

AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Task Force on Sudden Infant Death Syndrome

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

ABSTRACT. There has been a major decrease in the incidence of sudden infant death syndrome (SIDS) since the American Academy of Pediatrics released its recommendation in 1992 that babies be placed down for sleep in a nonprone position. Although the SIDS rate continues to fall, some of the recent decrease of the last several years may be a result of coding shifts to other causes of unexpected infant deaths. Since the AAP published its last statement on SIDS in 2000, several issues have become relevant, including the significant risk of side sleeping position so that the AAP no longer recognizes side sleeping as a reasonable alternative to fully supine sleeping. The AAP also stresses the need to avoid redundant soft bedding and soft objects in the infant's sleeping environment, the hazards of adults sleeping with an infant in the same bed, the SIDS risk reduction associated with having infants sleep in the same room as adults and with using pacifiers at the time of sleep, the importance of educating secondary caregivers and neonatology practitioners on the importance of "back to sleep," and strategies to reduce the incidence of positional plagiocephaly associated with supine positioning. This statement reviews the evidence associated with these and other SIDS-related issues and proposes new recommendations for further reducing SIDS risk.

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

Key words: SIDS, sudden infant death syndrome, sudden unexpected infant death, infant mortality, supine position, infant sleep, infant bedding.

ABBREVIATIONS: SIDS, sudden infant death syndrome; AAP, American Academy of Pediatrics; OR, odds ratio; ALTE, apparent life-threatening event; PWS, plagiocephaly without synostosis.

INTRODUCTION

Sudden infant death syndrome (SIDS) continues to be a phenomenon of unknown cause, and despite marked reductions in rates over the past decade, still is responsible for more infant deaths in the United States than any other cause of death during infancy beyond the neonatal period.¹ This statement endorses elements from the previous statement from the American Academy of Pediatrics (AAP)² that have not changed, includes information about recent research, and presents updated recommendations based on current evidence.

Although there is ongoing discussion about changing the definition,³ the current generally accepted definition of SIDS remains as follows:

“The sudden death of an infant under 1 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.”⁴

The occurrence of SIDS is rare during the first month of life, increases to a peak between 2 and 3 months of age, and then decreases. In conjunction with a >50% reduction in SIDS deaths since 1992, there has been a small shift in the age of death. A slightly higher proportion of deaths in the neonatal period and after 6 months of age were reported in 2001 than in 1992 (Fig 1).⁵

The following have been consistently identified across studies as independent risk factors for SIDS: prone sleep position, sleeping on a soft surface, maternal smoking during pregnancy,

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

overheating, late or no prenatal care, young maternal age, preterm birth and/or low birth weight, and male sex. Consistently higher rates are found in black and American Indian/Alaska Native children—2 to 3 times the national average.

Change in SIDS Statistics in the United States

Although SIDS was somewhat loosely defined until the mid 1980s, there was minimal change in the incidence of SIDS in the United States until the early 1990s. In 1992, in response to epidemiologic reports from Europe and Australia, the AAP recommended that infants be laid down for sleep in a nonprone position as a strategy to reduce the risk of SIDS.⁶ The National Institute of Child Health and Human Development began conducting national surveys of infant care practices to evaluate the implementation of the AAP recommendation. A “Back to Sleep” campaign was initiated in the United States in 1994, under the leadership of the National Institute of Child Health and Human Development and as a joint effort of the US Public Health Service, the AAP, the SIDS Alliance, and the Association of SIDS and Infant Mortality Programs (800-505-CRIB or www.nichd.nih.gov/sids/sids.cfm).

Since 1992, and consistent with a steady decrease in the prone sleeping rate, there has been a consistent decrease in the SIDS rate.⁵ In 1992, the SIDS rate for the United States was 1.20 deaths per 1000 live births. In 2001, the SIDS rate was reported at 0.56 deaths per 1000 live births,⁷ representing a decrease of 53% over 10 years. The rate in 2002 remained constant at 0.57.⁸ The all-cause postneonatal death rate over this period also decreased 27%, from 3.14 to 2.29 per 1000 live births (Fig 2).⁵ However, the all-cause postneonatal mortality rate has not changed since 1999 ($P = .61$), whereas until 2001, the postneonatal SIDS rate had continued to decrease at an average annual rate of 9.0% ($P < .01$).

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

Postneonatal mortality rates of several other causes of sudden unexpected infant death* have increased significantly, particularly over the years 1999 to 2001.⁹ These observations increase the likelihood that some deaths previously classified as SIDS are now being classified in other categories and the true SIDS rate since 1999 may be static. Categories of SIDS have been proposed with the intent to be more inclusive and reduce potential diagnostic shift.¹⁰ This proposal requires more discussion at the national level.

The apparent leveling of the previously declining SIDS rate is occurring coincident with a slowing in the reduction of the prevalence of prone positioning. The prevalence of prone positioning in the United States, as assessed from an ongoing national sampling, decreased from 70% in 1992 to 11.3% in 2002 and has increased slightly to 13.0% in 2004.¹¹ Racial disparity in the prevalence of prone positioning may also be contributing to the continued disparity in SIDS rates between black and white infants (Fig 3).^{5,12} The rate of SIDS among black infants was 2.5 times that of white infants in 2001.⁷ The prevalence of prone positioning in 2001 among white infants was 11%, compared with 21% among black infants.¹¹ Additional work in promoting appropriate infant sleep positions and sleeping environment conditions may be necessary to resume the previous rate of decline for SIDS and all-cause postneonatal mortality.

There also has been a decrease in the seasonality of SIDS over the past decade in the United States. SIDS deaths have historically been observed more frequently in the colder months, with the fewest SIDS deaths occurring in the warmest months.¹³ In 1992, SIDS rates had an average seasonal change of 16.3% compared with only 7.6% in 1999.¹⁴ This is consistent with reports from other countries.¹⁵

* Sudden unexpected infant death: other ill-defined and unspecified causes of mortality (*ICD-9*, 799[0-9]; *ICD-10*, R99); suffocation-in-bed (*ICD-9*, E913[0]; *ICD-10*, W75); suffocation-other (*ICD-9*, E913[1]; *ICD-10*, W76-7, W81-4).

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

Issues Related to Sleep Position

The original 1992 sleeping position recommendation from the AAP identified any nonprone position (ie, side or supine) as being optimum for reducing SIDS risk.⁶ In 2000, on the basis of new evidence, the AAP advised that placing infants on their backs confers the lowest risk and is the preferred position. However, the risk of side position was reported as less than prone, and the AAP advised that if the side position is used, caregivers should be advised to bring the dependent arm forward to lessen the likelihood of the infant rolling to the prone position.

With the large decrease in the proportion of infants placed to sleep prone in the years since the initiation of “back to sleep” campaigns around the world, the contribution of side sleep position to SIDS risk has increased. Several studies, including 2 in the United States, have demonstrated that side sleep position confers an increased risk relative to back.^{12,16-19} The population-attributable risk reported for side sleep position in the New Zealand¹⁵ and British¹⁶ studies were higher than those for prone position. In addition, the Nordic study²⁰ reported that the presence of infectious symptoms in combination with the side sleep position increased the risk far greater than the sum of the individual factors.

A study conducted in California¹⁷ after the “Back to Sleep” era (1997-2000) found that the SIDS risks associated with side and prone position were similar in magnitude (adjusted odds ratios [OR] = 2.0 and 2.6, respectively). Further examination found that the risk of SIDS was exceptionally high for infants who were placed on the side and found on the stomach (adjusted OR = 8.7). Previous studies have found that side sleep position is unstable. The probability of an infant rolling to the prone position from the side sleep position is significantly greater than rolling prone from the back.^{16,21,22}

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

The California study also extended 2 previous observations that infants unaccustomed to the prone position and placed prone for sleep were at greater risk than those usually placed prone.^{19,23} It found that infants who were usually placed supine but were placed on their sides or prone for the last sleep were at very high risk of SIDS (adjusted OR = 6.9 and 8.2, respectively).¹⁷ This emphasizes the importance of every caregiver using the back sleep position during every sleep period, particularly when the infant's accustomed position is supine.

Bedding

In 1944, Abramson et al²⁴ reported that approximately 40% of infants in New York City dying suddenly and unexpectedly during sleep were prone, with their nose and mouth burrowed into "soft pillows, mattresses, or mattress coverings." Early reports from the New Zealand Cot Death study²⁵ suggested that a majority of infants dying prone were on sheepskins. Soft crib mattresses, unfamiliar to North Americans, filled with "natural fibers," such as bark from the ti tree, were mentioned in studies from Australia linking prone sleep to sudden death.²⁶ Other studies have shown that infants dying from SIDS or "crib death" were more likely to have used a pillow or soft mattress, to have been found with their nose and mouth completely covered by bedding, and/or to have assumed a face-down posture.²⁷⁻³⁰ A case-control study from the United States³¹ has confirmed the strong association of SIDS and using soft bedding (OR = 5.1) or pillows (OR = 2.5), independent of prone sleep position (adjusted OR = 5.2 and 2.8, respectively). A strong interaction was found between prone sleep position and soft bedding surface, with an adjusted OR of 21.0, indicating that these 2 factors together are very hazardous. Soft surfaces have also been implicated in infant deaths occurring on adult beds.³²⁻³⁴

Bedsharing

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

Bedsharing between an infant and adult(s) is a highly controversial topic. Although electrophysiologic and behavioral studies offer a strong case for its effect in facilitating breastfeeding and the enhancement of maternal-infant bonding,^{35,36} epidemiologic studies of bedsharing have shown that it can be hazardous under certain conditions. Several case series of accidental suffocation or death from undetermined cause suggest that bedsharing is hazardous.^{34,37-39} A number of case-control studies of SIDS deaths have investigated the relationship of SIDS with parent(s) and/or other adults or children sleeping with an infant.^{16,31,40-48} Some of these studies have found the correlation between death and bedsharing to reach statistical significance only among mothers who smoked.^{41,47} However, the European Concerted Action on SIDS study,⁴² which was a large multisite study, found that bedsharing with mothers who did not smoke was a significant risk factor among infants up to 8 weeks of age. Similarly, a more recent study conducted in Scotland⁴⁸ found that the risk of bedsharing was greatest for infants younger than 11 weeks, and this association remained among infants with nonsmoking mothers. The risk of SIDS appears to be particularly high when there are multiple bedsharers³¹ and may also be increased when the bedsharer has consumed alcohol or is overtired.^{42,47} Also, the risk of SIDS is higher when bedsharing occurs with young infants.⁴⁰⁻⁴² It is extremely hazardous when adults sleep with an infant on a couch.^{31,40,41,48} Finally, the risk of bedsharing is higher the longer the duration of bedsharing during the night.^{41,47} Returning the baby to his or her crib was not associated with an increased risk in 2 studies,^{40,41} and in another, the risk was significant only when the bedsharing occurred for more than 1 hour or for the whole night.¹⁶ There is growing evidence that room sharing (infant sleeping in the parent's room) without bedsharing is associated with a reduced risk of SIDS.^{41,42,43,48} Data from the European Concerted Action on SIDS⁴² study led to the recommendation by its authors that the most protective sleep

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

setting for an infant is in a crib in the parents' room. On the basis of their study results, investigators in Scotland⁴⁸ endorsed the United Kingdom Department of Health's advice that the safest place for an infant to sleep is in a crib in the parents' room for the first 6 months.

Pacifiers

Several studies^{31,40,42,49-53} have reported a protective effect of pacifiers on the incidence of SIDS, particularly when used at the time of last sleep (Fig 4). The mechanism for this apparent strong protective effect is still unclear, but several mechanisms, such as lowered arousal thresholds, have been proposed.^{54,55}

Concerns about possible deleterious effects of pacifier use have prevented most SIDS experts and policy makers from making a recommendation for pacifier use as a risk-reducing method.⁵⁴⁻⁵⁶ Concerns specifically about breastfeeding have led others to recommend pacifiers only for bottle-fed infants.⁵³ Although several studies have shown a correlation between pacifiers and reduced breastfeeding duration, the results of well-designed randomized clinical trials indicate that pacifiers do not appear to cause shortened breastfeeding duration for full-term and preterm infants.^{57,58} One study reported a small deleterious effect of pacifier introduction in the first week of life on breastfeeding at 1 month of age, but this effect did not persist beyond 1 month.⁵⁹ Some dental malocclusions have been found more commonly among pacifier users than nonusers, but the differences generally disappeared after cessation.⁶⁰ The American Academy of Pediatric Dentistry policy statement on oral habits⁶¹ states that "non-nutritive sucking behaviors (ie, finger or pacifier) are considered normal in infants and young children... and in general, sucking habits in children to the age of five are unlikely to cause any long-term problems." There is an approximate 1.2-2 fold increased risk of otitis media associated with pacifier use, but the incidence of otitis media is generally lower in the first year of life, especially the first 6 months,

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

when the risk of SIDS is the highest.⁶²⁻⁶⁷ However, pacifier use, once established, may persist beyond 6 months, thus increasing the risk of otitis media. Gastrointestinal infections and oral colonization with *Candida* species were found to be more common among pacifier users.⁶³⁻⁶⁵

Secondary Caregivers

Two-thirds of US infants younger than 12 months are in nonparental child care. Infants of employed mothers spend an average of 22 hours each week in child care, and 32% of infants are in child care full-time (defined as 35 hours or more each week).⁶⁸ Of the infants who are cared for by secondary (nonparental) caregivers, approximately 50% are cared for by relatives, 10% are cared for by an in-home babysitter, and the remainder are in organized child care (ie, a child care center or family child care home).⁶⁸ In the United States, approximately 20% of SIDS deaths occur while the infant is in the care of a nonparental caregiver. Despite the remarkable decrease in the rate of SIDS and decreased frequency of prone sleeping nationally, the proportion of SIDS deaths occurring in child care remained constant between 1996 and 1998.⁶⁹ Many child care deaths have been associated with the prone sleep position, especially when the infant is unaccustomed to being placed in that position. This is particularly concerning, as unaccustomed prone sleep increases the risk of SIDS as much as 18-fold.^{23,70} It is frequently a nonparental caregiver who places the infant in an unaccustomed prone position.

A 1996 study⁷¹ revealed that 43% of licensed child care centers were unaware of the relationship between SIDS and infant sleep position, and subsequent surveys of child care centers have documented that, despite an increased awareness, 20% to 28% of centers continue to place infants prone for sleep,^{72,73} reportedly because they are unaware of the dangers of sleeping prone and/or are misinformed as to the risks and benefits of various sleep positions. However, licensed child care centers seldom have adequate regulations regarding safe sleep for

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

infants, and most states do not have safe sleep regulations for child care providers.⁷⁴ In addition, many infants are cared for by relatives and nonlicensed caregivers (babysitters, nannies, unregulated family child care homes) who may still be unaware of the importance of supine sleeping in a safe sleep environment.

Home Monitors, SIDS, and Apparent Life-Threatening Events

For many years, apnea was thought to be the predecessor of SIDS, and home apnea monitors were thought to be an effective strategy to prevent SIDS.⁷⁵ Although there is no evidence that home monitors are effective for this purpose,⁷⁶⁻⁷⁸ distribution of home monitors continues to be a substantial industry in the United States. An apparent life-threatening event (ALTE) is defined as “an episode that is frightening to the observer and is characterized by some combination of apnea (central or occasionally obstructive), color change (usually cyanotic or pallid but occasionally erythematous or plethoric), marked change in muscle tone (usually marked limpness), choking, or gagging.”⁷⁴ After interpreting data from the Collaborative Infant Home Monitoring Study Group,⁷⁹ the AAP has recommended that infant home monitoring not be used as a strategy to prevent SIDS but may be useful in some infants who have had an ALTE.⁸⁰ The AAP recognizes that monitors may be helpful to allow rapid recognition of apnea, airway obstruction, respiratory failure, interruption of supplemental oxygen supply, or failure of mechanical respiratory support. Infants for whom these indications may apply include infants who have experienced an ALTE. The Task Force on Sudden Infant Death Syndrome endorses these recommendations.

Immunizations and SIDS

Reports of a possible association between diphtheria-pertussis-tetanus immunizations and SIDS^{81,82} brought forth a series of reviews and studies that refuted the association.^{84,85} Still, of

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

100 deaths reported to the federally administered Vaccine Adverse Event Reporting System from 1997 to 1998, approximately half were attributed to SIDS.⁸⁵ Recent reports, however, continue to show no association between immunizations and SIDS.^{86,87}

Relationship Between Breastfeeding and SIDS

Physiologic sleep studies of infants demonstrate that breastfed infants are more easily arousable than their formula-fed counterparts during sleep,^{54,88} and this may explain a possible protective effect against SIDS. However, epidemiologic studies have not been consistent in demonstrating such a protective effect.^{16,18,31,49,89-98} Although some studies show a protective effect of breastfeeding on SIDS,^{18,98,99} others do not.^{31,49,91,96,97,100,101} In addition, a recent article has demonstrated that although breastfeeding is associated with decreased postneonatal deaths overall, it is not associated with a reduced risk of SIDS.¹⁰² Many of the case-control studies demonstrate a protective effect of breastfeeding against SIDS in univariate analysis but not when confounding factors are taken into account.^{31,49,91,96,97} This suggests that factors associated with breastfeeding, rather than breastfeeding itself, are protective. One of these possible factors is nonsmoking, which is associated with a decreased incidence of SIDS and with both increased initiation and duration of breastfeeding.¹⁰³⁻¹⁰⁷ Although breastfeeding is beneficial and should be promoted for many reasons, the task force believes that the evidence is insufficient to recommend breastfeeding as a strategy to reduce SIDS.

Positional Plagiocephaly

Over the past decade, several reports have suggested that there has been a dramatic increase in the incidence of plagiocephaly without synostosis (PWS).^{108,109} Although there have been no published population-based studies and there has been some debate as to whether there

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

has been a real increase or simply an increased awareness,^{110,111} it seems likely that both have occurred.¹¹²⁻¹¹⁵

Congenital PWS is generally thought to be caused by in utero or intrapartum molding and, therefore, is often associated with multiple births or birth injury.^{116,117} Infants born preterm may develop plagiocephaly or dolichocephaly from having fixed head positions during respiratory support administered while receiving neonatal intensive care. Some infants develop PWS as a result of torticollis caused by sternocleidomastoid shortening.^{112,118,119} However, a recent case-control study has shown that many cases of PWS are associated with supine sleeping position (OR = 2.51, 95% confidence interval = 1.23-5.16).¹¹⁹ Such infants are also more likely not to have had the head position varied when put down to sleep, more likely to have had less than 5 minutes a day of “tummy time,” and less likely to have been held in the upright position when not sleeping. Children with developmental delay and/or neurologic injury have increased rates of PWS, although a causal relationship has not been demonstrated.¹¹⁹⁻¹²³ One study showed that the incidence of PWS in healthy normal children decreases spontaneously from 20% at 8 months to 3% at 24 months of age.¹²⁴

Discharge From Neonatal Intensive Care Units and Newborn Nurseries

The original “Back to Sleep” recommendation in 1992 excluded “premature infants with respiratory distress.”⁶ Subsequent statements² and the current statement have removed the preterm infant as a recognized exception from the supine sleep recommendation because of the increased risk of SIDS among infants born preterm^{125,126} and evidence that the association between prone sleeping and SIDS among low birth weight infants is equal to, or perhaps even stronger than, the association among those born at term.¹⁹ However, a recent survey of mothers from Massachusetts and Ohio who had delivered preterm babies in 1995-1998¹²⁷ disclosed that

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

very low birth weight infants (birthweight less than 1500 g) were almost twice as likely to be placed prone for sleep at 1 month after hospital discharge as were babies born in the next higher low birth weight category (birthweight 1500-2500 g). Another study of babies delivered in 15 states during the same time period¹²⁸ also found that very low birth weight infants were especially unlikely to sleep supine. The authors surmised that this increased likelihood of prone positioning is a reflection of the following: 1) very preterm infants in intensive care nurseries are frequently managed in the prone position; 2) such infants and their caregivers become habituated to using this position; and 3) mothers are likely to follow the advice given by physicians and other health care professionals, and such advice is more likely to be conveyed during a long hospitalization. The task force believes that neonatologists, neonatal nurses, and other health care professionals responsible for organizing the hospital discharge of babies from neonatal intensive care units should become more vigilant about endorsing and modeling the SIDS risk-reduction recommendations significantly before the infant's anticipated discharge.

There is also some concern about practitioners in newborn nurseries continuing to place infants on the side after birth. The practice occurs presumably because of the impression that newborn infants need to clear their airways of amniotic fluid and may be less likely to aspirate in the side position. Although there is no evidence that such fluid will be cleared more readily in the side position, there is also no compelling evidence that sleep position is related to SIDS during the immediate neonatal period, because the incidence of SIDS at this age is quite rare. However, there is evidence that mothers will tend to copy the practices at home that they observe health care professionals practicing in the hospital and, therefore, may be more likely to use the side position at home, when the risk of SIDS and its relationship to sleep position increases.^{129,130} If there are concerns about possible choking during the first few hours after birth, hospital

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

personnel can place the babies on their sides, propped up against the side of the bassinet for stability. But the task force recommends that the babies be placed on their backs as soon as possible.

Infanticide and SIDS Recurrence

Several publications have suggested that the level of suspicion of foul play should be increased on the recurrence of SIDS within a family unit.¹³¹⁻¹³³ However, on the basis of an in-depth review of recurrent sudden unexpected infant deaths among families that had experienced one SIDS death, Carpenter et al¹³⁴ calculated an 87% probability that a second SIDS death within a family would be of natural cause. Calculations of the proportion of SIDS deaths attributable to covert homicide range from 6% to 10%, and recurrence risks for SIDS within a family in which one infant has previously died of SIDS range from 2% to 6%.^{135,136} Therefore, the task force supports the position that the vast majority of either initial or second sudden unexpected infant deaths within a family appear to be natural rather than attributable to abuse, neglect, or homicide. However, the task force maintains that a complete autopsy, examination of the death scene, and review of the clinical history are necessary to obtain the most accurate diagnosis.

Other Issues

There are several issues that were addressed in previous statements that have not been revisited in this statement because there have not been new findings, including the effects of overheating, maternal antenatal smoking, and infant environmental smoke on SIDS incidence; cardiac arrhythmias as an etiologic factor in SIDS; and complications of nonprone sleeping, other than plagiocephaly. The reader is referred to the previous statement for discussion of these issues.²

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

The predominant hypothesis regarding the etiology of SIDS remains that certain infants, for reasons yet to be determined, may have a maldevelopment or delay in maturation of the brainstem neural network that is responsible for arousal and affects the physiologic responses to life-threatening challenges during sleep. Recent examinations of the brainstems of infants who died of SIDS have revealed unique deficits in serotonin receptors in a network of neurons throughout the ventral medulla. The medullary regions involved develop in mid-gestation from a common embryonic anlage and are thought to be involved with arousal, chemosensitivity, respiratory drive, thermoregulation, and blood pressure responses.¹³⁷

RECOMMENDATIONS

The recommendations outlined here were developed to reduce the risk of SIDS in the general population. As it is defined by epidemiologists, risk refers to the probability that an outcome will occur given the presence of a particular factor or set of factors. Scientifically identified associations between risk factors (eg, socioeconomic characteristics, behaviors, or environmental exposures) and outcomes, such as SIDS, do not necessarily denote causality. Furthermore, the best current working model of SIDS suggests that more than one scenario of preexisting conditions and initiating events may lead to SIDS. Therefore, when considering the recommendations in this report, it is fundamentally misguided to focus on a single risk factor or to attempt to quantify risk for an individual infant. Individual medical conditions may warrant a physician to recommend otherwise, after weighing the relative risks and benefits.

1. Back to sleep. Infants should be placed for sleep in a supine position (wholly on the back) for every sleep. Side sleeping is not as safe as supine sleeping and is not advised.

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

2. Use a firm sleep surface. Soft materials or objects, such as pillows, quilts, comforters, or sheepskins, should not be placed under a sleeping infant. A firm crib mattress, covered by a sheet, is the recommended sleeping surface.
3. Keep soft objects and loose bedding out of the crib. Soft objects such as pillows, quilts, comforters, sheepskins, stuffed toys, and other soft objects should be kept out of an infant's sleeping environment. If bumper pads are used in cribs, they should be thin, firm, well secured, and not "pillow-like." In addition, loose bedding, such as blankets and sheets, may be hazardous. If blankets are to be used, they should be tucked in around the crib mattress so the infant's face is less likely to become covered by bedding. One strategy is to make up the bedding so that the infant's feet are able to reach the foot of the crib (feet to foot), with the blankets tucked in around the crib mattress and reaching only to the level of the infant's chest. Another strategy is to use sleep clothing with no other covering over the infant or infant sleep sacks that are designed to keep the baby warm without the possible hazard of head covering.
4. Do not smoke during pregnancy. Maternal smoking during pregnancy has emerged as a major risk factor in almost every epidemiologic study of SIDS. Smoke in the infant's environment after birth has emerged as a separate risk factor in a few studies, although separating this variable from maternal smoking before birth is problematic. Avoiding an infant's exposure to second-hand smoke is advisable for numerous reasons in addition to SIDS risk.
5. A separate but proximate sleeping environment is recommended. The risk of SIDS has been shown to be reduced when the infant sleeps in the same room as the mother. A crib, bassinet, or cradle that conforms to the safety standards of the Consumer Product Safety

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

Commission and ASTM (formerly the American Society for Testing and Materials) is recommended. “Cosleepers” (infant beds that attach to the mother’s bed) provide easy access for the mother to the infant, especially for breastfeeding, but safety standards for these devices have not yet been established by the Consumer Product Safety Commission.

Although bedsharing rates are increasing in the United States for a number of reasons, including facilitation of breastfeeding, the task force concludes that the evidence is growing that bedsharing, as practiced in the United States and other western countries, is more hazardous than the infant sleeping on a separate sleep surface and, therefore, recommends that infants not bedshare during sleep. Infants may be brought into bed for nursing or comforting but should be returned to their own crib or bassinet when the parent is ready to return to sleep. The baby should not be brought into bed when the parent is excessively tired or using medications or substances that could impair his or her alertness. The task force recommends that the baby’s crib or bassinet be placed in the parents’ bedroom, which when placed close to their bed, will allow for more convenient breastfeeding and contact. Infants should not bedshare with other children. Because it is very dangerous to sleep with an infant on a couch or armchair, no one should sleep with an infant on these surfaces.

6. Consider offering a pacifier at nap time and bedtime. Although the mechanism is not known, the reduced risk of SIDS associated with pacifier use during sleep is compelling, and the evidence that pacifier use inhibits breastfeeding or causes later dental complications is not. Until further evidence dictates otherwise, the task force

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

recommends use of a pacifier throughout the first year of life according to the following procedures:

- The pacifier should be used when placing the infant down for sleep and not be reinserted once the baby falls asleep. If the baby refuses the pacifier, he or she should not be forced to take it.
 - Pacifiers should not be coated in any sweet solution.
 - Pacifiers should be cleaned often and replaced regularly.
 - For breastfed infants, delay pacifier introduction until 1 month of age to ensure that breastfeeding is firmly established.
7. Avoid overheating. The infant should be lightly clothed for sleep, and the bedroom temperature should be kept comfortable for a lightly clothed adult. Overbundling should be avoided, and the infant should not feel hot to the touch.
 8. Avoid commercial devices marketed to reduce the risk of SIDS. Although various devices have been developed to maintain sleep position or to reduce the risk of rebreathing, none have been tested sufficiently to show efficacy or safety.
 9. Do not use home monitors as a strategy to reduce the risk of SIDS. Electronic respiratory and cardiac monitors are available to detect cardiorespiratory arrest and may be of value for home monitoring of selected infants who are deemed to have extreme cardiorespiratory instability. However, there is no evidence that use of such home monitors decreases the incidence of SIDS. Furthermore, there is no evidence that infants at increased risk of SIDS can be identified by in-hospital respiratory or cardiac monitoring.
 10. Avoid development of positional plagiocephaly.

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

- Encourage “tummy time” when the infant is awake and observed. This will also enhance motor development.
 - Avoid having the infant spend excessive time in car seat carriers and “bouncers,” in which pressure is applied to the occiput. Upright “cuddle time” should be encouraged.
 - Alter the supine head position during sleep. Techniques for accomplishing this include placing the infant to sleep with the head to one side for a week and then changing to the other and periodically changing the orientation of the infant to outside activity (eg, the door of the room).
 - Particular care should be taken to implement the aforementioned recommendations for infants with neurologic injury or suspected developmental delay.
 - Consideration should be given to early referral of infants with plagiocephaly when it is evident that conservative measures have been ineffective. In some cases, orthotic devices may help avoid the need for surgery.
11. Continue the “Back to Sleep” campaign. Public education should be intensified for secondary caregivers (child care providers, grandparents, foster parents, and babysitters). The campaign should continue to have a special focus on the black and American Indian/Alaska Native populations. Health care professionals in intensive care nurseries, as well as those in well-baby nurseries, should implement these recommendations well before an anticipated discharge.

ACKNOWLEDGEMENTS

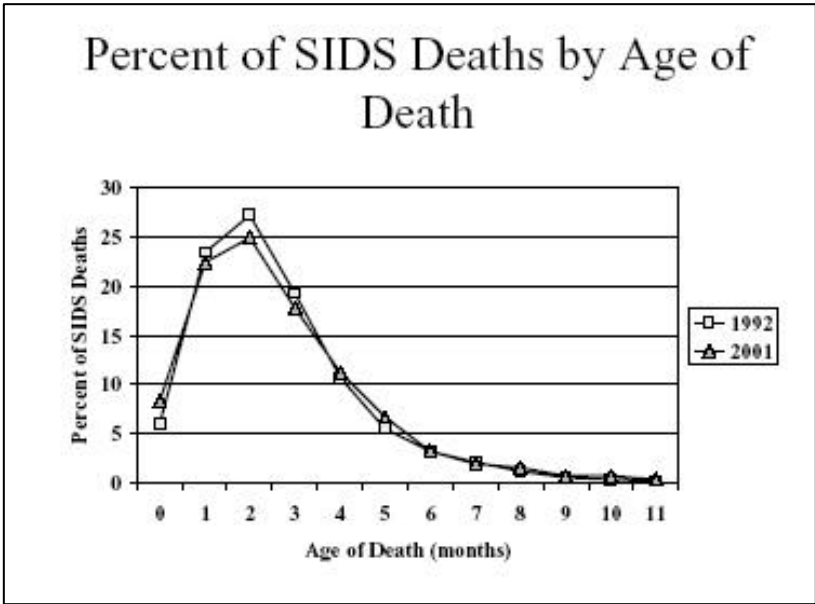
The Task Force on Sudden Infant Death Syndrome acknowledges the contributions provided by others to the collection and interpretation of data examined in preparation of this report. We are

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

particularly grateful for the reports submitted by Drs. Bradley Thach and James Kemp at Washington University and St. Louis University, respectively, and Dr. James McKenna at Notre Dame University. However, it should be noted that the consultants do not necessarily agree with the evidence analysis and recommendations set forth in this document.

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

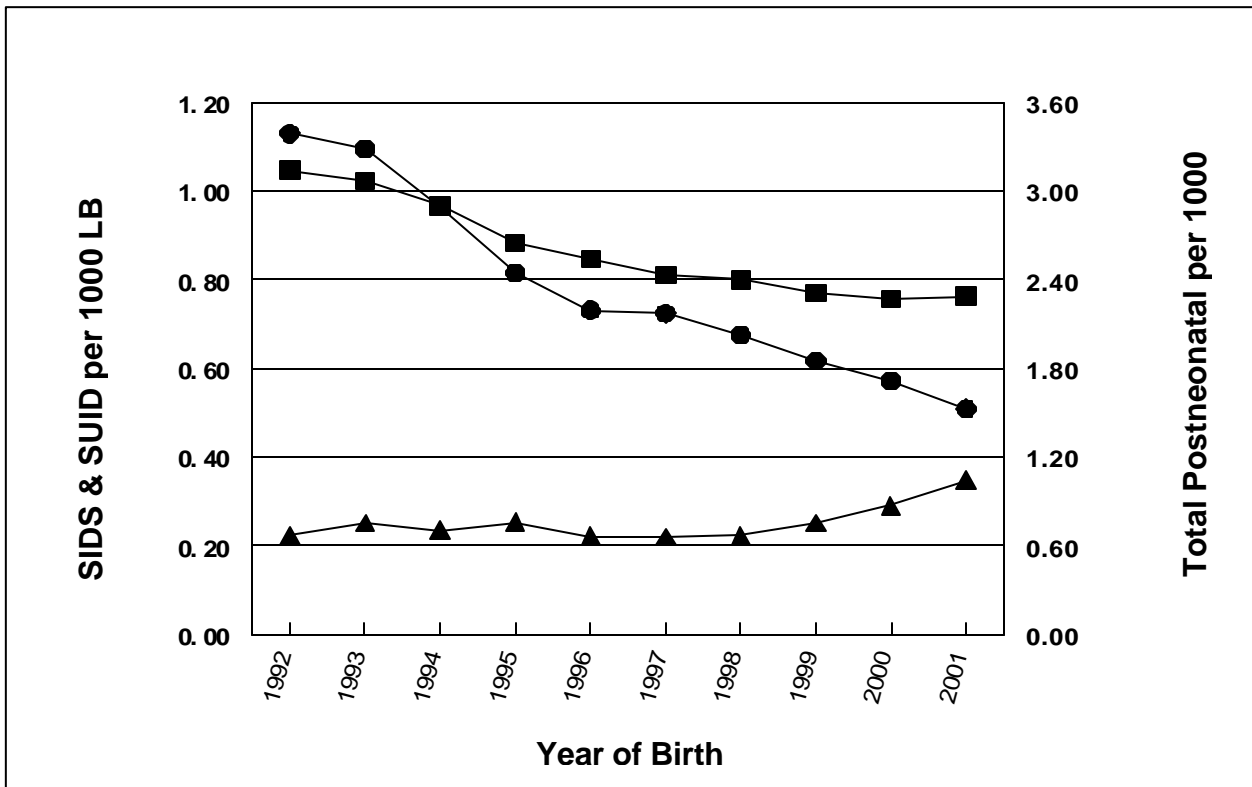
Fig 1. Percent of SIDS deaths by age of death⁵



The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

Fig 2. Trends in postneonatal mortality: United States 1992-2001⁵

Diagnosis	ICD9/ICD10 Code
SIDS	7980/R95
Sudden Unexpected Infant Death:	
Unknown and Unspecified Causes	799.9/R99
Suffocation in bed	E913.0/W75
Suffocation "other"	E913.1-E913.9/W76-W77 and W81-W85

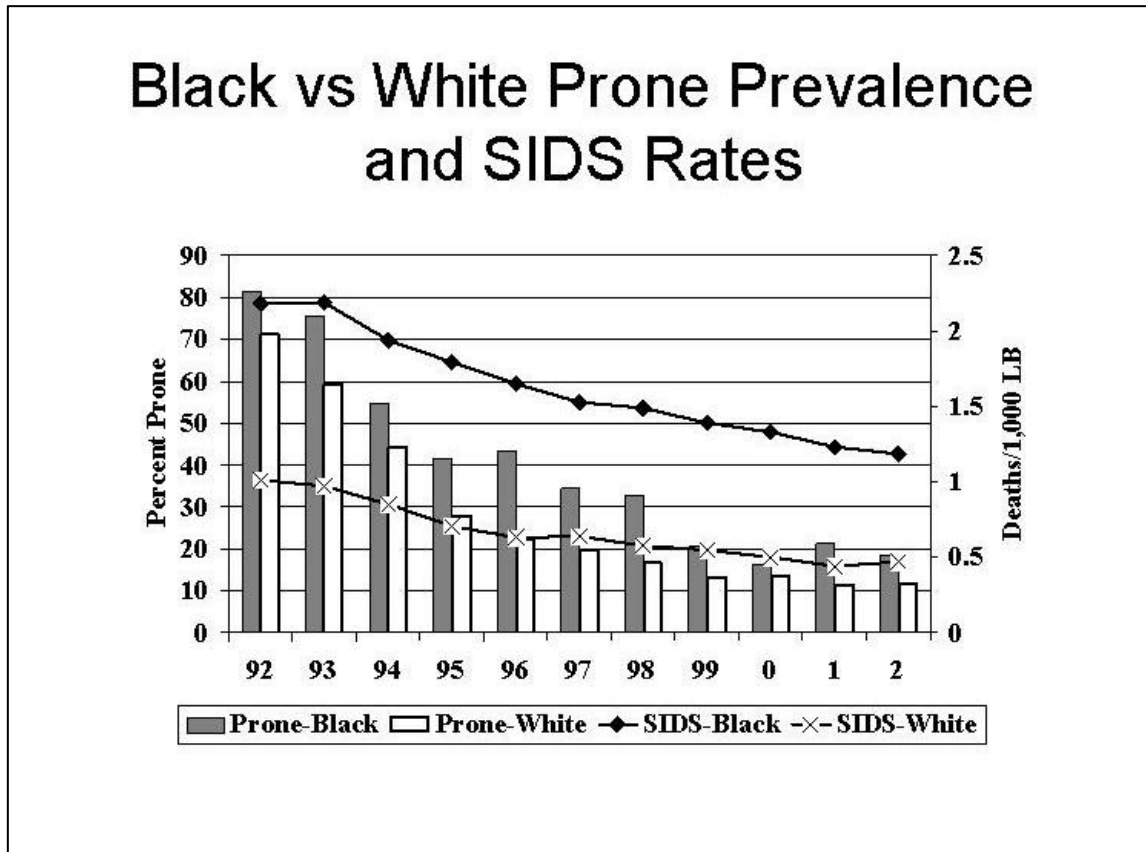


Legend for Figure 2:

- = All-cause Postneonatal mortality
- = SIDS
- ▲ = Sudden Unexpected Infant Death

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

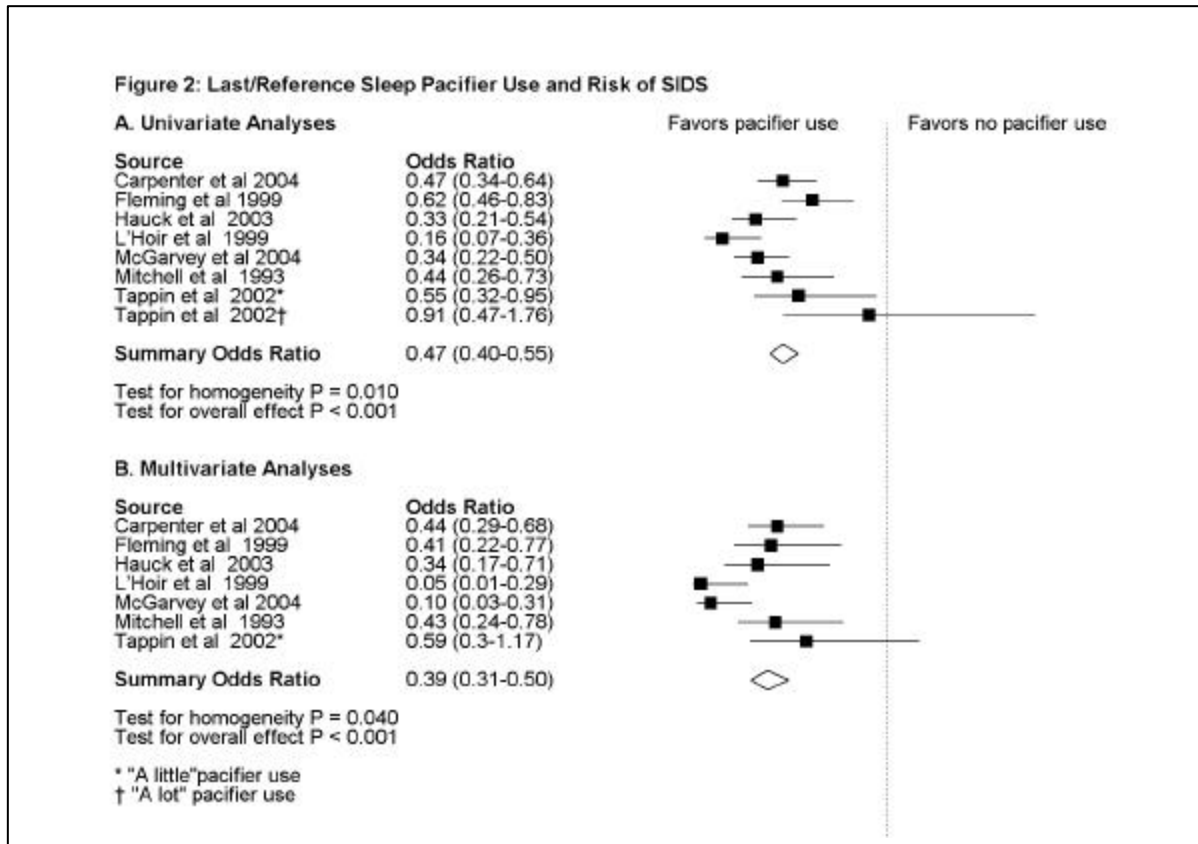
Fig 3. US trends in SIDS rates and prevalence of prone positioning by race^{5,12}



SIDS (♦) and % placed prone (■) for Blacks
 SIDS (×) and % placed prone (□) for Whites¹¹

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

Fig 4. Meta-analysis of studies examining the relationship of a pacifier used during the last sleep in SIDS victims versus controls. (Reprinted with permission from Hauck FR, Omojokun OO, Siadaty MS. Do pacifiers reduce the risk of sudden infant death syndrome? A meta-analysis. *Pediatrics*. In press.)



The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

TASK FORCE ON SUDDEN INFANT DEATH SYNDROME, 2005-2006

John Kattwinkel, MD, Chairperson

Fern R. Hauck, MD, MS

Maurice E. Keenan, MD

Michael Malloy, MD, MS

Rachel Y. Moon, MD

CONSULTANT

Marian Willinger, PhD

STAFF

James Couto

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

REFERENCES

1. Arias E, MacDorman MF, Strobino DM, Guyer B. Annual summary of vital statistics—2002. *Pediatrics*. 2003;112:1215-1230
2. American Academy of Pediatrics, Task Force on Infant Sleep Position and Sudden Infant Death Syndrome. Changing concepts of sudden infant death syndrome: implications for infant sleeping environment and sleep position. *Pediatrics*. 2000;105:650-656
3. Beckwith JB. Defining the sudden infant death syndrome. *Arch Pediatr Adolesc Med*. 2003;157:286-290
4. Willinger M, James LS, Catz C. Defining the sudden infant death syndrome (SIDS): deliberations of an expert panel convened by the National Institute of Child Health and Human Development. *Pediatr Pathol*. 1991;11:677-684
5. Centers for Disease Control and Prevention. CDC Wonder. Compressed Mortality File: Underlying Cause-of-Death. Mortality for 1979-1998 with ICD9 Codes and Mortality for 1999-2001 with ICD10 Codes. Available at: <http://wonder.cdc.gov/mortSQL.html>. Accessed February 23, 2005
6. Kattwinkel J, Brooks J, Myerberg D. American Academy of Pediatrics, Task Force on Infant Positioning and SIDS, Positioning and SIDS. *Pediatrics*. 1992;89:1120-1126
7. Mathews TJ, Menacker F, MacDorman MF. Infant mortality statistics from the 2001 period linked birth/infant death data set. *Natl Vital Stat Rep*. 2003;52(2):1-28
8. Kochanek KD, Murphy SL, Anderson RN, Scott C. Deaths: final data for 2002. *Natl Vital Stat Rep*. 2004;53:1-115
9. Malloy MH, MacDorman MF. Changes in the classification of sudden unexpected infant deaths: United States 1992-2001 *Pediatrics*. 2005;115:1247-1253

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

10. Krous HF, Beckwith JB, Byard RW, et al. Sudden infant death syndrome and unclassified sudden infant deaths: a definitional and diagnostic approach. *Pediatrics*. 2004;114:234-238
11. National Infant Sleep Position Public Access Web site. Available at: http://dccwww.bumc.bu.edu/ChimeNisp/Main_Nisp.asp. Accessed February 23, 2005
12. Hauck FR, Moore CM, Herman SM, et al. The contribution of prone sleeping position to the racial disparity in Sudden Infant Death Syndrome: the Chicago Infant Mortality Study. *Pediatrics*. 2002;110:772-780
13. Osmond C, Murphy M. Seasonality in the sudden infant death syndrome. *Paediatr Perinat Epidemiol*. 1988;2:337-345-365
14. Malloy MH, Freeman DH. Age at death, season, and day of death as indicators of the effect of the back to sleep program on sudden infant death syndrome in the United States, 1992-1999. *Arch Pediatr Adolesc Med*. 2004;158:359-365
15. Mitchell EA. The changing epidemiology of SIDS following the national risk reduction campaigns. *Pediatr Pulmonol Suppl*. 1997;16:117-119
16. Fleming PJ, Blair PS, Bacon C, et al. Environment of infants during sleep and risk of the sudden infant death syndrome: results of 1993-5 case-control study for confidential inquiry into stillbirths and deaths in infancy. *BMJ*. 1996;313:191-195
17. Li DK, Petitti DB, Willinger M, et al. Infant sleeping position and the risk of sudden infant death syndrome in California, 1997-2000. *Am J Epidemiol*. 2003;157:446-455
18. Mitchell EA, Tuohy PG, Brunt JM, et al. Risk factors for sudden infant death syndrome following the prevention campaign in New Zealand: a prospective study. *Pediatrics*. 1997;100:835-840

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

19. Oyen N, Markestad T, Skjaerven R, et al. Combined effects of sleeping position and prenatal risk factors in sudden infant death syndrome: the Nordic Epidemiological SIDS Study. *Pediatrics*. 1997;100:613-621
20. Helweg-Larsen K, Lundemose JB, Oyen N, et al. Interactions of infectious symptoms and modifiable risk factors in sudden infant death syndrome. The Nordic Epidemiological SIDS Study. *Acta Paediatr*. 1999;88:521-527
21. Waters KA, Gonzalez A, Jean C, Morielli A, Brouillette RT. Face-straight-down and face-near-straight-down positions in healthy, prone-sleeping infants. *J Pediatr*. 1996;128:616-625
22. Willinger M, Hoffman HJ, Wu KT, et al. Factors associated with the transition to nonprone sleep positions of infants in the United States: the National Infant Sleep Position Study. *JAMA*. 1998;280:329-335
23. Mitchell EA, Thach BT, Thompson JM, Williams S. Changing infants' sleep position increases risk of sudden infant death syndrome. New Zealand Cot Death Study. *Arch Pediatr Adolesc Med*. 1999;153:1136-1141
24. Abramson H. Accidental mechanical suffocation in infants. *J Pediatr*. 1944;25:404-413
25. Taylor BJ. A review of epidemiological studies of sudden infant death syndrome in Southern New Zealand. *J Pediatr Child Health*. 1991;27:344-348
26. Ponsonby AL, Dwyer T, Gibbons LE, Cochrane JA, Wang YG. Factors potentiating the risk of sudden infant death syndrome associated with the prone position. *N Engl J Med*. 1993;329:377-382

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

27. Scheers NJ, Dayton CM, Kemp JS. Sudden infant death with external airways covered: case-comparison study of 206 deaths in the United States. *Arch Pediatr Adolesc Med.* 1998;152:540-547
28. Carpenter RG, Shaddick CW. Role of infection, suffocation, and bottle-feeding in cot death: an analysis of some factors in the histories of 110 cases and their controls. *Br J Prev Soc Med.* 1965; 19:1-7
29. Hassall IB, Vandenberg M. Infant sleep position: a New Zealand survey. *N Z Med J.* 1985;98:97-99
30. Kemp JS, Thach BT. Rebreathing of exhaled air. In: Byard RW, Krous HF, eds. *Sudden Infant Death Syndrome - Problems, Progress and Possibilities.* London, England: Edward Arnold Publishers Limited; 2001:138-155
31. Hauck FR, Herman SM, Donovan M, et al. Sleep environment and the risk of sudden infant death syndrome in an urban population: the Chicago Infant Mortality Study. *Pediatrics.* 2003;111:1207-1214
32. Kemp JS, Livne M, White DK, Arfken CL. Softness and potential to cause rebreathing: differences in bedding used by infants at high and low risk for sudden infant death syndrome. *J Pediatr.* 1998;132:234-239
33. Flick L, White DK, Vemulapalli C, Stulac B, Kemp JS. Sleep position and the use of soft bedding during bedsharing among African American infants at increased risk for sudden infant death syndrome. *J Pediatr.* 2001;138:338-343
34. Scheers NJ, Rutherford GW, Kemp JS. Where should infants sleep? A comparison of risk for suffocation of infants sleeping in cribs, adult beds, and other sleeping locations. *Pediatrics.* 2003;112:883-889

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

35. Mosko S, Richard C, McKenna J. Infant arousals during mother-infant bed sharing: implications for infant sleep and sudden infant death syndrome research. *Pediatrics*. 1997;100:841-849
36. McKenna JJ, Mosko SS, Richard CA. Bedsharing promotes breastfeeding. *Pediatrics*. 1997;100:214-219
37. Unger B, Kemp JS, Wilkins D, Psara R, Ledbetter T, Graham M, et al. Racial disparity and modifiable risk factors among infants dying suddenly and unexpectedly. *Pediatrics*. 2003;111(2):e127-e131. Available at: <http://www.pediatrics.org/cgi/content/full/111/2/e127>. Accessed February 23, 2005
38. Kemp JS, Unger B, Wilkins D, et al. Unsafe sleep practices and an analysis of bedsharing among infants dying suddenly and unexpectedly: results of a four year, population-based, death-scene investigation study of sudden infant death syndrome and related deaths. *Pediatrics*. 2000;106(3):e41. Available at: <http://www.pediatrics.org/cgi/content/full/106/3/e41>. Accessed February 23, 2005
39. Drago DA, Dannenberg AL. Infant mechanical suffocation deaths in the United States, 1980-1997. *Pediatrics*. 1999;103(5):e59. Available at: <http://www.pediatrics.org/cgi/content/full/103/5/e59>. Accessed February 23, 2005
40. McGarvey C, McDonnell M, Chong A, O'Regan M, Matthews T. Factors relating to the infant's last sleep environment in sudden infant death syndrome in the Republic of Ireland. *Arch Dis Child*. 2003;88:1058-1064
41. Blair PS, Fleming PJ, Smith IJ, et al. Babies sleeping with parents; case-control study of factors influencing the risk of the sudden infant death syndrome. *BMJ*. 1999;319:1457-1461

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

42. Carpenter RG, Irgens LM, Blair PS, et al. Sudden unexplained infant death in 20 regions in Europe: case control study. *Lancet*. 2004;363:185-191
43. Mitchell EA, Thompson JMD. Co-sleeping increases the risk of SIDS, but sleeping in the parents bedroom lowers it. In: Rognum TO, ed. *Sudden Infant Death Syndrome. New Trends in the Nineties*. Oslo, Norway: Scandinavian University Press; 1995:266-269
44. Klonoff-Cohen HS, Edelstein SL. Bed sharing and the sudden infant death syndrome. *BMJ*. 1995;311:1269-1272
45. Luke JL. Sleeping arrangements of sudden infant death syndrome victims in the District of Columbia: a preliminary report. *J Forensic Sci*. 1978;23:379-383
46. Matthews T, McDonnell M, McGarvey C, Loftus G, O'Regan M. A multivariate "time based" analysis of SIDS risk factors. *Arch Dis Child*. 2004;89:267-271
47. Scragg R, Mitchell EA, Taylor BJ, et al. Bed sharing, smoking, and alcohol in the sudden infant death syndrome. New Zealand Cot Death Study Group. *BMJ*. 1993;307:1312-1318
48. Tappin DM, Ecob R, Brooke H. Bedsharing, roomsharing and sudden infant death syndrome in Scotland. A case-control study. *J Pediatr*. (in press)
49. Tappin D, Brooke H, Ecob R, Gibson A. Used infant mattresses and sudden infant death syndrome in Scotland: case-control study. *BMJ*. 2002;325:1007
50. Arnestad M, Andersen M, Rognum T. Is the use of dummy or carry-cot of importance for sudden infant death? *Eur J Pediatr*. 1997;156:968-970
51. Mitchell EA, Taylor BJ, Ford RP, et al. Dummies and the sudden infant death syndrome. *Arch Dis Child*. 1993;68:501-504
52. Fleming PJ, Blair PS, Pollard K, et al. Pacifier use and sudden infant death syndrome: results from the CESDI/SUDI case control study. *Arch Dis Child*. 1999;81:112-116

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

53. L'Hoir MP, Engelberts AC, van Well GT, et al. Dummy use, thumb sucking, mouth breathing and cot death. *Eur J Pediatr*. 1999;158:896-901
54. Franco P, Scaillet S, Wermenbol V, Valente F, Groswasser J, Kahn A. The influence of a pacifier on infants' arousals from sleep. *J Pediatr*. 2000;136:775-779
55. Kahn A, Sawaguchi T, Sawaguchi A, et al. Sudden infant deaths: from epidemiology to physiology. *Forensic Sci Int*. 2002;130(Suppl):S8-S20
56. Canadian Paediatric Society, Community Paediatrics Committee. Recommendations for the use of pacifiers. *Paediatr Child Health*. 2003;8:515-519
57. Kramer MS, Barr RG, Dagenais S, et al. Pacifier use, early weaning, and cry/fuss behavior: a randomized controlled trial. *JAMA*. 2001;286:322-326
58. Collins CT, Ryan P, Crowther CA, McPhee AJ, Paterson S, Hiller JE. Effect of bottles, cups, and dummies on breast feeding in preterm infants: a randomised controlled trial. *BMJ*. 2004;329:193-198
59. Howard CR, Howard FM, Lanphear B, et al. Randomized clinical trial of pacifier use and bottle-feeding or cupfeeding and their effect on breastfeeding. *Pediatrics*. 2003;111:511-518
60. Larsson E. The effect of dummy-sucking on the occlusion: a review. *Eur J Orthodont*. 1986;8:127-130
61. American Academy of Pediatric Dentistry, Council on Clinical Affairs. *Policy on Oral Habits*. Available at: <http://www.aapd.org/media/policies.asp>. Accessed February 23, 2005
62. Jackson JM, Mourino AP. Pacifier use and otitis media in infants twelve months of age or younger. *Pediatr Dent*. 1999;21:255-260

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

63. Daly KA, Giebink GS. Clinical epidemiology of otitis media. *Pediatr Infect Dis J*. 2000;19(5 Suppl):S31-S36
64. Darwazeh AM, Al-Bashir A. Oral candidal flora in healthy infants. *J Oral Pathol Med*. 1995;24:361-364
65. North K, Fleming P, Golding J. Pacifier use and morbidity in the first six months of life. *Pediatrics*. 1999;103(3):e34. Available at: <http://www.pediatrics.org/cgi/content/full/103/3/e34>. Accessed February 23, 2005
66. Niemela M, Uhari M, Hannuksela A. Pacifiers and dental structure as risk factors for otitis media. *Int J Pediatr Otorhinolaryngol*. 1994;29:121-127
67. Uhari M, Mantysaari K, Niemela M. A meta-analytic review of the risk factors for acute otitis media. *Clin Infect Dis*. 1996;22:1079-1083
68. Ehrle J, Adams G, Tout K. *Who's Caring for Our Youngest Children? Child Care Patterns of Infants and Toddlers*. Washington, DC: Urban Institute, 2001
69. Moon RY, Patel KM, Shaefer SJ. Sudden infant death syndrome in child care settings. *Pediatrics*. 2000;106:295-300
70. L'Hoir MP, Engelberts AC, van Well GT, Bajanowski T, Helweg-Larsen K, Huber J. Sudden unexpected death in infancy: epidemiologically determined risk factors related to pathological classification. *Acta Paediatr*. 1998;87:1279-1287
71. Gershon NB, Moon RY. Infant sleep position in licensed child care centers. *Pediatrics*. 1997;100:75-78
72. Moon RY, Biliter WM. Infant sleep position policies in licensed child care centers after Back to Sleep Campaign. *Pediatrics*. 2000;106:576-580

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

73. Moon RY, Weese-Mayer DE, Silvestri JM. Nighttime child care: inadequate sudden infant death syndrome risk factor knowledge, practice, and policies. *Pediatrics*. 2003;111:795-799
74. Moon RY, Biliter WM, Croskell SE. Examination of state regulations regarding infants and sleep in licensed child care centers and family child care settings. *Pediatrics*. 2001;107:1029-1036
75. Steinschneider A. Prolonged apnea and the sudden infant death syndrome: clinical and laboratory observations. *Pediatrics*. 1972;50:646-654
76. Hodgman JE, Hoppenbrouwers T. Home monitoring for the sudden infant death syndrome. The case against. *Ann N Y Acad Sci*. 1988;533:164-175
77. Ward SL, Keens TG, Chan LS, et al. Sudden infant death syndrome in infants evaluated by apnea programs in California. *Pediatrics*. 1986;77:451-458
78. Monod N, Plouin P, Sternberg B, et al. Are polygraphic and cardiopneumographic respiratory patterns useful tools for predicting the risk for sudden infant death syndrome? A 10-year study. *Biol Neonate*. 1986;50:147-153
79. Ramanathan R, Corwin MJ, Hunt CE, et al. Cardiorespiratory events recorded on home monitors: comparison of healthy infants with those at increased risk for SIDS. *JAMA*. 2001;285:2199-2207
80. American Academy of Pediatrics, Committee on Fetus and Newborn. Apnea, sudden infant death syndrome, and home monitoring. *Pediatrics*. 2003;111:914-917
81. Hutcheson R. DTP vaccination and sudden infant deaths—Tennessee. *MMWR Morb Mortal Wkly Rep*. 1979;28:131-132

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

82. Hutcheson R. Follow-up on DTP vaccination and sudden infant deaths—Tennessee. *MMWR Morb Mortal Wkly Rep.* 1979;28:134-135
83. Griffin MR, Ray WA, Livengood JR, Schaffner W. Risk of sudden infant death syndrome after immunization with the diphtheria-tetanus-pertussis vaccine. *N Engl J Med.* 1988;319:618-623
84. Hoffman HJ, Hunter JC, Damus K, et al. Diphtheria-tetanus-pertussis immunization and sudden infant death: results of the National Institute of Child Health and Human Development Cooperative Epidemiological Study of Sudden Infant Death Syndrome Risk Factors. *Pediatrics.* 1987;79:598-611
85. Silvers LE, Varricchio FE, Ellenberg SS, Krueger CL, Wise RP, Salive ME. Pediatric deaths reported after vaccination: the utility of information obtained from parents. *Am J Prev Med.* 2002;22:170-176
86. Jonville-Bera AP, Autret-Leca E, Barbeillon F, Paris-Llado J. Sudden unexpected death in infants under 3 months of age and vaccination status- -a case-control study. *Br J Clin Pharmacol.* 2001;51:271-276
87. MacIntyre CR, Leask J. Immunization myths and realities: responding to arguments against immunization. *J Paediatr Child Health.* 2003;39:487-491
88. Horne RS, Parslow PM, Ferens D, Watts AM, Adamson TM. Comparison of evoked arousability in breast and formula fed infants. *Arch Dis Child.* 2004;89:22-25
89. Ford RP, Taylor BJ, Mitchell EA, et al. Breastfeeding and the risk of sudden infant death syndrome. *Int J Epidemiol.* 1993; 22:885-890

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

90. Hoffman HJ, Damus K, Hillman L, Krongrad E. Risk factors for SIDS. Results of the National Institute of Child Health and Human Development SIDS Cooperative Epidemiological Study. *Ann N Y Acad Sci.* 1988;533:13-30
91. Kraus JF, Greenland S, Bulterys M. Risk factors for sudden infant death syndrome in the US Collaborative Perinatal Project. *Int J Epidemiol.* 1989;18:113-20
92. Henderson-Smart DJ, Ponsonby AL, Murphy E. Reducing the risk of sudden infant death syndrome: a review of the scientific literature. *J Paediatr Child Health.* 1998;34:213-219
93. Ponsonby AL, Dwyer T, Kasl SV, Cochrane JA. The Tasmanian SIDS Case-Control Study: univariable and multivariable risk factor analysis. *Paediatr Perinat Epidemiol.* 1995;9:256-272
94. Alm B, Wennergren G, Norvenius SG, et al. Breast feeding and the sudden infant death syndrome in Scandinavia, 1992-95. *Arch Dis Child.* 2002;86:400-402
95. McVea KLSP, Turner PD, Pepler DK. The role of breastfeeding in sudden infant death syndrome. *J Hum Lact.* 2000;16:13-20
96. Brooke H, Gibson A, Tappin D, Brown H. Case-control study of sudden infant death syndrome in Scotland, 1992-1995. *BMJ.* 1997;314:1516-1520
97. Gilbert RE, Wigfield RE, Fleming PJ, Berry PJ, Rudd PT. Bottle feeding and the sudden infant death syndrome. *BMJ.* 1995;310:88-90
98. L'Hoir MP, Engelberts AC, van Well GTJ, et al. Case-control study of current validity of previously described risk factors for SIDS in the Netherlands. *Arch Dis Child.* 1998;79:386-393

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

99. Wennergren G, Alm B, Oyen N, et al. The decline in the incidence of SIDS in Scandinavia and its relation to risk-intervention campaigns. Nordic Epidemiological SIDS Study. *Acta Paediatr.* 1997;86:963-968
100. Biering-Sorensen F, Jorgensen T, Hilden J. Sudden infant death in Copenhagen 1956-1971. I. Infant feeding. *Acta Paediatr Scand.* 1978;67:129-137
101. Watson E, Gardner A, Carpenter RG. An epidemiological and sociological study of unexpected death in infancy in nine areas of southern England. I: Epidemiology. *Med Sci Law.* 1981;21:78-88
102. Chen A, Rogan WJ. Breastfeeding and the risk of postneonatal death in the United States. *Pediatrics.* 2004;113(5):e435-439. Available at:
<http://www.pediatrics.org/cgi/content/full/113/5/e435>
103. Bertini G, Perugi S, Dani C, Pezzati M, Tronchin M, Rubaltelli FF. Maternal education and the incidence and duration of breast feeding: a prospective study. *J Pediatr Gastroenterol Nutr.* 2003;37:447-452
104. Amir LH, Donath SM. Does maternal smoking have a negative physiological effect on breastfeeding? The epidemiological evidence. *Breastfeed Rev.* 2003;11:19-29
105. Donath S, Amir L. The relationship between maternal smoking and breastfeeding duration after adjustment for maternal infant feeding intention. *Acta Paediatr.* 2004;93:1514-1518
106. Noble L, Hand I, Haynes D, McVeigh T, Kim M, Yoon JJ. Factors influencing initiation of breast-feeding among urban women. *Am J Perinatol.* 2003;20:477-483
107. Vingraite J, Bartkeviciute R, Michaelsen KF. A cohort study of term infants from Vilnius, Lithuania: feeding patterns. *Acta Paediatr.* 2004;93:1349-1355

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

108. Argenta LC, David LR, Wilson JA, Bell WO. An increase in infant cranial deformity with supine sleeping position. *J Craniofac Surg*. 1996;7:5-11
109. Kane AA, Mitchell LE, Craven KP, Marsh JL. Observations on a recent increase in plagiocephaly without synostosis. *Pediatrics*. 1996;97:877-885
110. Hunt CE, Puczynski MS. Does supine sleeping cause asymmetric heads? *Pediatrics*. 1996;98:127-129
111. Turk AE, McCarthy JG, Thorne CH, Wisoff JH. The “Back to Sleep campaign” and deformational plagiocephaly: is there a cause for concern? *J Craniofac Surg*. 1996;7:12-18
112. American Academy of Pediatrics, Committee on Practice and Ambulatory Medicine, Section on Plastic Surgery, and Section on Neurological Surgery. Prevention and management of positional skull deformities in infants. *Pediatrics*. 2003;112:199-202
113. David DJ, Menard RM. Occipital plagiocephaly. *Br J Plast Surg*. 2000;53:367-377
114. Dias MS, Klein DM. Occipital plagiocephaly: deformation or lambdoid synostosis II. A unifying theory regarding pathogenesis. *Pediatr Neurosurg*. 1996;24:69-73
115. Pollack IF, Losken HW, Fasick P. Diagnosis and management of posterior plagiocephaly. *Pediatrics*. 1997;99:180-185
116. Littlefield TR, Kelly KM, Pomatto JK, Beals SP. Multiple birth infants at higher risk for development of deformational plagiocephaly. *Pediatrics*. 1999;103:565-569
117. Peitsch WK, Keefer CH, LaBrie RA, Mulliken JB. Incidence of cranial asymmetry in healthy newborns. *Pediatrics*. 2002;100(6):e72. Available at: <http://www.pediatrics.org/cgi/content/full/100/6/e72>. Accessed February 25, 2005

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

118. Golden KA, Beals SP, Littlefield TR, Pomatto JK. Sternocleidomastoid imbalance versus congenital muscular torticollis: their relationship to positional plagiocephaly. *Cleft Palate Craniofac J.* 1999;36:256-261
119. Hutchison BL, Thompson JM, Mitchell EA. Determinants of nonsynostotic plagiocephaly: a case-control study. *Pediatrics.* 2003;112(4):e316. Available at: <http://www.pediatrics.org/cgi/content/full/112/4/e316>. Accessed February 23, 2005
120. Miller RI, Clarren SK. Long term developmental outcomes in patients with deformational plagiocephaly. *Pediatrics.* 2000;105(2):e26. Available at: <http://www.pediatrics.org/cgi/content/full/105/2/e26>. Accessed February 23, 2005
121. Panchal J, Amirshaybani H, Gurwitsch R, et al. Neurodevelopment in children with single-suture craniosynostosis and plagiocephaly without synostosis. *Plast Reconstr Surg.* 2001;108:1492-1498
122. Balan P, Kushnerenko E, Sahlin P, Huotilainen M, Naatanen R, Hukki J. Auditory ERPs reveal brain dysfunction in infants with plagiocephaly. *J Craniofac Surg.* 2002;13:520-525
123. Chaddock WM, Kast J, Donahue DJ. The enigma of lambdoid positional molding. *Pediatr Neurosurg.* 1997;26:304-311
124. Hutchison BL, Hutchison LAD, Thompson JMD, Mitchell EA. Plagiocephaly and brachycephaly in the first two years of life: a prospective cohort study. *Pediatrics.* 2004;114:970-980
125. Malloy MH, Hoffman HJ. Prematurity, sudden infant death syndrome, and age of death. *Pediatrics.* 1995;96:464-471

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

126. Sowter B, Doyle LW, Morley CJ, Altmann A, Halliday J. Is sudden infant death syndrome still more common in very low birthweight infants in the 1990s? *Med J Aust.* 1999;171:411-413
127. Vernacchio L, Corwin MJ, Lesko SM, et al. Sleep position of low birth weight infants. *Pediatrics.* 2003;111:633-640
128. Pollack HA, Frohna JG. Infant sleep placement after the back to sleep campaign. *Pediatrics.* 2002;109:608-614
129. Colson ER, Joslin SC. Changing nursery practice gets inner-city infants in the supine position for sleep. *Arch Pediatr Adolesc Med.* 2002;156:717-720
130. Willinger M, Ko CW, Hoffman HJ, Kessler RC, Corwin MJ. Factors associated with caregivers' choice of infant sleep position, 1994-1998: the National Infant Sleep Position Study. *JAMA.* 2000;283:2135-2142
131. Southall DP, Plunkett MCB, Banks MW, Falkov A, Samuels MP. Covert video recordings of life-threatening child abuse: lessons for child protection. *Pediatrics.* 1997;100:735-760
132. Meadow R. Unnatural sudden infant death. *Arch Dis Child.* 1999;80:7-14
133. Meadow R. A case of murder and the BMJ. *BMJ.* 2002;324:41-43
134. Carpenter RG, Waite A, Coombs RC, et al. Repeat sudden unexpected and unexplained infant deaths: natural or unnatural? *Lancet.* 2005;365:29-35
135. Oyen N, Skjaerven R, Irgens LM. Population-based recurrence risk of sudden infant death syndrome compared with other infant and fetal deaths. *Am J Epidemiol.* 1996;144:300-305

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

136. Levene S, Bacon CJ. Sudden unexpected death and covert homicide in infancy. *Arch Dis Child.* 2004;89:443-447
137. Panigrahy A, Filiano J, Sleeper LA, et al. Decreased serotonergic receptor binding in rhombic lip-derived regions of the medulla oblongata in the sudden infant death syndrome. *J Neuropathol Exp Neurol.* 2000;59:377-384

All policy statements from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.