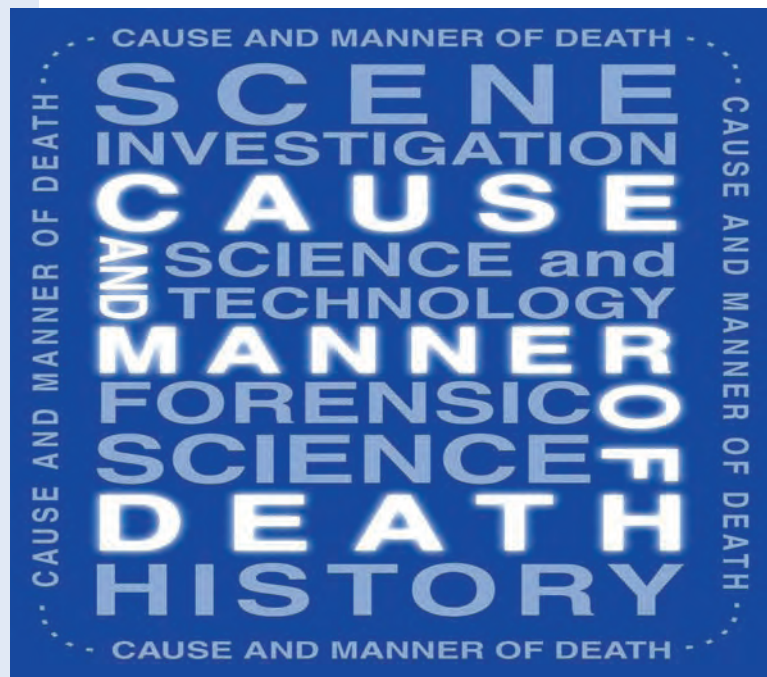


chapter 9



Randy Hanzlick, M.D.

Certification of Unexplained Infant Deaths

Cause of Death and the Death Certificate

Unit 29: Sudden, Unexplained Infant Death Certification

Unit 30: Reporting Cause of Death in SIDS-Like Cases

U.S. STANDARD CERTIFICATE OF DEATH						
1. NAME		2. SEX		3. DATE OF DEATH (Month, Day, Year)		
4. AGE (Last Birthday)		5. UNDER 1 YEAR		6. UNDER 5 DAY		7. DATE OF BIRTH (Month, Day, Year)
8. PLACE OF BIRTH (City and State or Foreign Country)		9. PLACE OF DEATH (City and State or Foreign Country)		10. PLACE OF DEATH (Specify)		
11. SURVIVING SPOUSE (If any, give maiden name)		12a. DECEDENT'S LEGAL OCCUPATION (Give kind of work done during most of working life. Do not use retired.)		12b. KIND OF BUSINESS/INDUSTRY		
13a. CITY, TOWN, OR LOCATION OF DEATH		13b. COUNTY		13c. STREET AND NUMBER		
14. HAD DECEDENT OR HISPANIC ORIGIN? (Specify by or type of race, specify Indian, Mexican, Puerto Rican, etc.)		15. RACE (American Indian, Black, White, etc. Specify)		16. DECEDENT'S EDUCATION (Specify and highest grade completed. Elementary, Secondary, GED, College, etc.)		
17. MOTHER'S NAME (First, Middle, Maiden Surname)		18. MAILING ADDRESS (Street and Number or Rural Route Number, City or Town, State, Zip Code)				
19. PLACE OF OBSESSION (Name of cemetery, institution, or other place)		20. LOCATION (City or Town, State)		21. LICENSE NUMBER (If known)		
22. NAME AND ADDRESS OF FACILITY		23. LICENSE NUMBER (If known)				



For research scientists focused on public health surveillance and the identification and isolation of risk factors associated with death, the death certificate is the single most essential piece of documentation available today. However, consistent reporting of SUID is problematic, specifically with regard to statements on the certificate that attempt to explain cause and manner of death. This chapter explains the need for accurate reporting of infant deaths nationwide.

OVERVIEW

Over the years, the very existence of SIDS has been debated, largely due to the “catch-all” status many certifiers believe the SIDS diagnosis has gained. The liberal application of SIDS on the death certificate and the failure to differentiate SIDS from other SUID is one reason that some have questioned the existence of SIDS.

Even though the definition of SIDS has changed, the fact remains that SIDS is a term practically applied to *the sudden death of an infant under one year of age, which remains unexplained after a thorough case investigation, including performance of a complete autopsy, examination of the death scene, and review of the clinical history*. Further, it has become apparent over the years that homicides of infants—and even serial murders—have been missed, as have accidental deaths from a variety of external causes, largely due to:

- Difficulties posed in investigating infant deaths.
- Reliance on potentially interested witnesses.
- Frequently retrospective scene investigations.
- The subtlety of findings in many cases.
- Lack of information about drug exposures and postmortem toxicology.
- A victim who was unable to speak.
- A very small decedent posing autopsy interpretation difficulties.

Although this chapter focuses on tasks typically performed by physicians, medical examiners, coroners, or pathologists, it is important for investigators and other interested parties to understand the concepts so that investigations can be geared toward answering the necessary questions and addressing issues that are relevant to the cause, manner, and circumstances of death.

Therefore, all participants in the infant death investigation (i.e., forensic pathologists, medical examiners, coroners, medicolegal death investigators, EMS, law enforcement, etc.) must be aware of their role in the investigation and the pitfalls associated with failure to adequately investigate all infant deaths.

This chapter takes a functional approach to establishing and assigning the cause and manner of death and in adequately reporting important information on the death certificate in Sudden Infant Death Syndrome and Other Infant Death (SIDS/OID)-cases.

SUPPORT MATERIALS

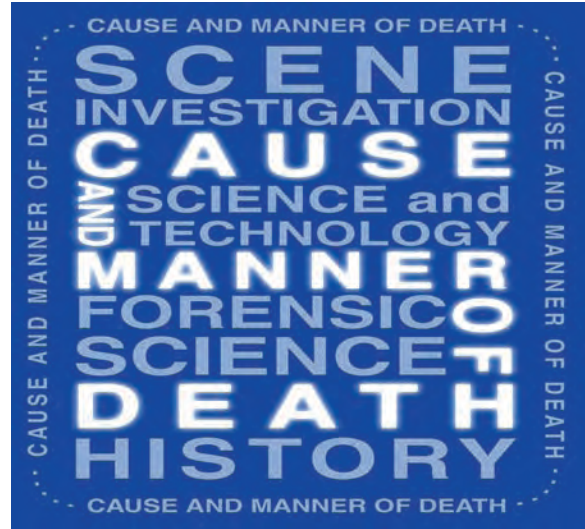
In addition to the SUIDI Reporting Form or jurisdictionally-approved equivalent, the following support materials are suggested for this chapter:

1. Guidelines for death scene investigation of sudden, unexplained infant deaths: recommendations of the Interagency Panel on Sudden Infant Death Syndrome. *MMWR* 1996;45 (RR-10).
2. National Association of Medical Examiners White Paper. "A functional approach to sudden unexplained infant deaths." Approved October 2005.
3. National Center for Health Statistics. *Medical Examiners' and Coroners' Handbook on Death Registration and Fetal Death Reporting*. Hyattsville, MD: Centers for Disease Control and Prevention; 2003.
4. National Association of Medical Examiners. Cause of Death Tutorial. 2005. <http://www.thename.org>. 2005.
5. College of American Pathologists. *Cause-of-Death Statements and Certification of Natural and Unnatural Deaths: Protocol and Options*. Northfield, IL: 1997. Revision expected March 2006.

CHAPTER OBJECTIVES

By the end of this chapter, students will be able to describe:

1. SUID certification.
2. Formatting cause-of-death statement options.



29

unit

Sudden, Unexplained Infant Death Certification

INTRODUCTION

Consistent reporting of SUID has great epidemiological value for research scientists focused on public health surveillance and the identification and isolation of risk factors associated with SUID. Information about risk factors also aids prevention efforts. However, inconsistencies in the collection and reporting of scene data to the forensic pathologist make the eventual establishment and reporting of cause and manner of death, as reported on the death certificate, less reliable. Only those cases in which the investigation has been inadequate, or cases that, after adequate investigation, are consistent with the concept of SIDS or that otherwise remain unexplained, should be classified as SUID or SIDS.

It is essential to assess whether or not the scene investigation has been adequate enough to report a specific cause of death. This unit is intended to provide background and rationale for a functional approach to certifying SUID.

DISTINGUISH SIDS FROM OTHER CAUSES OF DEATH

As covered earlier, the SIDS cause of death should only be used after specific tasks have been performed yielding negative results or another identified cause. The following represents the scope of investigation that might be deemed as the minimum to consider an infant death investigation complete or adequate and amenable to certification.

Conduct Complete Scene Investigation

A complete and systematic investigation of the scene where the incidents leading to death are thought to have occurred is critical. The scene investigation should be conducted by a medical examiner, coroner, or a person known to and acting officially on behalf of the medical examiner or coroner. The scene investigation should be documented in narrative form and augmented with photographs and/or diagrams. Witnesses at the scene should be interviewed. The original position of the infant when first found unresponsive should be determined as precisely as possible by questioning witnesses and recording their responses in detail. There are various supplemental means of describing the as-found position of the infant, but these methods should not replace proper interviewing.

Take Complete X-Rays of Infant

An X-ray of the infant should be taken, even if it is just a single babygram. A complete skeletal series is the gold standard. However, in jurisdictions in which this is not an option for financial or technical reasons, a single film will at least provide a radiographic record of gross findings.

Perform Complete Forensic Autopsy

An autopsy should be performed as described in the National Association of Medical Examiners' *Forensic Autopsy Performance Standards*. The autopsy examination should involve *insitu* examination of the brain, neck structures, and thoraco-abdominal organs with subsequent removal and dissection. At a minimum, if there is no gross or toxicological cause of death, microscopic examination should be conducted on the brain and meninges, heart, lungs, airways (epiglottis, trachea, bronchi), and liver. If not examined microscopically, stock tissue or paraffin blocks should include kidney, spleen, thymus, costochondral junction, endocrine organs, and representative sections of the gastrointestinal tract. At a minimum, the weights of the brain, heart, lungs, liver, kidneys, thymus, and spleen should be recorded. Blood and urine should be collected. If scene investigation, history, or autopsy suggests exposure to drugs (illicit, prescription, over-the-counter, or of a home-remedy nature), toxicology tests should be performed to evaluate suspected drugs. As a routine, a screening should be conducted to rule out ethanol and major classes of sedatives and stimulants (including cold medications, if being used) that might have caused or contributed to the death. Salicylates, acetaminophen, and carboxyhemoglobin can be tested as indicated by case-specific information.

Document Infant's Medical History

A medical history of the infant should be conducted to identify any birth-related problems and to assess the infant's growth, development, immunization history, and medical history. (Medical records should be used, when available.)

Determine Previous Sibling Deaths

It should be established whether there have been any previous unexplained deaths of infant or child siblings. If so, relevant details should be obtained. (Official records should be reviewed.)

Document Previous Encounters with Social Services and Law Enforcement

It should be established whether there have been previous social service or police contacts or interventions in the home. If so, the details should be obtained. (Official records should be reviewed.)

Draw Vitreous Fluid

Vitreous fluid should be collected for possible use as an adjunct to toxicology testing or if metabolic or hydration status is an issue. Care must be taken not to compromise an internal eye examination for retinal hemorrhages, if required.

Collect DNA Sample

A DNA sample should be archived for genetic testing, if indicated.

Perform Metabolic Screening

Metabolic screening results should be determined from the medical birth record. A blood-spot card should be prepared and retained in case autopsy findings suggest a metabolic disorder such as fatty-acid oxidation disorder. If the liver is fatty, and birth screening results are not available, the blood should be tested for common fatty-acid oxidation disorders such as medium chain Acyl-CoA dehydrogenase deficiency.

INVESTIGATIVE ADEQUACY

It is necessary to assess the adequacy of the investigation so that one can decide whether to assign a cause of death or to list the cause of death as “unclassified,” which means that a critical element of the investigation is lacking. The certifier of death ultimately will have to make this decision by comparing investigative and autopsy information along with the considered professional judgment of all those who participated in the death investigation.

Investigative Questions for Infant Death Investigations

The initial infant investigation should be geared toward documenting both general and specific case details. The goals of this process are to provide the pathologist with meaningful information relevant to the cause and manner of death and to guide the pathologist in case management and decision making. General case documentation may be gathered using the SUIDI Reporting Form or jurisdictionally approved equivalent. Listed below are questions considered critical to the investigation of SUID:

- What is the infant's name and DOB?
- What is the birth mother's date-of-birth?
- When was the infant put down to sleep?
- In what position was the infant put down?
- Who found the infant?
- Did you hear or check on the infant during the interim?
- In what position was the infant found?
- Where was the infant when found?
- What was the surface like where the infant was found?
- Was anything covering the infant's nose and mouth?
- Was the room extremely hot or cold?
- Did you notice any fluids on the bedding?
- What was the infant wearing?
- How many blankets were over the infant?
- Did the mother smoke tobacco products while pregnant?
- What was the general appearance of the residence?
- When was the infant last fed?
- Was the infant ill or on any medication?

Investigative Questions for the Pre-Autopsy Report (Detailed in Chapter 8)

In addition to addressing the Investigative Questions above, several specific questions should also be answered early in the investigation and before the autopsy. In general, these issues would be addressed with the finder, typically the person who discovered the infant dead or unresponsive. However, the answers to these questions might need to be obtained from more than one person. Investigation should be focused on addressing the following major issues and on whether preliminary investigation suggests any of the following:

- Asphyxia.
- Sharing of sleeping surface.
- Change in sleeping condition (unaccustomed stomach sleeping).
- Hyperthermia/hypothermia.
- Environmental hazards (carbon monoxide, noxious gases, chemicals, drugs, devices).
- Unsafe sleeping conditions (couch, waterbed, stuffed toys, pillows, soft bedding).
- Diet (introduction of new food type).
- Recent hospitalization.
- Previous medical diagnosis.
- History of acute life-threatening events.
- History of medical care without diagnosis.
- Recent fall or other injury.
- History of religious, cultural, or ethnic remedies.
- Cause of death due to natural causes other than SIDS.
- Prior sibling deaths.
- Previous encounters with police or social service agencies.
- Request for tissue or organ donation.
- Objection to autopsy.
- Pre-terminal resuscitative treatment.
- Death due to trauma (injury), poisoning, or intoxication.
- Suspicious circumstances.
- Other alerts for pathologist's attention.

All of the above information, including the written narrative of reported circumstances, should be available to the pathologist before the autopsy.

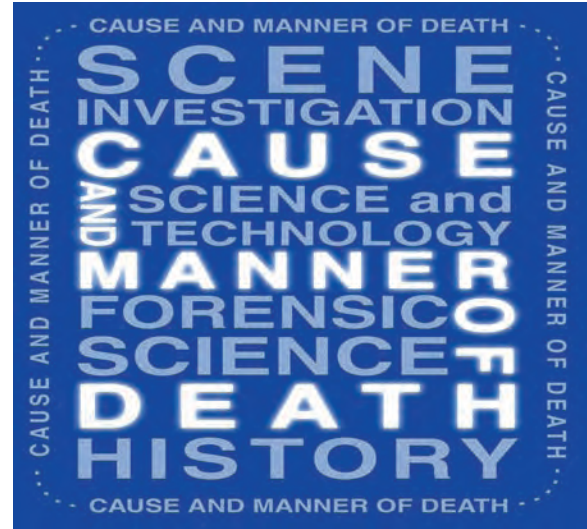
IDENTIFY GRAY ZONE FINDINGS

A “gray zone” finding is a disease condition, possible stressor, or possible external condition that might have contributed to death but for which a cause-and-effect relationship is difficult to establish or rule out. It is essential for the infant death investigator to document any potential causes of death at the scene and report them to the pathologist before the autopsy procedure begins.

It is recommended that the following conditions, if present in a specific case, be reported on the death certificate, especially under Part II: Other Significant Conditions:

- Sharing the same sleep surface such as a bed or sofa (bedsharing).
- Unsafe or soft sleep surface.
- Previous unexplained death of infant sibling.
- Excessive blanketing or wrapping.
- Face-down position when found.
- Intoxication (defined as detection of a substance in infant's system).
- Change in usual sleep position, location, and/or surface.
- Injuries of unknown significance (specifying the type).
- Disease conditions of unknown significance.

It is important to report on the death certificate any of the above conditions that are identified in an infant death investigation when the cause of death has not been determined but is consistent with SIDS. These items of information are important because each has been identified as a possible stressor that can contribute to the death of a vulnerable infant during a critical developmental stage (Triple Risk Model). Using the SUIDI Reporting Form or jurisdictionally approved equivalent, in conjunction with the forensic autopsy, will provide the necessary information to determine whether any of these conditions existed in the case in question.



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unit

— Reporting Cause of Death in SIDS-Like Cases

INTRODUCTION

There are approximately 2,285 medicolegal jurisdictions in the United States administered by medical examiners or coroners. These individuals are charged with the responsibility of certifying each medicolegal death that occurs within their jurisdiction—which includes SUID. Official death certification is recorded on the death certificate and used by local, state, national, and even international agencies for surveillance and prevention activities. It is essential that cause-of-death statements placed on the death certificate be accurate and consistent regardless of who completes the certificate. This can be problematic with all SIDS-like cases sharing the same International Classification of Diseases (ICD) code: R95 SIDS. Data pointing to other risk factors that may have contributed to or even caused the death might not be documented as no "traditional" certifying methods address this concern. This unit suggests methods of expressing known infant stressors or possible external causes of death on the standard death certificate.

CAUSE AND MANNER OF DEATH STATEMENTS

Every death certificate has a section for the certifier to list the cause and manner of death. This is a critical part of the certificate, as national health statistics use this information to code deaths. The following is a brief explanation of each.

Cause of Death

The cause of death is assigned by the official certifier, typically the medical examiner or coroner for the medicolegal jurisdiction where the death was reported. The cause of death is generally considered the disease or injury precipitating death. In addition to the *immediate* cause of death, listed in Part I of the cause of death section of the death certificate, any supporting or *underlying* causes of the death are also listed (i.e., Due to, or as a consequence of). Part II requires the certifier to list any other significant conditions that may have contributed to the death but were not stated in Part I.

Manner of Death

The manner of death is also assigned by the official certifier, typically the medical examiner or coroner for the medicolegal jurisdiction where the death was reported. The manner of death is how the death occurred and will fall into one (or more) of the following categories:

- Natural.
- Accident.
- Suicide.
- Homicide.
- Undetermined.
- Pending.

CODING SIDS IN THE ICD

Causes of death on all death certificates registered in the United States are classified and coded according to the Tenth Revision of the International Classification of Diseases (ICD-10). SIDS and related cause-of-death statements are coded as R95 in ICD-10. ICD-10 coding standards result in a code of R95 for the cause of death when the death certificate indicates any of the following statements:

- Sudden, unexplained infant death.
- Sudden death during infancy: no identifiable cause.
- Consistent with the definition of Sudden Infant Death Syndrome.
- Consistent with Sudden Infant Death Syndrome.
- Sudden Infant Death Syndrome.

SUGGESTED CAUSE OF DEATH REPORTING METHODS

The following examples are provided to illustrate various methods of formatting cause of death statements on the death certificate.

Classic SIDS (Figure 9.1)

A four-month-old infant dies in sleep, supine, complete investigation, autopsy, toxicology, etc., with no likely external causes identified. The words “Consistent with Sudden Infant Death Syndrome” or “Sudden Infant Death Syndrome” are also acceptable for Part I if the death is determined to be SIDS. In this case the "Undetermined" manner is preferred.

PART I IMMEDIATE CAUSE	
A. Sudden Unexplained Infant Death	
Due to, or as a consequence of	
B.	
Due to, or as a consequence of	
C.	
PART II OTHER SIGNIFICANT CONDITIONS Conditions contributing to death but not resulting in the underlying cause of death in Part I	
Manner of Death	How Injury Occurred
Undetermined	Undetermined if external causes were involved.

Fig. 9.1: Note that the Manner of Death is Undetermined and that the "How Injury Occurred" box contains an explanatory comment.

Sleep Surface Sharing (Figure 9.2)

A three-month-old infant found dead in parent's bed, prone, complete investigation, autopsy, toxicology, etc., with no external causes identified except sharing the bed with the parents. If a condition such as sharing of a sleep surface (which could be a stressor or possible external cause of death) needs to be reported on the death certificate, the following format is preferred and recommended because it allows sufficient room for details and explanations.

PART I IMMEDIATE CAUSE	
A. Sudden Unexplained Infant Death	
Due to, or as a consequence of	
B.	
Due to, or as a consequence of	
C.	
PART II OTHER SIGNIFICANT CONDITIONS Conditions contributing to death but not resulting in the underlying cause of death in Part I	
Manner of Death	How Injury Occurred
Undetermined	Undetermined if external causes were involved. Sharing sleep surface with 2 adults

Fig. 9.2: Note the additional explanation of a possible stressor.

Placement of the stressor, as shown in Figure 9.2, may be construed by some individuals to mean that the certifier believes that bedsharing (or any other condition) specifically caused the death. An option would be to report stressors as a risk factor in the "Other Significant Conditions" box in Part II as illustrated in Figure 9.3.

PART I IMMEDIATE CAUSE	
A. Sudden Unexplained Infant Death	
Due to, or as a consequence of	
B.	
Due to, or as a consequence of	
C.	
PART II OTHER SIGNIFICANT CONDITIONS Conditions contributing to death but not resulting in the underlying cause of death in Part I	
Sharing sleep surface with 2 adults	
Manner of Death	How Injury Occurred
Undetermined	Undetermined if external causes were involved.

Fig. 9.3: The risk factor "sharing sleep surface with 2 adults" is stated in the "Other Significant Conditions" section of the death certificate.

A third formatting option for a case involving a suspected "stressor" is shown in Figure 9.4.

PART I IMMEDIATE CAUSE	
A. Sudden Unexplained Infant Death associated with bedsharing with adults	
Due to, or as a consequence of	
B.	
Due to, or as a consequence of	
C.	
PART II OTHER SIGNIFICANT CONDITIONS Conditions contributing to death but not resulting in the underlying cause of death in Part I	
Manner of Death	How Injury Occurred
Undetermined	Undetermined if external causes were involved.

Fig. 9.4: Placing the possible "stressor" in Part I of the death certificate may be preferred by some certifiers.

No Forensic Autopsy (Figure 9.5)

Three-week-old infant dies in the emergency room of a local hospital for no apparent reason. The hospital physician signs the death certificate SIDS and releases the body to the family. Two weeks later, the medical examiner is reviewing county death certificates and notices the case. When a SUID did NOT have a complete scene investigation, review of clinical history, or autopsy, the SIDS diagnosis should NOT be used. Instead, the death should be reported as "unclassified."

PART I IMMEDIATE CAUSE	
A. Unclassified Infant Death	
Due to, or as a consequence of	
B.	
Due to, or as a consequence of	
C.	
PART II OTHER SIGNIFICANT CONDITIONS Conditions contributing to death but not resulting in the underlying cause of death in Part I	
Manner of Death	How Injury Occurred
Undetermined	Undetermined if external causes were involved. Found dead in bassinette. No autopsy was performed.

Fig. 9.5: No scene, no autopsy, no SIDS.

4. Complete Investigation (Figure 9.6)

A 11-month-old infant dies suddenly at home. A complete investigation is done without significant findings; the coroner orders an autopsy, which also produces no significant findings. The body is released to the family, who then contact the funeral home. If the investigation and autopsy disclose that an infant's death was not consistent with the definition of SIDS, yet no cause of death has been definitively established, the following format is recommended.

PART I IMMEDIATE CAUSE	
A. Unexpected and Undetermined Cause	
Due to, or as a consequence of	
B.	
Due to, or as a consequence of	
C.	
PART II OTHER SIGNIFICANT CONDITIONS Conditions contributing to death but not resulting in the underlying cause of death in Part I	
Manner of Death	How Injury Occurred
Undetermined	Undetermined if external causes were involved. Cause of death undetermined after complete investigation.

Fig. 9.6: Complete investigation and autopsy without significant findings, but the death is not consistent with the definition of SIDS.

STANDARD FORMATTING

A standardized reporting format is needed so that mortality data on infants are more comprehensive and easily interpreted. Good data will allow for better analysis and research on the causes of SUID. Adhering to the formats shown will foster consistency in death certification methods and allow the certifier to include a more descriptive explanation for their cause-of-death finding. Adhering to a standard format will allow distinction of uncomplicated SIDS/OID cases, cases with gray zone disease and/or other stressors, cases with inadequate investigation, and cases ultimately remaining unexplained but not consistent with SIDS.

In some infant deaths, a specific cause of death can be determined. Such deaths may be certified using standard methods.

Summary

DISCUSSION QUESTIONS

1. Describe the minimum set of information to be collected during infant death scene investigation in order to consider an investigation adequate.
2. Describe the minimum extent of autopsy in order to consider an autopsy adequate.
3. Describe the minimum set of information to be collected using laboratory testing in order to consider an investigation adequate.
4. Describe the minimum set of information to be collected from medical and other records during infant death investigation in order to consider an investigation adequate.
5. Describe potential stressors and other gray zone conditions that should be evaluated and reported on the death certificate.
6. Describe the formats that can be used to complete the death certificate for uncomplicated SIDS cases, cases involving gray zone medical conditions and/or stressors, deaths in which no cause of death has been identified but the circumstances are not consistent with SIDS, and deaths in which the extent of investigation was not adequate.
7. Discuss why multiple choices for wording the cause of death in SIDS cases do not affect official coding of the cause of death.
8. Discuss why natural or undetermined classification in the manner of death of an SIDS case is acceptable.
9. Discuss how SIDS is different from other causes of SUID, such as overlaying, wedging, or obstruction of the nose or mouth.

SAMPLE QUESTIONS

1. Which of the following would make an SUIDI fall into the category of “inadequate” for the purpose of death certification?
 - A. Lack of doll reenactment.
 - B. Failure to investigate the mother’s pregnancy history.
 - C. Failure to perform an autopsy.
 - D. Not taking the temperature of the dead infant.
2. The ICD code for SIDS is
 - A. S50.
 - B. R95.
 - C. T40.
 - D. A26.
3. What wording can be used to indicate that a cause of death is not consistent with SIDS but remains unexplained after complete investigation?
 - A. Sudden infant death.
 - B. Undetermined.
 - C. Unexpected and undetermined causes.
 - D. Unclassified infant death.

4. Approximately how many critical, general investigative questions (key issues) need to be addressed when conducting an SUIDI?
 - A. 5.
 - B. 25.
 - C. 95.
 - D. 100.

5. In reference to infant deaths, wedging refers to
 - A. Compression of the face or thorax between or against objects.
 - B. The tongue falling back into the throat.
 - C. Placing a pillow against the infant to keep the infant in a particular position.
 - D. Placing the infant next to the bumper pad in a crib.

6. A SUID-like death in which the infant died while sleeping in an adult bed with two adults involves
 - A. Child abuse.
 - B. Negligence.
 - C. A possible risk factor or stressor.
 - D. A non-natural cause of death.

7. In reference to the infant in a SUID-like death, intoxication means
 - A. A negative blood alcohol level.
 - B. Excessive intake of water.
 - C. The presence of a prescription drug in the infant's home.
 - D. Detection of an exogenous substance in the infant's system.