalised arteriosclerosis (unknown)</i>		
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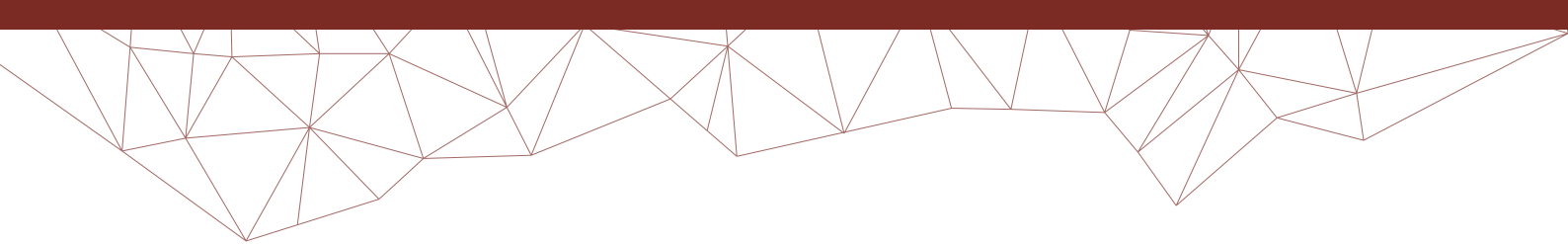
7. Guidelines for recording specific conditions

To help the classification and coding process for each death certificate, physicians need to give the fullest description possible of disease conditions. Examples of common conditions that have special instructions for certifying the deaths correctly are given in this lesson.

Objective	To provide students with guidelines for documenting specific conditions in the medical certificate
Duration	120 minutes
Method and resources	Interactive presentation (PowerPoint) and case-based examples (small group work)
Evaluation activities	None

Lesson plan

Topic 1	General instructions in death certification
Expected outcome	Students will learn the guidelines for documenting specific conditions
Content	<p>Neoplasms (tumours)</p> <p>When reporting death as a result of a neoplasm, try to provide detailed information about the tumour. This should include:</p> <ul style="list-style-type: none"> ■ The site (if known) of the neoplasm, whether benign or malignant, primary or secondary (give the site even if the primary neoplasm had been removed long before death) ■ Histological type (if known). <p>If the primary site of a secondary neoplasm is known, it must be stated; for example, 'primary carcinoma of the lung'. If the primary site of a secondary neoplasm is unknown, 'primary unknown' must be stated on the death certificate.</p> <p>Surgical procedures</p> <p>If death is a consequence of a surgical procedure, the name of the procedure should include the condition for which it was performed – for example, 'appendectomy for acute appendicitis'.</p> <p>Pregnancy and reporting maternal deaths</p> <p>If a woman dies during pregnancy or within 42 days of the termination of a pregnancy, the fact that the woman was pregnant should be indicated on the certificate, even if the direct cause of death (COD) is not related to the pregnancy or to childbirth. For example, the entry 'pregnant, period of gestation 26 weeks' may be reported in Part 2. If the death certificate includes a pregnancy check box, it should be ticked to indicate the woman was pregnant or was within 42 days of delivery when the death occurred, if that was the case.</p> <p>Hypertension</p> <p>If hypertension was essential or secondary to some other disease condition (eg chronic pyelonephritis), this must be stated. Essential primary hypertension is often a contributory COD rather than the underlying cause of death (UCOD).</p> <p>Infectious and parasitic diseases</p> <p>If the causative agent is known, note it on the certificate. If the causative agent is unknown, write 'cause unknown'. Always include the site of the infection, if known (eg urinary tract, respiratory tract).</p>



	<p>Diabetes mellitus</p> <p>The guidelines related to documenting COD when the patient has diabetes are complex. Diabetes mellitus can be the UCOD, or a risk factor for another UCOD. As a general rule, if the patient dies from a complication of diabetes mellitus (eg diabetes nephropathy), document diabetes mellitus (type I or II) as the UCOD. If a patient dies from stroke or acute myocardial infarction, document diabetes in Part 2 as a risk factor (other significant condition).</p> <p>Injuries, poisoning and external causes of death</p> <p>External CODs are events like motor vehicle accidents, suicide and homicide. When death occurs as a consequence of injury or violence, the external cause (the circumstance of the injury) must be listed as the underlying cause. The external cause should be described in as much detail as possible. For example, 'motor traffic accident' is not sufficiently precise, whereas 'pedestrian hit by motor car' is both clear and accurate. In a case of suicide, simply entering 'suicide' is insufficient; the method of suicide should be entered. For example, 'suicidal death by hanging' is a clear description. In countries where a coronial system is in place, physicians may need to inform the coroner about deaths from causes in this category before writing a death certificate. These are often referred to as unnatural deaths.</p> <p>Certifying perinatal deaths</p> <p>The perinatal period extends from 22 completed weeks of gestation (when the fetal weight is 500 g) to 7 completed days after birth. However, this definition may vary from country to country, depending on the chances of viability of the fetus when it is born (eg in some countries it is from the 28th week of gestation). The World Health Organization now recommends using the same certificate of COD to certify perinatal deaths as is used for adult deaths. In the certification of perinatal COD, both fetal and maternal factors are considered. The following case study is an example of the certification of perinatal death.</p>
	<p>Case study 9</p> <p>A 37-year-old multipara with gestational diabetes mellitus was admitted to hospital with dribbling at 32 weeks' gestation. She was diagnosed with premature rupture of the membrane and put on antibiotics. Two days later, she delivered a baby boy weighing 1.9 kg. On examination, the baby was found to be premature and was short of breath. The diagnosis of respiratory distress syndrome of neonates was made. The baby was sent to the premature baby unit for incubator care. Despite all treatment, the baby died 14 hours following birth.</p> <p>In the above example:</p> <ul style="list-style-type: none">■ The diseases or conditions in the fetus or infant are neonatal respiratory distress syndrome, prematurity and low birth weight.■ The maternal diseases or conditions affecting the fetus or infant are premature rupture of membranes, preterm labour, gestational diabetes mellitus and grand multiparity.■ The sequence of events leading to death is neonatal respiratory distress syndrome due to prematurity due to preterm labour caused by premature rupture of membranes. Gestational diabetes mellitus and grand multiparity will be considered contributory and reported in Part 2.

8. Assessing the quality of death certification

The University of Melbourne has developed a tool to assess the quality of death certification practices by checking for common errors on death certificates (Annex 2). This can be used to assess the quality of death certification as part of routine assessment, or to assess the training needs of physicians when designing cause of death (COD) certification training. This tool can be used to evaluate the effect of death certification training. This tool is available in manual, online and offline modes. As well as learning to recognise errors, students should be able to appreciate the impact of each error on the accuracy of mortality statistics.

Objective	To understand and recognise common errors in death certification
Duration	120 minutes
Method and resources	Practical exercises using the assessment tool ⁷
Evaluation activity	Select a sample of death certificates (de-identified) and ask the students to assess the death certificates using the death certificate assessment tool. This can be done as group work or as individual students. If done as group work, results can be presented in a short presentation or as a report.

Lesson plan

Topic 1	Death certification assessment
Expected outcome	Students can assess death certificates to identify common errors
Content	<p>Important: Before the lesson, collect a sample of de-identified death certificates to demonstrate common errors in death certificates.</p> <p>The list below gives the most common errors in death certification. Illustrate each error using two to three examples of incorrect death certificates. University of Melbourne's death certification assessment tool provides example errors in certification using actual death certificates from several countries. We recommend using a sample from the country of interest to demonstrate the errors. These common errors are:</p> <ul style="list-style-type: none"> ■ Multiple causes per line ■ Time intervals left blank ■ Leaving blank lines in between causes ■ Use of abbreviations ■ Illegibility ■ Incorrect sequence ■ Ill-defined underlying cause of death (UCOD).

⁷ Rampatige et al. *Assessing the quality of death certificates: Guidance for the rapid tool*. CRVS resources and tools. Melbourne, Australia: Civil Registration and Vital Statistics Improvement, The University of Melbourne, Bloomberg Philanthropies Data for Health Initiative; 2018.

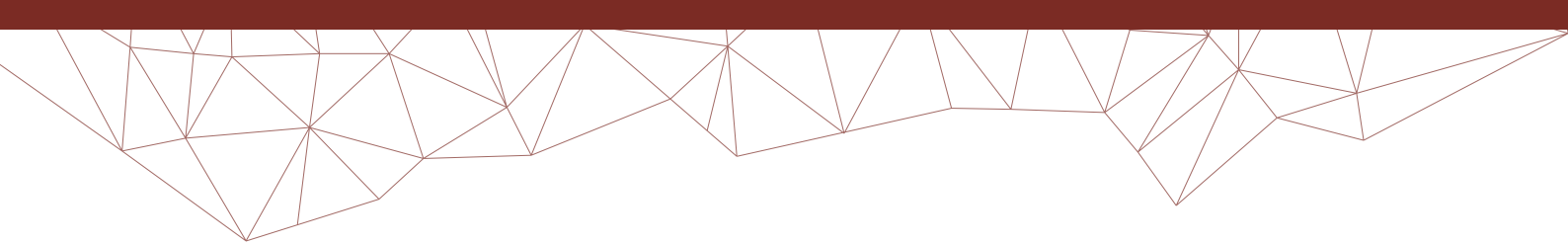


Expected outcome	Students can identify the death certificates that have reported more than one cause per line																										
Content	<p>Documenting multiple causes per line</p> <p>According to the World Health Organization International Statistical Classification of Diseases and Related Health Problems (ICD) guidelines, only one cause should be recorded per line on a death certificate. Reporting more than one cause on a single line on the death certificate makes the sequence of events leading to death unclear. This makes selecting the correct UCOD more difficult for coders. However, if there are multiple causes in the sequence leading to death, and not enough blank lines to record them on, then writing multiple causes per line may be acceptable. If this is the case, the certifier must clearly demonstrate the sequence by writing 'due to' in between conditions written on the same line.</p> <div style="text-align: right; border: 1px solid black; padding: 2px; margin-bottom: 10px;">Two causes recorded in line 1(a)</div> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="4" style="text-align: left; background-color: #f2f2f2;">Frame A: Medical data: Part 1 and 2</th> </tr> </thead> <tbody> <tr> <td rowspan="5" style="width: 30%; vertical-align: top;"> 1 Report disease or condition directly leading to death on line a Report chain of events in 'due to' order (if applicable) State the underlying cause on the lowest used line </td> <td rowspan="5" style="width: 5%; text-align: center; vertical-align: middle;"> </td> <td style="width: 5%;"></td> <td style="width: 20%;">Cause of death</td> <td style="width: 40%;">Time interval from onset to death</td> </tr> <tr> <td style="text-align: center;">a</td> <td><i>Cardiovascular bleed and community acquired pneumonia</i></td> <td><i>unknown</i></td> </tr> <tr> <td style="text-align: center;">b</td> <td>Due to:</td> <td></td> </tr> <tr> <td style="text-align: center;">c</td> <td>Due to:</td> <td></td> </tr> <tr> <td style="text-align: center;">d</td> <td>Due to:</td> <td></td> </tr> <tr> <td colspan="2" style="background-color: #f2f2f2;">2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)</td> <td colspan="3" style="border-top: 1px dashed black;"></td> </tr> </tbody> </table>	Frame A: Medical data: Part 1 and 2				1 Report disease or condition directly leading to death on line a Report chain of events in 'due to' order (if applicable) State the underlying cause on the lowest used line			Cause of death	Time interval from onset to death	a	<i>Cardiovascular bleed and community acquired pneumonia</i>	<i>unknown</i>	b	Due to:		c	Due to:		d	Due to:		2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)				
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		b	Due to:																								
		c	Due to:																								
		d	Due to:																								
2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)																											

Expected outcome	Students can identify the death certificates where time interval is not reported																										
Content	<p>Time interval reporting</p> <p>The column on the right-hand side of Part 1 of the death certificate is for recording the approximate time interval between the onset of the condition and the date of death. The interval should be entered for all conditions reported on the death certificate, especially for the conditions reported in Part 1. For conditions listed in Part 2, the time interval can be written in brackets after the condition – for example, 'obesity (15 years)'.</p> <p>These intervals are usually established by the physician on the basis of available information in the clinical records. In some cases, the time interval must be estimated. Any of minutes, hours, days, weeks, months or years can be used, as appropriate.</p> <p>If the time of onset is unknown or cannot be determined because of lack of information, it can be written as 'unknown'. Time intervals are very important for correctly coding certain diseases and provide a check on the accuracy of the reported sequence of conditions. Therefore, physicians must be asked to fill in the time lines.</p> <div style="text-align: right; border: 1px solid black; padding: 2px; margin-bottom: 10px;">Time not recorded</div> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="4" style="text-align: left; background-color: #f2f2f2;">Frame A: Medical data: Part 1 and 2</th> </tr> </thead> <tbody> <tr> <td rowspan="5" style="width: 30%; vertical-align: top;"> 1 Report disease or condition directly leading to death on line a Report chain of events in 'due to' order (if applicable) State the underlying cause on the lowest used line </td> <td rowspan="5" style="width: 5%; text-align: center; vertical-align: middle;"> </td> <td style="width: 5%;"></td> <td style="width: 20%;">Cause of death</td> <td style="width: 40%;">Time interval from onset to death</td> </tr> <tr> <td style="text-align: center;">a</td> <td><i>Pulmonary haemorrhage</i></td> <td></td> </tr> <tr> <td style="text-align: center;">b</td> <td><i>Advanced pulmonary tuberculosis</i></td> <td></td> </tr> <tr> <td style="text-align: center;">c</td> <td>Due to:</td> <td></td> </tr> <tr> <td style="text-align: center;">d</td> <td>Due to:</td> <td></td> </tr> <tr> <td colspan="2" style="background-color: #f2f2f2;">2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)</td> <td colspan="3" style="border-top: 1px dashed black;"></td> </tr> </tbody> </table>	Frame A: Medical data: Part 1 and 2				1 Report disease or condition directly leading to death on line a Report chain of events in 'due to' order (if applicable) State the underlying cause on the lowest used line			Cause of death	Time interval from onset to death	a	<i>Pulmonary haemorrhage</i>		b	<i>Advanced pulmonary tuberculosis</i>		c	Due to:		d	Due to:		2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)				
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Expected outcome	Students can identify the death certificates with blank lines																											
Content	<p>Presence of blank lines within the sequence of events</p> <p>When completing a death certificate, the certifier should use consecutive lines in Part 1 of the death certificate starting at line 1(a). The underlying cause should be recorded on the lowest used line in Part 1. There should not be any blank lines within the sequence/ chain of events leading to death, because the death certificate is a legal document and it is important that it cannot be easily altered or changed.</p> <div style="text-align: center; margin-bottom: 10px;"> Line 1(b) is blank </div> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="4" style="text-align: left; padding: 2px;"><i>Frame A: Medical data: Part 1 and 2</i></th> </tr> </thead> <tbody> <tr> <td style="width: 30%; padding: 2px; vertical-align: top;"> 1 Report disease or condition directly leading to death on line a Report chain of events in 'due to' order (if applicable) State the underlying cause on the lowest used line </td> <td style="width: 5%; padding: 2px; vertical-align: middle; text-align: center;"> </td> <td style="width: 60%; padding: 2px;"> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 5%;"></th> <th style="width: 55%;">Cause of death</th> <th style="width: 40%;">Time interval from onset to death</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">a</td> <td><i>Cardiogenic shock</i></td> <td></td> </tr> <tr> <td style="text-align: center;">b</td> <td>Due to:</td> <td></td> </tr> <tr> <td style="text-align: center;">c</td> <td><i>Acute coronary syndrome, cannot rule out pulmonary embolism</i></td> <td></td> </tr> <tr> <td style="text-align: center;">d</td> <td>Due to:</td> <td></td> </tr> </tbody> </table> </td> <td style="width: 5%;"></td> </tr> <tr> <td colspan="2" style="padding: 2px;"> 2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition) </td> <td colspan="2" style="padding: 2px;"> <div style="border-top: 1px dashed black; height: 15px;"></div> </td> </tr> </tbody> </table>	<i>Frame A: Medical data: Part 1 and 2</i>				1 Report disease or condition directly leading to death on line a Report chain of events in 'due to' order (if applicable) State the underlying cause on the lowest used line		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 5%;"></th> <th style="width: 55%;">Cause of death</th> <th style="width: 40%;">Time interval from onset to death</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">a</td> <td><i>Cardiogenic shock</i></td> <td></td> </tr> <tr> <td style="text-align: center;">b</td> <td>Due to:</td> <td></td> </tr> <tr> <td style="text-align: center;">c</td> <td><i>Acute coronary syndrome, cannot rule out pulmonary embolism</i></td> <td></td> </tr> <tr> <td style="text-align: center;">d</td> <td>Due to:</td> <td></td> </tr> </tbody> </table>		Cause of death	Time interval from onset to death	a	<i>Cardiogenic shock</i>		b	Due to:		c	<i>Acute coronary syndrome, cannot rule out pulmonary embolism</i>		d	Due to:			2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)		<div style="border-top: 1px dashed black; height: 15px;"></div>	
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Expected outcome	Students can identify when abbreviations are used																												
Content	**Use of abbreviations** Physicians are encouraged not to use abbreviations when certifying deaths, because abbreviations can mean different things to different people. Coders may misinterpret the abbreviation and code the death to an incorrect code. Some commonly used abbreviations are given below. Ask students to guess the conditions these abbreviations represent. If any other abbreviations are used in the country/hospitals, discuss them as well. Emphasise that abbreviations can be misinterpreted by mortality coders, leading to wrong assignment of UCOD.								----	------	-------	-----	-----	------		MI	HONK	K/C/O	DM	AAA	BHP		HT	ESRD	HTN	IHD	DEH	LAMA	
Expected outcome	Students can identify the illegible handwriting in death certification																												
Content	**Illegible handwriting** Death certificates need to be completed clearly so that coders and other users can read the information provided on the death certificate. However, some physicians have illegible handwriting that makes it hard for coders to correctly identify the stated condition. **17. CAUSES OF DEATH** I. Immediate cause: a: _____ Antecedent cause: b: _____ Underlying cause: c: _____ II. Other significant conditions contributing to death: _____																												

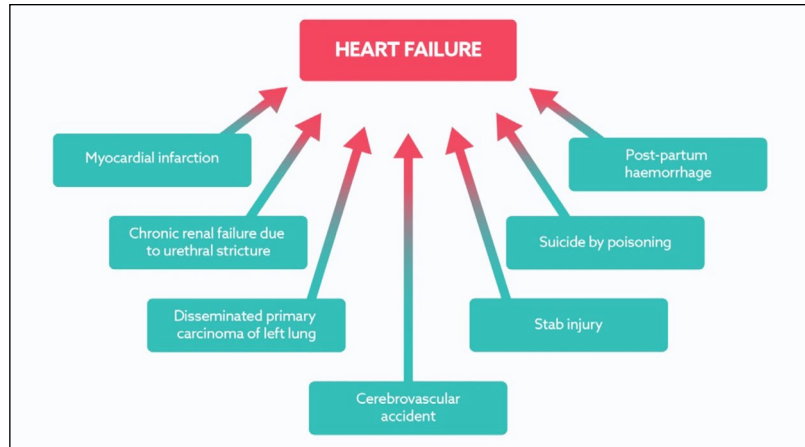


Expected outcome	Students can identify incorrect/clinically improbable sequences of events reported on death certificates																												
Content	<p>Incorrect /clinically improbable sequence of events leading to death</p> <p>Mortality statistics are based on the UCOD, which is the disease or injury that initiated the sequence of events that led directly to death. For example, when a person dies of a cerebral haemorrhage following a motor vehicle accident, cerebral haemorrhage is the direct COD, and the motor vehicle accident is the UCOD. Reporting the direct COD as the UCOD is probably the most common error.</p> <p>According to the guidelines, the certifying physician should identify a sequence of events leading to death and document that on the death certificate. When a clinically improbable sequence of events is recorded, the correct UCOD cannot be selected.</p> <div style="border: 1px solid red; padding: 5px; margin: 10px 0;"> <p>This shows a clinically improbable sequence of events leading to death, because chronic bronchitis does not cause gangrene or diabetes. It is likely that the diabetes caused the gangrene, which led to death, and that chronic bronchitis was a significant condition. This certificate also does not state if it was type I or type II diabetes.</p> </div> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="4" style="text-align: left; padding: 2px;">Frame A: Medical data: Part 1 and 2</th> </tr> </thead> <tbody> <tr> <td style="width: 30%; padding: 2px;">1 Report disease or condition directly leading to death on line a</td> <td style="width: 5%;"></td> <td style="width: 60%; padding: 2px;">Cause of death</td> <td style="width: 5%; padding: 2px;">Time interval from onset to death</td> </tr> <tr> <td style="padding: 2px;"></td> <td style="text-align: center; vertical-align: middle;">↻</td> <td style="padding: 2px;">a <i>Diabetes</i></td> <td style="padding: 2px;"><i>20 years</i></td> </tr> <tr> <td style="padding: 2px;">Report chain of events in 'due to' order (if applicable)</td> <td style="text-align: center; vertical-align: middle;">↻</td> <td style="padding: 2px;">b Due to: <i>Gangrene foot</i></td> <td style="padding: 2px;"><i>2 years</i></td> </tr> <tr> <td style="padding: 2px;"></td> <td style="text-align: center; vertical-align: middle;">↻</td> <td style="padding: 2px;">c Due to: <i>Chronic bronchitis</i></td> <td style="padding: 2px;"><i>5 years</i></td> </tr> <tr> <td style="padding: 2px;">State the underlying cause on the lowest used line</td> <td style="text-align: center; vertical-align: middle;">↻</td> <td style="padding: 2px;">d Due to:</td> <td style="padding: 2px;"></td> </tr> <tr> <td colspan="2" style="padding: 2px;">2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)</td> <td colspan="2" style="padding: 2px;">-----</td> </tr> </tbody> </table>	Frame A: Medical data: Part 1 and 2				1 Report disease or condition directly leading to death on line a		Cause of death	Time interval from onset to death		↻	a <i>Diabetes</i>	<i>20 years</i>	Report chain of events in 'due to' order (if applicable)	↻	b Due to: <i>Gangrene foot</i>	<i>2 years</i>		↻	c Due to: <i>Chronic bronchitis</i>	<i>5 years</i>	State the underlying cause on the lowest used line	↻	d Due to:		2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)		-----	
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	<p>Ill-defined conditions entered as underlying cause of death</p> <p>Ill-defined or vague conditions entered onto death certificates are of no value for public health and do not provide any information for decision-makers to guide them in designing preventive health programs.</p> <p>Such conditions are usually coded to unusable (previously referred to as 'garbage') codes, which belong to four main types:</p> <ol style="list-style-type: none"> 1. Impossible underlying causes, including signs and symptoms ('R' codes from ICD Chapter XVIII) 2. Intermediate causes 3. Modes of dying (eg cardiac or respiratory arrest) 4. Unspecified causes within a larger death category (eg ill-defined site of cancer or injury, unspecified accident). <p>Symptoms and signs (eg chest pain, cough and fever) should not be used on the death certificate. The disease or conditions that caused them should be reported.</p> <p>Physicians should not report the mode of dying on the death certificate. This includes terms such as 'cardiopulmonary arrest' and 'brain death'.</p> <p>In reporting the death of an elderly person, the terms 'senility' or 'old age' should be avoided. If at all possible, the physician should enter a specific cause.</p>																												

Ill-defined conditions

Entering ill-defined conditions on death certificates is of no value for public health. These conditions do not provide any information for decision-makers to guide them in designing preventive health programs. Organ failure (eg heart or liver failure) is not acceptable as a UCOD because it is the result of an underlying condition (Figure 11).

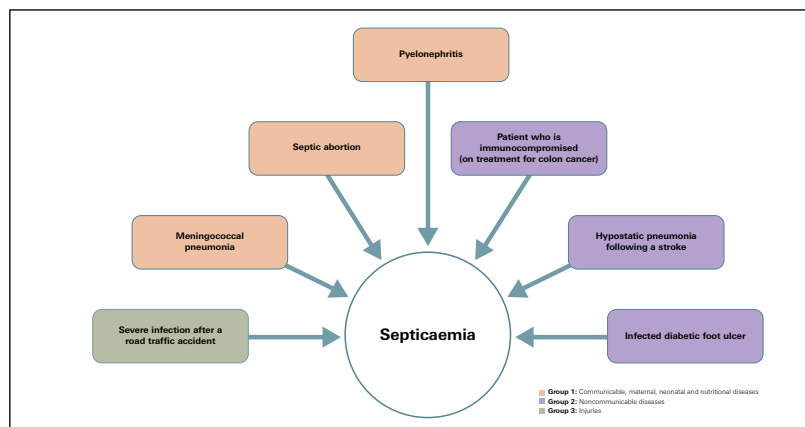
Figure 11: Possible underlying causes of death that can cause 'heart failure'



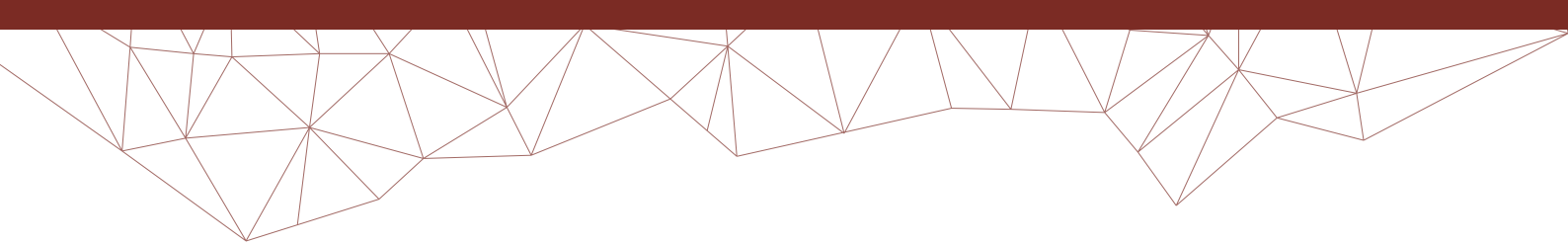
The disease or condition causing the organ failure should be entered as the underlying cause if at all possible.

Similarly, the term 'septicaemia' should not be used as an underlying cause if the source of the infection (eg septic abortion or community acquired pneumonia) can be identified. These are known as ill-defined conditions and should be avoided (Figure 12).

Figure 12: Possible underlying causes of death that can cause 'septicaemia'



Symptoms and signs (eg chest pain, cough and fever) are also considered to be ill-defined conditions. Physicians should not report the mode of dying on the death certificate. This includes terms such as 'cardiopulmonary arrest' or 'brain death'. In reporting the death of an older person, avoid the terms 'senility' and 'old age'. If at all possible, the physician must enter a specific cause. Where there is insufficient information to be certain of the COD, the physician may state 'unknown cause of death'. However, this diagnosis should only be used in exceptional circumstances.

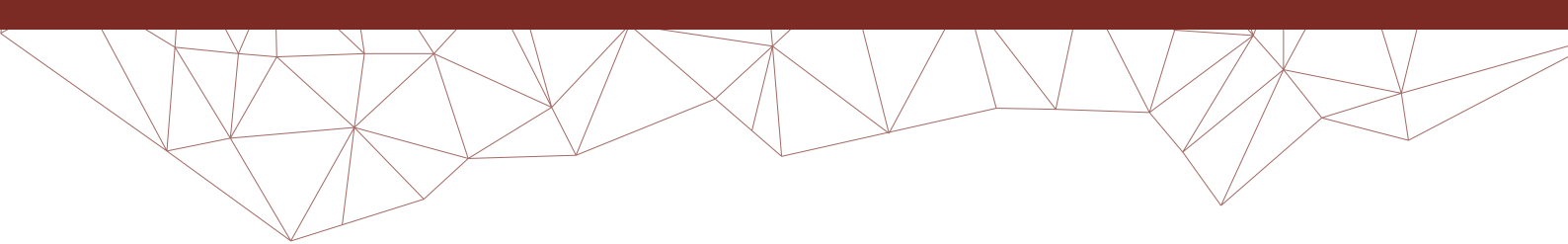


9. ICD-10 and mortality coding

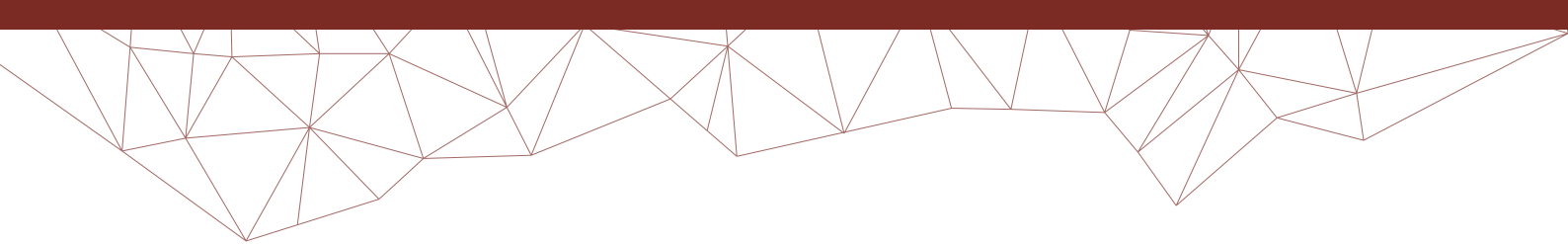
Objective	To introduce the definition and purposes of clinical coding and the uses of clinical classification systems, particularly the International Statistical Classification of Diseases and Related Health Problems (ICD) family
Duration	60 minutes
Method and resources	Interactive presentation (PowerPoint)
Evaluation activities	(Optional) The World Health Organization (WHO) online training tool for ICD-10 is designed for self-learning and classroom use. The tool is recommended for coders, clinicians and managers, and is available on the internet for download or as a CD-ROM. The course provides an overview of coding, outlines the chapters of ICD-10, gives a minimum amount of medical background and provides short summaries. The online ICD-10 training tool can be found at: http://apps.who.int/classifications/apps/icd/ICD10Training/

Lesson plan

Topic 1	Introduction to ICD-10
Expected outcome	Students understand the purposes of coding
Content	<p>Coding contributes to:</p> <ul style="list-style-type: none"> ■ Continuing patient care ■ Clinical research and epidemiological analysis ■ Funding and resource allocation ■ Utilisation review ■ Education/quality assurance ■ Health services planning and evaluation ■ Health policy.



Expected outcome	To describe a clinical classification system
Content	<p>A classification is a system of categories or groupings to which diseases, injuries, conditions and procedures are assigned according to established criteria. The grouping of similar terms is what distinguishes a statistical classification from a nomenclature. A nomenclature requires a separate name or title for each disease or procedure concept.</p> <p>ICD-10 is a statistical classification, which means that it contains a limited number of mutually exclusive code categories that describe all disease concepts. The classification is hierarchical in structure, with subdivisions to identify broad groups and specific entities.</p> <p>Types of disease classification systems:</p> <ul style="list-style-type: none"> ■ Part of the body affected (site or topography) ■ Cause (aetiology) ■ Morphology (the nature of the pathological change in the tissues) ■ Resulting functional abnormality ■ Statistical classification ■ Nomenclature. <p>A classification system allows easy storage, retrieval and analysis of morbidity and mortality data and so facilitates comparisons of data between hospitals, provinces or countries.</p> <p>Mortality coding</p> <p>Mortality coding refers to coding of causes of deaths recorded on death certificates and the selection of underlying cause of death (UCOD). First, codes are assigned to all the causes reported on death certificates. Selection of UCOD is done by the application of mortality coding rules. Coding is a specialised task that requires thorough training. Mortality coding is done by the expert coders who have undergone training.</p>



Expected outcome	Students understand the structure of the ICD-10
Content	<p>Development of ICD-10 began in 1983 with an international meeting in Geneva. Expert committees met in 1984 and 1987 and heard technical contributions from collaborating centres, WHO member states and regional offices. The ICD-10 consists of three volumes:</p> <ul style="list-style-type: none"> ■ Volume 1: Tabular list ■ Volume 2: Instructions and guidelines ■ Volume 3: Alphabetic index. <p>Volume 1: Tabular list</p> <p>This gives an alphanumeric listing of diseases and disease groups, along with exclusion and inclusion notes. The ICD-10 contains 22 chapters, each of which is identified by an uppercase roman numeral. When referring to a chapter, you should call it by its chapter number and not by the letters of the codes associated with it. For example, refer to Diseases of the Digestive System as Chapter XI and not as the K chapter. Each chapter is divided into blocks. The blocks are then divided into three, four and five-digit categories.</p> <p>ICD is an alphanumeric coding system. ICD codes consist of one letter followed by two to four numbers. ICD-10 was designed allowing room for further expansion and revision. Some example categories are:</p> <ul style="list-style-type: none"> ■ ICD three-character category: J02 – Acute pharyngitis ■ ICD four-character subcategory: J02.0 – Streptococcal pharyngitis ■ ICD five-character category: S02.01 – Open fracture of frontal bone. <p>Volume 2: Instruction manual</p> <p>This volume gives background and historical information about ICD, instruction notes about classification for morbidity, and mortality coding and selection rules.</p> <p>Volume 3: Alphabetical index</p> <p>Volume 3 is a comprehensive alphabetical index of the diseases and conditions found in the tabular list.</p>
Expected outcome	Students understand the structure of ICD codes
Content	<p>Coding is the translation of diseases, health-related problems and procedural concepts from text to alphabetic or numeric codes for storage, retrieval and analysis.</p> <div data-bbox="497 1485 1174 1731" style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p>The structure of the 4-character sub-categories is:</p> <div style="text-align: center;"> <p>B50.9</p> </div> </div> <ul style="list-style-type: none"> ■ The four-place alphanumeric coding scheme begins with an alphabetical character in the first position. Digits occupy the second, third and fourth positions. ■ The fourth position, following the decimal point, is not always used. ■ The fourth character is used for a variety of purposes, but '.8' is typically used for 'other' and '.9' is often used to mean 'no further specification' (beyond that given by the first three digits). ■ The code numbers range from A00.0 to Z99.9, with the letter U reserved for additions and changes.

Annex 1: International Form of Medical Certificate of Cause of Death (WHO 2016)

Administrative Data (can be further specified by country)																	
Sex	<input type="checkbox"/> Female				<input type="checkbox"/> Male				<input type="checkbox"/> Unknown								
Date of birth	D	D	M	M	Y	Y	Y	Y	Date of death	D	D	M	M	Y	Y	Y	Y
Frame A: Medical data: Part 1 and 2																	
1 Report disease or condition directly leading to death on line a Report chain of events in due to order (if applicable) State the underlying cause on the lowest used line			Cause of death	Time interval from onset to death													
		a															
		b	Due to:														
		c	Due to:														
d	Due to:																
2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)																	

Frame B: Other medical data															
Was surgery performed within the last 4 weeks?						<input type="checkbox"/> Yes		<input type="checkbox"/> No		<input type="checkbox"/> Unknown					
If yes please specify date of surgery						D	D	M	M	Y	Y	Y	Y		
If yes please specify reason for surgery (disease or condition)															
Was an autopsy requested?						<input type="checkbox"/> Yes		<input type="checkbox"/> No		<input type="checkbox"/> Unknown					
If yes were the findings used in the certification?						<input type="checkbox"/> Yes		<input type="checkbox"/> No		<input type="checkbox"/> Unknown					
Manner of death:															
<input type="checkbox"/> Disease			<input type="checkbox"/> Assault			<input type="checkbox"/> Could not be determined									
<input type="checkbox"/> Accident			<input type="checkbox"/> Legal intervention			<input type="checkbox"/> Pending investigation									
<input type="checkbox"/> Intentional self harm			<input type="checkbox"/> War			<input type="checkbox"/> Unknown									
If external cause or poisoning:						Date of injury		D	D	M	M	Y	Y	Y	Y
Please describe how external cause occurred (If poisoning please specify poisoning agent)															
Place of occurrence of the external cause:															
<input type="checkbox"/> At home		<input type="checkbox"/> Residential institution		<input type="checkbox"/> School, other institution, public administrative area				<input type="checkbox"/> Sports and athletics area							
<input type="checkbox"/> Street and highway		<input type="checkbox"/> Trade and service area		<input type="checkbox"/> Industrial and construction area				<input type="checkbox"/> Farm							
<input type="checkbox"/> Other place (please specify):						<input type="checkbox"/> Unknown									
Fetal or infant Death															
Multiple pregnancy						<input type="checkbox"/> Yes		<input type="checkbox"/> No		<input type="checkbox"/> Unknown					
Stillborn?						<input type="checkbox"/> Yes		<input type="checkbox"/> No		<input type="checkbox"/> Unknown					
If death within 24h specify number of hours survived								Birth weight (in grams)							
Number of completed weeks of pregnancy								Age of mother (years)							
If death was perinatal, please state conditions of mother that affected the fetus and newborn															
For women, was the deceased pregnant?						<input type="checkbox"/> Yes		<input type="checkbox"/> No		<input type="checkbox"/> Unknown					
At time of death						<input type="checkbox"/> Within 42 days before the death									
Between 43 days up to 1 year before death						<input type="checkbox"/> Unknown									
Did the pregnancy contribute to the death?						<input type="checkbox"/> Yes		<input type="checkbox"/> No		<input type="checkbox"/> Unknown					

Annex 2: University of Melbourne death certificate assessment tool

A correctly filled-in death certificate has none of the following errors. Did the certificate have:

Error type	Yes	No	Unsure because of illegible handwriting
1. Multiple causes of death per line			
2. Missing time interval from onset to death			
3. Blank lines within the sequence of events			
4. Abbreviations used in certifying the cause of death			
5. Illegible hand writing			
6. Incorrect or clinically improbable sequence of events leading to death			
7. Ill-defined condition(s) entered as the underlying cause of death			
<ul style="list-style-type: none"> ■ If yes, was the ill-defined condition: 			
<ul style="list-style-type: none"> – Impossible underlying cause (ie signs and symptoms) 			
<ul style="list-style-type: none"> – Intermediate cause 			
<ul style="list-style-type: none"> – Mode of dying (ie respiratory arrest) 			
<ul style="list-style-type: none"> – Unspecified causes within a larger death category (ie unspecified accident) 			
<ul style="list-style-type: none"> – Other – specify: 			
8. Were there additional errors on the certificate?			
<ul style="list-style-type: none"> ■ If yes, select all those that apply: 			
<ul style="list-style-type: none"> – For deaths from external causes, additional details were missing 			
<ul style="list-style-type: none"> – For deaths from neoplasms, additional details were missing 			
<ul style="list-style-type: none"> – Changes/alterations made by any means other than drawing a line through the original text (ie using correction fluid) 			
<ul style="list-style-type: none"> – No units specified for the age 			
<ul style="list-style-type: none"> – Other – specify: 			



Related resources and products

Further reading

World Health Organization. International Statistical Classification of Diseases and Related Health Problems, 10th revision, vol. 2. Geneva, Switzerland: WHO; 2016.

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WHO online training tool

The World Health Organization (WHO) has developed an online ICD-10 training tool. This interactive self-training tool helps users to understand and use ICD-10. User-specific paths include a fast track for people such as managers, and an in-depth training path for coders. This online tool has one module on cause of death certification to help physicians learn correct death certification practices. This training tool can be found at: apps.who.int/classifications/apps/icd/icd10training/.

The program partners on this initiative include: The University of Melbourne, Australia; CDC Foundation, USA; Vital Strategies, USA; Johns Hopkins Bloomberg School of Public Health, USA; World Health Organization, Switzerland.

Civil Registration and Vital Statistics partners:



For more information contact:

CRVS-info@unimelb.edu.au
crvsgateway.info

CRICOS Provider Code: 00116K

Version: 1118-01

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