

# SUID

Sudden Unexpected Infant Death

“not every infant who dies in a crib dies of crib death.”

Sudden Unexpected Infant Death (SUID)  
Sudden Infant Death Syndrome (SIDS)  
Sudden Unexplained Infant Death (SUID)

# Definitions

# Sudden Unexpected Infant Death

## Definition:

- SUID is the sudden and unexpected death of an infant in which the **manner** and **cause of death** are not immediately obvious prior to investigation.
- Emergency Department in the frontline to face this issue.
- SUID could be due to **natural, accidental, negligence** or **homicidal** causes .
- Current Situation:
- Inaccurate reporting
- Non-standard practices of classifying infant deaths

# Sudden Infant death Syndrome (SIDS)

## Definition:

- 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**.
- SIDS occurs suddenly without warning, often during periods of sleep.

# Classification of Sudden Unexpected Infant Death (SUID)

- Sudden infant death syndrome (SIDS) is one of several causes of SUID, but it is the most frequently reported. It is a diagnosis of exclusion, through a careful case investigation, which includes a thorough examination of the death scene, a complete autopsy, and a review of the infant's medical records. SIDS currently accounts (50% ) of SUID yields.
- **Unknown Cause:** The sudden death of an infant less than 1 year of age that cannot be explained because a thorough investigation was not conducted and cause of death could not be determined. (26%)
- **Sleep-related infant deaths:** accidental suffocation and strangulation in Bed. Suffocation by soft bedding such as a pillow or waterbed mattress. Overlay when another person rolls on top of or against the infant while sleeping. Wedging or entrapment when an infant is wedged between two objects such as a mattress and wall, bed frame, or furniture. Strangulation such as when an infant's head and neck become caught between crib railings. (18%)
- In approximately (10%-20%) of cases of SUID a specific cause of death is identified
  - **Accidental** versus **Neglect** (hyperthermia, hypothermia, carbon monoxide poisoning, drowning...) 3%
  - **Homicide:** Infanticide and intentional suffocation (1%-4%)
  - **Natural Diseases:** Infections 5%. Congenital anomalies 7%. Metabolic disorders 1%



**Figure 8** The diagnosis of SIDS is difficult due to lack of positive criteria and potential overlap of findings.

# SUID Investigation

**Homicide**

**Metabolic disorders**

**Natural causes**

**Premature low birth weight**

**Suffocation**

**SIDS**

Sudden Infant Death Syndrome

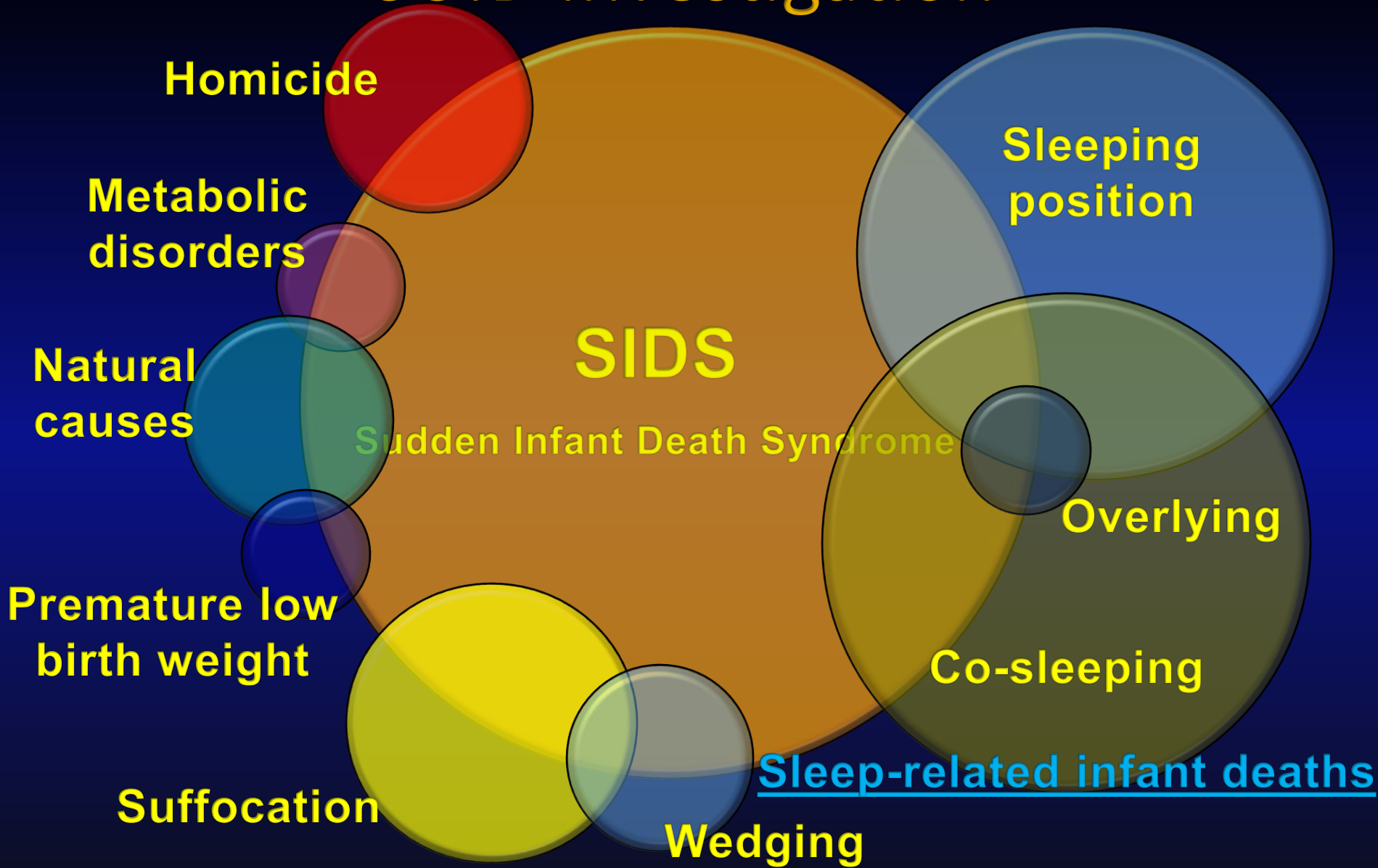
**Sleeping position**

**Overlying**

**Co-sleeping**

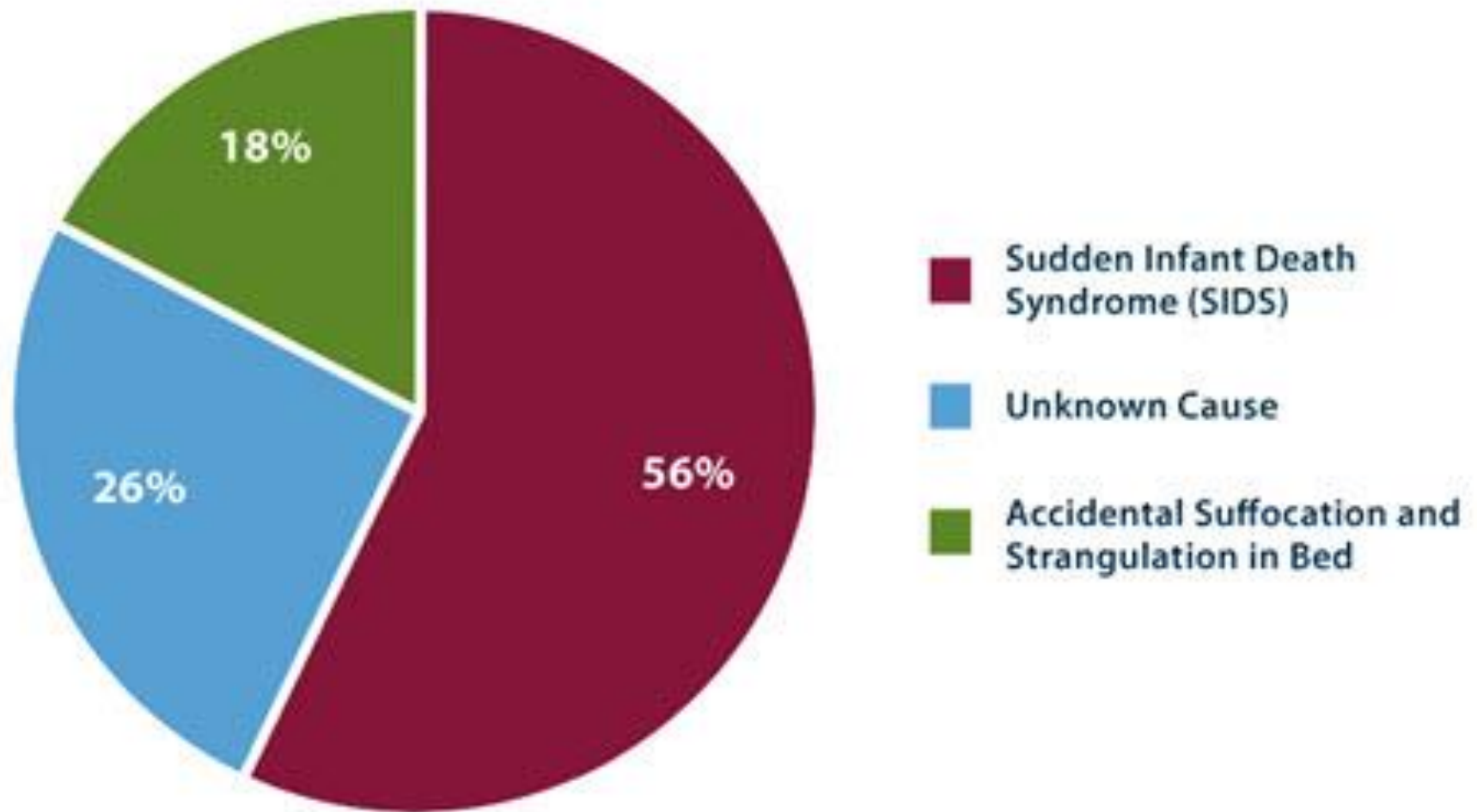
**Sleep-related infant deaths**

**Wedging**





## Breakdown of Sudden Unexpected Infant Death by Cause, 2011



# Sudden Unexpected Infant Death

Emergency Department

Complete autopsy  
Death scene investigation  
Review of the clinical record

No SUID  
Investigation

SUID  
Investigation



Unexplained

Unexplained

Explained

unknown  
unspecified

**Sudden Infant Death Syndrome SIDS**  
Consistent with the definition of SIDS  
Consistent with SIDS  
SIDS, but cannot rule out suffocation  
from unsafe sleep environment

Accidental suffocation  
Accidental Head injury  
Metabolic disorder  
Infanticide Neglect  
Hypo or hyperthermia

**R99**

**Sudden Unexplained Infant Death**

**R95**

# Why it is Crucial to have a Diagnosis of SUID cases?

## Family Level

Diagnosis is needed to **Support and Protect child's Family**

### Immediate:

- **Natural & Accidental:** support of parents or caregivers (issues of guilt , blame etc...).
- **Homicidal:** justice, protections of other children.

### Long term:

- **Natural:** prevent similar conditions in siblings.
- **Accidental:** raising awareness and good parenting.
- **Homicidal:** justice, protections of other children.

## National Level

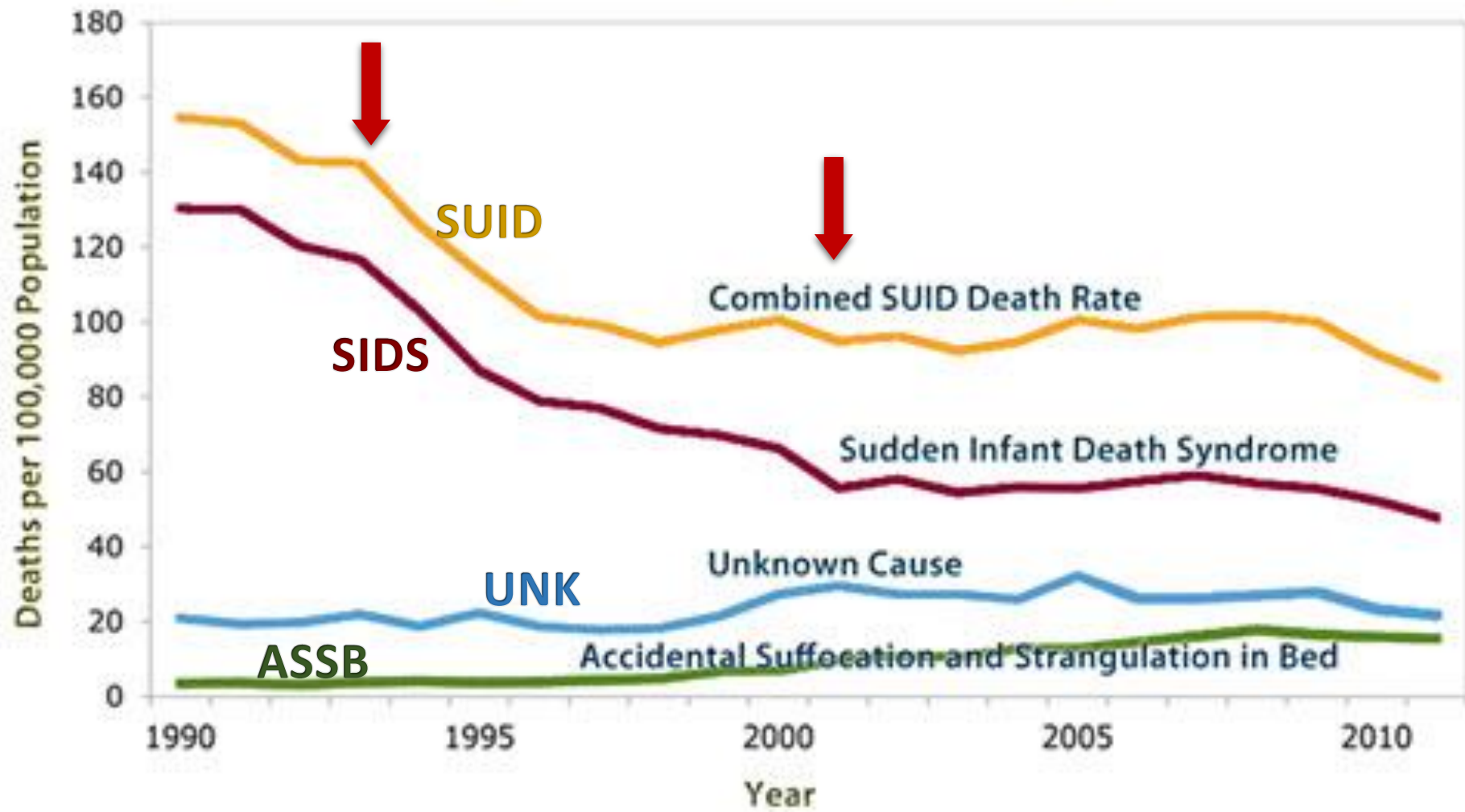
Data are needed for **Public Health** strategic planning

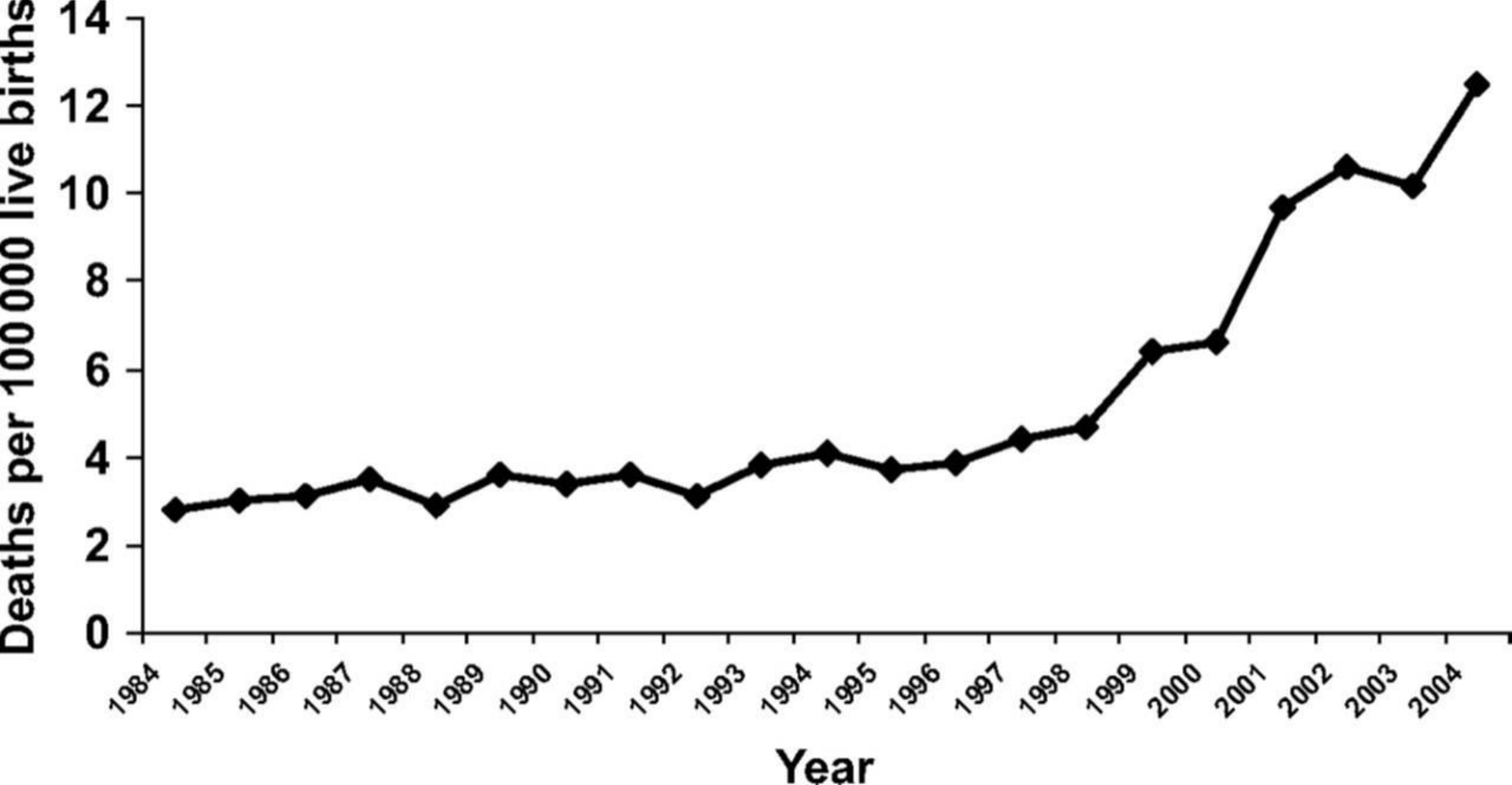
- 1) Infant mortality at the national level
- 2) Monitor trends in SUID
- 3) Conduct research to identify risk factors
- 4) Design and evaluate intervention and prevention programs

# Epidemiology SIDS

- Incidence between 0.3 and 1.5/1,000 live births.
- SIDS is the most common cause of death in infants aged one to eight months and the third leading cause of infant mortality, after congenital anomalies and short gestation and low birth weight.
- Since the early 1990s, SIDS rates have declined by more than 50%, in large part due to the Back-to-Sleep Campaign's.
- SIDS occurs most commonly in infants two to four months of age and rarely after eight months of age.
- SIDS also occurs more frequently in African Americans, American Indians, and Alaska Natives than in Caucasians.

# Trends in Sudden Unexpected Infant Death Rates by Cause, 1990-2011

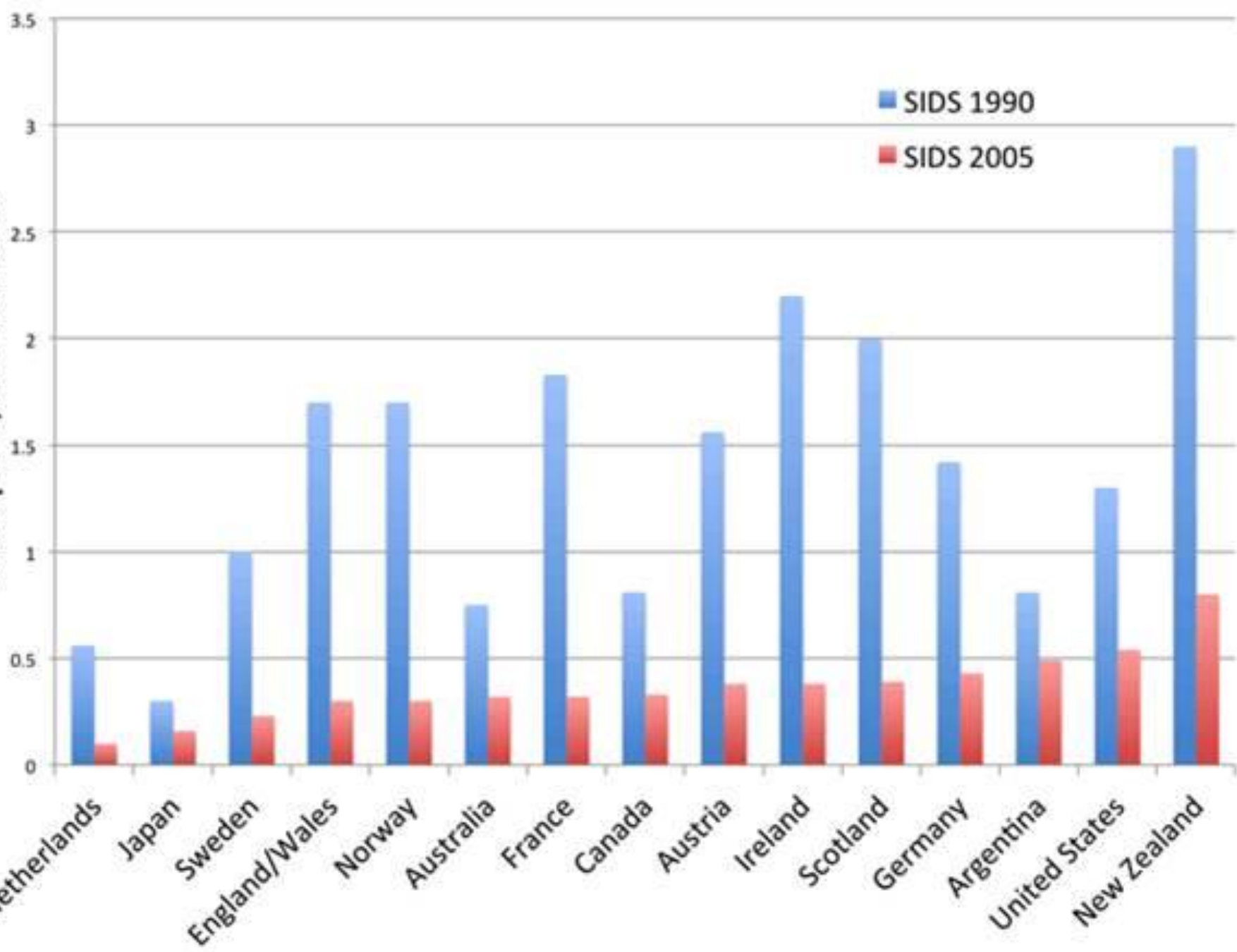




(accidental suffocation and strangulation in bed-ASSB)  
Rates per 100,000 Live Births, United States, 1984-2004

Shapiro-Mendoza. Pediatrics 2009;123:533-539  
Copyright ©2009 American Academy of Pediatrics

Rates per 1,000 live births



# Etiology and Risk Factors of SIDS

The cause of SIDS is unknown, and it has no pathological or genetic explanation till now.

Modifiable risk factors for SIDS include:

1) Sleep environment:

- Stomach and side sleeping positions.
- Overheating.
- Soft sleep surfaces.
- Loose bedding.
- Inappropriate sleep surfaces (such as a sofa or water bed).
- Sharing the same sleep surface.

2) Parent who is excessively tired or under the influence of alcohol or drugs.

3) Maternal smoking during pregnancy

4) Maternal drug use during pregnancy

5) Environmental tobacco smoke

Continue ... 2



# Etiology and Risk Factors of SIDS

Continued... Modifiable **risk factors** for SIDS include:

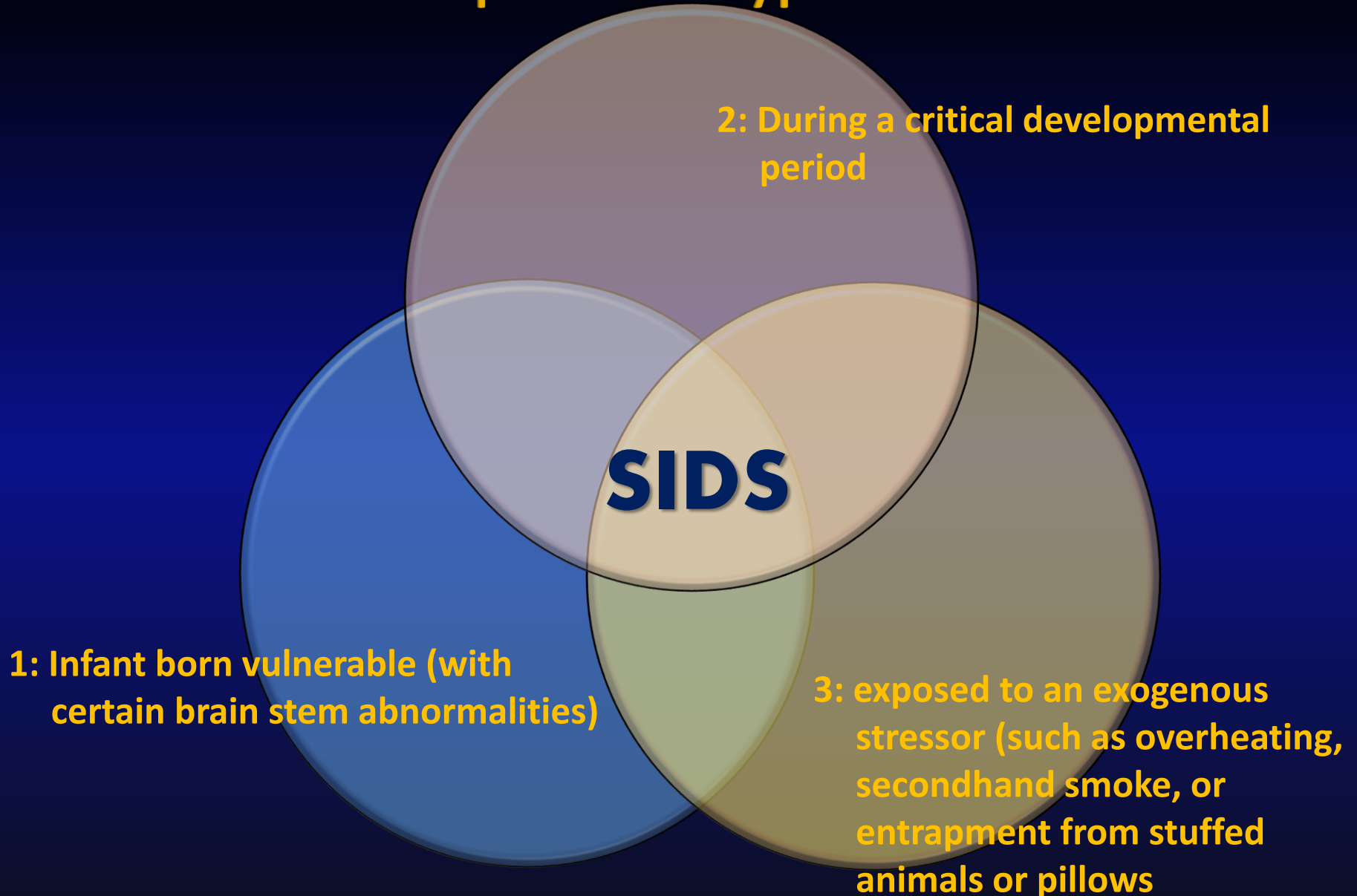
- 6) Late or no prenatal care
- 7) Mothers of lower age, education, income
- 8) Mothers not breast feeding infants
- 9) Prematurity and/or low birth weight
- 10) Male sex M:F 3:2
- 11) Race-ethnicity (in USA African American and Native American)

# most of the above risk factors are “unsafe practices” and “negative parental behavior” and are preventable

## Established Protective Factors for SIDS

- 1) Pacifier use when placed for sleep
- 2) Room sharing without bed sharing
- 3) Breastfeeding

# Triple-Risk Hypothesis



# Asphyxia and Suffocation

# Asphyxia and Suffocation

- Asphyxia or suffocation is caused by the inability to breathe.
- This condition leads to a lack of oxygen in the body, which can lead to loss of consciousness and death.
- Asphyxia can be caused by choking, constriction of the chest or abdomen, strangulation, narrowing of airway passages (severe allergic reaction or reactive airway disorders), or the inhalation of toxic gases.
- Common objects that are involved with asphyxia or suffocation include plastic bags, soft pillows, and soft materials such as bedding or stuffed animals.
- These objects can occlude the mouth and nostrils, causing suffocation.
- The most commonly reported cause of asphyxia in infants is accidental suffocation and strangulation in bed.

# Asphyxia and Suffocation

- Determine whether the manner of death was accidental or intentionally inflicted.

## Interfered with breathing:

- Overlaying or accidental suffocation on a shared sleep surface.
- Accidental strangulation from unsafe surroundings.
- Wedging or entrapment.
- Immersion in water or drowning.
- Choking. Aspiration.
- Neck compression
- Rebreathing

## Overlaying

- Occurs when adults share sleep surfaces with infants and unknowingly “rollover” the infant while asleep, causing the infant to suffocate.
- Document who is the person sleeping near the infant, including his or her approximate weight, height, and age.
- The investigator should **document the found position** of the infant and anyone else who was in bed with the infant using a doll reenactment.
- **Photographs** of the reenactment will assist the pathologist in determining cause of death.

- Wedging typically occurs when an infant gets “stuck” between two objects. Sleep in:
  - Cribs with a mismatched mattress
  - Sofas with “overstuffed” cushions.
- **Photographs** of the doll reenactment are critical to the pathologist.
  - found positions
  - sleeping surfaces, surrounding objects (pillows, cushions, etc.)
- **Measurements** documenting distances between objects (mattress and bed frame, gap between cushions, mattress and wall, etc.)

- Occurs when items lodge in the infant's airway passages i.e. food, toys, and other small objects...
- peak age is between 2 and 3 years with most cases occurring under 5 years.
- Anything small enough to fit in the child's mouth is a potential choking hazard.
- Investigators should ask questions about the **child's behavior** and **activities** prior to death and investigate the **surrounding area for objects** that may pose a choking risk.
- Answers **documented**, and the areas and objects located near the infant should be **photographed**.



- Obstruction of nose or Mouth by any object placed or pressed up against an infant's face can be a potential asphyxiation risk.
- This does not always occur during sleep; infants have asphyxiated while lying on pillows.
- **Photographic documentation of the sleeping environment** (including pillows, stuffed animals, blankets, etc.) as well as the **placed and found positions** can help determine if potential obstruction of the nose or mouth occurred.

- Rebreathing typically occurs when an infant's face (nose and mouth) is tucked into an enclosed space or "pocket" created by bedding or clothing.
- **Photographs** of the found position and sleeping environment are critical in such cases.

## Neck compression

- Can happen by any object or neck position. Premature infants placed in car seats or “infant” rockers with poor neck support have been known to asphyxiate due to neck compression. The weight of the infant’s head is enough to cause this to happen.
- **Photographs of both placed and found positions** using the doll reenactment as well as the apparatus the infant was found.

Asphyxia

Strangulation  
between bed railings

It is impossible to distinguish at autopsy between SIDS and intentional asphyxiation with a soft object.

- Previous history of abuse or the presence of its risk factors.
- Age at death older than 6 months
- Previous unexpected or unexplained deaths of 1 or more siblings
- Simultaneous or nearly simultaneous death of twins
- Previous death of infants under the care of caregiver.
- Small injuries or spots of blood.

- Accidental drowning: usually 4 years and 15–19 years
- Homicidal: infants can be hold under water without notable resistance..
- The diagnosis of drowning may not be straightforward and depends on circumstantial evidence and the exclusion at autopsy of underlying natural diseases or inflicted trauma.
- Interviewing parents and documenting the circumstances of death will provide the information necessary to determine Cause of death and Manner of Death.

# Diseases that cause Sudden Death in Infants and Children

Cardiac

Vascular

Infectious

Respiratory

Central nervous system

Hematological

Gastrointestinal

Genitourinary

Metabolic

Endocrine

Miscellaneous

Connective tissue disorders: Marfan syndrome, Ehlers–Danlos syndrome type IV

Skeletal disorders: achondroplasia

# Metabolic Error

- Inborn errors of metabolism are rare genetic disorders that stop or prevent the body from turning food into energy.
- These disorders are usually caused by defects in the enzymes that help break down foods in the body.
- When the body cannot process these foods, a buildup of toxic substances or a deficiency of substances needed for normal body function can occur. This buildup can be fatal if not controlled with diet or medication.
- Some metabolic diseases are inherited. **Medium chain acyl-CoA dehydrogenase deficiency** is one type of metabolic disorder thought to account for a small percentage of SUID.
- Other examples of metabolic disorders and conditions are **maple syrup urine disease, phenylketonuria, G6PD deficiency, and galactosemia.**



# Injury and Trauma

## Infanticide

# Injury or Trauma

- Injuries account for approximately 5% of infant deaths
- Injuries can be fatal or nonfatal, and they can occur unintentionally or intentionally (because of purposeful acts of harm).
- An adult physically abusing an infant is an example of an intentional injury.
- Shaken baby syndrome (SBS) is one form of abusive head trauma that occurs when an infant or young child is violently shaken or struck against a hard or soft surface. Shaking may cause bleeding over a large portion of the brain. SBS can cause severe brain damage as well as death. In SBS, there may be no signs of injury on the infant.

# Falls from Heights

- History of a short fall from height, is the usually given by parents when injury is suspected, but this is less lethal as it used to be believed.
- After a thorough examination most of this cases end to be “non-accidental head injury”
- Investigation: full autopsy, with clear documentation of injuries, including radiographs, independent verification of the history, and examination of the scene or scene photographs.
- Poisoning and Drug Toxicity

# Physical Abuse

- **Abusive Head Injury**
- **Shaken Baby Syndrome:** (most commonly less than 1 year old but it may occur up to 4 years old, never after 5 years old)
- **Impact injuries:** occurs in the first several months of life, picture not consistent with short fall.
- **Thoracoabdominal Injuries.**

# Poisoning and Drug Toxicity

- Deaths Related to Animal Activity



Munchausen syndrome by proxy  
Factitious disorder by proxy.

Unknown or  
Unclassified Causes

# Unknown or Unclassified Causes

- “Unknown” or “Unclassified” is assigned as a cause of death if
  - 1) the death scene investigation and/or
  - 2) autopsy were incomplete or not done and
  - 3) the death certifier has insufficient evidence to record a more specific cause of death.
- The way the cause and manner of death are reported on the death certificate depends on the circumstances of the case.

# Forensic Approach to SUID



# The Role of Autopsy Scene Investigation Clinical Record Review

# Role of Forensic Pathologist

- 1) Scene Investigation
- 2) Autopsy
- 3) Interpretation of Results of Scene and Autopsy
- 4) Certify Cause, Mode and Manner of Death
- 5) Unbiased Expert Witness
- 6) Testify in Court
- 7) Surveillance of Violence, Injuries, and Sudden Deaths.
- 8) Education based on clinical and pathology practice.
- 9) Clinical Forensic Medicine integration with forensic pathology.

# SUID Scene Documentation

## Sleep Surface Sharing

With Adults, With Children, With Pets

## Sleeping Condition Changes

Position Change, Location Change, Surface (bed) Change

## Unsafe Sleeping Conditions

Soft/Lumpy/Concave Sleeping Surface

Broken or Mismatched Crib/Bed/Mattress

Worn/Torn/Stained/Unclean/Wet Bedding

Cords/Wires)

## Hyperthermia/Hypothermia Concerns

Excessive Wrapping/Blanketing/Clothing

Hot or Cold Environment

# SUID Scene Documentation

## Environmental Hazards

Carbon Monoxide

Cleaning Chemicals and Sprays

Electricity and Devices Operating in the Area

Exposure to Illegal Drugs and Cigarette Smoke

Ligatures (Cords, String, Electrical Cords/Wires)

Bathtub

Possible origin of foreign bodies

# Distinguish SIDS from other causes of SUID

- Complete Scene Investigation
- Complete X-Rays of Infant
- Perform complete forensic Autopsy
- Draw Vitreous fluid
- Collect DNA Sample
- Perform Metabolic Screening
- Document
  - Infant's Medical History
  - Previous Sibling Deaths
  - Previous Encounters with Social Services and Law Enforcement
- Death Certification >>>

# INTERNATIONAL FORM OF MEDICAL CERTIFICATE OF DEATH

Cause of death	Approximate interval between onset and death
<b>I</b> Disease or condition directly leading to death *)	.....
a)..... due to (or as a consequence of)	.....
<b>Antecedent causes</b> Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last	.....
b)..... due to (or as a consequence of)	.....
c)..... due to (or as a consequence of)	.....
Part II is for unrelated but contributory conditions.	.....
Part I of the form is for diseases related to the train of events leading directly to death; the immediate cause of death, underlying causes. (i.e., Due to, or as a consequence of).	.....

*\*This does not mean the mode of dying, e.g. heart failure, respiratory failure. It means the disease, injury, or complication that caused death.*

# “Causes of death” definition

In 1967 the Twentieth World Health Assembly defined the causes of death to be entered on the medical certificate of cause of death as:

“all those diseases, morbid conditions or injuries which either resulted in or contributed to death and the circumstances of the accident or violence which produced any such injuries”

# Causes of Death Certification

## The Cause of Death Must include

- All the relevant information (the certifier does not select some conditions for entry and reject others)
- Manner of death

## The Cause of Death does not include

- Symptoms and
- Modes of dying, (Heart failure or respiratory failure).
  
- **An example of a death certificate with four steps (part 1) in the chain of events leading directly to death is:**
  - (a) Pulmonary embolism
  - (b) Pathological fracture
  - (c) Secondary carcinoma of femur
  - (d) Carcinoma of breast



# Manner of Death

The manner of death is also assigned by the official certifier. 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.

**R95** Sudden infant death syndrome  
**R96.1** Death known not to be violent for which no cause can be discovered.  
**R99** Unknown cause of mortality

**T71** Asphyxiation  
**W65** Drowning and submersion while in bath-tub  
**W75** Accidental suffocation and strangulation in bed  
**W78** Inhalation of gastric contents  
**W80** Inhalation and ingestion of other objects causing obstruction of respiratory tract  
**Y06** Neglect and abandonment

**T17** inhalation of food or foreign body  
**T74.1** Physical abuse  
**T74.4** shaken infant

**Munchausen syndrome by proxy; factitious disorder by proxy**

# ICD-10

International  
Statistical  
Classification  
of Diseases and  
Related Health  
Problems

---

**Tenth Revision**

---

Volume 1

**Second Edition**



World Health Organization  
Geneva

# ICD 10 Code R95

When we should use ICD 10 Code R95?

- 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.

**PART I IMMEDIATE CAUSE**



**A.** Sudden Infant Death Syndrome

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

Natural

**A four-month-old infant dies in sleep, supine, complete investigation, Medical records, Scene, Autopsy, Toxicology, etc., proved no external causes identified.**

**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 cradle. No autopsy performed.



**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. In reviewing this death certificate; complete scene investigation, review of clinical history, or autopsy, was not done. SIDS diagnosis should NOT be used.**

# SIUD Scene of Death & Doll Simulation

# SIUD Scene of Death

## Need for better SUID Investigations

### ▪ **Without a complete death scene investigation**

Difficult to determine cause and manner-of-death

- Pathologist conducting autopsy at disadvantage
- Evidence for child death review & for court cases limited

### ▪ **With a complete death scene investigation**

Improved classification and reporting of SUID leads to valid and reliable data

- Monitor trends in SUID
- Conduct research to identify risk factors
- Design interventions to prevent SUID
- Evaluate programs aimed at prevention

# Doll Simulation

A Death Scene Investigation needs to be performed on All Infant Deaths Even if baby was transported to hospital.

Asphyxia plays a greater role in many sudden infant deaths than has been previously reported.

A re-creation doll is an essential tool in the investigation



Responding to a SUID in the emergency department presents challenges from an emotional, cultural, procedural and legal perspective.

A team-based approach to provide family-centered care that is personal, individualized, compassionate and culturally sensitive is recommended.