Medical certification, ICD mortality coding, and reporting mortality associated with COVID-19

Technical note

7 June 2020

World Health Organization

Purpose

This technical note describes medical certification of cause of death and classification (International Classification of Diseases [ICD] mortality coding) of deaths related to COVID-19. The primary goal is to identify all deaths due to COVID-19 in all countries, including those not yet following WHO international norms and standards for medical certificates of cause of death and ICD mortality coding. It also addresses the related issue of estimating all deaths associated with the COVID-19 pandemic. The document is divided into three sections: identifying COVID-19 deaths; coding COVID-19 deaths; and measuring and reporting crude mortality in the context of the COVID-19 pandemic (excess mortality).

Definition of deaths due to COVID 19

- A death **due to** COVID-19 is defined for surveillance purposes as a death resulting from a clinically compatible illness, in a probable or confirmed[a] COVID-19 case, unless there is a clear alternative cause of death that cannot be related to COVID disease (e.g. trauma). There should be no period of complete recovery from COVID-19 between illness and death.
- A death **due to** COVID-19 may not be attributed to another disease (e.g. cancer) and should be counted independently of pre-existing conditions that are suspected of triggering a severe course of COVID-19.
- Deaths **due to** COVID-19 are the ones that are counted in cause of death data collection (for the purposes of COVID-19 death reporting).

NOTE: Deaths **due to** COVID-19 are different from COVID-19-**related** (or COVID-19–associated) deaths. These may be deaths due to accidental or incidental causes, or natural causes when COVID-19 is not identified as the underlying cause of death according to ICD coding guidance (see Section 4.2)

Guidance for certifying COVID-19 as a cause of death

In view of the need for accurate COVID-19 statistics, it is important to record and report deaths **due to** COVID-19 in a uniform way.

Recording COVID-19 on the medical certificate of cause of death

COVID-19 should be recorded on the medical certificate of cause of death for ALL decedents where the disease caused, or is assumed to have caused, or contributed to death.

Terminology

The official terminology, COVID-19,[b] should be used for all certification of this cause of death.

Because there are multiple coronaviruses that infect humans, it is recommended not to use "coronavirus" in place of COVID-19. This helps to reduce uncertainty in the classification or coding and to correctly monitor these deaths.

Chain of events

Specification of the causal sequence leading to death in Part 1 of the certificate is important. For example, in cases when COVID-19 causes pneumonia and fatal respiratory distress, both pneumonia and respiratory distress should be included, along with COVID-19, in Part 1. Certifiers should include as much detail as possible based on their knowledge of the case, as from medical records or laboratory testing (e.g. "COVID-19 (test positive)").

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[a] Confirmation of COVID-19 infection should be based on established laboratory diagnostic criteria[1]

[b] Temporary name was 2019-nCoV acute respiratory disease[2]

Example of how to certify the chain of events for deaths due to COVID-19 in Part 1 of the International Form of Medical Certificate of Cause of Death

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	Acute respiratory distress syndrome	2 days
		b	Due to: Pneumonia	10 days
		c	Due to: COVID-19 (test positive)	14 days
		d	Due to:	
			Underlying cause of death	
2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)				
Manner of death:				
☒ Disease	☐ Assault		☐ Could not be determined	
☐ Accident	☐ Legal intervention		☐ Pending investigation	
☐ Intentional self harm	☐ War		☐ Unknown	

Note: This is a typical course with a medical certificate of cause of death that has been filled in correctly. Please remember to indicate whether the virus causing COVID-19 had been identified in the deceased.

Comorbidities

There is increasing evidence that people with existing chronic conditions or compromised immune systems are at higher risk of death due to COVID-19. Chronic conditions may be non-communicable diseases, such as coronary artery disease, chronic obstructive pulmonary disease (COPD), and diabetes, or chronic communicable diseases, such as HIV (see below), or disabilities. If the decedent had existing chronic conditions such as these, they should be reported in Part 2 of the medical certificate of cause of death.

Examples of how to certify a chain of events for deaths due to COVID 19 in Part 1 of the International Form of Medical Certificate of Cause of Death, with comorbidities reported in Part 2

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	Acute respiratory distress syndrome	2 days
		b	Due to: Pneumonia	10 days
		c	Due to: Suspected COVID-19	12 days
			Due to:	
Underlying cause of death				
2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)			**Coronary artery disease [5 years], Type 2 diabetes [14 Years], Chronic obstructive pulmonary disease [8 years]**	
Manner of death:				
☒ Disease	☐ Assault		☐ Could not be determined	
☐ Accident	☐ Legal intervention		☐ Pending investigation	
☐ Intentional self harm	☐ War		☐ Unknown	

Note: This is a typical course with a medical certificate of cause of death that is filled in correctly. COVID-19 cases may have comorbidities. The comorbidities are recorded in Part 2.

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	Acute respiratory distress syndrome	2 days
		b	Due to: Pneumonia	10 days
State the underlying cause on the lowest used line		c	Due to: COVID-19	10 days
Underlying cause of death		d	Due to:	
2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)			Cerebral palsy [10 Years]	

Manner of death:					
☒ Disease		☐ Assault		☐ Could not be determined	
☐ Accident		☐ Legal intervention		☐ Pending investigation	
☐ Intentional self harm		☐ War		☐ Unknown	

Note: This is a typical course with a certificate that has been filled in correctly. COVID-19 cases may have comorbidities. The comorbidities are recorded in Part 2

Other examples

COVID-19 and maternal mortality:

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	Respiratory failure	2 days
		b	Due to: Pneumonia	8 days
State the underlying cause on the lowest used line		c	Due to: Pregnancy complicated by COVID-19	12 days
Underlying cause of death			Due to:	
2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)				

Manner of death:					
☒ Disease		☐ Assault		☐ Could not be determined	
☐ Accident		☐ Legal intervention		☐ Pending investigation	
☐ Intentional self harm		☐ War		☐ Unknown	

For women, was the deceased pregnant?	☒ Yes	☐ No	☐ Unknown
☒ At time of death	☐ Within 42 days before the death		
☐ Between 43 days up to 1 year before death	☐ Unknown		
Did the pregnancy contribute to the death?	☒ Yes	☐ No	☐ Unknown

Note: This is a typical course with a certificate that is filled in correctly. In case of a pregnancy, puerperium or birth leading to death in conjunction with COVID-19, please record the sequence of events as usual, and remember to enter the additional detail for pregnancies in frame B of the certificate of cause of death.

COVID-19 and HIV:

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	⟳	a	Cause of death Acute respiratory distress syndrome	Time interval from onset to death 3 days
	⟳	b	Due to: COVID-19	One week
	⟳	c	Due to:	
	⟳	d	Due to:	
2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)			HIV disease [5 years]	

Underlying cause of death

Manner of death:		
☒ Disease	☐ Assault	☐ Could not be determined
☐ Accident	☐ Legal intervention	☐ Pending investigation
☐ Intentional self harm	☐ War	☐ Unknown

Note: This is a typical course with a certificate that is filled in correctly. The certifier has identified HIV disease as contributing to the death and recorded it in Part 2.

The examples below show recording of cases where death may have been influenced by **COVID-19**, but death was caused by another disease or an accident.

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	⟳	a	Cause of death Hypovolaemic shock	Time interval from onset to death 1 day
	⟳	b	Due to: Aortic dissection	1 day
	⟳	c	Due to: Motor vehicle accident	2 days
	⟳	d	Due to:	
2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)			COVID-19	

Underlying cause of death

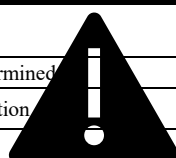| **Manner of death:**		
☐ Disease	☐ Assault	☐ Could not be determined
☒ Accident	☐ Legal intervention	☐ Pending investigation
☐ Intentional self harm	☐ War	☐ Unknown

NOT COVID-19 DEATH ⚠

Note: Persons with COVID-19 may die of other diseases or accidents. Such cases are not deaths due to COVID-19 and should not be certified as such. If it is thought that COVID-19 aggravated the consequences of the accident, COVID-19 may be reported in Part 2. Please remember to indicate the manner of death and record in Part 1 the exact kind of an incident or other external cause.

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	Heart failure	1 day
		b	Due to: Myocardial infarction	5 days
		c	Due to:	
		d	Due to:	
2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)			COVID-19	

Underlying cause of death

Manner of death:

☒ Disease	☐ Assault	☐ Could not be determined
☐ Accident	☐ Legal intervention	☐ Pending investigation
☐ Intentional self harm	☐ War	☐ Unknown

NOT COVID-19 DEATH

Note: The clinical illness and sequence of events leading to death may indicate that even in the presence of COVID-19 a person dies due to other conditions, as in the example above. Such cases are not deaths due to COVID-19 and should not be certified as such. The eventual presence of COVID-19 may then be recorded in part 2 of the certificate, in case it might have influenced the course of the condition leading to death.

Guidance for coding COVID-19 for mortality

This section addresses the specialized coding community. It provides information about the ICD 10 codes for COVID-19 and includes mortality classification (coding) instructions for statistical tabulation in the context of COVID-19.

New ICD-10 codes for COVID-19
- U07.1 COVID-19, virus identified[3]: https://icd.who.int/browse10/2019/en#/U07.1
- U07.2 COVID-19, virus not identified[3]: https://icd.who.int/browse10/2019/en#/U07.2
- Clinically or epidemiologically diagnosed COVID-19
  - Probable COVID-19
  - Suspected COVID-19

Details of the updates to ICD-10 are available online[4] at: https://www.who.int/classifications/icd/icd10updates/en/.

ICD-10 cause of death coding of COVID-19

Though "COVID-19" is the standard recommended terminology, certifiers may use a range of terms to describe COVID-19 as a cause of death. A list of potential terms can be found in the annex of this document.

Although both categories, U07.1 (COVID-19, virus identified) and U07.2 (COVID-19, virus not identified) are suitable for cause of death coding, it is recognized that in many countries detail as to the laboratory confirmation of COVID-19 will NOT be reported on the death certificate. In the absence of this detail, it is recommended, for mortality purposes only, to code COVID-19 provisionally to U07.1 unless it is stated as "probable" or "suspected".

The international rules and guidance for selecting the underlying cause of death for statistical tabulation apply when COVID-19 is reported on a death certificate. But, given the intense public health requirements for data, COVID-19 is not considered as due to, or as an obvious consequence of, anything else (in analogy to the coding rules applied for INFLUENZA and emerging diseases reportable to WHO). Further, there is no provision in the classification to link COVID-19 to other causes or modify its coding in any way.

With reference to section 4.2.3 of volume 2 of ICD-10, the purpose of mortality classification (coding) is to produce the most useful cause of death statistics possible. Thus, whether a sequence is listed as 'rejected' or 'accepted' may reflect interests of importance for public health rather than what is acceptable from a purely medical point of view. Therefore, always apply these instructions, whether they can be considered medically correct or not. Individual countries should not correct what is assumed to be an error, since changes at the national level will lead to data that are less comparable to data from other countries, and thus less useful for analysis.

A manual plausibility check is recommended for certificates where COVID-19 is reported, in particular for certificates where COVID-19 was reported but not selected as the underlying cause of death for statistical tabulation.

Chain of events

Example of how to code this chain of events and select the underlying cause of death for deaths due to COVID 19 in Part 1 of the International Form of Medical Certificate of Cause of Death

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	Acute respiratory distress syndrome J80	2 days
Report chain of events in due to order (if applicable)		b	Due to: Pneumonia J18.9	10 days
State the underlying cause on the lowest used line		c	Due to: COVID-19 (test positive) U07.1	14 days
		d	Due to:	
2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)			Underlying cause of death	

Manner of death:

☒ Disease	☐ Assault	☐ Could not be determined
☐ Accident	☐ Legal intervention	☐ Pending investigation
☐ Intentional self harm	☐ War	☐ Unknown

Note: Select COVID-19 as underlying cause of death. Step SP3 applies as causes have been reported on more than one line in Part 1 and the condition reported first on the lowest used line (COVID-19) can cause all the conditions, pneumonia (J18.9) and acute respiratory distress syndrome (J80)—mentioned on the lines above. [See ICD-10 2016 and later, Volume 2, Section 4.2.1].

Comorbidities

Examples of how to code this chain of events on the International Form of Medical Certificate of Cause of Death, and select the underlying cause of death for deaths due to COVID 19 in Part 1, with comorbidities reported in Part 2

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	Acute respiratory distress **syndrome** **J80**	2 days
Report chain of events in due to order (if applicable)		b	Due to: Pneumonia **J18.9**	10 days
State the underlying cause on the lowest used line		c	Due to: Suspected COVID-19 **U07.2**	12 days
			Due to: Underlying cause of death	
2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)			Coronary artery disease [5 years], Type 2 diabetes [14 Years], Chronic obstructive pulmonary disease [8 years] I25.1, E11.9, J44.9	

Manner of death:

☒ Disease	☐ Assault	☐ Could not be determined
☐ Accident	☐ Legal intervention	☐ Pending investigation
☐ Intentional self harm	☐ War	☐ Unknown

Note: Code all entries in Part 1 and 2, and, in this example, select COVID-19, specified as suspected (the case is explicitly stated as not having been confirmed) as underlying cause of death. Step SP3 applies as causes have been reported on more than one line in Part 1 and the condition reported first on the lowest used line (COVID-19) can cause all the conditions—pneumonia (J18.9) and acute respiratory distress syndrome (J80)—mentioned on the lines above. [See ICD-10 2016 and later, Volume 2, Section 4.2.1].

Frame A: Medical data: Part 1 and 2

		Cause of death		Time interval from onset to death
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	a	Acute respiratory distress syndrome	**J80**	2 days
	b	Due to: Pneumonia	**J18.9**	10 days
	c	Due to: COVID-19	**U07.1**	10 days
	d	Due to:		
2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)		Cerebral palsy [10 Years]		G80.9

Underlying cause of death

Manner of death:

☒ Disease	☐ Assault	☐ Could not be determined
☐ Accident	☐ Legal intervention	☐ Pending investigation
☐ Intentional self harm	☐ War	☐ Unknown

Note: Code all entries in Part 1 and 2, and, in this example, select COVID-19 as underlying cause of death (the case has probably tested positive). Step SP3 applies as causes have been reported on more than one line in Part 1 and the condition reported first on the lowest used line (COVID-19) can cause both of the conditions—pneumonia (J18.9) and acute respiratory distress syndrome (J80)—mentioned on the lines above. [See ICD-10 2016 and later, Volume 2, Section 4.2.1]

Other examples

Frame A: Medical data: Part 1 and 2

		Cause of death		Time interval from onset to death
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	a	Respiratory failure	*Code both, O99.5 and J96.9*	2 days
	b	Due to: Pneumonia	*Code both, O99.5 and J18.9*	8 days
	c	Due to: Pregnancy complicated by COVID-19	*Code both, O98.5 and U07.1*	12 days
2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)				

Underlying cause of death

Manner of death:

☒ Disease	☐ Assault	☐ Could not be determined
☐ Accident	☐ Legal intervention	☐ Pending investigation
☐ Intentional self harm	☐ War	☐ Unknown

For women, was the deceased pregnant?	☒ Yes	☐ No	☐ Unknown
☒ At time of death	☐ Within 42 days before the death		
☐ Between 43 days up to 1 year before death	☐ Unknown		
Did the pregnancy contribute to the death?	☒ Yes	☐ No	☐ Unknown

Note: Code all entries in Part 1 and 2, and, in this example, select other viral diseases complicating pregnancy, childbirth, and the puerperium (O98.5) as underlying cause of death. Step SP3 applies as causes have been reported on more than one line in Part 1 and the condition reported first on the lowest used line (other viral diseases complicating pregnancy, childbirth and the puerperium) can cause both of the conditions—pneumonia (O99.5 and J18.9) and acute respiratory distress syndrome (O99.5 and J80)—mentioned on the lines above. [See ICD-10 2016 and later, Volume 2, Section 4.2.1]. Use additional code to retain COVID-19. [See ICD-10 2016 and later, Volume 2, Section 4.2.8 Special instructions on maternal mortality (Step M4)].

Examples of incorrect certification

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	Acute respiratory distress syndrome J80	3 days
	b	Due to: COVID-19 U07.1	One week
Underlying cause of death	c	Due to: HIV disease B24	5 years
	d	Due to:	
2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)			

Manner of death:		
☒ Disease	☐ Assault	☐ Could not be determined
☐ Accident	☐ Legal intervention	☐ Pending investigation
☐ Intentional self harm	☐ War	☐ Unknown

Note: The certifier should have added the HIV disease as a comorbidity in Part 2 of the medical certificate of cause of death; however, the selection rules of ICD allow for identification of COVID-19 as underlying cause of death. COVID-19 is reported in a sequence starting with a terminal condition (Acute respiratory distress syndrome due to COVID-19). Mortality coding rule step SP4 applies as causes have been reported on more than one line in Part 1 and the condition reported first on the lowest used line (HIV disease) cannot cause all the conditions. [See ICD-10 2016 and later, Volume 2, Section 4.2.1].
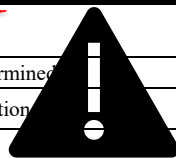
Frame A: Medical data: Part 1 and 2			
1 Report disease or condition directly leading to death on line a		Cause of death	Time interval from onset to death
Report chain of events in due to order (if applicable)	a	Hypovolaemic shock T79.4	1 day
	b	Due to: Aortic dissection S25.0	1 day
State the underlying cause on the lowest used line	c	Due to: Motor vehicle accident V89.2	2 days
Underlying cause of death	d	Due to:	
2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)		COVID-19 U07.1	

Manner of death:		
☐ Disease	☐ Assault	☐ Could not be determined
☒ Accident	☐ Legal intervention	☐ Pending investigation
☐ Intentional self harm	☐ War	☐ Unknown

NOT COVID-19 DEATH ⚠

Note: Code all entries in Part 1 and 2, and, in this example, select motor vehicle accident (V89.2) as underlying cause of death. Step SP3 applies as causes have been reported on more than one line in Part 1 and the condition reported first on the lowest used line, motor vehicle accident (V89.2), can cause all the conditions traumatic aortic dissection (S25.0) and traumatic hypovolemic shock (T79.4)—mentioned on the lines above. [See ICD-10 2016 and later, Volume 2, Section 4.2.1].

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	Heart failure I50.9	1 day
Report chain of events in due to order (if applicable)		b	Due to: Myocardial infarction I21.9	5 days
State the underlying cause on the lowest used line		c	Due to: *Underlying cause of death*	
		d	Due to:	
2 Other significant conditions contributing to death (time intervals can be included in brackets after the condition)			COVID-19 U07.1	

Manner of death:		
☒ Disease	☐ Assault	☐ Could not be determined
☐ Accident	☐ Legal intervention	☐ Pending investigation
☐ Intentional self-harm	☐ War	☐ Unknown

NOT COVID-19 DEATH ⚠

Note: The physician has determined and recoded that the myocardial infarction this person died of was not caused by COVID-19. Code all entries in Part 1 and 2, and, in this example, select acute myocardial infarction (I21.9) as underlying cause of death. Step SP3 applies as causes have been reported on more than one line in Part 1 and the condition reported first on the lowest used line, myocardial infarction (I21.9), can cause the condition, heart failure (I50.9), mentioned on the line above. [See ICD-10 2016 and later, Volume 2, Section 4.2.1].

WHO's requirements for Member States to report weekly number of COVID-19 deaths from their civil registration and vital statistics systems

Rationale

WHO has been the lead agency in gathering cause-of-death statistics from its Member States' civil registration and vital statistics (CRVS) systems yearly since the early 1950s. This function is becoming even more crucial as the during the global pandemic of COVID-19, in which the availability of timely, accurate, and complete data is essential to understand the true impact of the disease on mortality. Well-functioning CRVS systems produce cause-of-death statistics that are compiled from individual medical certificates of cause of death that follow WHO international norms and standards in ICD mortality coding. This enables COVID-19 mortality to be measured in a comparable manner.

During the current pandemic, deaths in health facilities are often the first to be counted, leaving out deaths in the community, elderly care facilities, etc., thus distorting the real impact.

Obtaining timely, accurate, and complete weekly mortality statistics will help show the impact of COVID-19 on overall mortality across countries, as well as the sex and age breakdown of mortality, and may identify possible under-reporting of COVID-19 deaths. Additionally, this will help monitor the impact of interventions. The reporting of certified deaths through the present system will enable more precise information on a subset (certified deaths) of all COVID-19 deaths, which will complement comprehensive weekly global surveillance for COVID-19 deaths already in place, as found in WHO's global surveillance guidance.[5]

Phase I

To ensure measurement of the indirect mortality impacts of COVID-19 and to include countries not yet following WHO international norms and standards in medical certificates of cause of death and ICD mortality coding, Member States are asked to submit:
- Total deaths aggregated by week of occurrence, sex, and age group according to a standard file layout. These data should ideally come from the CRVS system, namely, via established mortality notification systems in both facilities and communities;
- COVID-19 deaths aggregated by week of occurrence, sex, and age group, according to a standard file layout. These data should be compiled from the individual medical certificates of cause of death by the authorized national authorities.

List of data variables and metadata to be submitted to WHO

Variable	Description
Week	Week in which deaths occur
Sex	Sex of the deceased
Age	Age of the deceased by age-group
Cause of death	− Total deaths from all causes combined (natural and non-natural) − COVID-19 is mentioned anywhere on the death certificates (Parts 1 and 2) − COVID-19 is the underlying cause of death

Metadata

Variable	Rationale
Source of data	Countries may rely on several sources of data. This collection relies mainly on data from CRVS systems
Average length of time from occurrence of death to inclusion in statistics	Will help in understanding backlogs and expectations of revised and updated figures
Estimated completeness of total mortality data from all causes combined for the most recent week as submitted to WHO	Incomplete data need to be interpreted with caution and revised accordingly
Estimated completeness of COVID-19-specific mortality data for the most recent week as submitted to WHO	Incomplete data need to be interpreted with caution and revised accordingly
Proportion of deaths certified electronically	Another measure of timeliness, an electronic system for medical certification enables the information on death and causes of death to be shared with authorities with no or reduced delay.
Place(s) of occurrence of death	Deaths occur in health facilities, in care homes, and at home, as well in other places such as prisons or retention centres. Knowing which data are included in the data file will help in understanding data completeness.
Population(s) covered	Countries may have different policies around inclusion of non-citizen residents, deaths of citizens or residents abroad, or deaths of temporary visitors that occur within the country in their data. It is also important to know the denominator (catchment population), by age and sex, to which the mortality data refer.

Phase II

WHO will be approaching Member States to submit anonymized individual-level death records where COVID-19 is mentioned.

Goals

- o Allow investigation of comorbidities with COVID-19
- o Perform equity analyses or analyses of within-country disparities based on geography, ethnicity, profession, or other factors relevant to the determination of COVID-19 control policies

Reporting requirements

In addition to the variables reported in Phase I, the following variables would be also needed at the individual level:

- o Date of death (day and month and year)
- o Place of death (health facilities, care homes, home, prisons, retention centres, etc)
- o Was COVID-19 test performed? If yes, was it confirmed positive?
- o Place of usual residence by 1st and 2nd geographic area
- o Profession
- o Ethnicity
- o Pregnancy status
- o Multiple causes of death (all causes mentioned on Parts 1 and 2 of the death certificates)

Data safeguards

WHO has a formal and comprehensive policy for securely managing all databases and information sources hosted by the Organization. The policy includes information security, technical and physical data security, data access and retention procedures, and confidentiality arrangements in the context of public health emergencies. Accordingly, WHO will establish measures to safeguard confidential information about the deceased and prevent misuse of the information.[c]

Analysis of total mortality

Excess mortality

Excess mortality, measuring the increase in mortality rates that is attributable to the excess risk imposed by a specific disease or crisis condition, can be used to assess the impact of COVID-19 on mortality overall and to assess the impact of interventions. In-depth statistical analyses with more data variables than are currently available, including the essential ones outlined in this WHO guideline, will be required to more accurately quantify the excess mortality attributed to COVID-19 pandemic.

Nevertheless, as a crude measure, one can compare the observed death rates by age and sex during the period of the COVID-19 pandemic in 2020 with the projected deaths rates adjusted for any abnormal events (e.g. armed conflicts, natural disaster) based on reported data or reliable estimates for the same period in previous years, by age, sex, and cause of deaths where possible.

This would provide a general picture of the mortality impact of the COVID-19 pandemic. One example of monitoring excess mortality related to pandemics and other public health threats is the EUROMOMO project.[7] However, a number of factors need to be considered when interpreting such estimates, including the relative timeliness, completeness, and accuracy of death reporting for non-COVID-19 death in 2020 and the most recent years, other non-COVID-19 causes that contribute to the excess mortality in 2020 over and above any projected levels, and potential decrease in mortality from other causes affected indirectly by COVID-19 (e.g. decline in deaths from road traffic injuries due to physical distancing measures).

Analysis of COVID-19 related deaths

Age-standardized rates

Apart from differential mortality risks, the variation in mortality levels across different locations is also a function of varying population age structures. For comparisons between countries and regions with different population age structures, age-standardized rates for cases and deaths will be used in place of crude rates. When Member States or the WHO Secretariat calculate age-standardized rates, the WHO world standard population[8] should be used as weights to derive the weighted sum of age-specific rates.

(WHO world standard population : https://apps.who.int/healthinfo/statistics/mortality/whodpms/definitions/pop.htm.)

Case fatality rates and infection fatality rates

Case fatality rate (CFR), the proportion of deaths from a certain disease among all people diagnosed with the disease over a certain period of time, can be used as a measure to evaluate the severity of the disease and the effectiveness of treatments. An alternative measure is the infection fatality rate (IFR), which differs from CFR by using all infections as the denominator to additionally account for all asymptomatic and undiagnosed infections. Because older adults with pre-existing health conditions are potentially at higher risk of dying from COVID-19, it is recommended to examine the estimated CFR and IFR by age and/or by the health condition of patients where possible to gain a better understanding of the interaction of COVID-19 with age and other pre-existing diseases. For the numerator, a distinction should be made between deaths caused directly by COVID-19 and deaths related to COVID-19. If data permit, CFR and IFR for direct COVID-19 deaths should be separately calculated. Otherwise, the inclusion of deaths related to COVID-19 in the numerator should be clearly documented to ensure comparability. The calculation should take into account the lag between the occurrence of the infections and the associated deaths in a specific location, as the failure to do so will cause artificially lower or higher CFR and IFR estimates depending on the stage of the epidemic progression. As the COVID-19 pandemic is still evolving and many countries continue to build up the capacity and expand the population coverage for testing and reporting, it is likely the true numbers of COVID-19 cases are under-reported to varying degrees in different countries and over time, leading to artificially higher estimates of CFR compared with IFR. This bias needs to be considered when interpreting the estimated CFR and IFR.

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[c] The Policy Statement on Data Sharing by the World Health Organization in the Context of Public Health Emergencies has been published.[6] Eurostat collects anonymized individual-level death record but has put in place an EU regulation to safeguard the data. PAHO started such a similar project some years ago but due to resource-constraints was unable to continue the project. WHO HQ is considering implementing such a project within the expansion of its Mortality Database in 2021.

References

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3. World Health Organization. ICD-10 Version:2019. Available from https://icd.who.int/browse10/2019/. Accessed 29 May 2020.

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6. World Health Organization. Policy Statement on Data Sharing by the World Health Organization in the Context of Public Health Emergencies. Available from https://www.who.int/docs/default-source/publishing-policies/who-policy-statement-on-data-sharing.pdf?sfvrsn=71a41493_0. Accessed 29 May 2020.

7. EUROMOMO. https://euromomo.eu/. Accessed 29 May 2020.

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Annex: Additional WHO cause of death certification links

How to fill in a medical certificate of cause of death: Interactive Self Learning Tool (WHO)
https://apps.who.int/classifications/apps/icd/icd10training/ICD-10%20Death%20Certificate/html/index.html

Cause of Death on the Death Certificate: Quick Reference Guide (Section 7.1.2)
https://icd.who.int/browse10/Content/statichtml/ICD10Volume2_en_2016.pdf

International form of medical certificate of cause of death (Section 7.1.1)
https://icd.who.int/browse10/Content/statichtml/ICD10Volume2_en_2016.pdf

Examples of terms used by certifiers of cause of death to describe COVID-19 and that can be coded as synonyms of COVID-19:

- COVID Positive
- Coronavirus Pneumonia (unless clearly related to a non-COVID-19 coronavirus)
- COVID-19 Infection
- SARS-Cov-2 Infection (Coronavirus Two Infection)
- COVID-19 Coronavirus
- Infection – COVID-19 (Coroner Informed)
- Hospital Acquired Pneumonia - COVID-Positive
- Corona Virus two infection (SARS-Cov-2)
- Corona Virus Pneumonia (COVID-19)
- Coronavirus-Two Infection
- Novel coronavirus

WHO continues to monitor the situation closely for any changes that may affect this technical note. Should any factors change, WHO will issue a further update. Otherwise, this technical note will expire 2 years after the date of publication

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