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DEATH CERTIFICATION ERRORS: PRACTICAL PROBLEMS IN EVERYDAY PRACTICE

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Accurate, precise, current and complete information about national mortality is necessary for planning, determining health priorities, distributing services, allocating budgets and delivering equitable healthcare services. Despite World Health Organisation guidelines, errors in death certificates (DC) have been observed in all regions and are very common. Many studies have pointed to various error types during death certification, focusing on the presence or absence of certain specific entities. Although there are many ways to stratify the errors, they are generally categorised into major and minor. Major errors refer to errors that seriously impact the selection and classification of the underlying cause of death (UCD) (misclassification and definition of UCD, improper sequencing, mechanism of death without data of UCD, multiple and independent causes of death, insufficiently specific cause of death). In contrast, the minor errors have little impact on the classification of UCD (absence of time interval, abbreviations, specifying other significant conditions (comorbidities), more than one diagnosis on a line in Part I of DC, illegible handwriting). Completing the DC is an essential skill that physicians should possess. The key to reducing these errors lies in continuous training based on international guidelines, underlining the importance of ongoing education in this field.

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Key words: *death certificate, underlying cause of death, major errors, minor errors*

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Introduction

Accurate, precise, current, and complete information about national mortality is imperative. This information is necessary and the foundation for planning, determining health priorities, distributing services, allocating budgets, and delivering equitable healthcare services (1). Any deficiency in the quality of data reported on death certificates (DC) directly impacts the effectiveness of health management and politics. The medical section of DC, regularly completed by the attending physician or coroner, is the source of mortality data, making the accuracy of this information crucial.

The recognised factors in the occurrence of errors are clearly defined in three categories: the ability of the physician to fill in the DC accurately, the skill of the physician to code the condition from the DC accurately following the rules of the World Health Organisation (WHO), the separation of the underlying cause of death (UCD), and the application of clear statistical procedures and standards that convert individual UCD into mortality statistics (2, 3). The physician who determines the death and completes the DC represents the first link in determining the UCD. Corrections will not be needed if this step is done adequately, and the data will be of high quality.

Despite WHO guidelines, errors in the death certification have been observed in all regions and are very common (4–8). Many studies have shown that DC filling is often incomplete and inaccurate (9–14). The quality of mortality data is affected by several factors: the method of filling in and issuing the DC, the education of the physician who fills out the DC and who codes the UCD, the application of different versions of disease classifications, the application of inadequately grouped diagnoses, the application of different formats in which data are collected, poor choice of the International Classification Disease (ICD) 10 codes concerning the nature of the fatal outcome

as well as the application of garbage codes (GC) (1, 3).

Many studies have pointed to various error types, focusing on the presence or absence of certain specific entities. Although there are many ways to stratify the errors, they are generally categorised into major and minor (Table 1) (9, 11, 15–17). The first refers to errors that seriously impact the selection and classification of UCD. In contrast, the second one refers to errors that have little impact on the classification of UCD. However, their absence may help in the more precise determination and classification of the underlying aetiology of the fatal outcome.

II Major errors

Ill-defined UCD

Incorrect classification and definition of UCD is classified as a group of major errors. Namely, the indication of UCD may be missing or indicated on an inappropriate line in the DC or even in another medical part of the DC (17). From the public health perspective, the most effective strategy in preventing and controlling diseases and injuries is correctly identifying UCD since disease trends are based on that data (18). Therefore, the wrong identification of OUS can lead to incorrect decisions and interventions at the national level. Misidentification is directly related to filling out the DC. When determining the death in a violent manner, doctors very often neglect and do not mention the external circumstances of the injury that lead to the fatal outcome. The consequences of such mistakes are enormous. The absence of external circumstances of injury leads to masking of the accurate picture of the frequency of certain types of violent death (Table 2). As a result, death of violent origin is masked by some other, very often cardiovascular causes (ICD I00-I99) or undetermined causes of death (ICD R00-R99), which automatically changes the manner of death and the pattern of dying.

Improper sequencing

The death certification delivers the ability to differentiate the time sequence of diseases that may have led to fatal outcomes. The improper sequence in the immediate, intermediate and underlying causes of death belongs to the group of major errors since the correct sequence of events plays a crucial role in correctly selecting different causes. Inadequate sequence of events is the most frequently reported error in the literature (0.7%–94.6%) (5). Studies from India (19, 20) and Iran (21) have shown that inadequate sequencing is the most common mistake made by physicians. An acceptable sequence may be chronic kidney disease, congestive heart failure, and, finally, acute pulmonary oedema (Table 3). An improper sequence is an error that accounts unacceptable sequences, such as acute pulmonary oedema, chronic kidney disease, and congestive heart failure.

Table 1. Classification of the most common errors

MAJOR ERRORS	MINOR ERRORS
Misclassification and definition of UCD	Absence of a time interval
Improper sequencing	Abbreviations
Mechanism of death without data of UCD	Specifying other significant conditions (comorbidities)
Multiple and independent causes of death	More than one diagnosis on a line in Part I of DC
Insufficiently specific cause of death	Illegible handwriting

Table 2. Example of Ill-defined UCD

Medical data		WRONG	ACCURATE
Part I Cause of death	**a) Immediate cause**	R40.2 Coma, unspecified	R40.2 Coma, unspecified
	b) Intermediate cause		S06.5 Traumatic subdural haemorrhage
	c) Underlying cause	S06.5 Traumatic subdural haemorrhage	V29.4 The driver injured in a collision with another unmarked motor vehicle in a traffic accident
Part II Other significant conditions contributing to death		E10.9 Type 1 diabetes mellitus without complications	E10.9 Type 1 diabetes mellitus without complications

Table 3. Example of improper sequencing

Medical data		WRONG	ACCURATE
Part I Cause of death	**a) Immediate cause**	I50.0 Congestive heart failure	J81.0 Acute pulmonary oedema
	b) Intermediate cause	N18.5 Chronic kidney disease	I50.0 Congestive heart failure
	c) Underlying cause	J81.0 Acute pulmonary oedema	N18.5 Chronic kidney disease
Part II Other significant conditions contributing to death		E66. 9 Obesity	E66.9 Obesity

Mechanism of death without data of UCD

The mechanism of death is not part of the disease process and should not be considered the UCD (9). Mechanism of death was listed as the fifth most common error in a meta-analysis (22). It belongs to garbage diagnosis with no analytical value, and many diagnoses fall into the first severity level in public health decision-making. For this reason, the mechanisms are not usable in practice, and the UCD cannot be analysed based on them, nor can adequate prevention measures be applied. Many physicians identify cardiovascular events, most commonly cardiac arrest (I46.9), syncope (R05.4), as well as unspecified respiratory insufficiency (J96.0), and asphyxia (R09), as the UCD without understanding that it is a pathophysiological process that represents the terminal outcome. The Framingham study found that cardiovascular causes of death were overestimated in at least 24% of death certificates. (23) At the same time, Behrendt et al. concluded that nearly two-thirds of physicians used nonspecific cardiovascular mechanisms to code OUS (24).

Multiple and independent causes of death

This type of error refers to the existence of two or more causally unrelated, etiologically specific causes of death, listed in Part I of the DC (25). This error also occurs when several etiologically different diagnoses of the cause of death are written on one line. An example of such an error would be when entering on line a) a diagnosis of lung cancer (C34.1), on line b) thyrotoxicosis with goitre (E05.0), and on line c) atrial fibrillation and flutter (I48). In that case, a diagnosis should be determined according to the ICD rules, representing the UCD, which would be lung cancer (C34.1).

Table 4. Example of mechanism of a death without data of UCD

Medical data		WRONG	ACCURATE
Part I Cause of death	**a) Immediate cause**	I46.9 Cardiac arrest, cause unspecified	I21.9 ST elevation (STEMI) myocardial infarction of anterior wall
	b) Intermediate cause		
	c) Underlying cause	I46.9 Cardiac arrest, cause unspecified	I21.9 ST elevation (STEMI) myocardial infarction of anterior wall
Part II Other significant conditions contributing to death		I21.9 ST elevation (STEMI) myocardial infarction of the anterior wall I70.9 Other and unspecified atherosclerosis	I70.9 Other and unspecified atherosclerosis

Table 5. Example of multiple and independent causes of death

Medical data		WRONG	ACCURATE
Part I Cause of death	**a) Immediate cause**	C34.1 Lung cancer	C34.1 Lung cancer
	b) Intermediate cause	E05.0 Thyrotoxicosis with diffuse goitre	
	c) Underlying cause	I48 Atrial fibrillation and flutter	C34.1 Lung cancer
Part II Other significant conditions contributing to death			E05.0 Thyrotoxicosis with diffuse goitre I48 Atrial fibrillation and flutter

Insufficiently specific cause of death

WHO emphasises that specific causes should be used instead of general (non-specific) conditions (26). General and ill-defined conditions should not be listed as UCD since they have little value for public health analysis (27). Therefore, if there are more specific diagnoses, avoiding vaguely defined and general diagnoses is recommended. An example would be the diagnosis of an unspecified type of diabetes (E14.0–E14.9) or malignant neoplasm without specification of the site (C80.0). This error also occurs when entering three-digit instead of four-digit ICD codes if they exist in the codebook (e.g. J45 instead of J45.0).

II Minor errors

The absence of a time interval

The most common error reported in meta-analysis is the absence of a time interval, with a frequency ranging from 22% to 100% (22). Although the absence of a time interval falls into the category of minor errors, it makes it difficult to determine the UCD accurately (28). This information is mainly used to assist the nosologist, who codes the causes of death, ensuring they are listed correctly: the newest terms first, then the older ones on each subsequent row below in Part I DC. The Serbian version of DC has no field for specifying the time interval when entering diagnoses of the underlying, previous, and immediate cause of death. This deficiency in the national DC can be one of the more critical prerequisites for reporting errors in the coding of UCD.

Abbreviations

The use of abbreviations is not so rare in DC (22). However, abbreviations are not permissible due to their ambiguity. Their use may lead to wrong interpretations and conclusions since DC is used for different purposes, such as forensic medical evidence for family members by public health researchers. The most commonly used abbreviations are AMI for acute myocardial infarction, DM for diabetes mellitus, CKD for chronic kidney disease and MS for multiple sclerosis (Table 6).

Specifying other significant conditions (comorbidities)

Although most studies count comorbidities instead of UCD among minor errors, some classify this type as a MAJOR error (29). According to Alipur and Payandeh's research (22), there is a listing of other significant conditions (comorbidities) when filling out the DC. Comorbidities are entered in Part II of the DC and represent conditions and diseases that affect the development of events but do not directly lead to death. For this reason, comorbidities should not be coded instead of the UCD. Although other significant conditions do not directly affect the chain of events leading to death, analysing their association with UCD is of considerable value for policymaking and plans to reduce mortality.

Say a person who appears to have died from a combination of cryptococcal myocarditis and pneumocystis pneumonia, which occur as complications of human immunodeficiency virus (HIV) infection (Table 7). The instructions tell us not to list two states on the same line in part I. Furthermore, cryptococcal myocarditis and pneumocystis pneumonia should not be listed on separate lines in Part I because one did not cause or lead to the other. Since HIV infection causes both diseases, it should be written on the c) line as a UCD, and one of the mentioned diseases should be put in Part II.

More than one diagnosis on a line in Part I of DC

More than one diagnosis per line in the first part of the DC results in multiple sequences of events leading to death and makes the choice of UCD difficult. Therefore, this type of error should be avoided as much as possible. In Table 8, Osteoporosis, Acute gastric ulcer with haemorrhage, and Benign neoplasm of the parotid gland are written in line c). According to the WHO rules, only Acute gastric ulcers with bleeding can be UCD, and the other two will be written in Part II.

Table 6. Example of using abbreviations

Medical data		WRONG	ACCURATE
Part I Cause of death	a) Immediate cause		
	b) Intermediate cause		
	c) Underlying cause	CKD	Chronic kidney disease
Part II Other significant conditions contributing to death		DM, AMI, MS	Diabetes mellitus, Acute myocardial infarction, Multiple sclerosis

Table 7. Example of specifying other significant conditions (comorbidities)

Medical data		WRONG	ACCURATE
Part I Cause of death	a) Immediate cause	Cryptococcal myocarditis	Cryptococcal myocarditis
	b) Intermediate cause		
	c) Underlying cause	Pneumocystis pneumonia	Human immunodeficiency virus infection
Part II Other significant conditions contributing to death		Human immunodeficiency virus infection	Pneumocystis pneumonia

Table 8. Example of more than one diagnosis on a line in Part I of DC

Medical data		WRONG	ACCURATE
Part I Cause of death	a) Immediate cause		K25.0 Acute gastric ulcer with haemorrhage
	b) Intermediate cause		
	c) Underlying cause	K25.0 Acute gastric ulcer with haemorrhage M81 Osteoporosis D11.0 Benign neoplasm of parotid gland	K25.0 Acute gastric ulcer with haemorrhage
Part II Other significant conditions contributing to death			D11.0 Benign neoplasm of parotid gland M81 Osteoporosis

Illegible handwriting

This type of error is specific to paper-based death certification systems. The illegibility of information recorded in DC significantly influences the interpretation of the cause of death determination of the UCD and cause coding death. Computerising the death certificate form and planning the system prevents the registration of abbreviations instead of the causes of death, and the mandatory completion of the necessary fields can be a crucial step in reducing the number of death certificate completion errors in countries that continue to use the paper-based death certificate form.

Conclusion

Errors in filling out death certificates are common in both undeveloped and developed countries. Classification errors into major and minor groups helps prioritise issues related to DC completion and planning to improve the quality of cause-of-death documentation. Continuous training of physicians based on international guidelines, providing standard instructions for DC filling, implementing quality control mechanisms, providing feedback, and correcting existing errors can potentially reduce death certification errors.

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GREŠKE U POTVRDI O SMRTI: PRAKTIČNI PROBLEMI U SVAKODNEVNOJ PRAKSI

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Tačne, precizne, aktuelne i potpune informacije o nacionalnim podacima u vezi sa mortalitetom neophodne su za planiranje ciljeva, određivanje zdravstvenih prioriteta, raspodelu budžeta i pružanje adekvatne zdravstvene zaštite. Uprkos smernicama Svetske zdravstvene organizacije, greške u popunjavanju Potvrde o smrti (POS) primećuju se u svim regionima sveta i veoma su česte. Brojne studije ukazale su na različite vrste grešaka prilikom izdavanja POS-a, fokusirajući se pritom na prisustvo ili odsustvo određenih specifičnih pojava. Mada postoje različiti načini za stratifikaciju grešaka, one se generalno razvrstavaju na velike i male greške. Velike greške odnose se na greške koje ozbiljno utiču na izbor i klasifikaciju osnovnog uzroka smrti (OUS) i u njih spadaju: pogrešna klasifikacija i definicija OUS-a, nepravilan redosled dijagnoza, mehanizam smrti bez podataka o OUS-u, višestruki i nezavisni uzroci smrti, nedovoljno specifičan uzrok smrti. Nasuprot tome, male greške imaju neznatan uticaj na klasifikaciju OUS-a; takve su, na primer, odsustvo vremenskog intervala, skraćenice, navođenje drugih značajnih stanja (komorbiditeti), više od jedne dijagnoze na liniji u delu I POS-a i nečitak rukopis. Popunjavanje POS-a predstavlja važnu veštinu koju lekar koji se bavi utvrđivanjem smrtnog ishoda treba da ima. Ključ za smanjenje ovih grešaka leži u kontinuiranoj obuci lekara zasnovanoj na primeni međunarodnih smernica. Osim toga, treba naglasiti i da je stalna edukacija u ovoj oblasti od izuzetnog značaja.

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***Ključne reči**: Potvda o smrti, osnovni uzrok smrti, velike greške, male greške*