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Sudden Infant Death Syndrome: Current Guidelines for Reducing Risk

Introduction

Sudden unexpected infant death (SUID), also known as sudden unexpected death in infancy (SUDI), is a term used to describe any sudden and unexpected death in infants less than one year of age, where the cause of death is not immediately obvious prior to investigation. With a thorough case investigation, many of these sudden, unexpected infant deaths can be explained. Explainable causes for SUID include poisoning, metabolic disorders, hyper or hypothermia, suffocation, neglect and homicide (Fig.1).¹ When cases of SUID remain *unexplained* after a complete autopsy, examination of the death scene and review of the clinical history the death is classified as sudden infant death syndrome (SIDS). Ninety percent of SIDS deaths occur before 6 months of age, and the peak incidence occurs between 1 and 4 months. SIDS is uncommon after 8 months of age. It is the leading cause of death in infants from one month to one year of age. Historically, SIDS deaths were observed more often in the colder months of the year, but a pattern of seasonality is no longer apparent.

Background and Scope of the Problem

In the United States there are approximately 4600 SUID cases every year. Of those deaths, about 2300 are classified as SIDS. In 2006, the latest year from which data are available, 2327 infants died of SIDS.² There is a higher incidence among African American infants (99 per 100 000 live births) and American Indian/Alaskan Native infants (112 per 100 000 live births) than non-Hispanic white infants (55 per 100 000 live births).³ However, no ethnic, religious or socioeconomic group is immune to SIDS.

In their annual report to the governor and general assembly, Iowa's Child Death Review Team reported 91 sleep-related infant deaths (death of a child 1 year of age or less) for the years 2008 and

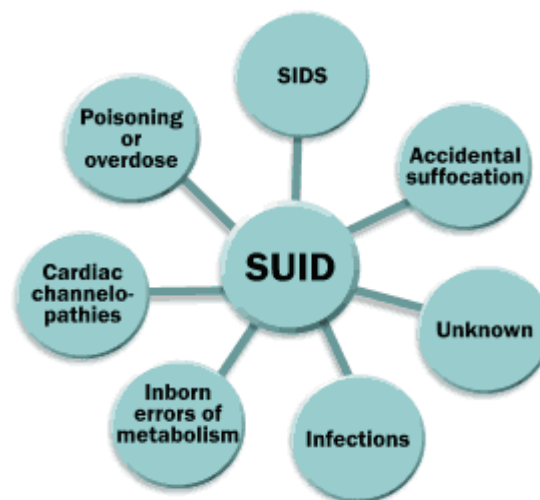


Figure1. Possible causes of SUID¹

2009.⁴ A sub-committee was formed to explore and analyze data from the 2008 and 2009 deaths. Of those 91 deaths, 22 infants died of SIDS, 42 deaths were classified as SUID, 25 infants died of asphyxia and in 2 cases the cause of death was undetermined. In a majority of these cases the sub-committee found identifiable risk factors in the baby’s sleep environment that increased the risk of SIDS and accidental death. The two most common sleep surfaces were adult beds and couches (28/91 and 21/91). Other significant factors included soft bedding (65/91), prone sleep position (34/91 placed prone to sleep and 48/91 found deceased in prone position), co-sleeping with adults or older children (40/91), exposure to tobacco products (53/91) and exposure to alcohol or illicit drugs either in utero, environmentally or their caretakers at the time of death were under the influence of these substances (45/91).

In 1992, the American Academy of Pediatrics (AAP) first recommended that infants be placed in a non-prone position for sleep as a strategy to reduce the risk of SIDS.⁵ The “Back to Sleep” campaign was initiated in 1994.⁶ Subsequently, the incidence of SIDS in the US declined from 120 deaths per 100 000 live births in 1992 to 56 deaths per 100 000 live births in 2001, a decrease of 53% over 10 years (Fig.2). However, in recent years that decline has plateaued.

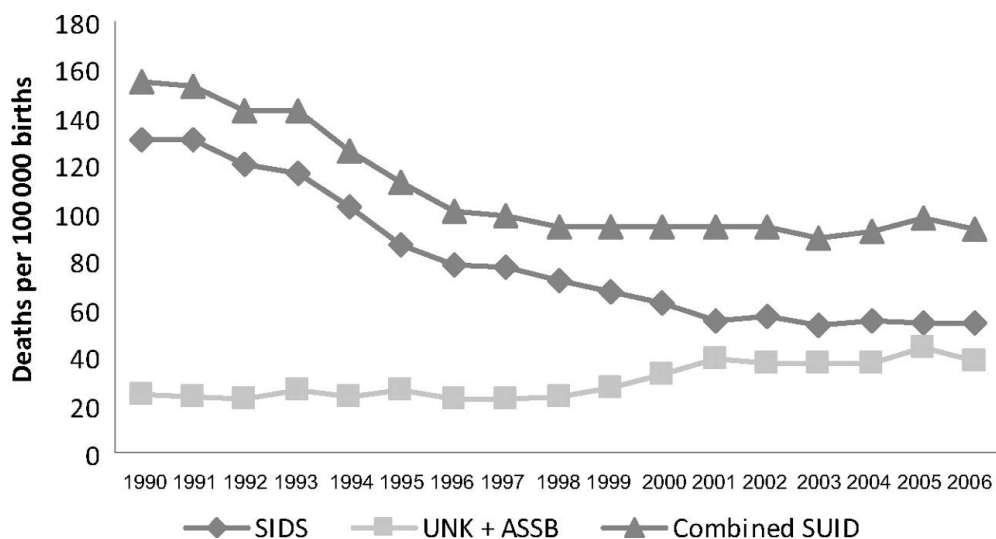


Figure 2. Trends in SIDS and other SUID mortality: United States 1990-2006. UNK indicates ill-defined or unspecified deaths.²

In 2005, the AAP published a policy statement on SIDS.⁷ Since then, sleep-related infant deaths due to suffocation, asphyxia, entrapment and other ill-defined or unspecified causes of death have increased. In October 2011, the AAP expanded its recommendations regarding SIDS to focus on a safe sleep environment to reduce the risk of all sleep-related infant deaths. These recommendations are published in their policy statement, “Sudden Infant Death Syndrome and Other Sleep-Related Infant Deaths: Expansion of Recommendations for a Safe Infant Sleeping Environment.”⁸ The background literature review and data analyses on which this policy statement is based are included in the accompanying technical report.⁹ Case-control studies are the standard regarding SIDS and other sleep-related deaths as there have been no randomized controlled trials.

The AAP recommendations were developed to reduce the risk of SIDS and sleep-related suffocation, asphyxia and entrapment among infants in the general population. They are intended for parents, health care providers and others who care for infants. Some recommendations are directed toward

women who are pregnant or may become pregnant. Most of the epidemiologic studies that established the risk factors for SIDS/SUID include infants up to one year of age. Therefore, the AAP recommendations for sleep position and sleep environment should be used consistently for infants throughout the first year of life.

Summary of Evidence and AAP Recommendations for Reducing the Risk of SIDS and SUID⁸⁻⁹

Back to sleep for every sleep.

- Infants should be placed supine, wholly on their back for every sleep until one year of age. Once an infant is able to independently roll from supine to prone he can remain in whatever sleep position he assumes. Supine sleeping does not increase the risk of choking and aspiration, even in infants with gastroesophageal reflux. The rare exception is the infant with an upper airway disorder where protective mechanisms are impaired.
- Side sleeping increases the infant's risk of rebreathing expired gases, resulting in hypercapnia and hypoxia. Recent studies have found the risk of SIDS with side sleeping to be similar to prone sleeping.
- Prone sleeping puts the infant at high risk for SIDS. It increases the risk of rebreathing expired gases and overheating. A recent study suggests that prone sleeping alters the autonomic control of the infant's cardiovascular system during sleep which can result in decreased cerebral oxygenation. Compared to back sleepers, babies who sleep on their stomach experience less movement, higher arousal thresholds and longer periods of deep sleep. For unaccustomed stomach sleepers (babies who usually sleep supine), their risk of SIDS when placed prone to sleep is increased by 20%.
- Elevating the head of the crib is not recommended. This is not effective in reducing gastroesophageal reflux and might result in the infant sliding to the foot of the crib into a position that compromises respiration.
- Preterm infants and other infants in the NICU should be placed supine for sleep as soon as they are "medically stable and significantly before the infant's anticipated discharge, by 32 weeks' postmenstrual age."

Use a firm sleep surface.

- Appropriate sleep surfaces include a crib, bassinet or portable crib/play yard that conforms to the current safety standards.* The crib mattress should be firm and maintain its shape so that there are no gaps between the mattress and the side of the crib, bassinet or play yard. Soft materials such as pillows, cushions, quilts, comforters or sheepskins should not be placed under the infant. The mattress should be covered only with a fitted sheet.
- Sitting devices such as car safety seats, strollers, swings and infant carriers are not recommended for routine sleep in the hospital or at home. If an infant falls asleep in a sitting device, he should be moved from the seat to a crib or other appropriate flat surface as soon as is practical.
- In 2010, the Consumer Product Safety Commission (CPSC) issued a statement warning consumers about the suffocation hazard to infants, particularly those younger than 4 months, who are carried in an infant sling. When using a sling or cloth carrier, the baby's head should be up and above the fabric so that his face is visible and the nose and mouth are not obstructed.

*Beginning June 28, 2011 the Consumer Product Safety Commission requires that all cribs manufactured and sold in the US (including resale) must comply with new and improved federal safety

standards. The new rules, which apply to full-size and non-full-size cribs, prohibit the manufacture or sale of traditional drop-side rail cribs, strengthen crib slats and mattress supports, improve the quality of hardware, and require more rigorous testing. The details of the rule are available on the CPSC website at, <http://www.cpsc.gov/info/cribs/index.html>. By December 28, 2012, child care centers must use only compliant cribs that meet the new federal safety standards.

Room-sharing without bed-sharing is recommended.

- In 2011, a meta-analysis of 11 studies confirmed that bed sharing, an infant sleeping on the same surface with another person, is a significant risk factor for SIDS. Bed-sharing, puts the baby at risk for accidental injury and death from suffocation, asphyxia, entrapment, falls and strangulation. Younger infants <12 weeks old and those born prematurely or with low birth weight are at greatest risk for SIDS while bed-sharing, possibly because they lack the motor skills to escape potential danger in their sleep environment. The risk of SIDS is higher, the longer the duration of bed-sharing during the night. There is a higher risk of SIDS when the infant is bed-sharing with someone who is not a parent and when there are multiple bed sharers. Epidemiologic studies have not found bed-sharing to be protective of SIDS for any subgroup of the US population. This includes the subgroup of breastfeeding mothers who do not smoke and have not consumed alcohol, drugs or arousal-altering medications.
- The AAP recommends that infants sleep on a separate sleep surface (crib, bassinet, play yard) in the parents' bedroom close to their bed. This arrangement is safer than bed-sharing or solitary sleeping (infant sleeping in a separate room), and it decreases the risk of SIDS by as much as 50%. Room-sharing allows the parents to sleep in close proximity to their infant which facilitates feeding, comforting and nurturing.
- Devices promoted to make bed-sharing "safe" are not recommended (eg, in-bed co-sleeper).
- Multiple studies have demonstrated an extremely high risk of SIDS and suffocation for infants sleeping with adults on couches and armchairs. The AAP recommends that infants not be held for feeding on a couch or armchair when there is a high risk that the parent might fall asleep.
- Co-bedding twins and higher order multiples is not recommended in the hospital or at home.

Keep soft objects and loose bedding out of the crib to reduce the risk of SIDS, suffocation, entrapment and strangulation.

- Pillows, quilts, comforters, sheepskins, soft toys and loose blankets in the baby's sleep environment are hazardous and increase the risk of suffocation and rebreathing exhaled gases. In many SIDS cases, the infant was found with his head covered by loose bedding. These objects should be kept out of the crib.
- As an alternative to loose blankets, parents should consider using wearable blankets or sleep sacks.
- Bumper pads and similar products are not recommended.

Pregnant women should receive prenatal care.

- Several epidemiologic studies have demonstrated a lower risk of SIDS for infants whose mothers obtained early and regular prenatal care.

Avoid smoke exposure during pregnancy and after birth.

- Maternal smoking before, during and after pregnancy continues to be a major risk factor for SIDS in many epidemiologic studies. Exposure to second-hand tobacco smoke adversely affects infant arousal and increases the risk for SIDS in a dose-dependent manner. Third-hand smoke refers to

residual contamination after the cigarette has been extinguished. There has been no research to date that demonstrates a risk for SIDS with third-hand smoke. In 2010, Dietz et al estimated that one third of SIDS deaths could be prevented if all maternal smoking during pregnancy was eliminated.

- Mothers should not smoke during pregnancy or after birth.
- Families are encouraged to set strict rules for smoke-free homes and cars to prevent exposure of infants and children to second-hand tobacco smoke.

Avoid alcohol and illicit drug use during pregnancy and after birth.

- Several studies have demonstrated an increased risk of SIDS with prenatal and postnatal exposure to alcohol and illicit drugs. In 50% of SIDS cases in Iowa in 2008 and 2009 (45/91), the infant was exposed to drugs in utero, environmentally or was being cared for by someone under the influence of drugs or alcohol at the time of death.
- Mothers should not use alcohol or illicit drugs before and during pregnancy.
- Parents should be advised that alcohol and/or illicit drug use in combination with bed-sharing places the infant at particularly high risk of SIDS.

Breastfeeding is recommended.

- Several recent studies support the protective role of breastfeeding for SIDS; however, they do not distinguish between nursing and feeding expressed human milk. In 2011, researchers reported that *any* breastfeeding was more protective of SIDS than no breastfeeding. And, the protective effect is increased with exclusivity for any duration. In the largest and most recent case-control study of SIDS, German researchers found that exclusive breastfeeding at 1 month of age halved the risk of SIDS. At all ages, the SIDS rate was lower for breastfed infants, partially or exclusively breastfed.
- If possible, infants should be exclusively fed breast milk (breastfeeding or feeding expressed human milk) for the first 6 months of life.

Consider offering a pacifier at nap time and bedtime.

- Several studies have demonstrated a protective effect of pacifier use on the incidence of SIDS. In two meta-analyses the risk of SIDS was decreased by 50-60%. Even when the pacifier falls out of the baby's mouth the protective effect continues throughout that sleep period. The mechanism of protection is unclear, but the following theories have been proposed: lowered arousal thresholds, favorable modification of autonomic control during sleep, and maintaining airway patency during sleep.
- The AAP recommends that a pacifier be offered when placing the infant down to sleep. Once he falls asleep, it is not necessary to reinsert the pacifier. If the baby refuses the pacifier, he should not be forced to take it.
- Pacifiers should not be attached to clothing or stuffed toys when the infant is sleeping as this may pose a strangulation or suffocation risk.
- To avoid disruption in breastfeeding, pacifier introduction can be delayed until breastfeeding is well established, usually by 3-4 weeks of age.
- There is currently no evidence that thumb-sucking or finger-sucking is protective for SIDS.

Avoid overheating.

- Studies have shown an increased risk of SIDS with overheating, but the definition of overheating varies.

- Infants should be dressed appropriately for the environment, with no more than 1 layer more than an adult would wear to be comfortable.
- Over-bundling and covering the infant's face and head should be avoided. Caregivers should watch for signs of overheating, such as sweating or the baby's chest feeling hot to the touch.
- It has been suggested that improving/increasing room ventilation with a floor fan or ceiling fan may decrease the risk of SIDS. However, after reviewing the current data the AAP task force concluded that there is insufficient evidence to recommend the use of fans as a strategy to reduce the risk of SIDS.

Infants should be immunized in accordance with recommendations of the AAP and the Centers for Disease Control and Prevention.

- There is no evidence of a causal relationship between immunizations and SIDS. And, recent evidence suggests that immunizations may have a protective effect against SIDS. In a 2007 meta-analysis researchers found the risk of SIDS to be halved for those infants who were immunized.

Avoid commercial devices marketed to reduce the risk of SIDS.

- In September 2010, the FDA and CPSC issued a joint press release urging parents and caregivers to *stop* using infant sleep positioners because of the risk of suffocation with their use, www.fda.gov/medicaldevices/safety/alertsandnotices/ucm227301.htm. They reported 12 infant deaths related to these devices in the past 13 years. Sleep positioners are devices intended to keep a baby in a desired position during sleep. The two most common types of positioners are the sleeping bolster (Fig. 4) and the wedge-style positioner (Fig. 5). There is no evidence that any benefits of these devices outweigh the risk of suffocation.



Figure 4. Sleeping bolster



Figure 5. Wedge-style positioner

- Commercial devices including wedges, positioners, special mattresses, and special sleep surfaces should be avoided as there is no evidence that these devices are safe or reduce the risk of SIDS.

Do not use home cardiorespiratory monitors as a strategy to reduce the risk of SIDS.

- Home cardiorespiratory monitors can be useful for detecting apnea or bradycardia in cases where the infant has had an apparent life-threatening event. However, there is no evidence that home monitors are effective for preventing SIDS.

Supervised, awake tummy time is recommended to facilitate development and to minimize development of positional plagiocephaly.

- Positional plagiocephaly refers to the persistent flat spot that develops on the back or one side of a baby's head when he sleeps in the same position repeatedly.
- Supervised, awake tummy time is recommended for infants on a daily basis, beginning as early as possible to promote motor development and minimize the risk of positional plagiocephaly.
- Other preventive strategies include routinely changing the baby's orientation in the crib and avoiding excess time spent in sitting devices.

- For detailed information regarding diagnosis, management and prevention strategies see the recent AAP clinical report, “Prevention and management of positional skull deformities in infants.”¹⁰

Health care professionals, staff in newborn nurseries and neonatal intensive care nurseries, and child care providers should endorse the SIDS risk-reduction recommendations as soon as the infant is clinically stable and significantly before anticipated discharge.

- Healthcare providers in neonatal intensive care units and newborn nurseries are encouraged to implement and model all of the recommendations to reduce the risk of SIDS.
- All physicians, nurses, other health professionals and child care providers should receive education on safe infant sleep practices.
- Child care providers should implement these safe sleep practices, and it is preferable that they have a written safe sleep policy.

Media and manufacturers should follow safe sleep guidelines in their messaging and advertising.

- In a recent study, investigators examined magazines targeted toward child-bearing women. They found that one-third of the sleeping infants pictured and two-thirds of the sleeping environments portrayed unsafe sleep positions and sleep environments.
- “Safe sleep messages should be reviewed, revised and reissued every 5 years to address the next generation of new parents and products on the market.”

The AAP recommends that the national campaign to reduce the risks of SIDS be expanded to include a major focus on the safe sleep environment and ways to reduce the risks of *all* sleep-related infant deaths, including SIDS, suffocation, and other accidental deaths. Pediatricians, family physicians, and other primary care providers should actively participate in this campaign.

Resources

Iowa SIDS Foundation, a statewide, nonprofit, voluntary health organization dedicated to providing emotional support to SIDS and SUID families residing in Iowa, educating professionals and the general public about SIDS and risk reduction, and funding medical research into the causes of SIDS. Visit website at, www.iowasids.org; Call toll free at, (866) 480-4741.

First Candle, a national nonprofit organization dedicated to eliminating stillbirth, SIDS and other sudden unexpected infant deaths. Visit website at, <http://www.firstcandle.org/>.

National Institutes of Health, National Institutes of Health, National Institute of Child Health and Human Development (NICHD), Safe Sleep for Your Baby: Reduce the Risk of Sudden Infant Death Syndrome. Information available at, http://www.nichd.nih.gov/publications/pubs/safe_sleep_gen.cfm.

Safe to Sleep, a public education campaign. Visit website at, <http://www.nichd.nih.gov/sids/>; Call toll free at, (800) 505-CRIB (2742).

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