
CAUSE-OF-DEATH STATEMENTS AND CERTIFICATION OF NATURAL AND UNNATURAL DEATHS

Protocol and Options

Randy L. Hanzlick, MD, Editor

**Prepared by: The Autopsy Committee and
The Forensic Pathology Committee
of the College of American Pathologists
in conjunction with
The National Association of Medical Examiners**



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College of American Pathologists
325 Waukegan Road
Northfield, IL 60093-2750
800-323-4040

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RANDY L. HANZLICK, MD, EDITOR

PREFACE

This manual is intended for any person who must write cause-of-death statements for autopsy reports, death certificates, or other medical documents. It is meant to supplement, not replace, the College of American Pathologists' (CAP) *The Medical Cause-of-Death Manual: Instructions for Writing Cause-of-Death Statements for Deaths Due to Natural Causes* (1994), which provides basic instructions for writing cause-of-death statements. Familiarity with *The Medical Cause-of-Death Manual* is recommended to facilitate better understanding of the concepts presented in this manual. *Cause-of-Death Statements and Certification of Natural and Unnatural Deaths* provides guidance for writing cause-of-death statements for selected types of cases that are relevant to various practice settings and medical specialty areas.

Information from cause-of-death statements on the death certificate and other medical documents provides statistical information useful for mortality surveillance, epidemiologic research, public health planning, and allocation of funding for health and safety research projects and programs. The reporting of complete and accurate cause-of-death information improves the usefulness of mortality data for all of those processes. This manual provides instructions, options, and other information to foster complete and accurate cause-of-death statements and death-certification procedures for commonly encountered deaths involving:

- *Natural causes in general*
- *Dementia*
- *Injury or poisoning*
- *Periprocedural complications*
- *Infants and neonates*
- *The elderly*
- *Human immunodeficiency virus infection*
- *Circumstances in which the manner of death is unclear or controversial*
- *Disease and injury together*

Each of these topics is addressed in a specific section of this manual.

This manual was designed as a ring binder with tabs to allow for easy replacement of its various sections if revisions occur, and for the addition of new options if they are developed.

Seldom is there a single "correct" way of completing the cause-of-death statement. There are good ways, better ways, and inadequate or incomplete ways, however. Judgment is required. It is hoped that the protocol and options in this manual will foster good judgment and the writing of complete and accurate cause-of-death statements.

Cause-of-death statements and death certification sometimes involve issues of confidentiality, political concerns, and real or perceived culpability. This manual has been written with such issues in mind.

THE BASIC FACTS

Information from a death certificate completed locally is eventually filed at the state vital statistics office, from where some of the information is eventually forwarded to the National Center for Health Statistics (NCHS) for incorporation into a national mortality data base. Thus, the seemingly inconsequential task of completing an individual death certificate is really a very important component of national mortality history and deserves complete and professional attention in every case.

If a death certificate is inadequately completed, the vital statistics office may be required to conduct a query to clarify the details. A query takes the time and resources of the vital statistics office and the certifier of death. Complete and accurate completion of the death certificate can eliminate the need for a query.

Specific information is of greater potential use than general information. Specific information can be lumped into general categories, but general information is not easily subcategorized. For example, if the cause-of-death were simply reported as "stab wound of chest," the death could be classified only under "wound," "stab wound," "stab wound of chest," or "wound of chest." However, if the fatal complications such as "transection of left subclavian vein," "left intrathoracic hemorrhage," and "air embolism" were also included in the cause-of-death statement, numerous classification, coding, and data retrieval possibilities exist and potential uses and value of the specific cause-of-death statement are increased.

NCHS can code up to 20 conditions listed in the cause-of-death section of the death certificate, although rarely are that many reported. Its coding system also captures the line on which the condition was reported and, if more than one condition is listed on a line (which is not recommended), the sequence of the condition within the line. The process allows the identification and coding of the underlying cause of death according to agreed upon algorithms and rules set forth by the World Health Organization (WHO). Further, the NCHS data base will soon include the literal text that appeared in the cause-of-death section of the death certificate. Obviously: 1) the more completely a cause of death is reported on the death certificate, the greater is the potential use of the information, and 2) adherence to the rules and regulations of cause-of-death reporting will facilitate the classification and coding process.

It is with these basic facts in mind that the instructions and options in this manual were assembled.

COMMENTS FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Cause-of-Death Statements and Certification of Natural and Unnatural Deaths: Protocols and Options provides an important extension of and complement to *The Medical Cause-of-Death Manual*, which was previously published under the auspices of the College of American Pathologists. *The Medical Cause-of-Death Manual* provides general guidelines for completing cause-of-death statements on death certificates along with clear and readily understandable examples of case studies transformed into proper cause-of-death statements.

The present manual, building on the same set of principles for completing death certificates, provides guidance on what could be called "problem cases." Those are deaths where, for example, the causal chain of events leading to death is not as clear or as unambiguous as those described in the first manual. These include deaths from HIV infection, from dementia, from medical misadventures; and deaths for elderly persons, and for infants and perinatal deaths. This manual also touches on the complex question of reporting the "manner of death," that is, whether the death is a homicide, accident, suicide, or a natural death. As a comprehensive guide to completing cause-of-death statements, *Cause-of-Death Statements* in combination with *The Medical Cause-of-Death Manual* can serve as a standard reference and an authoritative source for training in medicine and public health, as well as a valuable tool for state vital statistics programs in their outreach efforts to improve cause-of-death reporting by physicians in their states.

Cause-of-death statistics continue to be one of the most valuable data bases for monitoring health at the local, state, and national levels, and for epidemiological and medical research. Manuals like these ensure that the quality of health data based on death certificates will continue to improve. Once again, the American College of Pathologists is to be congratulated for sponsoring this important work. And special appreciation is expressed to Dr. Randy Hanzlick, editor of both manuals, who through his experience as a forensic pathologist and epidemiologist, his appreciation for mortality statistics, and his close collaboration with the National Center for Health Statistics, has produced a work that is conceptually sound, technically correct, and broadly applicable.

Harry M. Rosenberg, Ph.D.
Chief, Mortality Statistics Branch
Division of Vital Statistics
National Center for Health Statistics
Centers for Disease Control and Prevention

George Gay
Special Assistant for Registration Methods
Division of Vital Statistics
National Center for Health Statistics
Centers for Disease Control and Prevention

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SECTION 1: PROTOCOL FOR WRITING CAUSE-OF-DEATH STATEMENTS FOR NATURAL CAUSES

I. INTRODUCTION

The physician's role in completing death certificates varies among institutions and medical specialty areas. These guidelines are generally applicable and are offered as a basic approach for *any physician* who must, on occasion, write the cause of death on a death certificate or other medical report. The guidelines pertain mainly to deaths resulting from *natural causes* (diseases) and include information about the cause of death as it relates to autopsy reporting.

The death certificate serves two basic purposes: it documents the fact of death for legal and other uses and it provides data for vital statistics and public health policy. Uniformity and consistency in the approach to writing cause-of-death statements serve both purposes and are especially helpful to the latter. This protocol is offered to promote uniformity and consistency when writing cause-of-death statements.

The definitions, concepts, and examples in this protocol are presented in an abridged format based on the College of American Pathologists (CAP) manual *The Medical Cause-of-Death Manual: Instructions for Writing Cause-of-Death Statements for Deaths Due to Natural Causes*. For additional information and examples concerning completion of the death certificate, readers should consult the CAP manual and the handbooks prepared by the National Center for Health Statistics (see bibliography).

II. PREREQUISITES

1. *Be familiar with the concept of a cause-of-death statement.* A cause-of-death statement consists of the wording written in the format used on a death certificate to indicate the cause(s) of death and other significant conditions that contributed to death.
2. *Be familiar with the death certificate form(s) used in your locality,* especially the space on the form for the cause-of-death statement and the small number of other information items that the physician who signs the death certificate is required to complete.
3. *Be familiar with local regulations and procedures* for completing and filing the death certificate. Specifically, know the requirements for timely completion of the death certificate, the options for filing a certificate as "pending" for completion at a later date, and the provisions and requirements for amending a death certificate once it has been filed. Instruction manuals can usually be obtained from the state vital statistics office or the local death certificate or vital records registrar who, in most areas, is a county-level agent within the health department or county government.
4. *It is essential that you be familiar with local laws* that describe the types of death that must be reported to the medical examiner, coroner, or other such authority in your locality. In general, these are deaths that are known or suspected to have resulted from the immediate or delayed effects of intentional or unintentional injury (or poisoning), regardless of the interval between onset and death, or deaths that are sudden and unexpected and for which no reasonably certain explanation is available. Because statutes may also require the investigation of specific types of deaths (such as deaths in legal custody, on-the-job deaths, anesthetic or therapy-related deaths, and various others), knowledge of local law is essential. Know to whom such deaths should be reported and whether deaths are to be reported to the medical examiner or coroner in the county (or other jurisdiction) where the *death* occurred, or the county (or other jurisdiction) where the *events leading to death* occurred.

5. *Be familiar with the concept of manner of death.* Manner of death is a classification of death based on the type of conditions that cause death and the circumstances under which they occur. In addition to the cause of death, the manner of death is stated in a separate place on the death certificate. Deaths which are solely due to disease or the aging process are regarded as being natural in manner. Deaths resulting from injury or poisoning (external causes) are unnatural and either homicidal, suicidal, or accidental in manner, depending on whether the injury or poisoning is intentional or unintentional and whether it is self-inflicted or inflicted by another person or external condition. Deaths in which the manner cannot be determined are usually described as undetermined in manner. In general, deaths that are known or suspected of being other than natural in manner should be reported to, and will usually be investigated and certified by, the medical examiner or coroner. Most physicians who are not serving as a medical examiner or coroner will be concerned primarily with death certificates for persons whose manner of death is natural—the subject of this protocol.

6. *Know how to properly indicate a natural manner of death* on the death certificate used in your locality.

III. PRELIMINARY STEPS

When faced with the foreseeable duty of completing a death certificate, do the following:

a. Determine whether the death is reportable to the medical examiner (or coroner) or other such authority; if it is reportable, verify whether it has been reported. If the death is reportable but has not been reported, you should report it. If you are in doubt as to whether the death is reportable, report it. The medical record should reflect when, to whom, and by whom a death has been reported. If the medical examiner (or coroner) declines to accept a case for investigation, documentation in the medical record of a waiver number provided by the medical examiner (or coroner) may also be helpful.

b. If the medical examiner (or coroner) accepts the case for official investigation, he or she will complete and sign the death certificate; you do not need to proceed any further except to comply with procedural instructions issued by the medical examiner (or coroner) under provisions of local law.

c. If the death does not come under the jurisdiction of the medical examiner (or coroner), or if the medical examiner (or coroner) has been notified of the death and declines to accept the case, determine whether another physician is required, by law or by hospital policy, or would be better qualified to complete the death certificate. Aside from possibly having a legal obligation to certify the death, the decedent's attending, pronouncing, or personal physician may have more comprehensive knowledge of the patient's medical problems and history and be able to more accurately state the likely cause of death. If such a physician can be found, encourage the physician to complete and sign the death certificate; if there is no such physician, proceed as outlined below.

IV. COMPLETING THE CAUSE-OF-DEATH STATEMENT

If you complete the cause-of-death section of the death certificate and sign your name on the death certificate, you are attesting that, to the best of your knowledge, the person named on the certificate died from the cause(s) of death stated. You thus become the certifier of death. The stated cause of death represents your *opinion*; however, if your opinion should change, the death certificate can be amended at a later time.

Before it is completed, the portion of the death certificate that contains the cause-of-death statement usually resembles the diagram below.

Part I	A.	
		Due to, or as a consequence of:
	B.	
		Due to, or as a consequence of:
Part II	C.	
		Due to, or as a consequence of:
	D.	
	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

A cause-of-death statement can consist of two parts. Part I is a series of lines on which causes of death can be entered, one below the other, to indicate a sequence of causes that led to death. Part I consists of Lines A through D in the previous example. Part II allows the certifier to cite other significant conditions, preexisting or coexisting conditions, that contributed to death. Part I must be completed in all cases. Part II is used only when applicable. Although Part I consists of multiple lines, it is not always necessary to use all of the lines and, in fact, some cause-of-death statements can consist of a single line. In Part I, each line that is used should contain only one disease (condition). In Part II, more than one condition may be listed as other significant conditions.

If necessary, the certifier may insert additional lines into Part I of the cause-of-death statement.

The underlying cause of death is the disease (condition) that started the train of morbid events that lead to death. It is the one disease (condition) that occurred first in time and that initiated and was ultimately responsible for any subsequent disease, condition, or complication that resulted in death. It is "the cause of death boiled down" or "the bottom line." The underlying cause of death should be stated as etiologically specific as possible. Other words have been used to describe the underlying cause of death, but using words such as "proximate" can have specific legal meaning and should be avoided.

The immediate cause of death is the final disease (complication) that resulted from the underlying cause of death. It is the last (most recent) event that occurred before death.

An intermediate cause of death is a disease (condition) or complication that occurs sometime between the underlying cause of death and the immediate cause of death. Other words have sometimes been used to describe an intermediate cause of death, but using words such as "intervening" can have specific legal meaning and should be avoided.

The underlying cause of death, an intermediate cause of death, and an immediate cause of death have a sequential cause and effect relationship when read from bottom to top in Part I of the cause-of-death statement. They are placed in Part I of the cause-of-death statement with the most recent condition (the immediate cause of death) at the top (on line A), with each antecedent condition, going backward in time, on progressively lower lines so that the underlying cause of death appears on the lowest line completed.

Underlying, intermediate, and immediate causes of death should only be written in Part I of the cause-of-death statement. This concept is illustrated in the diagram below:

Part I	A.	IMMEDIATE CAUSE (e.g., Upper gastrointestinal hemorrhage)
		Due to, or as a consequence of:
	B.	INTERMEDIATE CAUSE (e.g., Ruptured esophageal varices)
		Due to, or as a consequence of:
C.	INTERMEDIATE CAUSE (e.g., Cirrhosis of the liver)	
	Due to, or as a consequence of:	
D.	UNDERLYING CAUSE (e.g., Chronic alcoholism)	

Of course, the words "immediate cause," "intermediate cause," and "underlying cause" in the previous example are for illustrative purposes only and are not written on the death certificate—only the causes themselves are written.

It is not always necessary to use all of the lines (lines A-D) in Part I. The following examples are additional formats that may be used to complete Part I of the cause-of-death statement:

Part I	A.	IMMEDIATE CAUSE (e.g., Pneumocystis carinii pneumonia)
		Due to, or as a consequence of:
	B.	INTERMEDIATE CAUSE (e.g., Acquired immunodeficiency syndrome)
		Due to, or as a consequence of:
C.	UNDERLYING CAUSE (e.g., Human immunodeficiency virus infection)	
	Due to, or as a consequence of:	
D.		

Part I	A.	IMMEDIATE CAUSE (e.g., Spontaneous pneumothorax)
		Due to, or as a consequence of:
	B.	UNDERLYING CAUSE (e.g., Chronic obstructive pulmonary disease)
		Due to, or as a consequence of:
C.		
	Due to, or as a consequence of:	
D.		

Part I	A.	UNDERLYING CAUSE (e.g., Alzheimer's dementia) (also serves as the immediate cause)
		Due to, or as a consequence of:
	B.	
		Due to, or as a consequence of:
C.		
	Due to, or as a consequence of:	
D.		

The single line Part I format shown in the last example (Alzheimer's dementia) should only be used when the underlying cause of death is known and there is insufficient information to cite a separate immediate cause of death. In such a case, it would also be acceptable to write "Complications of Alzheimer's dementia" as the underlying cause of death.

All cause-of-death statements must include an underlying cause of death in Part I. Regardless of the number of lines completed in Part I, the lowermost completed line in Part I contains the underlying cause of death and is the most important line in the cause-of-death statement.

Other significant conditions are coexisting or pre-existing conditions that contributed to death but do not result in the underlying cause of death listed in Part I. Other significant conditions are cited in Part II. For example, if hypertension (with left ventricular hypertrophy) and diabetes (with small vessel disease) contributed to heart disease and death in a person whose major problem was chronic ischemic heart disease from coronary artery disease, the cause-of-death statement might be completed as shown below:

Part I	A.	Chronic ischemic heart disease
		Due to, or as a consequence of:
	B.	Atherosclerotic coronary artery disease
		Due to, or as a consequence of:
	C.	
		Due to, or as a consequence of:
	D.	
Part II	OTHER SIGNIFICANT CONDITIONS: <small>Conditions contributing to death but not resulting in the underlying cause of death in Part I</small> Hypertension, diabetes mellitus	

In this example, hypertension and diabetes are coexisting conditions that contributed to death, and although they are risk factors for atherosclerotic coronary artery disease, they are not causes of atherosclerotic coronary artery disease. Thus, in a case such as this one, they are most appropriately cited as other significant conditions. Some states may require that selected conditions, such as recent pregnancy, be listed as other significant conditions even if the condition did not contribute to death. Such local requirements should be followed when applicable.

In summary, a cause-of-death statement must include an underlying cause of death, and may include an immediate cause of death, one or more intermediate cause(s) of death, and one or more other significant conditions. Any of these may consist of an injury or poisoning (external causes). In general, when an injury or poisoning is involved, the death is not due solely to natural causes and should be reported to the medical examiner (or coroner). Further discussion of deaths due to injury or poisoning is beyond the scope of this protocol. (See Section 4 of this manual.)

CASE EXAMPLE OF A CAUSE-OF-DEATH STATEMENT

Case history: A 47-year-old male had a well-documented history of alcohol abuse and alcohol withdrawal seizures. A previous liver biopsy showed micronodular cirrhosis and metastatic carcinoma that was subsequently shown to originate in the colon. His alcohol abuse continued; he was ultimately admitted to the hospital with asterixis and was found to have hepatic encephalopathy. He lapsed into hepatic coma, developed respiratory arrest, ventricular fibrillation, and cardiac arrest, and then died. An autopsy confirmed the cirrhosis and also disclosed a small, localized papillary carcinoma of the thyroid in addition to the colon carcinoma with extensive liver metastases.

Part I	A.	Hepatic encephalopathy
		Due to, or as a consequence of:
	B.	Cirrhosis of liver
		Due to, or as a consequence of:
	C.	Chronic alcoholism
		Due to, or as a consequence of:
	D.	
Part II	OTHER SIGNIFICANT CONDITIONS: <small>Conditions contributing to death but not resulting in the underlying cause of death in Part I</small> Adenocarcinoma of colon, metastatic to liver	

Analysis and comment: The preceding diagram constitutes a cause-of-death statement. The underlying cause of death (i.e., the specific disease or condition that started the train of morbid events leading to death) is "chronic alcoholism." Alcoholism resulted in "cirrhosis of the liver," which serves as an intermediate cause of death, which, in turn, culminated in the complication of "hepatic encephalopathy," which serves as the immediate cause of death. As this example shows, it is not always necessary to use all of the lines that are available in Part I.

Cirrhosis of the liver and hepatic encephalopathy are nonspecific processes because they can have more than one cause, but their presence in this cause-of-death statement is clearly explained by a specific underlying cause of death (chronic alcoholism) on a lower line in the cause-of-death statement. The underlying cause of death should be stated as etiologically specific as possible, as should any intermediate and immediate cause of death.

The patient's liver failure may well have been partially related to the coexistence of metastatic adenocarcinoma in the liver. However, the metastatic carcinoma did not cause the chronic alcoholism. Therefore, it is appropriately listed as an other significant condition, because it was coexisting and probably contributed to hepatic insufficiency and death. The thyroid carcinoma did not contribute to death and is therefore not included in the cause-of-death statement (unless required in the state where the death is reported).

Mechanistic terminal events, such as respiratory arrest, cardiac arrest, asystole, ventricular fibrillation, electromechanical dissociation, and cardiopulmonary arrest, have an almost limitless differential diagnosis. They are agonal or terminal pathophysiologic or biochemical derangements that are common final pathways that explain how a cause of death exerts its lethal effect. In general, mechanistic terminal events should not be used in cause-of-death statements because they are extremely nonspecific and are of little value for mortality statistics that are derived from death certificates. In the example, one could argue that hepatic encephalopathy (a nonspecific process) is a mechanism and need not appear in the cause-of-death statement. However, the words "hepatic encephalopathy" do conjure up a relatively small set of differential diagnoses and their presence in the cause-of-death statement in this case is helpful by indicating that death occurred in an encephalopathic fashion as opposed to a hemorrhagic fashion from ruptured varices. Thus, although not absolutely necessary, inclusion of "hepatic encephalopathy" in the cause-of-death statement in this case does provide some useful information—much more than would be gained by adding "cardiac arrest" as the immediate cause of death. See Section 8 of this manual for further discussion of mechanisms of death.

There is often more than one acceptable way to write a cause-of-death statement. For this case scenario, the underlying cause of death could be written as "Alcoholic cirrhosis" because alcoholic cirrhosis is a single condition which is etiologically specific.

Judgment is required when writing a cause-of-death statement. A good rule is to include sufficient information to tell a story about the sequence of diseases (conditions), nonspecific processes, and complications leading to death, being sure not to omit an underlying cause of death that is stated as etiologically specific as possible.

V. COMMON MISTAKES

1. *Reversing the order of immediate, intermediate, and underlying cause of death.* Because the lines in Part I are lettered A through D from top to bottom, many certifiers inadvertently place the first disease (or condition) to occur (the underlying cause of death) on the top line (A) and then list subsequent diseases (conditions) on progressively lower lines (B,C,D). Thus, the cause-of-death statement reads backwards and the nosologist who codes the cause of death for vital statistics may code the underlying cause of death incorrectly. Certifiers should be aware of this potential problem and remember that the most recent disease (condition)—the immediate cause of death—should be listed on the top line, and the underlying cause of death should be listed on the last line completed in Part I.
2. *Citing mechanistic terminal events.* Unfortunately, when physicians cite mechanisms, they tend to omit a more specific underlying cause of death in the cause-of-death statement. In general, terminal events such as asystole, electromechanical dissociation, cardiac arrest, respiratory arrest, and cardiopulmonary arrest should not be cited in cause-of-death statements.
3. *Citing a nonspecific process as the underlying cause of death.* Cause-of-death statements often include a structural or functional nonspecific process with multiple possible causes, such as "gastrointestinal hemorrhage." Unfortunately, a specific underlying cause of death is sometimes omitted. It is acceptable, and often necessary, to include nonspecific processes in cause-of-death statements (particularly as an intermediate or immediate cause of death), but they should not be cited as an underlying cause of death and should not be included in cause of death statements unless they are further qualified by citing a more specific cause on a lower line or by stating that a more specific cause is not known (see "Other Considerations," VI-2). Remember, the underlying cause of death should be etiologically specific.
4. *Listing more than one condition per line in Part I.* To assist nosologists in the classification and coding of causes of death, official guidelines advise against listing more than one condition per line in Part I of the cause-of-death statement. Thus, although one may be tempted to attribute an underlying cause of death to "hypertensive and atherosclerotic heart disease," or an immediate cause of death in a patient with AIDS to "*Pneumocystis carinii* pneumonia and disseminated *Mycobacterium avium intracellulare* infection," official guidelines recommend against combining more than one condition per line. Instead, it is incumbent upon the certifier to select the *one* most important condition for listing in Part I and to list the other as an other significant condition. Following this recommendation does not violate the concept of an other significant condition since, although the condition listed in Part II may have been a *result of* the underlying cause of death, it does not *result in* the underlying cause of death.
5. *Losing sight of the underlying cause of death.* The clinical course is sometimes so protracted that the physician may lose sight of the underlying cause of the patient's problems. Thus, a certifier might attribute the underlying cause of death to a urinary tract infection, when in fact, the urinary tract infection was caused by a catheter in a patient with a neurogenic bladder from multiple sclerosis. In such a case, multiple sclerosis is the underlying cause of death, and urinary tract infection is an intermediate or immediate cause of death. The certifier should distinguish between complications and the underlying cause of death, and the latter should appear on the lowermost completed line in Part I of the cause-of-death statement.

6. *Forgetting an injury or poisoning.* For patients who die of medical complications of an injury or poisoning, such as pneumonia following thermal burns or drug-induced coma, one may forget that the underlying cause of death was an injury (or poisoning), especially if the interval between the injury (or poisoning) and death was lengthy. Other common examples include pulmonary embolism after a fractured hip sustained in a fall or a fatal seizure disorder caused by remote head trauma, both of which have an injury as the underlying cause of death. Each time a death is to be certified, the potential certifier should evaluate whether an apparent medical cause of death is actually a complication of an injury or poisoning. If so, the death should be reported to the medical examiner, coroner, or other such authority.

7. *Inadequately documenting descriptive details of disease pathology.* The cause-of-death statement should include descriptive details relevant to the pathologic aspects of the cause of death. For example, deaths resulting from malignancies should include the primary site, grade, and cell type of the malignancy, if possible (e.g., poorly differentiated adenocarcinoma of lung, right upper lobe). As another example, the cause-of-death statement for cerebrovascular deaths should specify not only the pathologic process (e.g., cerebral infarction or intracerebral hemorrhage), if possible, but also the underlying cause of the process (e.g., cerebral artery atherosclerosis). The wording in these two examples is preferable to "lung cancer" or "cerebrovascular accident," which provide little specific information.

VI. OTHER CONSIDERATIONS

1. *Qualifying the underlying, intermediate, or immediate cause of death.* It is acceptable to use "probable" or "presumed" in a cause-of-death statement to indicate some degree of uncertainty. As an example, a person with no medical history or prior symptoms dies after having chest pain and EKG changes suggestive of infarction, but diagnostic criteria have not been fully met; the death has been reported to the medical examiner (or coroner) who for some reason has declined to accept jurisdiction in the case; permission for autopsy has been requested from but not granted by the next-of-kin; and you are faced with the duty of completing the death certificate, you may write "probable atherosclerotic coronary artery disease" as the underlying cause of death.

Part I	A.	Probable atherosclerotic coronary artery disease
		Due to, or as a consequence of:
	B.	
		Due to, or as a consequence of:
Part II	C.	
		Due to, or as a consequence of:
	D.	
		Due to, or as a consequence of:
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

The medical examiner (or coroner) should be notified and will usually investigate and certify a death when the underlying cause of death is not known, but such is not always the case. If the medical examiner (or coroner) will not be conducting an autopsy or signing the death certificate in such cases, permission for autopsy should be requested of the next-of-kin in order to determine a cause of death and provide more accurate information for completion of the death certificate. If permission for autopsy is not granted, the certifier may find it necessary to use a qualified cause-of-death statement such as the one in the example above.

Although qualifying words such as “probable” are not necessary and may not be captured when the cause of death is coded for vital statistics (until literal text is routinely stored), the qualifiers may assist the certifier and may be of help to any user of the cause-of-death statement by indicating uncertainty about the cause of death when appropriate. Further, in the future, if nosologic codes were to incorporate the ability to code for degree of certainty regarding the cause-of-death statement, assessment of the degree of confidence in vital statistics may be facilitated, which may be of value to researchers and statisticians.

2. *Qualifying a nonspecific process.* Every effort should be made, including performing an autopsy, if possible, to identify an etiology-specific cause of death. If it is not possible to be etiologically specific when writing the underlying cause of death (not even to the point of stating that a condition is “probable” or “presumed”), the cause-of-death statement may include an indication that a specific cause is unknown or undetermined, and due to natural causes, if injury and poisoning can be ruled out. Thus, if a person dies of upper gastrointestinal hemorrhage apparently caused by disease, the medical examiner (or coroner) has been notified but declines to investigate the death or sign the death certificate, permission for autopsy cannot be obtained, and the specific natural cause of the gastrointestinal hemorrhage is unknown or has not been determined with a reasonable degree of certainty, the immediate cause may be written as “upper gastrointestinal hemorrhage,” and the underlying cause indicated as “undetermined natural cause.” (See next page.)

Part I	A.	Upper gastrointestinal hemorrhage
		Due to, or as a consequence of:
	B.	Undetermined natural cause(s)
		Due to, or as a consequence of:
	C.	
		Due to, or as a consequence of:
	D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

If there was a history of gastric peptic ulcer symptoms or some other inconclusive information pointing to peptic ulcer disease as a likely cause for the hemorrhage, the nonspecific process could be qualified as in the following cause-of-death statement:

Part I	A.	Upper gastrointestinal hemorrhage
		Due to, or as a consequence of:
	B.	Probable gastric peptic ulcer
		Due to, or as a consequence of:
	C.	
		Due to, or as a consequence of:
	D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

Qualifying a nonspecific process is helpful because it assures a user of the cause-of-death statement that an underlying cause of death has not been omitted through the certifier's oversight or failure to recognize the underlying cause of death. Judgment is required to select the most appropriate statement of the cause of death and qualifiers should be used only when necessary, as when an autopsy cannot be performed and sufficient information is not available.

3. *Risk Factors.* One of the motivating factors in developing a standard format for documenting causes of death was to assure the acquisition of important epidemiologic data. Risk factors (such as intravenous drug abuse, cigarette smoking, obesity, and alcohol intoxication) are an important part of such data bases. Consequently, as long as there is no conflict with local or state regulations and procedures, it may also be helpful to list relevant risk factors on the death certificate. However, existing guidelines and instructions are unclear as to when and how to report risk factors. For example, if a person dies from human immunodeficiency virus (HIV) infection apparently contracted from intravenous drug abuse, how is this handled in the cause-of-death statement? Some states have modified their death certificate to allow for the inclusion of certain risk factors; other states have not. First, comply with any local death registration regulations that exist regarding risk factors. If guidelines for risk factors do not exist, or if they are inadequate, a risk factor known to have existed in the patient may be cited as an other significant condition.

Part I	A.	Pneumocystis carinii pneumonia
		Due to, or as a consequence of:
	B.	Acquired immunodeficiency syndrome
		Due to, or as a consequence of:
Part I	C.	Human immunodeficiency virus infection
		Due to, or as a consequence of:
Part II	D.	
	OTHER SIGNIFICANT CONDITIONS: <small>Conditions contributing to death but not resulting in the underlying cause of death in Part I</small> Intravenous drug abuse	

As in this example, a risk factor may actually seem to be the underlying cause of death, but it is often quite difficult to prove a cause-and-effect relationship between a risk factor and death in a specific case, making one hesitant to cite the risk factor as the underlying cause of death. Other significant conditions, by definition, do not have a cause-and-effect relationship to the underlying cause of death, so it may seem incorrect to list a risk factor as an other significant condition when the risk factor may have been causally associated with death. Thus, some agreement on a conventional way to report risk factors is needed to promote consistent reporting. The approach described above is offered as an option. Risk factors (such as obesity or smoking) for other underlying causes of death can be indicated in a similar fashion. Comply with local procedures if they exist.

If a risk factor is cited in the cause-of-death statement, it is advisable that there be documentation or reasonable probability that the risk factor existed.

VII. COMPLETING A DEATH CERTIFICATE AS "PENDING"

If relevant information such as autopsy reports, laboratory results, or medical records will not be available by the death certificate filing deadline established by state vital records law, it is usually possible to file a pending certificate that must be amended at a later date. (See Heading VIII.) Usually, a pending death certificate is completed as usual, but the cause of death is stated as "Pending further information." The death certificate in some states has been modified to allow specific indication that the cause of death is pending. There is usually a requirement to complete the cause of death within a specified time interval after the pending certificate is filed. Consult your state or local vital records registrar for details. Filing a pending certificate in a timely fashion may assist the family by allowing them to proceed with personal matters brought about by the death, but pending certificates should not be used unless necessary.

VIII. CORRECTING ERRORS: THE AMENDMENT PROCESS

1. Most states have provisions and procedures to correct or update (amend) information on the death certificate. Amendment is usually a simple process and is encouraged in cases where it is warranted. Usually, amendments must be made in writing by the original certifier; there may be a requirement to make amendments within a specified time interval after the original death certificate was filed. Some states have a worksheet for making amendments. The local death certificate registrar can provide information about how to amend a death certificate.
2. If you become aware that a death certificate you have signed contains incorrect information, you should amend the death certificate to make it correct. If you become aware (by performing an autopsy or through other ways) that a death certificate completed by a certifier other than yourself is in error, you may contact the certifier and suggest that the certifier consider amending the death certificate.
3. An amended cause of death may involve causes which require that the death be reported to the medical examiner (or coroner). Be sure to consider this possibility when making amendments and report appropriate cases to the medical examiner (or coroner).
4. Certifiers should be aware that a vital records registration or processing fee may be charged when an amendment is made and that additional expense may be incurred by the funeral director or family.

IX. INTERVAL BETWEEN ONSET OF CONDITIONS AND DEATH

For each condition listed in Part I of the cause-of-death statement, a space exists to indicate the approximate time interval between the onset of the condition and death. For each condition, the interval should be indicated as accurately as possible based on the certifier's assessment of available information. It is acceptable to list the interval as unknown or approximate if such is the case. General intervals are also acceptable, such as seconds, minutes, hours, days, weeks, months, and several years. A range such as seconds to minutes or other statement such as "Known for six years" may also be used. Stating the interval should not be approached casually—the information may be used to assess preexisting conditions in some medicolegal settings or when insurance claims are processed. Stating the interval also serves as a check that the immediate, intermediate, and underlying causes of death have been written in the proper order. The stated interval should be based on consideration of the clinical history, symptomatology, natural disease course, and knowledge of the potential uses of such information, not solely on the interval since diagnosis.

Part I	A.	Pneumocystis carinii pneumonia	Approximate interval between onset and death 3 weeks
		Due to, or as a consequence of:	
	B.	Acquired immunodeficiency syndrome	3 years
		Due to, or as a consequence of:	
	C.	Human immunodeficiency virus infection	5 years
		Due to, or as a consequence of:	
	D.		
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I Intravenous drug abuse		

X. THE CAUSE OF DEATH, CLINICIANS, AND AUTOPSY REPORTING

1. The autopsy is a useful tool to determine underlying, intermediate, and immediate causes of death and other significant conditions for the purpose of completing the death certificate. Permission for performing an autopsy should be requested by clinicians in cases where an autopsy may improve the accuracy of the death certificate. Some institutions may find it advantageous for the autopsy pathologist to certify the death when an autopsy is performed, making sure that the attending physician is consulted.
2. If an autopsy is performed, regardless of whether the death certificate is signed by a clinician or the autopsy pathologist, when possible, the death certificate should reflect relevant autopsy findings. A pending certificate may be filed if necessary, amending it at a later date.
3. A clinician who has obtained permission for autopsy and who will act as certifier should promptly contact the autopsy pathologist to discuss the autopsy findings so the death certificate can be accurately completed in a timely fashion. If the certifier does not contact the autopsy pathologist soon after autopsy findings are available, the autopsy pathologist should contact the certifier to discuss the autopsy findings.
4. If the death certificate has been signed prior to an autopsy, a copy of the death certificate should be provided to the pathologist to allow correlation with autopsy findings. If there is significant inconsistency between the autopsy findings and the cause of death on the death certificate, the pathologist should contact the certifier and suggest that the certifier amend the death certificate. If warranted, the certifier should amend the death certificate in such cases.
5. It is suggested that the autopsy report contain the cause-of-death statement that is written on the death certificate by the clinician, autopsy pathologist, or other certifier after necessary amendments, if any, have been made. Doing so will link autopsy findings with cause-of-death information from the death certificate, which may prove valuable for statistical analyses, autopsy-based studies, mortality reviews, and outcomes analysis. The autopsy pathologist and hospital may need to develop a procedure for obtaining a copy of the death certificate when an autopsy is performed.

XI. OTHER DETAILS

1. The death certificate should not be used to make political or social statements—it should be completed objectively. The potential for survivors to perceive certain cause-of-death statements as intrusive or contrary to their interests should be considered, but should not dictate the choice of wording in the cause-of-death statement.
2. The certifier is usually required to complete several items on the death certificate in addition to the cause-of-death statement. Consult the local vital records personnel for instructions, if necessary.
3. If the necessary equipment and software are not available to complete the death certificate electronically with a laser printer, type the death certificate using a black ribbon. If the certificate cannot be typed, hand print the certificate using black ink.
4. It is helpful to determine whether hospital policy addresses the circumstances under which the attending physician, pathologist, or other physician should or should not complete the death certificate of a hospitalized patient. If a policy does not exist or is ineffective in producing death certificates with cause-of-death statements of consistently good quality, work with hospital administration and the medical staff to develop an effective policy that is consistent with state or local laws and regulations and that includes quality assurance measures.

NOTE:

The death certificate in most states is substantially based upon a United States Standard Certificate of Death developed by the National Center for Health Statistics and other interested parties, such as state vital record registrars. The Standard Certificate provides a reasonable vehicle to document causes of death. A major problem is that many physicians fail to use the vehicle as it was intended. This protocol was developed as an aid to individual certifiers and to provide basic information on the principles of death certification and promote uniformity and consistency in death certification practices.

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SECTION 2: CAUSE-OF-DEATH STATEMENTS AND THE ELDERLY

I. INTRODUCTION

Writing cause-of-death statements for elderly people can be difficult for several reasons:¹⁻³

- Elderly people sometimes seem to die “with their disease” rather than “of their disease.”
- Several diseases may coexist, none of which alone or together clearly caused death.
- Death may occur many years after “normal life expectancy” and the relationship of aging, “senescence,” disease, and death are unclear.
- Conditions that may not occur or be fatal in a young person may cause the death of an elderly person.
- Dementia or injury may be overlooked as the underlying cause of death.
- A specific underlying cause of death (such as the cause of a “stroke”) may be overlooked.
- Fractures are common, and non-traumatic pathologic fractures must be distinguished from fractures due to external conditions (injury).
- Elderly people may be more susceptible to death because of a pre-existing condition or “frailty.”

It is assumed that the reader is familiar with the basic principles of writing cause-of-death statements as outlined by the National Center for Health Statistics and by the College of American Pathologists’ publication, *The Medical Cause of Death Manual: Instructions for Writing Cause-of-Death Statements for Deaths Due to Natural Causes*.^{4,5} The basic tenets within those publications will not be reiterated here.

Example scenarios will now be presented, along with appropriate explanations, for various options that may be used for writing cause-of-death statements for the elderly.

II. EXAMPLES

Scenario 1. Complication of dementia. A 62-year-old woman with Alzheimer’s disease had recurrent bouts of aspiration pneumonia and finally died in the hospital with fulminant pneumonia.

Part I	A. Aspiration pneumonia	Approximate interval between onset and death Weeks
	Due to, or as a consequence of: B. Alzheimer’s disease	Approx. 15 years
	Due to, or as a consequence of: C.	
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

COMMENT: As in this case, when death results from complications of dementia, the specific type of dementia should be reported as the underlying cause of death, if possible (see Section 3 of this manual). Of course, complications of the dementia which serve as an intermediate or the immediate cause of death (such as aspiration pneumonia in this case) should also be reported in the cause-of-death statement.

Scenario 2. Reasonably certain underlying cause of death. An 84-year-old woman had a well-documented history of atherosclerotic coronary artery disease with angina that required occasional nitroglycerin. She had angina on the morning of her death shortly before she lay on the sofa, then dying about an hour later. The medical examiner was notified, but because of the decedent's age, known condition, and lack of suspicious circumstances, declined to investigate and certify the death. The family did not wish to have an autopsy performed. Her physician went to her home and pronounced death and noted mild bilateral lower extremity edema.

Part I	A. Atherosclerotic coronary artery disease	Approximate interval between onset and death Years
	Due to, or as a consequence of: B.	
	Due to, or as a consequence of: C.	
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

COMMENT: In this case, because of the history, circumstances, and death, there was compelling evidence that, more likely than not, death resulted from atherosclerotic coronary artery disease. Sufficient evidence was lacking, however, to report a more specific immediate cause of death, for it was not determined whether myocardial infarction, dysrhythmia, or some other entity such as congestive heart failure occurred. Thus, a Single Line Part I Format was used. When a specific cause of death is apparent, based on all available information, it should be reported in the cause-of-death statement.

Scenario 3. Death involving a fracture. A 69-year-old female had joint pain related to osteoporosis and its complications. One day while walking, she had acute pain in her hip and was admitted with a pathologic fracture. Five days postoperatively she died of pulmonary embolism which originated in a lower extremity deep vein thrombosis.

Part I	A. Pulmonary embolism	Approximate interval between onset and death Minutes
	Due to, or as a consequence of: B. Deep leg vein thrombosis	Several days
	Due to, or as a consequence of: C. Pathologic fracture of left femoral neck	5 days
	Due to, or as a consequence of: D. Osteoporosis	Years
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

COMMENT: It is important not to overlook the underlying condition, osteoporosis, as the underlying cause of death. It is also important to realize that such pathologic fractures are natural manifestations of a disease because no external condition (injury event) is involved, as might be the case when a person falls and fractures the hip from the impact of falling. Deaths involving fractures from external conditions (injury) should be reported to the medical examiner or coroner.

Scenario 4. Death of a “compromised” elderly person. A 69-year-old man had several previous myocardial infarctions due to coronary artery atherosclerosis. He also had an inguinal hernia which began to hurt severely one day, culminating in a visit to the emergency department the next day where emergency surgery was deemed necessary for a strangulated hernia. While being transported to surgery, he developed chest pain and died before surgery could be performed. Autopsy confirmed an early myocardial infarction and necrotic bowel in the strangulated segment.

Part I	A. Acute myocardial infarction	Approximate interval between onset and death Hours
	Due to, or as a consequence of: B. Atherosclerotic coronary artery disease	Years
	Due to, or as a consequence of: C.	
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I Strangulated inguinal hernia	

COMMENT: The acute myocardial infarction was the pathologic consequence of coronary artery atherosclerosis, and was probably brought about acutely by stresses related to the strangulated hernia. Thus, it is appropriate to report all of these conditions in the cause-of-death statement. Because coronary artery atherosclerosis is pathogenetically linked to the acute myocardial infarction, it is appropriate to report that cause-of-death sequence in Part I. Strangulated inguinal hernia is appropriately reported in Part II because it contributed to death, but did not result in the underlying cause of death (coronary atherosclerosis). The hernia did, however, contribute to the immediate cause of death listed in Part I (acute myocardial infarction), but that relationship does not preclude reporting of the hernia in Part II.

Scenario 5. Death in which a specific underlying cause may be overlooked. An 82-year-old male died of cerebral infarction with subsequent pneumonia and systemic sepsis. Autopsy confirmed these findings and also showed a thrombosed atherosclerotic plaque of the left middle cerebral artery.

Part I	A. Pneumonia with sepsis	Approximate interval between onset and death 4 days
	Due to, or as a consequence of: B. Left cerebral infarction	1 week
	Due to, or as a consequence of: C. Thrombosis of left middle cerebral artery	1 week
	Due to, or as a consequence of: D. Cerebral artery atherosclerosis	Years
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

COMMENT: It is important to remember that entities such as "stroke" or "cerebrovascular accident" often have an identifiable underlying cause that should be reported in the cause-of-death statement, when possible. Pathologic terminology such as "cerebral infarction" or "left internal capsule brain hemorrhage" are preferred to the words such as "stroke" or "cerebrovascular accident." Furthermore, an "accident" involves external conditions (injury or poisoning) and applies to manner-of-death classification, not cause-of-death wording. This cause-of-death statement is much more informative than one that reads "cerebrovascular accident." The possibility of overlooking, and failing to report, a specific underlying cause of death also exists in many other death scenarios among the elderly.

Scenario 6: Cause of death questionable. A 92-year-old man was found dead in bed by his son. He had a 20-year history of mild hypertension and a 5-year history of diet-controlled diabetes mellitus. Chemical studies on autopsy specimens showed no evidence of hypoglycemia or diabetic ketoacidosis, but moderate cardiac hypertrophy was present, consistent with the history of hypertension. No specific cause of death could be identified.

Part I	A. Undetermined natural causes	Approximate interval between onset and death Unknown
	Due to, or as a consequence of: B.	
	Due to, or as a consequence of: C.	
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I Essential hypertension with cardiac hypertrophy	

COMMENT: This format lets a reader of the cause-of-death statement know that a specific cause of death was not apparent, but that hypertension and its cardiac sequelae may have had some role in causing death. When this method is used, if more than one condition is listed in Part II, the most important one should be listed first, with the others listed in descending order of importance.

One might argue that the format shown for Scenario 6 is not an appropriate use for Part II because the condition listed in Part II may actually have been the underlying cause of death. Regardless, the approach shown here is a functional one because it accommodates the occasional need for the certifier to indicate that a specific cause of death is not straightforward. Furthermore, this approach does not interfere with statistical classification and coding procedures.

Scenario 7. Cause of death not apparent. A 92-year-old man was found dead in bed. He had a 10-year history of gradual decline but no specific medical problems had been diagnosed or treated. There was no suspicion or evidence of foul play. The medical examiner was notified but declined to investigate the death. The family consented to an autopsy which did not disclose a reasonably certain cause of death. Mild generalized atherosclerosis was observed, as was mild "senile" cerebral atrophy.

Part I	A. Undetermined natural causes	Approximate interval between onset and death Unknown
	Due to, or as a consequence of: B.	
	Due to, or as a consequence of: C.	
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

COMMENT: This format appropriately lets a reader of the cause-of-death statement know that a specific natural cause of death was not known. The conditions found at autopsy would be expected in a person of the decedent's age. Although some people advocate that the cause of death be written as "old age" or "senescence" in such cases, using such wording is unnecessary because the stated cause of death may be interpreted in light of the decedent's age as also reported on the death certificate. Furthermore, there is no standardized, age-related definition of senescence or old age.

III. DISTRACTORS OF WHICH TO BEWARE

There are a number of situations in which the complications of an underlying cause of death may clinically overshadow the underlying condition itself, resulting in the certifier forgetting to include the underlying cause in the cause-of-death statement.

Some of the more common complications that cause such problems, along with commonly associated underlying disease categories are listed below. Any time one of these complications exists in an elderly person who died, a conscientious attempt should be made to identify and report as the underlying cause of death the condition which caused the complication. The complications should be reported as an intermediate or immediate cause of death, as appropriate for the case.

PNEUMONIA

Often a complication of dementia, cerebrovascular disease, cardiac disease, lung disease.

GANGRENE

Often a complication of peripheral vascular disease, diabetes mellitus, and embolic conditions.

SEPSIS

A nonspecific complication of many disorders in the elderly, commonly urinary tract infection which, in turn, may be secondary to chronic catheterization for underlying neurologic or other disease.

DECUBITUS ULCERS

Almost always due to some underlying debilitating, neurologic, or systemic disease process.

PULMONARY EMBOLISM

A nonspecific complication of many diseases that immobilize the decedent or involve hyperviscosity.

URINARY TRACT INFECTION/UROSEPSIS

Often a complication of neurologic disease, other debilitating disease, or other more specific urinary tract problems such as prostatism.

ASPIRATION PNEUMONIA

Often a complication of specific neurologic or neuromuscular disorders.

MALNUTRITION

Often a complication of underlying systemic disease or neoplasia.

CHRONIC BEDRIDDEN STATE

Usually due to some identifiable underlying condition.

IV. THINK OF THE MEDICAL EXAMINER/CORONER

Several situations are common among the elderly, which may necessitate notification of the medical examiner or coroner.

Abuse or neglect. Elderly people may be victims of abuse or neglect. If a cause-of-death statement is being written that indicates the possibility of abuse or neglect, the medical examiner or coroner should be notified as required by state law, if notification has not already taken place.

Inconspicuous injury. Falls, traumatic fractures, and other types of injuries are common among the elderly, but may present as natural disease processes. For example, *subarachnoid hemorrhage* may result from head trauma but present as "spontaneous" intracranial hemorrhage. *Seizure disorders* may be post-traumatic. *Pulmonary embolism* may be the final complication of myriad injuries. *Bleeding diathesis* could indicate a poisoning. *Cardiac rhythm disturbance* may indicate tricyclic antidepressant or other type of drug toxicity. An *infected soft tissue* may be the result of an inflicted injury.

Suicide. Suicide rates are high among the elderly. When a reasonably certain, non-suicidal cause-of-death cannot be determined, the possibility of suicide should always be considered, and the medical examiner or coroner should be notified as required by state law, and if circumstances dictate. *Tricyclic antidepressants* are often prescribed and are not infrequently used in suicide attempts. A history of depression should alert the certifier to the possibility of suicide. Some methods of *suicide can be masked* by family members, making suicide difficult to detect—a fact that should always be borne in mind.

Hypothermia and hyperthermia. Elderly people may be at increased risk for death involving environmental hypothermia (cold exposure) or hyperthermia (heat stroke). Hypothermia and hyperthermia may also be endogenous, however, usually due to infectious processes or neurologic disorders. If a cause-of-death statement includes reference to hypothermia or hyperthermia, the certifier must attempt to ascertain whether the condition is endogenous or exogenous. If exogenous causes are a real possibility, state law may require that the death be reported to the medical examiner or coroner because external conditions (injury or poisoning) may be involved. If endogenous, every attempt should be made to identify the underlying cause of the hypo- or hyperthermia and to report the underlying cause as the underlying cause of death—reporting the hypo- or hyperthermia as an intermediate or immediate cause of death as appropriate for the case.

V. PSYCHIATRIC DISORDERS

Some types of psychiatric disorders may cause death—such as *excited delirium*, *catatonia*, *acute manic episodes*—and so can adverse reactions to the treatment of psychiatric disorders, such as the *neuroleptic malignant syndrome* that is occasionally associated with major tranquilizer therapy, and *accidental overdoses* or toxicity of psychiatric medications such as antidepressants. Such possibilities should always be considered, and if drug overdose or toxicity is suspected, the death should be reported to the medical examiner or coroner as detailed in state law.

VI. NEOPLASIA

Neoplasia is common among the elderly. When death results from the complications of neoplasia, the neoplastic condition should be reported in the cause-of-death statement, usually as the underlying cause of death. The primary site and cell type (e.g., “squamous cell carcinoma of left mainstem bronchus”), and nature of the fatal complication (e.g., “hemorrhage due to aorto-pulmonary fistula,” or “multiple metastases to brain”) should also be reported, if possible.

VII. SUMMARY

Cause-of-death statements for elderly individuals may be approached as follows:

- If the death involves conditions that, with reasonable medical probability, constitute the cause-of-death sequence, then the cause-of-death statement may be written using the same basic principles that would be used for certifying the death of a younger individual.
- If a cause of death cannot be determined with reasonable medical probability, but seems to be due solely to natural causes, the certifier may attribute death to Undetermined Natural Causes.
- If a condition existed which may have caused death, but reasonable medical probability is tenuous, Part I may be reported as Undetermined Natural Causes and the condition may be reported in Part II.
- Certifiers should be aware of common complications that may cause one to overlook, and fail to report the underlying cause of death, making sure to report such underlying causes of death.
- Special consideration should always be given to the possibility of abuse or neglect, inconspicuous injury, suicide, complications of psychiatric disorders, and exogenous hyper- or hypothermia.
- For deaths involving neoplasia, the cell type, primary site, and nature of fatal complication(s) should each be reported in the cause-of-death statement.
- It is important to differentiate pathologic fractures from traumatic fractures.
- Do not overlook some form of dementia as an underlying cause of death.

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SECTION 3: OPTIONS FOR REPORTING DEMENTIAS WHEN WRITING CAUSE-OF-DEATH STATEMENTS

Autopsy and Neuropathology Committees of the College of American Pathologists

I. INTRODUCTION

For deaths involving dementia, studies have shown that important information is sometimes omitted from the death certificate, including omission of the underlying cause of death.¹⁻⁴ For example, for a person who dies of aspiration pneumonia (immediate cause of death) because of Alzheimer's disease (underlying cause of death), some may incorrectly cite "aspiration pneumonia" as the only cause of death on the death certificate, with no mention of Alzheimer's disease. Such an approach provides incomplete information for mortality studies and statistics, which may result in suboptimal assessment of mortality patterns, in turn resulting in suboptimal or misdirected research funding and public health programs.

An option is provided here that may be useful when writing the cause-of-death statement for a patient who has died as a result of progressive dementia, to ensure that a specific type of dementia is cited, if possible, and that the more acute complications that culminate in death are also cited in correct format. Deaths resulting from the various encephalopathies that may be reversible and secondary to a host of underlying systemic disease conditions are not addressed here.

It is assumed that the reader/user of this protocol is familiar with the basic principles of writing cause-of-death statements as outlined by the National Center for Health Statistics⁵ and by the College of American Pathologists' publications, *Protocol for Writing Cause-of-Death Statements for Natural Causes*⁶ (Section 1) and *The Medical Cause-of-Death Manual: Instructions for Writing Cause-of-Death Statements for Deaths Due to Natural Causes*.⁷ The basic tenets within those publications will not be reiterated.

II. BASIC PRINCIPLES

When writing a cause-of-death statement for a death resulting from dementia, the cause-of-death statement should include the specific type or classification of dementia as the underlying cause of death, and the important complications of the dementia should be included as the immediate or an intermediate cause of death as shown in the following examples:

Part I	A. Aspiration pneumonia (Complications, i.e., immediate cause)	Approximate interval between onset and death Days
	Due to, or as a consequence of: B. Alzheimer's disease (Underlying cause)	10 years
	Due to, or as a consequence of: C.	
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

In some cases, the sequence of events may involve a longer chain of complications, requiring the inclusion of one or more intermediate causes of death as shown in this example:

Part I	A. Systemic sepsis (Complication, i.e., immediate cause)	Approximate interval between onset and death 3 days
	Due to, or as a consequence of: B. Infected decubiti (Complication, i.e., intermediate cause)	2 weeks
	Due to, or as a consequence of: C. Alzheimer's disease (Underlying cause)	10 years
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

It is not always possible to use the Sequential Part I Format as shown in the previous examples. For example, consider the patient with Huntington's disease, whose death was expected but occurred at home and an autopsy was not performed. There may be insufficient information to cite a specific immediate cause of death, and a Single Line, Part I Format may be required as shown in this example:

Part I	A. Huntington's disease	Approximate interval between onset and death 12 years
	Due to, or as a consequence of: B.	
	Due to, or as a consequence of: C.	
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

It would also be acceptable to state the cause of death in this case as "Complications of Huntington's disease." When a Single Line, Part 1 Format is used, the condition listed is the underlying cause of death, but also serves as the immediate cause of death.

III. EXCLUSION OF TERMINAL EVENTS

Mechanisms of death that are terminal events (see Section 8 of this manual) such as cardiac arrest, respiratory arrest, cardiopulmonary arrest, ventricular fibrillation, asystole, and electromechanical dissociation) are extremely nonspecific and should not be included in the cause-of-death statement.

IV. NONSPECIFIC PROCESSES AND DERANGEMENTS

People who die of dementia often develop one or more nonspecific complications of the underlying dementia. Such nonspecific complications may serve as the immediate or an intermediate cause of death.

Some common examples include:

- Aspiration pneumonia
- Pneumonia
- Seizure disorder
- Decubitus ulcers (with or without osteomyelitis)
- Systemic sepsis
- Pulmonary embolism

It is appropriate to include such nonspecific complications in the cause-of-death statement as the immediate or intermediate cause of death, but a specific type of dementia should be specified as the underlying cause of death, if possible. A nonspecific complication should not be cited as the underlying cause of death when death results from a dementia.

V. DEMENTIAS THAT MAY BE CITED AS THE UNDERLYING CAUSE OF DEATH

The table below lists some specific types of dementia which, based on current medical knowledge, are primary conditions with a specific or unknown etiology. In every case in which death appears to have resulted from dementia, an attempt should be made to specify one of the conditions in the table as the underlying cause of death when writing a cause-of-death statement.

TABLE I. DEMENTIAS WITH SPECIFIC OR UNKNOWN ETIOLOGY

Alzheimer's disease (includes the "presenile" and "senile" types)
Dementia with Lewy bodies*
Vascular dementia, multi-infarct type
Vascular dementia, lacunar type
Vascular dementia, Binswanger's type
Vascular dementia, otherwise unspecified
Pick's disease
Frontal lobe dementia
Idiopathic Parkinson's disease with dementia
Progressive supranuclear palsy
Corticobasal degeneration
Creutzfeldt-Jakob disease
Huntington's disease
Multisystem atrophy
Motor neuron disease with dementia
Senile dementia, unclassified
Dementia, otherwise unclassified

*Neuropathologists have not reached a consensus regarding the classification of dementias in this category. "Lewy body variant of Alzheimer's disease," "Senile dementia of the Lewy body type," "Mixed

Alzheimer's disease and Lewy body disease," and "Diffuse Lewy body disease"; each has been used and may apply in specific cases. At present, each is acceptable as a cause of death.

COMMENT: In some cases, a vascular dementia may be listed as the underlying cause of death. In other cases, vascular dementia may be secondary to an identifiable underlying cause, such as cerebral artery arteriosclerosis. When a vascular dementia is known to be due to an underlying cause, the vascular dementia may be listed as an immediate or intermediate cause of death, with the underlying condition being listed as the underlying cause of death.

Part I	A. Klebsiella pneumonia	Approximate interval between onset and death 1 week
	Due to, or as a consequence of: B. Multi-infarct vascular dementia	10 years
	Due to, or as a consequence of: C. Cerebral arteriosclerosis	Unknown
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

Autopsy, histologic examination, or other postmortem studies may be required to diagnose some of the dementias listed in Table 1. When possible, the death certificate should reflect such information. The death certificate may be amended if relevant information surfaces after the death certificate is filed.

VI. GETTING SPECIFIC

When writing the cause-of-death statement, an attempt should be made to state each condition as specifically as possible, including condition subtype, anatomic sites and etiologic agents, if known. The following cause-of-death statement serves as an example:

Part I	A. Systemic staphylococcal sepsis	Approximate interval between onset and death 3 days
	Due to, or as a consequence of: B. Infected decubitus ulcer of left buttocks	2 weeks
	Due to, or as a consequence of: C. Multi-infarct vascular dementia	10 years
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

The preceding example includes a specific etiologic agent (staphylococcus), a specific anatomic location (left buttocks), and a specific disease categorization (vascular dementia, *multi-infarct* type).

VII. OTHER SIGNIFICANT CONDITIONS

In some cases, a dementia may contribute to death, but another condition is more important pathophysiologically and constitutes the underlying cause of death. For example, a person may die from ischemic heart disease, but the presence of Alzheimer's disease may also have played a role, perhaps by exacerbating heart failure by producing aspiration pneumonia. In such a case, it is appropriate to list the dementia in Part II of the cause-of-death statement as an "other significant condition."

Part I	A. Congestive heart failure	Approximate interval between onset and death 3 days
	Due to, or as a consequence of: B. Chronic ischemic heart disease	10 years
	Due to, or as a consequence of: C. Atherosclerotic coronary artery disease	15 years
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I Alzheimer's disease with aspiration pneumonia	

If a dementia is present at the time of death, but the dementia does not cause or contribute to death, the dementia should not be cited in the cause-of-death statement unless otherwise required by local death registration laws, regulations, policies, or procedures.

For further information regarding "other significant conditions," nonspecific processes, and the underlying, intermediate, and immediate causes of death, consult references 5-7 and Section 1 of this manual.

VIII. REPORTING SELECTED CASES TO THE MEDICAL EXAMINER/CORONER

Persons with dementia may sustain injuries which may be unintentional (such as injury resulting from a fall) or intentional (such as injury from physical abuse). Some persons with dementia may be institutionalized. The laws in many states require that deaths of institutionalized patients or deaths involving known or suspected injury be reported to the medical examiner or coroner. Be familiar with local and state laws regarding the types of deaths which must be reported to the medical examiner or coroner, and ensure that such deaths are reported when they occur or are suspected. In general, if a person with dementia has died from a known or suspected injury, the medical examiner/coroner will probably investigate the death and complete the death certificate, assuming the death has been reported to the medical examiner/coroner in the first place.

IX. REFERENCES

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- 7) College of American Pathologists Autopsy Committee. *Medical Cause of Death Manual: Instructions for Writing Cause-of-Death Statements for Deaths Due to Natural Causes*. Hanzlick R, ed. Northfield, IL: College of American Pathologists; 1994.

SECTION 4: OPTIONS FOR WRITING CAUSE-OF-DEATH STATEMENTS BY INCLUDING INJURY EVENTS, TRAUMA, AND FATAL DERANGEMENTS

The Autopsy Committee and Forensic Pathology Committees of the College of American Pathologists

I. INTRODUCTION

The option here is designed for persons who must certify deaths that result from injury or poisoning. It is recognized that the approach to certifying such deaths varies among certifiers—even among medical examiners and coroners who certify most deaths resulting from injury and poisoning. Some certifiers prefer to write cause-of-death statements which include only the underlying cause of death (e.g., gunshot wound of thorax), while others prefer to write more comprehensive cause-of-death statements, which also include one or more intermediate cause of death (e.g., hemopericardium) and an immediate cause of death (e.g., cardiac tamponade). While certifiers of death must have the liberty to write cause-of-death statements which best meet their needs in a particular case, some guidelines may be useful. The option presented here is one approach based on differentiating an injury event from the resulting trauma and fatal derangement.

It is assumed that the reader/user of this protocol is familiar with the basic principles of writing cause-of-death statements and manner of death as outlined by the National Center for Health Statistics¹⁻³ and by the College of American Pathologists' publications, *Protocol for Writing Cause-of-Death Statements for Natural Deaths*⁴ and *The Medical Cause-of-Death Manual: Instructions for Writing Cause-of-Death Statements for Deaths Due to Natural Causes*.⁵ The basic tenets within those publications will not be reiterated. It is also assumed that the reader is aware that, in general, death resulting from injury should be reported to, and will usually be certified by (or at the direction of), the medical examiner or coroner.

II. INJURY EVENT, TRAUMA, AND FATAL DERANGEMENTS

Although the words injury and trauma are often used synonymously, the National Center for Health Statistics (NCHS), which provides guidelines for completion of the death certificate, recommends that the certifier "report each injury or poisoning that caused a bodily trauma," and that the "fatal injury" (e.g., gunshot wound to thorax) and the "trauma" (e.g., perforation of heart) be reported along with the fatal "impairment of function" (e.g., cardiac tamponade). Further discussion of these concepts may be helpful to foster consistency when writing cause-of-death statements.

By virtually all definitions, an injury is caused by an external agent or force (external condition) that is usually physical or chemical in nature. Thus, for the purpose of writing cause-of-death statements, an *injury event* may be viewed as an event involving one or more external conditions which damage bodily tissue or its function. *Trauma* may be viewed as the damage sustained by bodily tissue when an injury event occurs. The trauma may result in some specific or nonspecific anatomic or functional derangement that causes death, which may be viewed as a *fatal derangement*.⁵ For example, if a person who has been stabbed near the base of the neck sustains a transection of the subclavian vein with fatal left hemothorax, the "stabbing" (or sharp force injury) may be viewed as the *injury event*, "stab wound of neck" and "transection of the subclavian vein" may each be viewed as *trauma*, and "intra-thoracic hemorrhage" (or hemothorax) may be viewed as the *fatal derangement*. Thinking in these terms may be helpful when writing a cause-of-death statement, as each may be included in the cause-of-death statement, in order to fully document the nature of the injury and its fatal consequences.

III. GENERAL APPROACH

In general, a useful approach to writing Part I of cause-of-death statements involving an injury event (or poisoning) is shown in the following example:

Part I	A. Fatal derangement (e.g., cardiac tamponade)	Approximate interval between onset and death
	Due to, or as a consequence of: B. Bodily trauma (e.g., perforation of heart)	
	Due to, or as a consequence of: C. Injury event (e.g., gunshot injury to chest)	
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

IV. SAMPLE CAUSE-OF-DEATH STATEMENTS

For a scenario involving a stab wound, the cause-of-death statement may be written as follows, where the injury event constitutes the *underlying cause of death*, each sequential trauma is cited as an *intermediate cause of death*, and the fatal derangement is cited as the *immediate cause of death*.

Part I	A. Left intrathoracic hemorrhage	Approximate interval between onset and death 20 minutes
	Due to, or as a consequence of: B. Transection of left subclavian vein	20 minutes
	Due to, or as a consequence of: C. Penetrating wound of left shoulder	20 minutes
	Due to, or as a consequence of: D. Stab injury	20 minutes
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

Although this example is descriptive and technically correct in the context of the principles outlined above, some may view it as excessive in detail or length. To avoid redundancy, a more conventional approach may be used by combining the injury event with the initial trauma, as long as the nature of the injury event is apparent, as shown in the following example:

Part I	A. Left intrathoracic hemorrhage	Approximate interval between onset and death 20 minutes
	Due to, or as a consequence of: B. Transection of left subclavian vein	20 minutes
	Due to, or as a consequence of: C. Stab wound of left shoulder	20 minutes
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

In the example immediately above, it is explicit that a sharp force injury event is involved without a direct statement of that fact. Such an approach may be used for many death scenarios involving an injury event, trauma, and a fatal derangement. Although some certifiers may wish to write the cause of death statement simply as "stab wound of shoulder," it should be obvious that such information will not be of much use for studying the nature of the complications produced by the injury event. One must keep in mind that mortality data may be used to evaluate public health and emergency response needs, and including complete information in the cause-of-death statement is helpful. For example, if it were shown from mortality data that many or most stab wounds of the subclavian region involved air embolism, such information may be useful to emergency response planning.

V. OTHER ITEMS REQUIRING COMPLETION

When death is caused by external conditions (i.e., results from injury or poisoning), several other items of information must be completed on the death certificate:

- 1) The manner of death
- 2) How the injury occurred
- 3) The date, time, type of place, and address where injury occurred
- 4) Whether the injury occurred at work (Yes/No)
- 5) The interval between onset and death for each condition in Part I

For a death resulting from injury or poisoning, the manner of death is usually indicated as either homicide, suicide, accident, or undetermined. Manner of death is determined by the type(s) of cause(s) resulting in death and the circumstances under which the cause(s) occur(s). A full discussion of manner of death is beyond the scope of this section, and further information may be found in the referenced publications and Section 7 of this manual.

To "describe how injury occurred," enough information must be supplied to address questions that would be anticipated in the type of injury involved. For example, in motor vehicle collisions, it is desirable to indicate whether the decedent was a driver, passenger, or pedestrian, and whether the incident was a vehicle-vehicle collision, or an impact with another object such as a tree (e.g., driver of car that struck tree). The space allowed for such entries on many death certificates is very short, and telegraphic statements are sometimes required.

For the date and time of injury, "unknown" is acceptable if such is the case, or the date and time may be specified as "approximate" or "found."

The "type of place" should be stated generically (e.g., "fast-food restaurant"), avoiding specific names of places or businesses. It is also helpful to be unambiguous, specifying, for example, if a death in a home occurred in "decedent's home" or "another's apartment." The address of the location should include the street and street number, city, state, and Zip code.

Criteria have recently been established by the National Association of Public Health Statistics and Information Systems (NAPHSIS) (formerly the Association of Vital Records and Health Statistics [AVRHS]) and other groups to assist in determining if an injury occurred at work, and they are included at the end of this section.⁶ Persons who complete this entry on the death certificate should be familiar with the AVRHS criteria, because some injury deaths that occur while working or going to work are not considered to involve "injury at work." (See end of this section for details.)

Discussion of the "interval between onset and death" is contained in the referenced publications and in Section 1 of this manual. In brief, these intervals may be stated precisely if adequate information is available, or in broad terms (e.g., minutes), or as "unknown," or they may be indicated as approximations (e.g., approx. 3 years). When possible, the intervals should be stated as accurately as possible without guessing.

Using the principles discussed on the preceding page, an injury-related cause-of-death statement that also includes the other necessary items of information is shown below.

Part I	A. Subarachnoid hemorrhage	Approximate interval between onset and death Minutes
	Due to, or as a consequence of: B. Blunt force trauma of head	Minutes
	Due to, or as a consequence of: C. Motor vehicle crash	Minutes
	Due to, or as a consequence of: D.	
Part II OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I Acute ethanol intoxication		

29. MANNER OF DEATH Accident	30a. DATE OF INJURY Jan. 19, 1995	30b. TIME OF INJURY Approx. 2:30 a.m.	30c. INJURY AT WORK? NO
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30d. DESCRIBE HOW INJURY OCCURRED Driving car/hit tree/ejected

30e. PLACE OF INJURY City street	30f. LOCATION 619 Slippery Trail, Catapolis, Georgia 33996
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In the example above, some may argue that "motor vehicle crash" should not be included in Part I because item 30d describes what happened. It does no harm to include general injury event information in Part I, however, and it can be helpful in some cases as described in further detail below.

If an external condition (injury or poisoning) is listed in Part I or Part II of the cause-of-death statement, all of the injury-related items (items 30a-30f in the example) must be completed. If an injury is listed as the underlying cause of death, the manner must be designated as other than natural (i.e., homicide, suicide, accident, or undetermined).

When disease and injury combine to result in death (e.g., a person who falls from a roof during an acute myocardial infarction and sustains a fatal neck injury), writing the cause-of-death statement and assigning a manner of death can be difficult. Further discussion of such dilemmas is beyond the scope of this section (see Sections 7 and 10 of this manual).

VI. OTHER EXAMPLES AND VARIATIONS

In some cases, the trauma resulting from an injury event may not connote a specific type of injury event. For example, blunt force trauma may result from a fall from a height, from being struck by a vehicle, from a blow with a fist, and from other causes. Although the "describe how an injury occurred" section can be used to clarify the circumstances (e.g., pedestrian struck by car), it may be helpful in some cases to also cite the injury event in the cause-of-death statement to clarify the type of injury event that occurred. For example:

Part I	A. Intra-abdominal hemorrhage	Approximate interval between onset and death 1 hour
	Due to, or as a consequence of: B. Lacerations of liver	1 hour
	Due to, or as a consequence of: C. Blunt force trauma of abdomen	1 hour
	Due to, or as a consequence of: D. Fall from height	1 hour
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

In the example shown above, the "describe how injury occurred" item on the death certificate would contain further specific information such as "fell from radio broadcast tower." Selecting the best way to state the cause of death requires judgment, and must include considerations of clarity, the scope of available information, the space available on the certificate, and other needs—such as a need for circumspection in some medical-legal cases where complete disclosure of the cause or circumstances of death could interfere with an ongoing investigation.

For the remainder of this section, in order to conserve space, only the cause-of-death statement (Part I and Part II) will be indicated in the examples. The other items requiring completion will not be included in the examples.

Some cases require additional thought and use of Part II (other significant conditions). For example, assume that in the stab-wound case scenario presented earlier, air embolism was also present. Although one may be tempted to write "left intrathoracic hemorrhage and air embolism" as the immediate cause of death, NCHS guidelines advise against the reporting of more than one condition per line in Part I of the cause-of-death statement in order to facilitate nosologic coding, classification, and prioritization of conditions. It is incumbent upon the person writing the cause-of-death statement to select one of the two conditions as the most important and cite it in Part I, and to cite the less important condition in Part II as an *other significant condition*. Thus, if the air embolism was felt to be of lesser importance, the cause-of-death statement could be written as:

Part I	A. Left intrathoracic hemorrhage	Approximate interval between onset and death 20 minutes
	Due to, or as a consequence of: B. Transection of left subclavian vein	20 minutes
	Due to, or as a consequence of: C. Stab wound of left shoulder	20 minutes
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I Air embolism	

In some instances, more than one type of trauma may result from an injury event. Consider the case of a person who is struck in the head with a baseball bat (injury event) and sustains a right parietal skull fracture (trauma), a lacerated middle-meningeal artery (trauma), and an epidural hematoma (fatal derangement) and death. The cause-of-death statement may be written as shown in the next example, including each trauma, sequentially as appropriate, as an intermediate cause of death, if such facts are known.

Part I	A. Right parietal epidural hematoma	Approximate interval between onset and death 1 hour
	Due to, or as a consequence of: B. Laceration of right middle-meningeal artery	1 hour
	Due to, or as a consequence of: C. Right parietal skull fracture	1 hour
	Due to, or as a consequence of: D. Blunt impact to head	1 hour
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

As discussed above, whether to include "struck with baseball bat" in the cause-of-death statement or "describe how injury occurred" section, or both, is a matter of personal preference and specific needs of the case. If it is important to not disclose the baseball bat as the weapon, as might occur in some medical-legal cases, one may have to write "struck with blunt object." Regardless of the wording, the "describe how injury occurred item" must be completed for all deaths due to injury, as must the other injury-related items on the death certificate.

It is not always possible to follow the guidelines as shown in the previous examples. The amount and type of trauma may be so extensive that more generic statements must be used. Consider the driver of a car who crashes and sustains lacerations of liver, spleen, and heart with significant internal hemorrhage, but also sustains multiple skeletal fractures and traumatic subarachnoid hemorrhage. In such cases, space limitations may require a more generic approach as shown in the following example.

Part I	A. Internal hemorrhage of thorax and abdomen	Approximate interval between onset and death 15 minutes
	Due to, or as a consequence of: B. Multiple visceral lacerations	15 minutes
	Due to, or as a consequence of: C. Generalized blunt force trauma	15 minutes
	Due to, or as a consequence of: D. Motor vehicle collision	15 minutes
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	
	Traumatic subarachnoid hemorrhage	

In other cases, the nature of the fatal derangement may be so complex that its nature is elusive or it cannot be adequately stated in the space provided. Consider the case of a suicidal gunshot wound to the head in which the bullet perforates both cerebral hemispheres. Just what is the fatal derangement? Hemorrhage, traumatic brain necrosis, vasospasm, neuronal shock, and other derangements are all possibilities that may be difficult or impossible to sort out. Again, a more generic statement may be required as shown in the next example of a through-and-through gunshot wound of the head.

Part I	A. Perforating brain trauma	Approximate interval between onset and death 10 minutes
	Due to, or as a consequence of: B. Gunshot wound of head	10 minutes
	Due to, or as a consequence of: C.	
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I.	

One may argue that inclusion of "perforating brain trauma" is not needed, and that "gunshot wound of head" by itself would suffice. That may be true in some cases, but citation of "perforating brain trauma" does differentiate the trauma in this case from that in a case where the bullet, for example, simply impacts with, and cracks the skull, causing an epidural hemorrhage and death. Note also in this example that "firearms injury" need not be stated specifically since the nature of the injury event is explicit as stated.

In some cases where death results from medical complications of an injury, it may be necessary to combine the principles used to write cause-of-death statements for deaths due to disease, with those used to cite injury and trauma. Consider the case of a person who is burned when a tar vat explodes, then, over the ensuing two weeks, develops wound infection, pneumonia, sepsis, and then dies.

Part I	A. <i>Pseudomonas</i> sepsis	Approximate interval between onset and death 2 days
	Due to, or as a consequence of: B. <i>Pseudomonas</i> pneumonia	5 days
	Due to, or as a consequence of: C. Cutaneous burn wound infection	10 days
	Due to, or as a consequence of: D. 3rd degree thermal burns	14 days
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

In the above example, the "describe-how-injury occurred" section could be used to indicate that the decedent was "burned when tar vat exploded."

VII. POISONING

Poisoning is an injury event caused by a chemical or other noxious substance, and the same principles may be used to write cause-of-death statements for poisoning as are used for other injury events. In some cases involving alcohol, other drugs, or other substances which result in death by poisoning, a specific fatal derangement may be known, while in other cases, the fatal derangement is presumed or is a matter of little more than speculation. For example, a person who ingests anticoagulant-containing rat poison may die of a perceivable fatal derangement such as gastrointestinal hemorrhage. In such a case, the cause-of-death statement might be written as follows:

Part I	A. Gastrointestinal hemorrhage	Approximate interval between onset and death Unknown
	Due to, or as a consequence of: B. Coagulopathy	Unknown
	Due to, or as a consequence of: C. Dicumarol rodenticide poisoning	Unknown
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

Of course, dicumarol poisoning is the "injury event" (or poisoning event) and gastrointestinal hemorrhage is the fatal derangement. Technically, the "trauma" might be most accurately stated as "hepatocellular dysfunction," but the wording in the above example (coagulopathy) also makes the pathogenetic sequence clear. One may "describe how injury occurred" in this case by writing "ingested rat poison."

Sometimes the immediate cause of death is not known and cannot be accurately stated with reasonable certainty. Consider the person who is found dead and is shown to have died from a cocaine overdose (poisoning) and who may have died of a dysrhythmia, a seizure, or perhaps even an excited delirium with hyperthermia—but the circumstances and available information do not allow differentiation of which one occurred. In such a case, a generic, single line Part I format may be used as shown in the following example.

Part I	A. Acute cocaine poisoning	Approximate interval between onset and death Minutes to
	Due to, or as a consequence of: B.	
	Due to, or as a consequence of: C.	
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

In the preceding example, if investigation showed that the cocaine had been taken by nasal insufflation, it would be acceptable to write "snorting cocaine" in the "describe how injury occurred" section. As an alternative, the cause-of-death statement may be written as follows:

Part I	A. Acute cocaine poisoning	Approximate interval between onset and death Minutes to
	Due to, or as a consequence of: B. Cocaine snorting	Minutes to hours
	Due to, or as a consequence of: C.	
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

If the method shown in the example last cited were used, it would still be necessary in the "describe-how-injury-occurred" section to state "snorting cocaine" or some similar terminology such as "illicit use of cocaine."

Also, if it were known, for example, that the cocaine poisoning caused a fatal seizure, "cocaine-induced seizure" would constitute the fatal derangement and could be written as the immediate cause of death.

As another example, assume that a person died from delirium as a result of crack cocaine smoking. The cause-of-death statement may be written as follows:

Part I	A. Excited delirium	Approximate interval between onset and death Minutes
	Due to, or as a consequence of: B. Cocaine poisoning	Minutes
	Due to, or as a consequence of: C. Crack cocaine smoking	Unknown
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

When a fatal derangement can be determined in a poisoning death, it is appropriate to report the fatal derangement (excited delirium in the example shown above) as the immediate cause of death.

The method of choice for writing cause-of-death statements in such cases depends on a thorough analysis of all findings, including analysis of the sequence of events, circumstances preceding death, and autopsy and toxicologic findings. In general, if a specific fatal derangement has been identified, it may be included in the cause-of-death statement. Otherwise, a more generic statement may be required.

VIII. MORE ON PART II: "OTHER SIGNIFICANT CONDITIONS"

Conditions or risk factors that, with reasonable medical probability, pre-existed or co-existed in the decedent and contributed to death, may be indicated in Part II of the cause-of-death statement as an other significant condition. Some common examples include alcohol intoxication (i.e., a risk factor for motor vehicle collisions) or a malignancy that may have been the reason a person cited for committing suicide. It is difficult to be consistent in citing such conditions, because the necessary information may not be available when the cause-of-death statement is completed. Consistent reporting of such conditions is recommended, however, and there should be documentation or reasonable probability that the condition or risk factor existed in the decedent.

Part II is also used to report conditions that may have contributed to death, but did not result in the underlying cause of death in Part I. An example involves a hemophiliac who is shot in the abdomen with perforating hepatic trauma. The gunshot injury would be listed in Part I, and the hemophilia in Part II, because it did not result in the gunshot wound, but it contributed to death. Further discussion of other significant condition is beyond the scope of this section, and the reader may consult the references for further information.

IX. MEDICAL-LEGAL CONSIDERATIONS

Most deaths that involve an injury event (or poisoning) will be investigated and certified by or under the authority of the medical examiner or coroner, whichever serves your area. Although state laws vary somewhat, most states have death investigation laws that require the medical examiner or coroner to be notified when a death occurs that is suspected or known as having resulted from injury (or poisoning), *regardless of the interval between onset and death*. Be familiar with local laws and abide by the provisions, being sure to report cases to the medical examiner or coroner as required.

In general, specific brand names should be avoided in cause-of-death statements and the related death certificate items, unless there is a high degree of confidence that a specific brand name product was involved. There may be a requirement or opportunity to report deaths involving injuries to specific agencies such as the Occupational Safety and Health Administration, Consumer Product Safety Commission, the Food and Drug Administration, or to other agencies. Be familiar with requirements and reporting systems that may apply to individual case reporting in your area.

X. SUMMARY

Rigid adherence to the option described here is not always possible. It is not always necessary to specifically cite the injury event if the nature of the injury event is otherwise explicit in the cause-of-death statement or described in the "describe how injury occurred" section of the death certificate. Certifiers should recognize that complete information is valuable for statistical, research, and public health-planning purposes, but in individual cases, judgment is required to select the most appropriate wording for the cause-of-death statement. Judgment should be based on the needs of the case, space availability, an awareness of the value of completeness, and the scope of available information.

Finally, it is recommended that certifiers of death use methods for writing cause-of-death statements that include information stated as specifically and completely as possible, in a fashion that is consistent as possible from case to case.

For further information on the types of conditions that may be cited as immediate or intermediate causes of death, including conditions that are often perceived as "mechanisms" of death, see Section 8 of this manual.

XI. REFERENCES

- 1) National Center for Health Statistics (NCHS). *Instructions for Completing the Cause-of-Death Section of the Death Certificate for Injury and Poisoning*. Hyattsville, MD: National Center for Health Statistics; December 1994. Department of Health and Human Services.
- 2) National Center for Health Statistics (NCHS). *Physician's Handbook on Medical Certification of Death*. Hyattsville, MD: National Center for Health Statistics; 1987. Department of Health and Human Services publication (PHS)87-1108.
- 3) National Center for Health Statistics (NCHS). *Medical Examiners' and Coroners' Handbook on Death Registration and Fetal Death Reporting*. Hyattsville, MD: National Center for Health Statistics; 1987. Department of Health and Human Services publication 87-1110.
- 4) College of American Pathologists' Autopsy Committee. *Protocol for Writing Cause-of-Death Statements for Natural Causes*. Hanzlick R, ed. Northfield, IL: College of American Pathologists; 1996.
- 5) College of American Pathologists' Autopsy Committee. *Medical Cause-of-Death Manual: Instructions for Writing Cause-of-Death Statements for Deaths Due to Natural Causes*. Hanzlick R, ed. Northfield, IL: College of American Pathologists; 1994.
- 6) Centers for Disease Control and Prevention. AVRHS Operational Guidelines for Determination of Injury at Work. *NAME NEWS*. 1994; 2:3.

OPERATIONAL GUIDELINES FOR DETERMINATION OF INJURY AT WORK

1. Complete the injury-at-work item if any other than natural cause of death is mentioned in Part I or Part II of the medical certification, including homicides, suicides, and accidents including motor vehicle deaths.
2. The injury-at-work item must be completed for decedents ages 14 or older and may be completed for those younger than 14 years of age if warranted. Consider possibility of work injury regardless of whether injury occurred in the course of work in "usual" or other occupation and/or industry. If decedent's "usual" occupation is housewife, student, or retired, consider possible injury during other employment. If occupation is transportation-related, suspect injury at work and evaluate per criteria.

Injury at Work		CRITERIA
Yes	No	
✓ ✓ ✓		On Employer Premises <ul style="list-style-type: none"> • Engaged in work activity, apprentice, vocational training • On break; in hallways, rest room, cafeteria, storage area • In employer parking lots while working, arriving, or leaving
	✓ ✓	<ul style="list-style-type: none"> • Engaged in recreational activities on employer-controlled facilities (games, etc.) for personal enjoyment • As visitor for non-work purposes, not on official business
✓ ✓ ✓ ✓ ✓		Off Employer Premises <ul style="list-style-type: none"> • Working for pay or compensation, including at home • Working as a volunteer EMS, firefighter, or law-enforcement officer • Working in family business, including family farm. Activity should be clearly related to a profit-oriented business • Traveling on business, including to and from customer/business contacts • Engaged in work activity where vehicle is considered the work environment (e.g., taxi driver, truck driver, etc.)
	✓ ✓ ✓ ✓ ✓	<ul style="list-style-type: none"> • Homemaker working at homemaking activities • Working for self – non-profit, i.e., mowing lawn, repairing own roof, hobby, or recreation activities • Student engaged in school activities • Operating vehicle (personal or commercial) for non-work purposes • Commuting to or from work site

These guidelines were developed jointly by: The Association for Vital Records and Health Statistics (AVRHS), the National Institute of Occupational Safety and Health (NIOSH), the National Center for Health Statistics (NCHS), and the National Center for Environmental Health (NCEH).

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For questions contact your State Vital Statistics Office

SECTION 5: OPTIONS FOR WRITING CAUSE-OF-DEATH STATEMENTS FOR PERIPROCEDURAL DEATHS

The Autopsy and Forensic Pathology Committees of the College of American Pathologists

I. INTRODUCTION

The Autopsy Committee of the College of American Pathologists defines a **periprocedural death** as a death that is known or suspected as having resulted in whole or in part from diagnostic, therapeutic, or anesthetic procedures. The "procedure" may be as simple as the administration or ingestion of a drug. Some periprocedural deaths have been referred to as "misadventures," "iatrogenic," or "errors and accidents in medical care."¹ However, the words "misadventure" and "iatrogenic" may connote negligence, but many periprocedural deaths do not involve negligence, mistakes, or culpability. Thus, the CAP Autopsy Committee suggests that the generic and objective term periprocedural death be used, to also include deaths that are temporally, but not necessarily causally related to medical procedures, therapies, or devices.

It is recognized that the agencies or individuals responsible for investigating periprocedural deaths vary among locations and that the approach to certifying such deaths varies among certifiers—even among medical examiners and coroners who investigate and certify many periprocedural deaths. While certifiers of death must have the liberty to write cause-of-death statements which best meet their needs in a particular case, some suggestions may be useful. The option presented here represents one approach for writing cause-of-death statements for periprocedural deaths.

It is assumed that the reader is familiar with the basic principles of writing cause-of-death statements and manner of death as outlined by the National Center for Health Statistics²⁻³ and by the College of American Pathologists.⁴ The basic tenets in those publications will not be reiterated. It is also assumed that readers are familiar with local and state death investigation statutes and regulations which, in some areas, may require that known or suspected periprocedural deaths be reported to the medical examiner or coroner.

II. MANNER OF DEATH

A brief summary of the manner of death concept is warranted because periprocedural deaths may involve various manners of death which must be stated on the death certificate. The **manner of death** is a classification of death based on the type of conditions that cause death and the circumstances under which the conditions occur. A death which is **natural** in manner is due solely to disease (and/or the aging process). If an external condition (injury or poisoning) causes or contributes to death, a manner other than natural usually applies. The manner of death for a death due to unintentional injury (or poisoning) is **accident**. Death resulting from intentional injury is either a **homicide** or a **suicide**, depending on whether the intentional injury was inflicted by another person or the decedent, respectively. Occasionally, the manner of death cannot be ascertained, and the manner of death is regarded as being **undetermined** (or "could not be determined").

Although some certifiers suggest (or actually practice) that the manner of death for periprocedural deaths be indicated as "Therapeutic Complication,"⁵ such a designation is not acceptable to many vital records' offices. Further, the designation does not provide distinction between the various types of periprocedural death.

Further guidance is needed for writing cause-of-death statements and assigning the manner of death for periprocedural deaths. The options here are a first step in providing such guidance.

It is recognized that some periprocedural deaths may be regarded legally as homicide (murder or manslaughter) – as an act of commission, omission, or negligence. This section does not address such cases and it is assumed that periprocedural deaths result either from natural causes (manner = natural), unintentional injuries (manner = accident), or a combination of the two (manner may be variable).

III. NOSOLOGIC ICD CODING OF PERIPROCEDURAL DEATHS

Information from the cause-of-death statement is coded by nosologists for state and national statistical purposes using the International Classification of Diseases (ICD)—currently ICD-9.⁶

Periprocedural deaths will usually be categorized under one of several major ICD categories:

- “Accidental poisoning by drugs, medicinal substances, and biologicals” (E850-E858)
(e.g., accidental overdose, wrong drug given)
- “Misadventures to patients during surgical and medical care” (E870-E876)
(e.g., accidental perforation, retained foreign body)
- “Surgical and Medical Procedures as the cause of abnormal reaction of patient or later complication, without mention of misadventure at the time of procedure” (E878-E879)
(e.g., malfunction of prosthetic device, rejection of transplanted organ)
- “Drugs, medicinal, and biological substances causing adverse effects in therapeutic use” (E930-E949)
(e.g., adverse effect of properly administered drug)

Of course, a death may be coded as resulting from the underlying natural disease, depending on how the cause-of-death statement is written. The options presented here facilitate such coding.

IV. CATEGORIES OF PERIPROCEDURAL DEATH

Several subcategories of periprocedural death may be defined:

- 1) **Perianesthetic** (related to an anesthetic agent, procedure, or device)
- 2) **Peritherapeutic** (related to a therapeutic agent, procedure, or device)
- 3) **Peridiagnostic** (related to a diagnostic agent, procedure, or device)
- 4) **Perioperative** (related to a surgical procedure or device: may be further subcategorized as intraoperative or postoperative)

The term **periprocedural** is a generic term that may be used to include any of the subcategories defined above.

V. ENSURING THAT A PERIPROCEDURAL DEATH IS EVIDENT

To ensure that periprocedural deaths are evident for coding and other purposes, the periprocedural nature of death may be indicated in the cause-of-death statement. The appropriate category of periprocedural death as shown in part IV (i.e., peritherapeutic, peridiagnostic, perianesthetic, perioperative [or intraoperative or postoperative], or periprocedural) is included in the wording in the cause-of-death statement, as shown in this example:

Part I	A. Intraoperative myocardial infarction	Approximate interval between onset and death Hours
	Due to, or as a consequence of: B. Atherosclerotic coronary artery disease	Years
	Due to, or as a consequence of: C.	
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I Resection of adenocarcinoma of colon	

VI. CIRCUMSTANTIAL CLASSIFICATION OF PERIPROCEDURAL DEATH

Periprocedural deaths may be classified by the circumstances surrounding the death in question, as determined after adequate investigation:

- 1) **Malfunction of (or a defective) medical device, tool, or diagnostic/therapeutic agent**
 - (e.g., internal short circuit in cautery device causing electrocution)
 - (e.g., malfunctioning thermostat on whirlpool causing scalding)
 - (e.g., embolism from broken strut on defective synthetic heart valve)
 - (e.g., contaminated injectable drug preparation)
- 2) **Incorrect use of a medical device, tool, or diagnostic/therapeutic agent**
 - (e.g., setting the voltage too high on cautery device causing electrical burn)
 - (e.g., gas embolism from pressing wrong button on endoscope)
 - (e.g., esophageal intubation during an elective procedure)
 - (e.g., administering the wrong drug or agent)
 - (e.g., administering the wrong dosage of a drug or agent)
 - (e.g., inadvertent withholding of a necessary medication)
- 3) **Rarely occurring complication with recognized untoward potential**
 - (e.g., hepatic necrosis following isoniazid therapy)
 - (e.g., anaphylaxis following iodine-based dye)
 - (e.g., anesthetic death from halothane hepatotoxicity)
 - (e.g., malignant hyperthermia from anesthesia)
 - (e.g., fatal dysrhythmia during colonoscopy)
 - (e.g., thrombosis of artery following uneventful catheterization)

4) Unanticipated complication

- (e.g., leaving a surgical towel in the abdomen)
- (e.g., inadvertently cutting an artery)
- (e.g., inadvertently ligating the wrong artery)

5) Reasonably anticipated outcome of an indicated medical therapy or procedure

- (e.g., bone marrow suppression following chemotherapy)
- (e.g., digoxin toxicity in patient with CHF)
- (e.g., theophylline toxicity in patient with asthma)
- (e.g., pneumothorax from PEEP required to ventilate patient with severe pneumonia)

6) Inherent and accepted risk of an invasive procedure or surgery

- (e.g., inability to wean from cardiopulmonary bypass pump)
- (e.g., rejection of a transplanted organ)

7) Nonspecific stress(es) of a procedure or therapy not falling in other classification

- (e.g., death during hip surgery in elderly, compromised patient—not in another category)

8) Periprocedural death otherwise not classifiable

- (e.g., death during surgery but cause cannot be determined)

Classification of a death into one of these categories may be helpful when classifying the manner of death (see parts VII and VIII).

VII. THE DILEMMA OF FORMAT

In principle: (1) If an injury or poisoning is the underlying cause of death, the trauma must be indicated as having been initiated by an accident, a suicidal venture, a homicidal event, or in an undetermined manner (or could not be determined); (2) the underlying cause of death should be antecedent to the intermediate or immediate cause of death in a *cause-and-effect* relationship; (3) if death was due primarily to an injury or poisoning, the injury or poisoning should be listed as the underlying cause of death in Part I of the cause-of-death statement, and (4) if an injury or poisoning is listed in either Part I or Part II of the cause-of-death statement, further information about the date, time, place, and nature of injury should also be reported.³ Periprocedural deaths often involve circumstances that suggest or include an "injury" or "poisoning." Thus, in regard to periprocedural deaths, dilemmas may occur regarding (A) which periprocedural events constitute an "injury," (B) where and how to report the injury in the cause of death statement, (C) how to relate and report an injury in relation to existing disease processes, (D) how to designate the manner of death, and (E) how to completely and accurately certify death without inciting litigation or unduly raising issues of culpability when a periprocedural incident presents itself as an injury.

A helpful approach to selecting the format for the cause-of-death statement is to answer a simple (usually) question: *Would death have been imminent in the procedure's absence?* The structure of the cause-of-death statement may be based on whether the answer is yes or no.

Example—Death imminent in procedure's absence. Consider an elderly individual with refractory congestive heart failure on the basis of atherosclerotic coronary heart disease, who dies of digoxin toxicity because of the high dosages required. The following format may be used:

Part I	A. Digoxin toxicity	Approximate interval between onset and death Hours
	Due to, or as a consequence of: B. Peritherapeutic complication of digoxin therapy	Hours
	Due to, or as a consequence of: C. Congestive heart failure	5 weeks
	Due to, or as a consequence of: D. Atherosclerotic coronary heart disease	Years
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

This approach, the *combined format* (i.e., everything is stated in Part I) may be used for other similar deaths, such as theophylline toxicity in a patient with refractory asthma, a death in a patient with a neoplasm whose death results from a chemotherapeutic agent through some toxic effect, or a ventilator-induced pneumothorax in an AIDS patient with respiratory insufficiency from pneumonia. The format is consistent with WHO guidelines, and even though a "toxicity" is mentioned in Part I, does not require designation of a non-natural manner of death because the underlying cause of death as stated is a natural disease. One could argue, however, that the conditions in Part I are not truly linked pathogenetically, and that congestive heart failure and atherosclerosis should be listed in Part II. Such an argument is an argument more about form than substance, however.

Example—Death not imminent in procedure's absence. Consider an elderly man with a previous stroke (cerebral infarction) from carotid artery atherosclerosis, who died of scald burns sustained in an overheated whirlpool being used as part of the physical therapy regimen to treat lower-extremity contractures that occurred following the stroke. Prior to the scald burns he had been stable.

Part I	A. Pseudomonas burn wound sepsis	Approximate interval between onset and death 2 days
	Due to, or as a consequence of: B. Peritherapeutic cutaneous scald burns	4 days
	Due to, or as a consequence of: C. Whirlpool therapy for leg contractures	4 days
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I Carotid artery atherosclerosis with remote cerebral infarction	

This approach, the *split format* (i.e., both Part I and Part II are used), may be used for many other types of periprocedural deaths in which death would likely not have been imminent in the procedure's absence (see heading VI). The ICD-coded multiple-cause mortality data will also include the fact that the patient had carotid atherosclerosis and cerebral infarction, an important consideration because those conditions explain why the patient was in the whirlpool. Listing the atherosclerosis and cerebral infarction in Part II is consistent with WHO guidelines.

The cause-of-death statement for periprocedural deaths may be reported using either the combined or split format. Classification of manner of death as accident or natural will be subsequently discussed, but may be facilitated by selecting the most applicable format. The formats provide the necessary flexibility to assign whatever manner of death is appropriate. In general, however, especially if the assigned manner is other than natural, the split format is recommended.

The split format shown above is also consistent with the principles outlined in Section 4 of this manual, regarding cause-of-death statements for deaths involving injury. The injury event (whirlpool treatment) is listed as the underlying cause of death, the bodily trauma (burns) is listed as the intermediate cause of death, and the final fatal derangement (burn wound sepsis) is listed as the immediate cause of death.

VIII. GENERAL GUIDELINES FOR CLASSIFYING THE MANNER OF DEATH

Although exceptions will be encountered and some periprocedural deaths are of debatable manner, some general guidelines are offered below. The suggestions are based on the classification of periprocedural deaths shown under heading VI, and include a suggested manner of death and reporting format of the combined [C] or split [S] method.

Class of periprocedural death	Suggested Manner	Format
1) Malfunction of a medical device, tool, or diagnostic/therapeutic agent	Accident	S
2) Incorrect use of a medical device, tool, or diagnostic/therapeutic agent	Accident	S
3) Rarely occurring complication with recognized untoward potential	Variable*	S/C
4) Unanticipated complication	Variable*	S/C
5) Reasonably anticipated outcome of necessary medical therapy/procedure	Natural	C
6) Inherent and accepted risk of invasive procedure or surgery	Natural	C
7) Nonspecific stresses of a procedure or therapy not in another class	Natural	C
8) Periprocedural death not otherwise classifiable	Undetermined	C

* General consensus about manner of death is lacking in such cases. Medical judgment is required in each case.

Most cases will clearly fall into one of the classifications above. Judgment is required in all cases when selecting a format and classifying the manner of death—especially those cases that do not fall clearly into one of the classes or those falling into classes 3 and 4. Further discussion of manner-of-death determinations in difficult cases is presented in Section 7, *Manner of Death Dilemmas*, which summarizes opinions of experienced medical examiners obtained through a survey.

IX. CLARIFYING THE NATURE OF INJURY

If it is assumed that the death of the man who was scalded in the whirlpool was certified as an accidental death because of the scald injury involved, the descriptive injury information might appear in item 30d (numbers may vary by state) as follows:

Part I	A. Pseudomonas burn wound sepsis	Approximate interval between onset and death 2 days
	Due to, or as a consequence of: B. Peritherapeutic cutaneous scald burns	4 days
	Due to, or as a consequence of: C. Whirlpool therapy for leg contractures	4 days
	Due to, or as a consequence of: D.	
Part II OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I Carotid artery atherosclerosis with remote cerebral infarction		

29. MANNER OF DEATH Accident	30d. DESCRIBE HOW INJURY OCCURRED Scalded in overheated water in whirlpool
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Note that item 30d, "Describe how injury occurred," indicates that the patient was scalded in overheated water in a whirlpool. The certifier need not state whether the whirlpool malfunctioned, was defective, or was improperly used. Such judgments may be beyond the abilities of the certifier, may carry legal ramifications, and are more appropriately addressed elsewhere—perhaps by persons other than the certifier of death. It is appropriate to state that the whirlpool was overheated, however, to explain how the burns occurred.

Injury descriptions should be objective yet clearly describe what happened, use generic terms, and avoid ascribing blame to a specific individual.

Of course, additional information must also be reported, such as the date, time, place, and address of injury (see heading XIII, and Section 4 of this manual).

X. RELATIONSHIP OF FORMAT TO MANNER OF DEATH

In general, deaths that are to be assigned a natural manner of death are best accommodated by the combined format, because a natural disease is stated as the underlying cause of death.

In general, deaths that are to be assigned a manner of death other than natural are best accommodated by the split format because an injury event is stated as the underlying cause of death.

XI. SAMPLE CAUSE-OF-DEATH STATEMENTS

Sample scenarios and cause-of-death statements are provided below, based on the eight classifications presented under heading VI. The examples can serve as templates which may be used for other types of periprocedural death that fall into the same class as a given example. Each is reported in either a combined or split format.

CLASS 1: Malfunction of a medical device, tool, or diagnostic/therapeutic agent. This scenario involves a patient who had metastatic adenocarcinoma of the prostate and was on a morphine drip with an infusion pump. The roller on the pump was defective and tore the tubing, pumping air into the patient and producing fatal air embolism.

Part I	A. Intravenous air embolism	Approximate interval between onset and death Minutes
	Due to, or as a consequence of: B. Peritherapeutic injury by analgesia infusion pump	Minutes
	Due to, or as a consequence of: C.	
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I Metastatic adenocarcinoma of the prostate	

NOTE: Most certifiers would probably designate the manner of death as accident in this Class 1 case.

CLASS 2: Incorrect use of a medical device. This scenario involves a person who is undergoing retrograde pancreatic endoscopy for biliary tree problems. The physician inadvertently pushed the wrong button and instilled gas instead of water, causing dissection of gas into tissues and a fatal gas embolism. Autopsy confirmed gas embolism and a common duct stone.

Part I	A. Gas embolism	Approximate interval between onset and death Minutes
	Due to, or as a consequence of: B. Periprocedural injury during diagnostic endoscopy	Minutes
	Due to, or as a consequence of: C.	
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I Choledocholithiasis with biliary obstruction	

Note: Most certifiers would probably designate the manner of death as accident in this Class 2 case.

CLASS 3: Rarely occurring complication with recognized untoward potential. Shortly following surgery for an inguinal hernia, the patient developed malignant hyperthermia and died. Halothane was the primary anesthetic. The history and autopsy findings were consistent with a halothane-induced malignant hyperthermia.

Part I	A. Malignant hyperthermia	Approximate interval between onset and death Hours
	Due to, or as a consequence of: B. Perianesthetic complication of halothane anesthesia	Hours
	Due to, or as a consequence of: C.	
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I Inguinal hernia and herniorrhaphy	

Note: General agreement is lacking about the manner of death in cases such as this Class 3 case. In the split format shown, the manner could be assigned as accident. If a natural manner were assigned, a combined format could be used.

CLASS 4: Unanticipated complication. A man underwent an “uneventful” cholecystectomy for gallstones and was discharged from the hospital. He developed peritonitis, however, and died shortly after returning to the hospital, complaining of fever and abdominal pain, 5 days postoperatively. Autopsy showed a retained surgical towel in the abdomen with diffuse peritonitis.

Part I	A. Peritonitis	Approximate interval between onset and death Days
	Due to, or as a consequence of: B. Retained surgical towel in abdomen	5 days
	Due to, or as a consequence of: C. Perioperative complication of cholecystectomy	5 days
	Due to, or as a consequence of: D.	
Part II OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I Cholelithiasis		

Note: General agreement is lacking about the manner of death in cases such as this Class 4 case.

CLASS 5: Reasonably anticipated outcome of an indicated or necessary medical procedure. A patient with a history of IV drug abuse and acquired immunodeficiency syndrome developed *Pneumocystis carinii* pneumonia. She became progressively difficult to ventilate, ultimately requiring extreme positive pressure ventilatory assistance. Bilateral pneumothoraces were produced by the necessarily high ventilator pressures, and the patient died.

Part I	A. Bilateral pneumothoraces	Approximate interval between onset and death Minutes
	Due to, or as a consequence of: B. Peritherapeutic complication of ventilatory support	Minutes
	Due to, or as a consequence of: C. <i>Pneumocystis carinii</i> pneumonia	5 weeks
	Due to, or as a consequence of: D. Acquired immunodeficiency syndrome	3 years
Part II OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I Intravenous drug abuse		

NOTE: Most certifiers would probably designate the manner of death as natural in this Class 5 case.

CLASS 6: Inherent and accepted risk of a procedure. A female underwent laparotomy and removal of the gallbladder with placement of drains. The specimen showed that patient had cholelithiasis and acute cholecystitis. No problems were encountered during surgery. Postoperatively the bile drainage did not diminish in the usual time and the patient developed bile peritonitis, shock, and death. Autopsy did not disclose any surgical failures.

Part I	A. Bile peritonitis	Approximate interval between onset and death 3 days
	Due to, or as a consequence of: B. Postoperative complication of cholecystectomy	5 days
	Due to, or as a consequence of: C. Cholelithiasis	Months
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I Cholecystitis	

NOTE: Most certifiers would probably designate the manner of death as natural in this Class 6 case.

Cholecystitis is listed in Part II in this example not because a split format was desired, but because recommendations advise against the reporting of more than one condition per line in Part I. The basic format here remains a combined one. This format was chosen to emphasize the cholelithiasis as the major problem.

CLASS 7: Nonspecific stress during surgery or procedure. A 63-year-old man died on the operating table while undergoing triple bypass coronary artery surgery for atherosclerosis. He had a history of unstable angina and was rated as a high-risk patient preoperatively. The patient elected to have the procedure because angina severely restricted his lifestyle and quality of life. Autopsy did not show any surgical failures.

Part I	A. Intraoperative death during coronary bypass surgery	Approximate interval between onset and death Hours
	Due to, or as a consequence of: B. Atherosclerotic coronary artery disease	Years
	Due to, or as a consequence of: C.	
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

NOTE: Most certifiers would probably designate the manner of death as natural in this Class 7 case.

CLASS 8: Perioperative death but otherwise not classifiable. A 45-year-old man died on the operating table while undergoing inguinal herniorrhaphy. A thorough autopsy, medical record review, and death investigation failed to identify an immediate cause of death. Basically, this seemingly healthy person died during a relatively minor procedure for no determined reason.

Part I	A. Intraoperative death during inguinal herniorrhaphy	Approximate interval between onset and death Hours
	Due to, or as a consequence of: B. Undetermined cause(s)	Unknown
	Due to, or as a consequence of: C.	
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

NOTE: An undetermined manner may be appropriate in such cases as this Class 8 case.

XII. POISONING AND MEDICATION ERRORS

When a periprocedural death involves unintentional poisoning, the cause-of-death statement should indicate the periprocedural nature of the poisoning and the generic name (not trade or brand name) of the drug or substance.

In general, unintentional periprocedural poisonings and medication errors fall into one of several categories, each of which can be clarified by using carefully selected wording in the "describe how injury occurred" section.

Drug preparation or drug dilution mishap. The drug preparation was formulated, mixed, or diluted incorrectly.

Temporal drug dosage mishap. The drug or substance was not given at the proper intervals.

Drug dosage mishap. A properly constituted formula was given in incorrect dosage.

Drug administration route mishap. A drug or substance was given via the wrong route (e.g., IV versus intramuscular).

Administration of wrong drug (drug substitution mishap). The incorrect drug was administered.

These statements should only appear in the "describe how injury occurred" section if the specifics are known with reasonable probability in the death in question. Otherwise, more generic statements may be used such as "medication error," or "received excessive drug," etc.

The following example shows how such terminology may be used:

Part I	A. Peritherapeutic intravenous potassium chloride poisoning	Approximate interval between onset and death Minutes
	Due to, or as a consequence of: B.	
	Due to, or as a consequence of: C.	
	Due to, or as a consequence of: D.	
Part II OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I		
Atherosclerotic heart disease		

29. MANNER OF DEATH Accident	30d. DESCRIBE HOW INJURY OCCURRED Drug dilution mishap: failure to dilute drug injected by another
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NOTE: Item 30d does not specify an individual such as a nurse or physician. It also does not specify if the dilution error occurred in the pharmacy or at bedside. It does clarify, however, that the injection was done by someone other than the decedent, and that a dilution error was involved.

XIII. OTHER DEATH CERTIFICATE ITEMS REQUIRING COMPLETION

If an injury or poisoning is cited in Part I or Part II of the cause-of-death statement, the date, time, address, and type of place where the injury occurred must be indicated in addition to describing how the injury or poisoning occurred. In some states, a specific place exists on the death certificate to indicate the date and reasons for surgery or invasive procedures, even if such procedures did not cause or contribute to death. Be familiar with, and abide by, the regulations in your state.

XIV. MEDICAL-LEGAL CONSIDERATIONS

Most deaths that involve an injury event (or poisoning) will be investigated and certified by or under the authority of the medical examiner or coroner, whichever serves your area. Some state laws specifically address periprocedural deaths, while others do not. Although state laws vary somewhat, most states have death investigation laws that require the medical examiner or coroner to be notified when a death occurs that is sudden and unexpected, unusual, accidental, or suspected or known as having resulted from, or contributed to by, injury (or poisoning) *regardless of the interval between onset and death*. Be familiar with local laws and abide by the provisions, being sure that appropriate cases are reported to the medical examiner or coroner as required. If you report a death to the medical examiner or coroner who then declines to investigate or certify the death, obtain a case waiver number for documentation in your files, and proceed as instructed. If you are responsible for completion of the death certificate or a cause-of-death statement, the information herein may be useful.

XV. CONCERNS ABOUT LITIGATION, IMPLICATION, ALIENATION, AND ALARM

Although the death certificate is primarily a statistical document, it may constitute an important source of information for family members and other people or agencies. Such people or agencies may impart too much, or inappropriate significance to the death certificate, especially if they are not aware of its general purpose, limitations, and opinion-based nature. Thus, a major issue to those who certify periprocedural deaths is concern about whether cause-of-death wording and manner-of-death classification will foster litigation, unnecessarily implicate a treating physician or other person or agency, alienate professional colleagues, or unnecessarily alarm family members and survivors. Problems may also result if the cause-of-death statement is oversimplified, or if the certifier omits known complications because some people may perceive an attempt to conceal facts or cover up a problem. Although such concerns are real and need to be considered by certifiers of death, an objective approach that is based on documented or reasonably probable facts should minimize such problems through stating the truth to the best of one's knowledge.

XVI. PHILOSOPHICAL ISSUES AND SCHOOLS OF THOUGHT

A common school of thought is that "predictable," "anticipated," or "expected" periprocedural complications are extensions of the underlying disease process and that the underlying cause of death may therefore be attributed to the disease or to "complications of the disease" while ascribing a natural manner of death. The options above allow that school of thought to be followed in practice, but also allow other schools of thought to be practiced as deemed appropriate by the certifier of death.

Some issues of death certification are a matter of *style* while others are a matter of *substance*.⁵ For the most part, the split format and combined format presented above address matters of style in reporting the cause-of-death statement. The major issue of substance involves how the manner of death is classified. The various options for style allow the certifier to indicate the manner of death as deemed appropriate. It is hoped that the options presented here bring additional information that promote greater consistency in both style and substance.

"Therapeutic complication" has been used as a manner of death when predictable complications arise from indicated (appropriate) diagnostic or therapeutic procedures,⁵ because such deaths are not caused exclusively by disease, yet classification as accidental may seem unduly inflammatory when death is caused by predictable complications of appropriate therapy. However, acceptance of "therapeutic complication" as a manner of death by vital records' registrars and certifiers of death is not widespread, nor does such a manner of death appear on the U.S. Standard Certificate of Death. Further, one may argue that ascribing "therapeutic complication" as a manner of death may be inflammatory compared to the option of "natural" that applies to some periprocedural deaths. Of course, if death results from an unpredictable complication or an inappropriate therapy or procedure, the manner of death may be classified as accident.

The options presented in this section make it evident that death resulted from a periprocedural or peritherapeutic complication. The difference between the options in this section and alternative approaches is largely a matter of style, as each gets the necessary information across.

For a few examples of manner-of-death determinations for periprocedural deaths, see scenario numbers 8, 9, 13, 18, and 19 in Section 7, Manner-of-Death Dilemmas.

XVII. REFERENCES

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SECTION 6: OPTIONS FOR WRITING CAUSE-OF-DEATH STATEMENTS FOR NEONATAL AND INFANT DEATHS

I. INTRODUCTION

Studies have shown that death certificates for perinatal deaths often contain nonspecific or even implausible causes of death.^{1,2} For example, it is not uncommon for "prematurity" to be stated as the cause of death, or for an immediate cause of death (e.g., pneumothorax) or an intermediate cause of death (e.g., hyaline membrane disease) to be cited as the cause of death while a specific underlying cause of death (e.g., chorioamnionitis) is not mentioned in the cause-of-death statement. Options are presented here for writing cause-of-death statements in a consistent and complete fashion for neonatal and infant deaths.

It is assumed that the reader/user of this protocol is familiar with the basic principles of writing cause-of-death statements and manner of death as outlined by the National Center for Health Statistics^{3,4} and by the College of American Pathologists' publication, *The Medical Cause-of-Death Manual: Instructions for Writing Cause-of-Death Statements for Deaths Due to Natural Causes*.⁵ The basic tenets within those publications will not be reiterated. It is also assumed that the reader is aware that, in general, neonatal death resulting from injury or poisoning (including neonatal death from maternal injury or poisoning), should be reported to, and will usually be certified by (or at the direction of), the medical examiner or coroner.

II. GENERAL APPROACH

In general, a useful approach to writing Part I of cause-of-death statements for neonatal and infant deaths is shown in the following example:

Part I	A. Peritherapeutic ventilator-induced pneumothorax (Immediate cause)	Approximate interval between onset and death Minutes
	Due to, or as a consequence of: B. Hyaline membrane disease (Intermediate cause)	1 week
	Due to, or as a consequence of: C. Premature labor with prematurity (EGA 26 weeks) (Intermediate cause)	10 days
	Due to, or as a consequence of: D. Chorioamnionitis (Underlying cause)	Unknown
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

Note that the underlying, intermediate, and immediate causes of death have a sequential cause-and-effect relationship when read from bottom to top. The underlying cause of death is a **specific condition** as compared with prematurity, hyaline membrane disease, and pneumothorax, which are nonspecific conditions or processes that may result from a number of causes. The specific underlying cause of death explains the existence of the intermediate and immediate causes of death. Intermediate and immediate causes of death should also be stated as specifically as possible.

Of course, when writing the cause-of-death statement, only the medical conditions are actually written—it is not necessary to write the words “immediate cause,” “intermediate cause,” and “underlying cause” as shown in the example. To foster clarity and to facilitate statistical ICD coding by nosologists, only one condition should be indicated on a given line in Part I of the cause-of-death statement (Lines A-D, above).

III. BACKGROUND THINKING

The underlying cause of neonatal and infant deaths will usually fall into one of the following major categories:

Congenital and genetic disorders

- Inherited disorders (e.g., hemophilia)
- Genetic aberrations (e.g., trisomy 18)
- Congenital anomalies (e.g., anencephaly)

Placental/Amniotic disorders (e.g., chorioamnionitis, funisitis, placental abruption)

Fetal-Fetal disorders (e.g., twin-transfusion syndrome)

Maternal-Fetal disorders (e.g., hemolytic disease of the newborn)

Maternal disorders (e.g., genital herpes infection, malnutrition, drug dependency, diabetes, lupus, hypertension, pre-eclampsia, drug intoxication)

External conditions (e.g., maternal trauma)

Complications of labor and delivery

Conditions that affect neonates and infants

The cause-of-death statement should be written clearly enough that a reader of the cause-of-death statement could classify the death into one of the categories above—for example:

Part I	A. Herpes simplex pneumonia	Approximate interval between onset and death 3 days
	Due to, or as a consequence of: B. Congenitally acquired herpes infection	1 week
	Due to, or as a consequence of: C. Maternal genital herpes simplex type 1 infection	Unknown
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

When discussing causes of death among neonates and infants, one should not ignore conditions that existed in the mother which may have set in motion the sequence of events that led to neonatal or infant death. For example, on the U.S. Standard Report of Fetal Death, used only in cases where live birth did not occur, maternal and fetal conditions are each itemized. An analogous situation exists when a death certificate is completed for a live-born neonate, because maternal factors may contribute to neonatal or infant death, and it is appropriate to include contributing maternal conditions in the cause-of-death statement, explicitly or implicitly.

IV. TYPICAL IMMEDIATE, INTERMEDIATE, AND UNDERLYING CAUSES OF DEATH

Moore and co-authors have reviewed the literature and more than 1500 fetal and neonatal deaths at Johns Hopkins Hospital in order to determine which causes of death would usually be listed as an immediate, intermediate, or underlying cause of death.⁶ The tables below contain the most common conditions that would typically be cited as immediate, intermediate, or underlying causes of death. For rare conditions that are not included in the tables, a comparison to these tables might facilitate the decision whether to cite a given condition as an immediate, intermediate, or underlying cause of death.

The tables have been modified slightly from those prepared by Moore and co-authors, and, in general, show the conditions in decreasing order of frequency.⁶

TABLE 1. SELECTED NONSPECIFIC CONDITIONS USED TO STATE THE IMMEDIATE OR AN INTERMEDIATE CAUSE OF DEATH, BUT NOT THE UNDERLYING CAUSE OF DEATH

Fetal pneumonia
Pneumothorax
Hydrocephalus
Bronchopneumonia
Sepsis
Bronchopulmonary dysplasia
Disseminated intravascular coagulation
Hyaline membrane disease
Hydrops
Perinatal asphyxia*
High-grade intraventricular brain hemorrhage (Grade 3 or 4)
Hypoplasia of lung (pulmonary hypoplasia)
Meconium aspiration
Peritonitis

*In some cases, "Perinatal asphyxia" may be listed as the underlying cause of death if no underlying reason for it can be determined. Often, however, an underlying cause can be determined.

TABLE 2. SELECTED SPECIFIC CONDITIONS USED TO INDICATE THE UNDERLYING CAUSE OF DEATH

Chorioamnionitis
Abruptio placentae
Trisomy (including #)
Atrial septal defect
Necrotizing enterocolitis*
Coarctation of the aorta
Renal dysplasia
Cord "accident" (compression or around neck; not truly an "accident")
Renal agenesis
Omphalocele
Diaphragmatic hernia
Myelomeningocele
Anencephaly
Bicuspid aortic valve with stenosis/atresia
Potter's syndrome*
Atresia of aortic valve
Spina bifida
Encephalocele
Transposition of the great arteries
Interrupted aortic arch
Polysplenia syndrome
Prune belly syndrome
Anomalous pulmonary venous return
Holoprosencephaly
Twin transfusion syndrome
Tracheoesophageal fistula
Polycystic kidney disease
Dandy Walker syndrome
Meningocele
Turner syndrome

* In some instances, this may be secondary to some other underlying cause of death, and may be more appropriately used as an intermediate or immediate cause of death.

V. WHEN AN UNDERLYING CAUSE OF DEATH IS UNKNOWN

Deaths in which a specific underlying cause of death cannot be determined with reasonable probability (more likely than not) may be reported as shown in this example:

Part I	A. Pneumonia, organism unidentified	Approximate interval between onset and death Days
	Due to, or as a consequence of: B. Meconium aspiration	1 week
	Due to, or as a consequence of: C. Premature labor with prematurity (EGA 22 weeks)	1 week
	Due to, or as a consequence of: D. Undetermined natural cause	Unknown
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

VI. OTHER SIGNIFICANT CONDITIONS

Conditions that pre-existed or co-existed in the decedent and contributed to death may be indicated in Part II of the cause-of-death statement as an other significant condition. More than one condition may be listed in Part II. To be listed, however, the condition should have contributed to death, but should not have resulted in the condition listed as the underlying cause of death. For example, consider an infant who develops pneumonia from a tracheoesophageal fistula, but who also has a significant left ventricular septal defect. Clinically, there was evidence of heart failure, but the cause of death appears to have been primarily due to pneumonia:

Part I	A. Bilateral bronchopneumonia	Approximate interval between onset and death 5 days
	Due to, or as a consequence of: B. Congenital tracheoesophageal fistula	10 days
	Due to, or as a consequence of: C.	
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I Congenital ventricular septal defect	

The ventricular septal defect probably contributed to death by contributing to heart failure, but the septal defect did not result in the tracheoesophageal fistula. The ventricular septal defect is, therefore, appropriately cited as an other significant condition.

VII. WHEN MULTIPLE CONDITIONS SEEM TO BE INSEPARABLE

Sometimes, two or more conditions seem to "add together," or are conceptually and temporally inseparable as an underlying, intermediate, or immediate cause of death. Consider the infant who dies with streptococcal pneumonia and meningitis. In some cases, one condition may clearly have preceded the other, and writing the cause-of-death statement in a Part I Sequential Format is appropriate and straightforward. In other cases, however, the two conditions may seem to have coexisted without a definite sequence. In such cases, it is incumbent upon the certifier to select the condition that appears to have been the most important and to cite it in Part I, and to cite the other condition in Part II as an other significant condition, because recommendations advise against listing more than one condition per line in Part I. Following this procedure assists in ICD coding and allows the certifier, rather than the nosologist doing the coding, to indicate the most important condition.

Part I	A. Streptococcal meningitis	Approximate interval between onset and death 2 days
	Due to, or as a consequence of: B.	
	Due to, or as a consequence of: C.	
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I Streptococcal pneumonia	

This example also serves to illustrate a **Single Line, Part I Format** in which only a single line in Part I is needed to state the cause of death. In such cases, Part I contains the underlying cause of death, which also serves as the immediate cause of death. Obviously, it is not always necessary to use all of the lines provided in Part I of the cause-of-death statement.

VIII. RISK FACTORS

In some cases, conditions exist that may have caused or contributed to death, but a cause-and-effect relationship is difficult or impossible to prove. For example, in a premature infant born to a mother with pre-eclampsia, did the pre-eclampsia cause the premature birth? If a pregnant woman uses cocaine during pregnancy and delivers a stillbirth, was intrauterine demise caused by the cocaine? Some examples of conditions that may constitute a risk factor for fetal or neonatal death are:

- Maternal toxemia
- Maternal diabetes
- Maternal lupus
- Breech delivery
- Premature rupture of membranes
- Twin pregnancy
- Oligohydramnios
- Polyhydramnios
- Maternal drug abuse
- Bicornate uterus
- Placenta previa
- Maternal fever
- Forceps delivery
- Emergency cesarean section

If it is reasonably probable that such a condition contributed to death, the condition(s) may be cited in Part II as shown in this example:

Part I	A. Peritherapeutic ventilator-induced pneumothorax	Approximate interval between onset and death Minutes
	Due to, or as a consequence of: B. Hyaline membrane disease	1 week
	Due to, or as a consequence of: C. Premature labor with prematurity (EGA 26 weeks)	10 days
	Due to, or as a consequence of: D. Undetermined natural causes	Unknown
Part II OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I		
Maternal bicornate uterus		

To be cited, there should be documentation or reasonable probability that the condition existed in the case in question. If a cause-and-effect relationship between a risk factor and death can be established in a given case, then the condition may be indicated as the underlying cause of death, although, in general, such cases will be uncommon.

IX. SUDDEN INFANT DEATH SYNDROME AND RELATED SCENARIOS

Ideally, to report Sudden Infant Death Syndrome in the cause-of-death statement, the criteria defined by the National Institute of Child Health and Human Development (NICHD) should be met.⁷

The criteria include:

- An infant under 1 year of age
- Review of the infant’s clinical history
- Performance of a scene investigation
- No cause of death determined after a complete autopsy

Unfortunately, these criteria are not always fulfilled. Furthermore, so-called “gray zone” cases are common, in which subtle anatomic findings make judgment difficult when deciding if death should be attributed to sudden infant death syndrome or some other condition.⁸

To address such situations, options are provided below for common situations that may be encountered when writing cause-of-death statements for infant deaths.

Situation #1. The NICHD criteria for SIDS have been FULLY MET (infant under 1 year of age, no cause of death determined after scene investigation, complete autopsy, and review of clinical history):

Part I	<p>A. Sudden Infant Death Syndrome</p> <hr/> <p>Due to, or as a consequence of:</p> <p>B.</p>
Part II	<p>OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I</p>

Situation #2. All findings are consistent with SIDS, but the NICHD criteria for making a diagnosis of SIDS have NOT BEEN COMPLETELY MET (no scene investigation, for example):

Part I	<p>A. Presumed Sudden Infant Death Syndrome</p> <hr/> <p>Due to, or as a consequence of:</p> <p>B.</p>
Part II	<p>OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I</p>

Situation #3. When the significance of a positive finding cannot be established, as might occur in some "gray zone" cases such as a death consistent with SIDS, but having mild acute bronchiolitis:

Part I	A. Consistent with Sudden Infant Death Syndrome
	Due to, or as a consequence of: B.
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I Mild acute bronchiolitis

In any of Situations 1, 2, or 3, it would be appropriate to undertake SIDS Counseling.

Situation #4. Circumstances and findings are NOT consistent with SIDS and a reasonably probable cause of death cannot be found:

Part I	A. Undetermined causes
	Due to, or as a consequence of: B.
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I

For Situation #4, the manner of death could be indicated as natural, if appropriate, or another manner of death (such as undetermined), if appropriate. If investigation is complete, however, including complete autopsy with histology, toxicology, scene investigation, and review of the history, Situation #4 cases will be uncommon.

Situation #5. Death is explained (a competent cause of death other than SIDS is determined, such as florid viral myocarditis):

Part I	A. Viral Myocarditis
	Due to, or as a consequence of: B.
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I

The options shown offer three advantages:

- The person who is writing the cause-of-death statement may report what is known without over diagnosing or under diagnosing SIDS. In other words, the certifier may "tell it like it is."
- The options do not interfere with current statistical classification and coding procedures.
- The options provide a way to report complete information that may be useful for subcategorizing apparent SIDS cases and other deaths that occur among infants.

X. INTERVAL BETWEEN ONSET AND DEATH

The interval between onset and death should be stated as accurately as possible without guessing. Generic terms such as "hours," "weeks," and "unknown" are acceptable. When prematurity is involved in the cause-of-death statement, the estimated gestational age should be indicated as shown in the example in part VIII (previous page), and the interval should consist of the time period between birth and death.

XI. DIFFERENT FORMS FOR DOCUMENTING DEATH AND STILLBIRTHS

If a live birth has occurred and is followed by death, a standard death certificate is completed. States have a special form for documenting stillbirths based on the U.S. Standard Report of Fetal Death, used in cases where live birth has not occurred. The forms in some states have specific boxes to indicate with check marks or otherwise the existence of selected risk factors, obstetric procedures, complications of labor and delivery, method of delivery, and congenital anomalies. Familiarity with forms and definitions used locally is essential. Further discussion of stillbirths is beyond the scope of this section, and is contained elsewhere.⁴

XII. MEDICAL-LEGAL CONSIDERATIONS

Although state laws vary, in general, if there is any indication that an injury to, or poisoning of the mother, fetus, neonate, or infant caused or contributed to death, the medical examiner or coroner should be notified. It is also prudent (if not required by law) to report deaths in which there is evidence of an attempt to conceal pregnancy, conceal birth, or terminate pregnancy illegally. Whether or not such deaths are investigated by the medical examiner or coroner depends on local laws and practices. If you report a death to the medical examiner or coroner who declines to investigate the death, obtain a waiver number for documentation in your records.

XIII. USE OF GENERIC STATEMENTS

In some cases not investigated by the medical examiner or coroner, and in which permission for autopsy cannot be obtained, it may be necessary to state the cause of death in somewhat generic terms. For example, there may be clinical evidence of congenital heart disease, but death may occur before definitive diagnoses can be made. In such cases, the cause of death may have to be stated simply as "congenital heart disease." The cause of death is the best opinion of the certifier, is based on available information and reasonable medical probability (i.e., more likely than not), and can be changed at a later date if further information becomes available. Consult the local or state vital record office for details on how to change (amend) a cause of death that has been stated on a death certificate.

XIV. SUMMARY

The cause-of-death statement should be written as accurately and completely as possible, making all attempts to include a *specific* underlying cause of death, along with important intermediate and immediate causes of death, and other significant conditions. Knowledge of local laws, forms, policies, and procedures is essential.

XV. REFERENCES

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SECTION 7: MANNER OF DEATH DILEMMAS

From the National Association of Medical Examiners

During the fall of 1995, at its annual meeting and via a mailing to the membership, the National Association of Medical Examiners distributed a questionnaire with 23 death scenarios designed to represent a sample of cases for which manner-of-death determinations may be inconsistent or controversial.¹ Each NAME member was asked to assign a manner of death for each scenario. In addition, a cause-of-death statement was prepared for each scenario (a manner of death was not indicated), and a nosologist at the National Center for Health Statistics assigned an ICD code on the basis of the cause-of-death statement and a description of how injury occurred.

One hundred ninety-eight NAME members responded to the questionnaire. Results are presented below. The itemized issues were added for reader interest and were not presented to those who completed the questionnaire. These data should be useful to show the divergence of opinion for a given scenario; to allow individual certifiers of death to compare their own practices with the most common practice; to compare responses with the NCHS classification; and perhaps, to foster consistency through awareness of the results.

CASE 1. A young couple, both with history of intravenous drug abuse, bought a packet of heroin from a new dealer. Both were seated on the couch in the home of a friend, who was an eyewitness. The young man, being a gentleman, injected the first shot into his girlfriend's right arm with her consent. She collapsed and was DOA at the local emergency room. Toxicology revealed a high level of morphine in her blood at autopsy.

ISSUES:

- a) Does illegal administration of an illegal substance by another person, even in the lack of intent to kill, justify designation of the manner of death as homicide?
- b) Does the consent of the deceased influence the manner of death?

RESPONSES: (other = 1.5%)

Natural	Homicide	Suicide	Accident	Undetermined
	38.9%		49.5%	10.1%

NCHS: E850.0 Accidental poisoning by heroin

CASE 2. At a party/gathering, an ex-national guardsman, well-trained in weaponry, walked into a room waving a gun. When asked to put the gun away and stop pointing it in the direction of people, he replied, "It isn't loaded. See," as he put it to his head and pulled the trigger. The weapon discharged. Autopsy showed a contact gunshot wound to the right side of the head. The blood alcohol concentration was .2 grams percent.

ISSUES:

- a) Does an intentionally self-committed, reckless, and inherently dangerous act justify ascribing the manner of death as suicide?
- b) Does alcohol intoxication influence the manner of death when the alcohol is not, in and of itself, a cause of death?

RESPONSES: (other = 0.5%)

Natural	Homicide	Suicide	Accident	Undetermined
	0.5%	32.0%	57.4%	9.6%

NCHS: E922.9 Accident caused by firearms missile

CASE 3. A 40-year-old male with a long, clear history of hepatic cirrhosis due to a well-documented history of chronic alcoholism, died in the hospital from slowly progressive liver failure.

ISSUES:

- a) Does chronic "toxicity" of alcohol warrant designating the manner of death as other than natural?
- b) Does the "subintent" involved in slowly killing one's self through substance abuse warrant a non-natural manner of death?

RESPONSES: (other = 0.5%)

Natural	Homicide	Suicide	Accident	Undetermined
98.0%			0.5%	1.0%

NCHS: 571.2 Alcoholic cirrhosis of the liver (natural)

CASE 4. A 20-year-old college student attended a fraternity house party after finals and drank all night. He was found dead in his room the following morning. Autopsy was unremarkable except for toxicology which showed a blood ethanol of .38 grams percent.

ISSUES:

- a) Does an acute alcohol overdose warrant a manner of death other than natural?
- b) Regarding the manner of death, does it matter whether the decedent knew the potentially fatal risk of acute over ingestion of alcohol?

RESPONSES: (other = 1.0%)

Natural	Homicide	Suicide	Accident	Undetermined
2.0%			93.4%	3.5%

NCHS: E860 Accidental poisoning by alcohol

CASE 5. A well-known drug abuser was reportedly found dead by one of his fellow junkies. Toxicology showed a blood morphine level of 172 ug/ml.

ISSUES:

a) Does an acute event in a chronic drug abuser constitute an accident?

RESPONSES: (other = 1.0%)

Natural	Homicide	Suicide	Accident	Undetermined
2.6%	1%	1%	60.8%	33.5%

NCHS: E850.0 Accidental poisoning by heroin

CASE 6. A 17-year-old was playing Russian Roulette with a friend while drinking and listening to music by "Natas." He spun the chamber, put the gun to his head and pulled the trigger. The weapon discharged on the first try. Autopsy findings included a contact gunshot wound to the right temple and a blood ethanol level of .13 grams percent.

ISSUES:

a) Does Russian Roulette in and of itself connote a specific manner of death?

b) Does the number of bullets in the chamber influence the manner of death?

c) Does the influence of cult music or belief on the decedent's frame of mind influence the manner of death?

d) Does alcohol intoxication modify the usual manner of death attributed to Russian Roulette deaths?

RESPONSES: (other = 0.5%)

Natural	Homicide	Suicide	Accident	Undetermined
		61.5%	31.3%	6.7%

NCHS: E922.0 Accident caused by firearms missile (handgun)

CASE 7. An elderly 62-year-old male was riding in a four-wheel-drive vehicle driven by his 60-year-old girlfriend while they were being chased by teenagers in a white sports utility vehicle, who were out to have fun by trying to frighten this older couple. Witnesses observed the couple's vehicle to take a sharp turn into a parking lot, at a high rate of speed, fail to break fast enough, and run directly into a concrete wall. The 62-year-old man was dead at the scene. The decedent was sitting in the right front seat and was wearing his seatbelt. Autopsy confirmed multiple injuries as the cause of death.

ISSUES:

a) Does assault (fear of danger) or aggression justify a homicidal manner of death?

RESPONSES: (other = 0.5%)

Natural	Homicide	Suicide	Accident	Undetermined
	63.8%		33.7%	2.0%

NCHS: E815 Motor vehicle accident

CASE 8. A relatively healthy female went into a local hospital for bowel obstruction and underwent surgical resection and a cholecystectomy. Surgery went well and she was recovering in her room the following day when she suddenly had a cardiorespiratory arrest. Autopsy revealed a 2200 cc right hydrothorax. Analysis of the fluid showed it to be consistent with lactated ringers. The tip of the right subclavian line was protruding into the right chest cavity and through the lung. The immediate cause of death was a right hydrothorax.

ISSUES:

a) Does a misadventure involving a well-recognized, but rare complication of a therapeutic procedure warrant designation of the manner as other than natural?

RESPONSES: (other = 2.0%)

Natural	Homicide	Suicide	Accident	Undetermined
12.2%	1.0%		82.1%	2.6%

NCHS: E870.1 Accidental perforation during infusion or transfusion

CASE 9. A 60-year-old male went into a local hospital for his second coronary artery bypass operation. The operation was completed without complication and he was taken to the recovery room where he continued to receive a slow lidocaine drip as an antiarrhythmic agent. While there he had episodes of ventricular arrhythmia. His blood pressure began to decline and the doctor ordered a volume expander to be given intravenously and run "wide open." The bags, because of similar color codes, were confused and instead of a volume expander the patient received a bag of fluid containing lidocaine. He arrested and died.

ISSUES:

- a) Does the administration of the wrong drug warrant a manner other than natural?
- B) Does the patient's underlying disease status modify the manner?

RESPONSES: (other = 1.0%)

Natural	Homicide	Suicide	Accident	Undetermined
7.7%	1.5%		82.6%	3.6%

NCHS: E855.2 Accidental poisoning with local anesthetic

CASE 10. A young man went out with members of his gang on Saturday night. They arrived at a local establishment where they were greeted by members of a rival gang who told them to leave and then proceeded to throw them out. The deceased resisted being thrown out and was stabbed through the temporal bone. After stitches at a local emergency room he went home; however, he developed encephalitis due to bacteria introduced by the stab wound and died one week later.

ISSUES:

- a) Does the delay modify the manner?
- b) Does the resistance by the decedent to being tossed out of the bar modify the manner?
- c) If antibiotic treatment was not given, or was inappropriate during and following the wound repair, does this modify the manner of death?

RESPONSES:

Natural	Homicide	Suicide	Accident	Undetermined
	100%			

NCHS: E966 Assault by cutting and piercing instrument (homicide)

CASE 11. A well-known female drug abuser was admitted to the hospital for high fever, and an echocardiogram revealed vegetations on the tricuspid valve. Despite immediate antibiotic therapy, she died of endocarditis.

ISSUES:

a) What is the manner of death when a disease process that arises from chronic substance abuse causes death?

RESPONSES: (other = 0.5%)

Natural	Homicide	Suicide	Accident	Undetermined
84.3%			13.2%	2.0%

NCHS: 305.9 Nondependent abuse of drugs (natural)

CASE 12. A 55-year-old male was cleaning out the gutters and preparing to paint the trim on his house when he ran into a nest of wasps and was stung multiple times. Despite resuscitative efforts at the local hospital, he died less than 2 hours after having been attacked by the wasps. Autopsy revealed laryngeal edema, an elevated IgE level and multiple small black stingers in the upper arms and shoulders.

ISSUES:

a) Does fatal anaphylactic reaction to a venom warrant a manner other than natural?

b) Is the manner dependent on whether the decedent knew of the allergy?

RESPONSES:

Natural	Homicide	Suicide	Accident	Undetermined
17.7%			82.3%	

NCHS: E905.3 Accident due to natural and environmental factors, hornets, wasps, bees

NOTE: At the NAME Interim Meeting, it was also shown to be most popular to regard as accidental those deaths involving other animal/fish/plant venoms, or toxins, even if ingested (such as guanyolax shellfish poisoning, scombroid fish poisoning, ciguatera, shrimp allergy, mushroom poisoning).

CASE 13. A 46-year-old female was given a shot of penicillin for a minor infection. Within minutes, she began to have difficulty breathing and despite efforts to intubate her, she died during transport from the physician's office to the local hospital. Autopsy revealed marked laryngeal edema.

ISSUES:

- a) Does an anaphylactic reaction to an administered medication warrant a manner other than natural?
- b) Does it matter whether the decedent knew of the allergy?
- c) Does the appropriateness of the treatment influence the manner?
- d) Is the manner influenced by whether the substance, in general, is known to be capable of causing anaphylaxis?

RESPONSES: (other = 2.5%)

Natural	Homicide	Suicide	Accident	Undetermined
37.6%			56.3%	3.6%

NCHS: E930.0 Drug causing adverse effect in therapeutic use (penicillins). Note that a specific manner is not inferred.

For Scenario 13, some certifiers would state that the manner of death is "therapeutic complication" because the death resulted from a recognized potential adverse effect (i.e., predictable effect) of an appropriate therapy.

CASE 14. A 28-year-old male was observed to drive erratically and then cross the center line and strike a van. He was dead at the scene and autopsy revealed extensive blunt-force injuries. Further investigation revealed that the decedent had been shot during an argument in a bar four years prior to his death. Although the bullet did not penetrate the skull, he subsequently developed a seizure disorder and post-traumatic stress syndrome. On the morning of the fatal accident his mother found him semi-conscious on the floor. He told her he felt strange and had suffered another seizure. Autopsy revealed extensive multiple lethal injuries.

ISSUES:

- a) Does the interval between the shooting incident and death modify the manner?
- b) What is the burden of proof required to associate the seizure disorder with death in such cases (i.e., did a seizure cause the accident?)

RESPONSES: (other = 1.5%)

Natural	Homicide	Suicide	Accident	Undetermined
1.0%	32.0%		48.7%	16.8%

NCHS: E812.0 Motor vehicle traffic accident

CASE 15. A 34-year-old man and his 5-year-old daughter were traveling eastbound through a green traffic light, when their vehicle collided with a pickup truck traveling northbound, through a red light. The pickup truck was stolen at gun point from an elderly lady. The driver was being chased by the police. Both the man and his daughter died of multiple injuries.

ISSUES:

- a) Does the felony involved in such cases modify the manner?
- b) Does involvement of police pursuit modify the manner?

RESPONSES: (other = 0.5%)

Natural	Homicide	Suicide	Accident	Undetermined
	48.0%		51.0%	0.5%

NCHS: E812.0 Motor vehicle accident

CASE 16. A 33-year-old female walked out of a local bar in the very early morning, intoxicated. She attempted to cross a city street, in the crosswalk. She was struck by a pickup truck. The driver of the truck did not stop. Fifteen minutes later a pedestrian noticed the body and called for an ambulance. The woman was dead when she reached a local emergency room, forty-five minutes later, due to blood loss from bilateral compound femoral fractures.

ISSUES:

- a) Does hit-and-run connote a specific manner of death?
- b) Does the decedent's intoxication modify the manner?
- c) Does the delay in getting help modify the manner?

RESPONSES: (other = 0.5%)

Natural	Homicide	Suicide	Accident	Undetermined
	29.1%		65.8%	4.6%

NCHS: E814.7 Motor vehicle accident involving collision with pedestrian

CASE 17. A 48-year-old man was once again fighting with his family when he announced, "I've had all I can take of this. I am going to kill myself." He then ran out of the house, through the yard and jumped in front of a large truck. He was struck by the truck. The driver of the truck did not stop. Fifteen minutes later the man's wife emerged from the house, saw her husband's body in the street and called for an ambulance. The man was dead when he reached a local emergency room, forty-five minutes later, due to blood loss from bilateral compound femoral fractures.

ISSUES:

- a) What weight does the man's statement carry?
- b) Does the hit-and-run modify the manner?
- c) Does the delay in discovery modify the manner?

RESPONSES: (other = 0.5%)

Natural	Homicide	Suicide	Accident	Undetermined
	7.1%	87.8%	1.5%	3.1%

NCHS: E958.0 Suicide by jumping or lying before moving object

CASE 18. A refractory asthmatic had been on long-term steroids and theophylline and was admitted to the hospital for unrelated reasons. She was found dead in her bathroom, and autopsy showed findings consistent with an acute asthma exacerbation. The patient had been in the hospital for five days. Unfortunately, the admitting physician forgot to write orders for her asthma medication.

ISSUES:

a) Does failure to prescribe needed medication justify a manner of death other than natural?

RESPONSES: (other = 0.5%)

Natural	Homicide	Suicide	Accident	Undetermined
83.0%	0.5%		8.8%	7.2%

NCHS: 493.9 Asthma, unspecified (natural)

CASE 19. An apparently healthy 33-year-old had been having vague cardiac symptoms and went in for catheterization. The catheterization showed an anomalous coronary artery. About a day or so following the catheterization, a thrombotic occlusion of the artery occurred at the puncture site, limb ischemia developed, and amputation was required. Following amputation, stump infection and sepsis occurred and the patient died.

ISSUES:

a) Does a major complication stemming from a relatively minor procedure justify a manner of death other than natural?

b) Does age modify the manner in such cases?

RESPONSES: (other = 3%)

Natural	Homicide	Suicide	Accident	Undetermined
56.4%			36.9%	3.6%

NCHS: 746.8 Specified anomaly of the heart (natural)

For Scenario 19, some certifiers would state that the manner of death is "therapeutic complication" because the death resulted from a recognized potential adverse effect (i.e., predictable effect) of an appropriate therapy.

CASE 20. A 45-year-old man was swimming in a lake and yelled to his friends in a boat that his chest was hurting. He went under the water and was not seen again until he was recovered two hours later, dead. Autopsy showed classic stigmata of drowning and an evolving myocardial infarction (hours to days old) with coronary artery thrombosis.

ISSUES:

a) If drowning is agonal or constitutes the immediate cause of death, but is brought about by disease, is the manner other than natural?

RESPONSES:

Natural	Homicide	Suicide	Accident	Undetermined
29.8%			68.2%	2.0%

NCHS: E910.2 Accident caused by submersion while engaged in sport/recreation

CASE 21. An apparently healthy 35-year-old man got into an argument with his girlfriend, who bit him on the shoulder, leaving a well-defined bite mark. He got mad and left. He drove to his parent's house, and about 30 minutes after the bite, he was recounting the incident to his parents. He suddenly slumped over and died. Autopsy did not reveal an anatomic cause of death. The heart was normal. Death is presumed to be due to a cardiac dysrhythmia.

ISSUES:

- a) What is the maximum amount of time that can elapse between an assault (or battery) and death, for the two to be associated when determining whether death is natural or unnatural?
 b) Does the time interval modify the manner between one unnatural manner and another?

RESPONSES:

Natural	Homicide	Suicide	Accident	Undetermined
71.4%	8.71%		0.5%	19.4%

NCHS: E968.8 Assault by bite of human being (homicide)

CASE 22. A man had been acting strangely and the neighbors in the apartment building called the police. There were previous reports by neighbors of suicidal ideation. The police arrived and the man got into a standoff with police, pointing a gun at them. The police tried to talk him into putting the gun away, but he would not. Eventually, the man charged toward the police, pointing his gun at one of them, and the policeman being charged shot the man, killing him.

ISSUE:

- a) Does forcing the police to shoot one's self constitute suicide?

RESPONSES: (other = 0.5%)

Natural	Homicide	Suicide	Accident	Undetermined
	82.2%	11.2%	1.5%	4.6%

NCHS: E970 Legal intervention. Note that no manner is inferred.

CASE 23. A 20-year-old man was depressed and decided to commit suicide. He documented his thoughts in written notes as he drank alcohol, took several types of pills, and large quantities of aspirin. Through the evening, his handwriting deteriorated in the more than 30 pages he had written describing his disappointment with life. At one point, after taking many medications, he changed his mind and called his psychologist who took him to the emergency room. He was confused but conscious. His stomach was pumped and he was placed in a room where he fell asleep. Despite gastric lavage he died from a toxic salicylate concentration.

ISSUES:

- a) Does changing one's mind about suicide modify the manner?
- b) Can any intervening factor modify the manner?

RESPONSES:

Natural	Homicide	Suicide	Accident	Undetermined
		96.5%	3.0%	0.5%

NCHS: E950.0 Suicide with analgesic/antipyretic

These findings will be reported in a subsequent publication being developed as an outgrowth of the meeting.¹ The publication will also include in-depth discussions involving invited panelists and the NAME meeting attendees regarding the issues and opinions raised by the scenarios.

It is hoped that information obtained through surveys such as this one will be used by professional organizations and other agencies to develop further guidelines and recommendations for manner-of-death classification.

The CAP and NAME wish to acknowledge Julia Goodin, MD, New Mexico Office of Chief Medical Investigator, who organized the session and prepared the scenario questionnaire.

REFERENCE

1. Hanzlick R, Goodin J. Mind Your Manners Part III. Individual scenario results from the National Association of Medical Examiners' Manner-of-Death Questionnaire, 1995. *Am J Forensic Med Pathol.* 1997 (in press). Cases and data used with permission.

SECTION 8: MECHANISMS OF DEATH AND CAUSE-OF-DEATH STATEMENTS

Principles for Including or Excluding "Mechanisms" of Death When Writing Cause-of-Death Statements

I. INTRODUCTION

Mechanism of death is a term that often arises when discussing causes of death and the death certificate. In general, most instructions, guidelines, and other publications advise certifiers of death not to include mechanisms of death in cause-of-death statements.¹⁻⁶ A problem arises, however, because mechanisms of death have been variably defined. Further, recent improvements in electronic mortality data collection practices among states have set the stage for improving the content and usefulness of cause-of-death information. Therefore, it may be helpful to more specifically define and categorize mechanisms of death with the goal of fostering more complete and consistent reporting of causes of death which, in turn, will facilitate improvement in the NCHS national mortality database. Definitions and principles are provided herein for evaluating whether so-called mechanisms of death would be helpful to include when completing the death certificate, or writing cause-of-death statements for autopsy reports and other purposes.

II. THE BASICS OF CAUSE-OF-DEATH STATEMENTS

It is assumed that the reader understands the basic format for writing cause-of-death statements. Part I contains the underlying cause of death, and often, complications of the underlying cause of death including a sequence of conditions with an immediate and one or more intermediate causes of death. Part II may contain conditions that contributed to death, but did not lead to the underlying cause of death list in Part I. Publications with instructions are available elsewhere.^{1,2} The principles below are geared toward determining which so-called mechanisms of death may be appropriate for listing in Part I as immediate or intermediate causes of death.

III. BACKGROUND INFORMATION ON MECHANISMS OF DEATH

Adelson defined the mechanism of death as "the physiologic derangement or biochemical disturbance *incompatible* with life, which is initiated by the cause of death."³ Representative conditions that Adelson regarded as mechanisms of death include "hemorrhage, hypovolemic shock, acidosis, alkalosis, cardiac asystole, ventricular fibrillation, respiratory depression and paralysis, cardiac tamponade, sepsis with profound bacterial toxemia, and the like." Kircher similarly defined the mechanism of death to be "the physiologic derangement or biochemical disturbance produced by a cause of death and is the means by which the cause exerts its lethal effect."⁴ The *CAP Handbook of Forensic Pathology* defines mechanism of death as "the process that causes one or more vital organs or organ systems to fail when a fatal disease, injury, abnormality, or chemical insult occurs. It is the functional or structural change that makes independent life no longer possible after a lethal event has occurred."⁵ Cardiac standstill, hemorrhagic shock, and secondary wound infection and sepsis were cited as examples of mechanisms of death. In their chapter on certification of death in the same handbook, Graham and Gantner defined mechanism of death similarly to Adelson and Kircher, and offered tamponade, dysrhythmia, and heart failure as examples.⁵ Recently, Hirsch and Flomenbaum paraphrased the definition offered by Adelson, and included disseminated intravascular coagulation, sepsis, cardiac arrhythmias, congestive heart failure, asphyxiation, and exsanguination as examples.⁶

Some of the conditions cited above are not necessarily incompatible with life, and consequently, do not meet Adelson's definition. Further, some of the conditions listed are often forerunners of others that are listed. For example, hypovolemic shock may lead to ventricular fibrillation or asystole. In such instances (of which there are many) it may be difficult to determine exactly which complications should be viewed as mechanisms and which should not, and therefore, which should be reported or omitted when completing the death certificate. Graham and Gantner addressed this issue by stating that "most individuals would not squabble if the death certificate includes the mechanism of death, so long as the cause of death is also identified."⁵

Attempting to clarify matters, the CAP Autopsy Committee has identified a subset of mechanisms which, except in extremely rare instances, need never be cited on the death certificate.¹ This subset includes:

- asystole
- cardiac arrest
- ventricular fibrillation
- cardiopulmonary arrest (or cardiorespiratory arrest)
- electromechanical dissociation
- respiratory arrest.

Unfortunately, a much larger, ill-defined, and largely unitemized group of so-called mechanisms exist for which specific guidelines are lacking concerning their reporting in cause-of-death statements.

IV. RATIONALE FOR THE PRINCIPLES

There are many instances in which the inclusion of so-called "mechanisms" of death on the death certificate may be useful. Consider, for example, the use of mortality data for predicting the needs for institution-based health care for treatment of coronary artery disease. If all deaths due to coronary artery disease were simply reported as being due "coronary artery atherosclerosis," useful information obtained from the death certificate for specific planning would be limited. However, the ability to separately enumerate from death certificates those complications of coronary disease that may require long-term, intensive, or repetitive use of health care facilities and resources, such as those involving congestive heart failure, might be helpful for health care resource planning. Likewise, it might be helpful to know the proportion of hospitalized patients who ultimately die of systemic sepsis. Many other examples could be cited. Such research and planning needs go beyond routine mortality surveillance and enumeration of underlying causes of death. The issues often relate more to the complications of the underlying cause of death than to the underlying cause of death itself. Therefore, principles might be helpful to facilitate more complete cause-of-death reporting.

V. THE PRINCIPLES

It is assumed for the purpose of these principles that readers can identify the underlying cause of death in a given case. For example, chronic alcohol abuse would constitute the underlying cause of death in a chronic alcoholic who develops hepatic cirrhosis, portal hypertension, and fatal hepatic encephalopathy.

Definitions:

A *nonspecific anatomic process* is a complication of the underlying cause of death and a macroscopic or microscopic morphological alteration that may have functional consequences and more than one possible cause. A small list of examples includes hepatic cirrhosis, diffuse alveolar damage, hemopericardium, peritonitis, and hydrocephalus. Each of these is nonspecific and anatomically demonstrable. In general, it is acceptable, if not appropriate, to include a nonspecific anatomic process in the cause-of-death statement as an immediate or intermediate cause of death, but not as an underlying cause of death (because etiologic specificity is lacking).

A *mechanism of death* is a complication of the underlying cause of death that 1) is a physiologic derangement or biochemical disturbance; 2) is a disturbance through which the underlying cause ultimately exerts its lethal effect; 3) has more than one possible cause; and 4) is not an etiologically specific or criteria-defined disease, injury, or poisoning event.

Mechanisms of death may be divided into two subsets—*terminal events* and *nonspecific physiologic derangements*. A *terminal event* may be defined as a final complication of the underlying cause of death that is one of a defined set of common final pathways that is uniformly fatal if not immediately reversed (see below). A nonspecific physiologic derangement is a complication of the underlying cause of death that is not defined as a terminal event or a nonspecific anatomic process.

With these definitions in mind, three principles may be employed to determine which complications might be included in the cause-of-death statement as an immediate or intermediate cause of death.

Principle 1. Terminal events should not be listed on the death certificate and include:

- asystole (or cardiac standstill)
- cardiac arrest
- ventricular fibrillation
- cardiopulmonary arrest (or cardiorespiratory arrest)
- electromechanical dissociation
- respiratory arrest

Principle 2. A nonspecific anatomic process or a nonspecific physiologic derangement is included in the cause-of-death statement if it meets the following criteria:

- 1) It is a recognized, potentially fatal complication of the underlying cause of death;
- 2) It comprises part of the sequence of conditions that led to death in the patient in question as judged by clinical presentation, the historical sequence of events, or anatomic or laboratory findings;
- 3) It is not a symptom or sign;
- 4) Its existence in the patient would not be apparent unless explicitly stated in the cause-of-death statement;
- 5) Its inclusion does not represent an oversimplification of the facts;
- 6) An etiologically specific underlying cause of death is also reported, when possible.

Principle 3. If the existence in the patient of a nonspecific process or derangement (i.e., complication) is obvious on the basis of the underlying cause of death or another reported condition or complication, it need not be reported. For example, if the underlying cause of death were "intravenous potassium chloride poisoning," it would be unnecessary to cite "hyperkalemia" as a complication (immediate cause of death).

VI. EXAMPLE.

For a chronic alcoholic who developed cirrhosis, portal hypertension, asterixis, hyperammonemia, and then died from hepatic encephalopathy with respiratory arrest and asystole, the cause-of-death statement may be written as follows:

Hepatic encephalopathy
due to: Portal hypertension
due to: Hepatic cirrhosis
due to: Chronic alcohol abuse

Respiratory arrest and asystole were excluded with Principle 1, because they are, by definition, terminal events. Asterixis was excluded with Principle 2, Criterion 3, because it is a sign. Hyperammonemia was excluded with Principle 2, Criteria 4 and 5, because its existence is apparent through reporting of other items and because listing it would be an oversimplification of the facts. Hepatic encephalopathy and portal hypertension are mechanisms of death, because they are nonspecific physiologic derangements (perhaps with a nonspecific anatomic counterpart as well), but their existence in this patient would not be apparent unless they are included and are explicitly stated in the cause-of-death statement. Hepatic cirrhosis is a nonspecific anatomic process and is also included, because its existence in this patient would not be apparent unless it is included in the cause-of-death statement. Chronic alcohol abuse, of course, is included, because it is the underlying cause of death. Thus, using the principles, inclusion of all of the complications shown in the example may be explained.

Another way of justifying the example cause-of-death statement is:

- a) Not all persons who die of hepatic encephalopathy have portal hypertension;
- b) Not all persons who die of complications of portal hypertension have cirrhosis, nor do all people who die of cirrhosis have hepatic encephalopathy as a fatal complication;
- c) Not all persons who die of complications of cirrhosis acquired cirrhosis because of chronic alcohol abuse;
- d) Not all persons who die of chronic alcohol abuse do so from cirrhosis and its complications.

Thus, each condition listed as an intermediate or immediate cause of death, regardless of whether it is perceived as a mechanism of death or otherwise, existed in the patient in question, and the reported sequence completely explains why this patient died, compared to possible complications that could have occurred in other patients who die from the same underlying cause of death. In essence, the "unique" story of this patient's death sequence is reported.

It should be obvious that the information contained in the example is potentially more useful than a cause-of-death statement that simply reads "chronic alcohol abuse." To reiterate and paraphrase Graham and Gantner's thoughts in the context of the example, few would squabble over the listing of hepatic encephalopathy and portal hypertension in this cause-of-death statement, because the underlying cause of death is also identified. Actually, few would argue with the claim that the cause-of-death statement is more complete and useful than it would have been had the so-called mechanisms been omitted.

Each of the conditions listed in the example has a specific ICD code. NCHS will also soon capture the literal text of the cause-of-death statement, so reported conditions that may not have a unique code will also be identifiable in the NCHS mortality data base.

Table 1 at the end of this section lists terminal events and some common nonspecific physiologic derangements and nonspecific anatomic processes.

VII. DISCUSSION

Aside from its being a complete and comprehensive statement of the cause of death, much of the value of reporting cause-of-death statements as shown in the example has to do with the potential usefulness of the information. It has been stated by certifiers of death that "how registrars code...is their business," and "systems of classification and coding [are regarded] as our servants, not our masters."⁶ True, the writing of cause-of-death statements must allow the certifier enough flexibility to meet the needs of a given case, and death certification methods should not be detrimentally enslaved to classification and coding guidelines and procedures. However, it is within the certifier's duty to recognize the potential uses of the information from death certificates that are coded and classified—uses such as surveillance, research, allocation of funds and resources for public health planning and programs, and prioritization of governmental decisions that affect health care. *The information from individual death certificates is the very stuff from which our national mortality data base is made, and the data base, in turn, is the major source of mortality information for making decisions regarding national mortality issues.* These considerations oblige us to re-examine our traditional view of so-called mechanisms of death as they relate to death-certification practices.

It is not always possible to identify specific complications or mechanisms that result from an underlying cause of death because of their multiple or complex nature, or because sufficient information is lacking as might occur when an autopsy cannot be performed. In some cases, the underlying cause-of-death may be known with certainty while the immediate cause of death is not known with reasonable probability, as might occur when a patient with terminal prostate cancer dies at home and no autopsy is performed. In such cases, rather than guessing, oversimplifying, or specifying just one of multiple postulated mechanisms, it may be preferable to limit the cause-of-death statement to the underlying cause of death, or to generally describe the complication in such terms as "perforating brain trauma" due to "gunshot wound to the head." There are many cases, however, in which a well-defined sequence of complications may be stated with a high degree of confidence and correctness.

Some may take issue with the distinction made here between nonspecific anatomic processes and nonspecific physiologic derangements, claiming that the distinction is a step backward in pathophysiologic concepts, because structure and function are intimately related. The distinction has been made, however, to allow for clearer definitions and to facilitate communication about mechanisms of death.

VIII. CONCLUSIONS

Principles are presented to determine which complications of an underlying cause of death may be reported in cause-of-death statements, particularly in regard to conditions that are often viewed as mechanisms of death. *Mechanisms of death* include a defined list of *terminal events* (such as asystole) and a larger group of *nonspecific physiologic derangements* (such as portal hypertension). Mechanisms of death are therefore distinguished from *nonspecific anatomic processes* (such as cirrhosis).

The content of a cause-of-death statement should be based on whether the information is, within reason, potentially useful, and upon the value of reporting the unique sequence of a given person's death. Relying solely upon whether a given condition is defined or construed as a mechanism will result in cause-of-death statements that are less useful than they otherwise might be. Mechanisms of death defined as terminal events, however, need not be reported in cause-of-death statements.

IX. REFERENCES

- 1) College of American Pathologists' Autopsy Committee; Hanzlick R, ed. *The Medical Cause-of-Death Manual: Instructions for Writing Cause-of-Death Statements for Deaths Due to Natural Causes*. Northfield, IL: College of American Pathologists; 1994.
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Table 1. Sample mechanisms of death (terminal events and nonspecific physiologic derangements) and nonspecific anatomic processes and their relation to immediate or intermediate causes of death.

MECHANISMS: Terminal Events ¹	MECHANISMS: Nonspecific physiologic derangements ²	NONSPECIFIC ANATOMIC PROCESSES ³
asystole cardiac arrest cardiopulmonary arrest cardiorespiratory arrest electromechanical dissociation respiratory arrest ventricular fibrillation	arrhythmia coagulopathy coma congestive heart failure dehydration dysrhythmia exsanguination hepatic encephalopathy hepatic failure hypercalcemia hypotension ketoacidosis multi-organ failure pneumothorax portal hypertension pulmonary insufficiency renal failure sepsis septic shock shock	acute myocardial infarction anoxic encephalopathy bowel obstruction cirrhosis epidural hematoma gastrointestinal hemorrhage hemopericardium hemothorax peritonitis pneumonia pulmonary embolism subarachnoid hemorrhage subdural hematoma

1. Never placed on the death certificate.

2,3. Placed on the death certificate based on application of the principles.

SECTION 9: OPTIONS FOR WRITING CAUSE-OF-DEATH STATEMENTS FOR DEATHS DUE TO HUMAN IMMUNODEFICIENCY VIRUS (HIV) INFECTION

I. INTRODUCTION

When a risk factor for a fatal condition has, with reasonable probability, played a role in causing the death of an individual, the risk factor may be regarded as a condition when writing the cause-of-death statement. Previous publications address risk factors, but are not entirely clear regarding when and how to report such conditions in cause-of-death statements.¹⁻⁵ This section provides options for reporting significant conditions that are related to acquiring human immunodeficiency virus (HIV) infection, a significant cause of mortality in some areas of the United States, and a source of frequently asked questions regarding acceptable methods for writing cause-of-death statements.

It is assumed that the reader/user of this protocol is familiar with the basic principles of writing cause-of-death statements as outlined by the National Center for Health Statistics³ and by the College of American Pathologists' publication, *The Medical Cause-of-Death Manual: Instructions for Writing Cause-of-Death Statements for Natural Deaths*.⁵ The basic tenets within those publications will not be reiterated.

II. HIV RISK FACTORS

Risk factors for acquiring HIV infection include:

- A) Sexual contact
- B) Parenteral substance abuse
- C) Maternal infection (transmission to fetus or infant)
- D) Blood product transfusion/administration
- E) Occupational exposure—as where a laboratory worker sustains an inadvertent needle-stick or is exposed to infected blood products or body fluids. Such cases may involve an injury (such as a puncture wound, and some such deaths might be considered as accidental (unintentional injury) in manner.

Not all persons who have such risk factors acquire HIV infection. If a death occurs from HIV infection which is, with reasonable probability, related to one or more of these risk factors, then it is appropriate to regard them as significant conditions and to report them when completing the cause-of-death statement. The situation is analogous to circumstances that may arise in other types of death, such as: reporting intravenous substance abuse when a person dies from fungal endocarditis arising from drug abuse; reporting alcohol intoxication when a person dies of drowning;⁴ reporting cancer of the stomach because it was a basis for a person having committed suicide;⁴ or reporting cigarette smoking when a person dies of chronic lung disease.³

III. ASSESSING AND REPORTING SIGNIFICANT CONDITIONS

In general, the certifier should use all medical and historical information that is available to determine which significant conditions were present and associated with HIV infection. If a significant condition is cited in the cause-of-death statement, it is advisable that there be documentation or reasonable probability that it contributed to the death of the patient in question.

IV. EXAMPLES

Case Scenario A: A 46-year-old male told his doctor he had repeatedly abused heroin intravenously over a seven-year period. His forearms showed chronic needle tracks. He was admitted to the county hospital with shortness of breath. He was found to have pneumocystis carinii pneumonia, which was refractory to treatment, and he died of respiratory failure about three weeks after admission. Other than parenteral substance abuse (heroin), no other HIV risk factors were documented or known. Two years prior to death, the patient had been admitted with community-acquired pneumonia and was found to have HIV antibody in his serum.

Part I	A. Pneumocystis carinii pneumonia	Approximate interval between onset and death 3 weeks
	Due to, or as a consequence of: B. Acquired Immune Deficiency Syndrome	Months
	Due to, or as a consequence of: C. Human immunodeficiency virus infection	2+ years
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I Parenteral substance abuse—heroin	

Comment: In above example, it could be argued that parenteral substance abuse was the underlying cause of death and should be cited in Part I of the cause-of-death statement instead of Part II. However, parenteral substance abuse does not, in and of itself, cause HIV infection. Further, more than one significant condition may exist, and official guidelines for writing cause-of-death statements advise against the reporting of more than one condition per line in Part I of the cause-of-death statement. For these reasons, and to promote consistency in writing cause-of-death statements, it is suggested that the format shown above be used, reporting the relevant significant condition(s) in Part II, unless a cause-and-effect relationship is proven (see Case D, which follows).

Case Scenario B: A 5-month-old infant died of cerebral toxoplasmosis secondary to HIV infection, which was acquired in utero. Other opportunistic infections had preceded the toxoplasmosis. The mother had apparently acquired HIV from intravenous substance abuse.

Part I	A. Cerebral toxoplasmosis	Approximate interval between onset and death 1 month
	Due to, or as a consequence of: B. Acquired Immune Deficiency Syndrome	2 months
	Due to, or as a consequence of: C. Intrauterine human immunodeficiency virus infection	5 months
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

In this example, maternal-fetal transmission of HIV is explicit. The significant condition that affected the infant (i.e., maternal infection) need not be restated in Part II. If the mother were to die of her HIV infection, significant conditions relevant to her death (e.g., intravenous substance abuse) would be reported on her death certificate, so there is no need to report the condition(s) on the infant's death certificate.

Case Scenario C: A 28-year-old male had hemophilia (Factor VIII) deficiency and contracted HIV infection from an infected blood product which was used to treat his hemophilia. The specific blood product which was infected with HIV was determined retrospectively. He died of disseminated mycobacterium avium infection.

Part I	A. Disseminated mycobacterium avium infection	Approximate interval between onset and death 2 months
	Due to, or as a consequence of: B. Acquired Immune Deficiency Syndrome	2 years
	Due to, or as a consequence of: C. Human immunodeficiency virus infection	8 years
	Due to, or as a consequence of: D. Blood product infusion for hemophilia	28 years
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

For the case scenario presented on the preceding page, the format shown is suggested for several reasons. First, the cause-and-effect relationship between hemophilia, blood transfusions, and HIV infection was proven. Second, hemophilia is a specific disease condition without which, in this patient, HIV infection would not have occurred. Third, the format shown makes it clear that hemophilia is the underlying cause of death.

Case Scenario D: A 26-year-old female died of pneumocystis carinii pneumonia, following HIV infection and AIDS. No medical history information could be developed regarding the presence of other significant conditions.

Part I	A. Pneumocystis carinii pneumonia	Approximate interval between onset and death 3 weeks
	Due to, or as a consequence of: B. Acquired Immune Deficiency Syndrome	2 years
	Due to, or as a consequence of: C. Human immunodeficiency virus infection	4 years
	Due to, or as a consequence of:	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

Case Scenario E: A 24-year-old female clinical laboratory worker died of pneumocystis carinii pneumonia, following HIV infection and AIDS. She had sustained an unintentional needle puncture while processing blood that was shown subsequently to be HIV positive. Thorough evaluation failed to disclose other HIV risk factors.

Part I	A. Pneumocystis carinii pneumonia	Approximate interval between onset and death 1 month
	Due to, or as a consequence of: B. Acquired Immune Deficiency Syndrome	3 years
	Due to, or as a consequence of: C. Human immunodeficiency virus infection	5 years
	Due to, or as a consequence of: D. Occupational puncture wound of hand	5 years
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I	

As in Case Scenario C, the cause of the HIV infection (puncture wound) in this case was essentially proven. Because the underlying cause of death involved an external condition that was an unintentional injury (i.e., puncture wound), the manner of death may be certified as "accident" rather than "natural." Information would also be required for the death certificate indicating the date, time, place, and address of injury, a description of how the injury occurred (e.g., "skin puncture with syringe needle"), and an indication that the injury occurred at work. In general, such injury-related deaths should be reported to the medical examiner or coroner. Further discussion of injury deaths is beyond the scope of this document and can be obtained by consulting Section 4 of this manual.

Sexual contact. The nature and role of sexual contact as a significant condition is difficult to establish and report—much more so than the other factors shown in Heading II— which are comprised of medically distinct entities or events. Also, data systems exist for sexual behavior risk factor surveillance.² For these reasons, the reporting of sexual contact as a condition is left to the judgment of the certifier, based on the quality of available information and needs of the case.

V. MULTIPLE RISK FACTORS

When the need exists to report multiple conditions in Part II, each should be reported, separating them with a comma, and listing them in descending order of importance.

VI. OTHER CONSIDERATIONS

It may seem redundant to specify human immunodeficiency virus infection as the underlying cause of death when death results from acquired immune deficiency syndrome (AIDS) because, by definition, AIDS is due to human immunodeficiency virus (HIV) infection. However, there is latent period between HIV infection and the development of AIDS that varies considerably among patients. Specifying the interval between HIV infection and AIDS may be useful for statistical, classification, and coding purposes. Thus, it is appropriate that human immunodeficiency virus infection be cited as the underlying cause of death and that the interval between onset and death be reported.

VII. LOCAL AND CONFIDENTIALITY ISSUES

The approach to AIDS confidentiality issues varies among states. Familiarity and compliance with applicable laws and procedures is essential.

VIII. REFERENCES

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SECTION 10: WHEN DISEASE AND INJURY SEEM INSEPARABLE

I. GENERAL PRINCIPLES

Cases will occur in which combinations of disease and injury cause death, or in which one seems to lead to the other. Such cases may cause dilemmas in selecting an appropriate format for writing the cause-of-death statement. In general, there are four variations:

Type 1. Significant underlying disease is exacerbated by an injury that in many people would be survivable (e.g., coronary artery disease exacerbated by the stress of a fractured hip sustained in a fall or fatal wound infection of a relatively "minor" wound in someone with diabetes).

Type 2. A serious disease causes a fatal injury to occur (e.g., a person has a heart attack while swimming and drowns).

Type 3. Injury and disease coexist, but the cause of death is elusive (e.g., a case in which marginal coronary artery disease and a superficial stab wound exist, but the role of each in causing death is unclear).

Type 4. An injury seems to have caused disease that proves fatal (e.g., lye ingestion with subsequent esophageal scarring and fatal esophageal cancer that develops years later).

For managing such cases, an option is to develop an opinion as to whether the injury or disease was the most important and to list the most important one in Part I and the less important one in Part II, using a split format as described in Section 5 for periprocedural deaths. If the condition listed in Part I as the underlying cause of death is the injury, then the manner may be reported as other than natural (homicide, suicide, accident, or undetermined as appropriate). If the disease condition is listed in Part I as the underlying cause of death, then the manner may be reported as natural.

Thus, using the Type I case described above (coronary artery disease exacerbated by hip fracture sustained in a fall), for a case in which a person had an acute myocardial infarction 2 days after falling from a ladder, and then died 3 days later, one option is as follows:

Part I	A. Acute myocardial infarction	Approximate interval between onset and death 3 days
	Due to, or as a consequence of: B. Atherosclerotic coronary artery disease	Years
	Due to, or as a consequence of: C.	5 years
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I Left hip fracture from a fall	

Using this option, the manner of death could be reported as natural if the certifier felt that such classification was appropriate. By stating the natural disease in Part I, the certifier is indicating that the natural disease process played the most important role in causing the death of this person. The injury-related items including date, time, place, address, and "describe how injury occurred" would have to be completed, however, because an injury is reported. The format shown in this example is acceptable, because the condition reported in Part II (hip fracture) contributed to death, but did not result in the underlying cause of death reported in Part I (coronary atherosclerosis).

The other option in the example case is to report the injury in Part I and the underlying disease in Part II:

Part I	A. Acute myocardial infarction	Approximate interval between onset and death 3 days
	Due to, or as a consequence of: B. Left hip fracture	5 days
	Due to, or as a consequence of: C. Fall from ladder	5 days
	Due to, or as a consequence of: D.	
Part II	OTHER SIGNIFICANT CONDITIONS: Conditions contributing to death but not resulting in the underlying cause of death in Part I Atherosclerotic coronary artery disease	

Using this option, the manner of death could be reported as other than natural (accident based on the circumstances presented). Of course, the injury-related items would have to be completed. By stating the injury information in Part I, the certifier is stating that the injury played the most important role in causing the death of this person. The format shown in this example is acceptable, because the condition reported in Part II (coronary artery disease) contributed to death, but did not result in the underlying condition reported in Part I (fall from ladder).

Which of these split formats would be used requires the judgment of the person writing the cause-of-death statement, but a major factor to be considered in selecting the format is whether the manner of death will be reported as natural, or other than natural. The split format allows for such discretion.

Type 1, Type 2, and Type 3 cases described on the preceding page can be managed by using the split format as needed. Type 4 cases can be managed with the split format, if the role of the injury is unclear, or by using a Sequential Part I Format (Combined Format) if the cause-and-effect relationship of injury and disease has been reasonably established.

II. DISCUSSION

The most common practice concerning the classification of manner of death when death results from disease and injury is one which has been recommended.¹ In general, if death was brought about or hastened by an injury, preference is given to the injury when classifying the manner of death, because death would not have occurred at the time it did, had the injury not occurred. The principle usually applies, regardless of the interval between the injury and death. Thus, for a person who dies of a post-traumatic seizure disorder, which resulted from an unintentional motor vehicle crash 10 years earlier, the manner of death would often be classified as accidental. Not all certifiers subscribe to such principles, however, and room for discretion is required to accommodate the needs and circumstances of individual cases.

Some cases can be quite difficult. For the purpose of discussion, consider the Type 4 case described earlier (lye ingestion with subsequent delayed death from esophageal carcinoma). Assume that the lye was ingested as a suicidal venture, the attempt was unsuccessful (in the short term, at least), the individual lived for many years before developing the carcinoma, and suicidal tendencies were never again manifest before dying from the carcinoma. One might argue that the cause-and-effect relationship between lye ingestion and carcinoma was tenuous, the decedent lacked any knowledge of the potential delayed complications of lye ingestion, and that suicidal ideation was not only lacking at the time of death, but had not been present for many years. Should the general principle of ignoring the interval between onset and death be applied in this case and the manner of death be classified as suicide? How strong is the cause-and-effect association between the lye ingestion and carcinoma? Did the former really cause the latter? Perhaps accident, natural, or undetermined would be more suitable alternatives in view of these questions. No recommendation will be made here for such cases, but the case points to the need for more specific recommendations, including criteria, to promote greater uniformity in the approach to classifying the manner of death for this and the many other instances in which the manner of death is arguable, like some of the cases presented in Section 7.

III. SUMMARY

When death results from the effects of both injury and disease, the cause-of-death statement may be written using a split format. The most important condition may be cited as the underlying cause of death in Part I, and the less-important condition may be cited in Part II. A major factor to be considered when writing the cause-of-death statement is whether the manner of death will be reported as natural, or other than natural, (homicide, suicide, accident, undetermined). For Type 4 cases in which an injury seems to be the etiology of a disease, a Sequential Part I Format may be used, if appropriate.

IV. REFERENCE

1) Adams V, Hirsch C. Trauma and Disease. In: Spitz W, Fisher R, eds. *Medicolegal Investigation of Death*. 3rd ed. Springfield, IL: CC Thomas Publishers; 1993: 175-198.

SECTION 11: GLOSSARY

Using terms and concepts based on National Center for Health Statistics guidelines, in combination with new terms and concepts introduced in this manual and its forerunner, a language now exists to facilitate communication about cause-of-death statements. For example, if you are asked if you think the cause-of-death statement for a particular patient's death should be stated, using a combined or split format, you should know what the question means and be able to use the concepts to answer the question and explain your reasoning. The glossary contains the terminology that forms the language of cause-of-death statements.

Amendment: The process of changing or updating the information on a death certificate after it has been filed with the registrar. Usually, amendment must be done in writing and by the original certifier.

Cause-of-death's rule of thumb: A cause-of-death statement must contain an underlying cause of death; a nonspecific process should not be listed as the underlying cause of death unless it is qualified.

Cause-of-death statement: A cause of death written or otherwise stated in a format similar to that used on a death certificate. It must include an underlying cause of death, and may include an immediate cause of death, one or more intermediate causes of death, and one or more other significant conditions.

Certifier: The physician, coroner, or medical examiner who indicates the cause of death on a death certificate and signs the certificate attesting, in his or her opinion, that death resulted from the causes stated to the best of his or her knowledge.

Combined format: A method of writing cause-of-death statements in which the complications and the underlying condition are both reported in Part I.

Ensuring that natural causes are evident: Ensuring that conditions in the cause-of-death statement, if they can be caused by external conditions, are specified as being due to natural causes, if such is the case.

External conditions: Injury (chemical, physical, or other) or poisoning that causes or contributes to death. Deaths resulting from external conditions are usually designated as homicidal, suicidal, or accidental in manner, and are, in general, certified by or under the authority of the medical examiner or coroner.

Fatal agent: The etiologic agent, instrument, tool, force, toxin, poison, or other implement that produces the condition(s) that lead to death. Except for infectious agents, fatal agents are not usually specified in cause-of-death statements for natural deaths.

Fatal derangement: Any pathophysiologic process or event that is involved in dying or producing the death of a person, including mechanisms of death, nonspecific processes, and specific conditions. For deaths due to injury or poisoning, the term is used to describe the final fatal impairment of bodily function that follows an injury event and its associated trauma.

Immediate cause of death: The final disease (condition) or complication resulting from the underlying cause of death, occurring closest to the time of death, and directly causing death. The immediate cause of death is always placed on line A in Part I of the cause-of-death statement.

Injury event: An event involving one or more external conditions (injury or poisoning) that damages bodily tissue or its function. Two examples include "gunshot injury of chest" and "fall from height."

Intermediate cause of death: A disease (condition) or complication occurring somewhere in time between the underlying cause of death and the immediate cause of death.

Interval between onset and death: An item of information that is to be completed for each condition listed in Part I of the cause-of-death statement. The interval should be stated as accurately as possible.

Manner of death: A classification of death based on the type of conditions that cause death, and the circumstances under which they occurred. The manner of death may be natural, homicidal, suicidal, accidental, or undetermined.

Mechanism of death: A complication of the underlying cause of death that 1) is a physiologic or biochemical disturbance; 2) is a disturbance through which the underlying cause of death exerts its lethal effect; 3) has more than one possible cause; and 4) is not an etiologically specific or criteria-defined disease, injury, or poisoning event. Mechanisms of death include mechanistic terminal events (such as asystole) and nonspecific physiologic derangements (such as congestive heart failure).

Mode of dying: Describes how a death occurred rather than why it occurred, such as a hemorrhagic mode from a hereditary coagulation disorder or a cardiac mode from cocaine intoxication. In general, modes of dying are not included in cause-of-death statements for natural deaths.

National Center for Health Statistics (NCHS): A center administratively and organizationally within the Centers for Disease Control and Prevention (CDC), based in Atlanta, Georgia, NCHS is responsible for compiling and publishing national vital statistics (births, deaths, fetal deaths, marriages, and divorces) obtained from state records filed under state law.

Natural causes (natural manner) of death: A cause of death due solely to disease.

Nonspecific anatomic process: A complication of the underlying cause of death and a macroscopic or microscopic morphological alteration that may have functional consequences and more than one possible cause (such as hepatic cirrhosis).

Nonspecific physiologic derangement: A mechanism of death and a complication of the underlying cause of death that is not defined as a terminal event or nonspecific anatomic process. Pulmonary insufficiency is one example.

Nonspecific process: An anatomic (structural), or functional (physiologic) derangement that has more than one possible cause. A nonspecific process may be cited as an immediate or intermediate cause of death, but should not be cited as an underlying cause of death unless it is qualified.

Nosologist: A person who classifies and codes causes of death for statistical and epidemiologic purposes.

Other significant condition: Listed in Part II of the cause-of-death statement, an other significant condition is a coexisting (or pre-existing) condition that contributed to death, but did not have a causal relationship to (i.e., did not lead to) the underlying cause of death. For surveillance purposes, certain states require that some conditions (such as pregnancy) be reported as an other significant condition, even if the condition did not contribute to death.

Part I of the cause-of-death statement: Contains lines for writing the immediate, intermediate, and underlying causes of death. When a death is certified, an entry must be made in Part I of the cause-of-death statement. If possible, only one condition should be listed on each line in Part I.

Part II of the cause-of-death statement: Contains the space to indicate other significant conditions. More than one condition may be listed. For some deaths, where there are no other significant conditions, Part II of the cause-of-death statement may be left blank.

Periprocedural death: A death occurring while in surgery or under anesthesia, or known or suspected as having been brought about or hastened by a medical therapy, treatment, procedure, or device.

Qualified cause-of-death statement: A cause-of-death statement that contains a specific condition that has been qualified as being probable or presumed and/or a nonspecific process that has been qualified as being of probable, presumed, unknown natural, undetermined natural, or unspecified natural etiology.

Qualifying: Including words such as probable, presumed, unknown, unspecified, or undetermined in the cause-of-death statement. Qualifying is used to express a degree of uncertainty about the accuracy of the cause-of-death statement, or to assure a user of the cause-of-death statement that a specific underlying cause of death has not been omitted through the certifier's oversight or failure to search to specificity.

Query: An inquiry made by the registrar to clarify or complete missing information on the death certificate or in the cause-of-death statement. Queries can be avoided by properly completing the death certificate on the first attempt.

Registrar: An agent within the government or health department responsible for the official filing of death certificates and other vital records such as birth certificates. There is a registrar on the state level and often a registrar at the county or local level who acts as an agent of the registrar and is responsible for the initial filing of vital records.

Risk factors: Medical, behavioral, environmental, or demographic conditions or circumstances that place a person at risk for the development of a specific condition. Risk factors may be reported as other significant conditions if they were operative in the decedent.

Search for specificity: A thought process used by the certifier to identify an underlying cause of death that is as etiologically specific as possible.

Sequential Part I format: Completion of Part I of the cause-of-death statement by using more than one line in Part I. This creates a cause-of-death statement where one condition has resulted from another, going backward in time on progressively lower lines in Part I. All conditions listed in the sequential Part I format must have a cause-and-effect relationship when read from bottom to top.

Single line Part I format: Completion of Part I of the cause-of-death statement by using only line A, which must include an underlying cause of death that also serves as the immediate cause of death. A single line Part I format should only be used when there is insufficient information available to state an immediate cause of death with reasonable certainty in addition to the underlying cause of death.

Specific condition: A disease (condition) that can lead to death, and has only one etiology (either proven or assumed based on current medical knowledge). The underlying cause of death should consist of a specific condition, if possible.

Specificity paradox: When a nonspecific process has qualities that may cause it to be perceived as a specific condition and be incorrectly cited as an underlying cause of death. Writers of cause-of-death statements must avoid being trapped by the specificity paradox.

Split format: A method of writing cause-of-death statements in which Part I and Part II are both used to report complications and the underlying condition, in order to emphasize the most important ones in Part I.

Terminal event (or mechanistic terminal event): A final complication of the underlying cause of death that is one of a defined set of common final pathways that is uniformly fatal if not reversed. These include asystole, cardiac arrest, ventricular fibrillation, cardiopulmonary arrest, electromechanical dissociation, and respiratory arrest. Terminal events should not be reported in the cause-of-death statement.

Trauma: The damage sustained by bodily tissue when an injury event occurs. Two examples include "perforating wound of lung" and "laceration of spleen."

Underlying cause of death: For deaths due to natural causes, the disease (condition) that initiated the train of morbid events leading directly to death. The underlying cause of death is stated on the lowest completed line in Part I of the cause-of-death statement.

Unqualified cause-of-death statement: A forthright, specific cause-of-death statement that connotes that the cause-of-death statement has been made with a high degree of certainty about its accuracy.

U.S. standard certificate of death: A model death certificate developed by the National Center for Health Statistics in cooperation with state vital statistics offices and other interested organizations and individuals upon which the death certificates in the states are based in design.