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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

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American Academy of Pediatrics

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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 (AAP) released its recommendation in 1992 that infants 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; 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. *Pediatrics* 2005;116:1245-1255; 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 more than 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, overheating, late or no prenatal care, young maternal age, preterm birth and/or low birth weight, and male gender. 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 defined somewhat loosely 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. The "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; 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

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Fig 1. Percent of SIDS deaths by age of death.⁵



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% ($P < .01$).

Postneonatal mortality rates of several other causes of sudden unexpected infant death* have increased significantly, particularly over the years 1999–2001.⁹ 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 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.

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

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 which is consistent with reports from other countries.¹⁵

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 [ORs]: 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}

Diagnosis	ICD-9/ICD-10 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

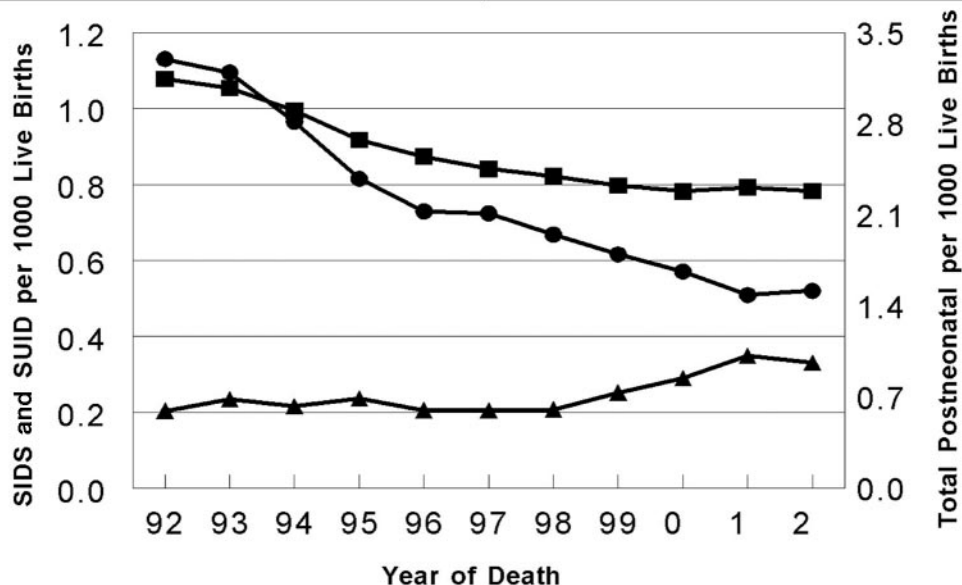


Fig 2. Trends in postneonatal mortality: United States 1992–2002.⁵ ■ indicates all-cause postneonatal mortality; ●, SIDS; ▲, sudden unexpected infant death. SUID indicates sudden unexpected infant death.

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 was 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 which 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

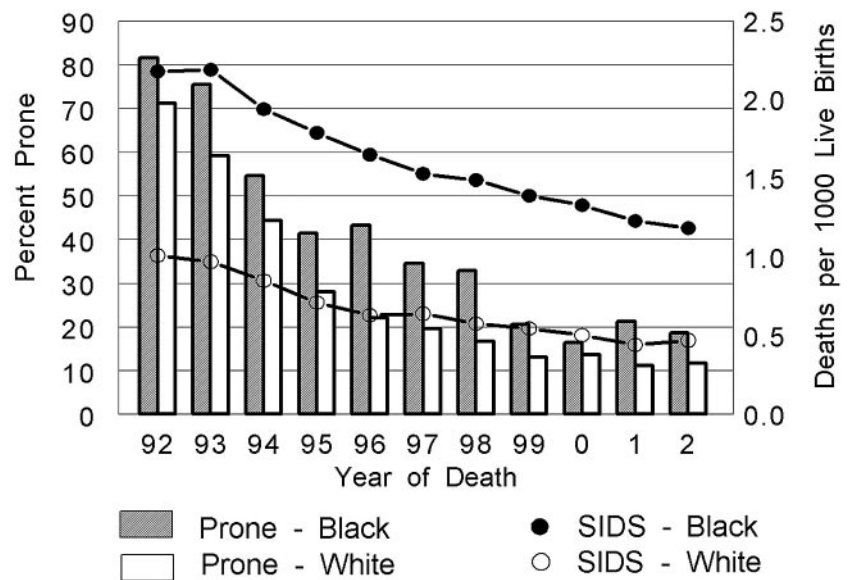
In 1944, Abramson²⁴ reported that approximately 40% of infants in New York City dying suddenly and unexpectedly during sleep were prone, with their nose and mouth burrowed into "soft pillows, mattresses, or mattress coverings." Early reports from the New Zealand Cot Death study²⁵ suggested that a majority 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}

BED SHARING

Bed sharing 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 bed sharing have shown that it can be hazardous under certain conditions. Several case series of accidental suffocation or death from undetermined cause suggest that bed sharing 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 sleep-

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



ing with an infant.^{16,31,40-48} Some of these studies have found the correlation between death and bed sharing 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 bed sharing 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 bed sharing was greatest for infants younger than 11 weeks, and this association remained among infants with nonsmoking mothers. The risk of SIDS seems to be particularly high when there are multiple bed sharers³¹ and also may be increased when the bed sharer has consumed alcohol or is overtired.^{42,47} Also, the risk of SIDS is higher when bed sharing 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 bed sharing is higher the longer the duration of bed sharing during the night.^{41,47} Returning the infant 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 bed sharing 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 bed sharing 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 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 of life.

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 seem to cause shortened breastfeeding duration for 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 "nonnutritive 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- to 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, 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

A. Univariate Analyses

Source	Odds Ratio
Carpenter et al 2004	0.47 (0.34-0.64)
Fleming et al 1999	0.62 (0.46-0.83)
Hauck et al 2003	0.33 (0.21-0.54)
L'Hoir et al 1999	0.16 (0.07-0.36)
McGarvey et al 2004	0.34 (0.22-0.50)
Mitchell et al 1993	0.44 (0.26-0.73)
Tappin et al 2002*	0.55 (0.32-0.95)
Tappin et al 2002†	0.91 (0.47-1.76)

Summary Odds Ratio 0.47 (0.40-0.55)

Test for homogeneity $P = 0.010$

Test for overall effect $P < 0.001$

B. Multivariate Analyses

Source	Odds Ratio
Carpenter et al 2004	0.44 (0.29-0.68)
Fleming et al 1999	0.41 (0.22-0.77)
Hauck et al 2003	0.34 (0.17-0.71)
L'Hoir et al 1999	0.05 (0.01-0.29)
McGarvey et al 2004	0.10 (0.03-0.31)
Mitchell et al 1993	0.43 (0.24-0.78)
Tappin et al 2002*	0.59 (0.30-1.17)

Summary Odds Ratio 0.39 (0.31-0.50)

Test for homogeneity $P = 0.040$

Test for overall effect $P < 0.001$

* "A little" pacifier use

† "A lot" pacifier use

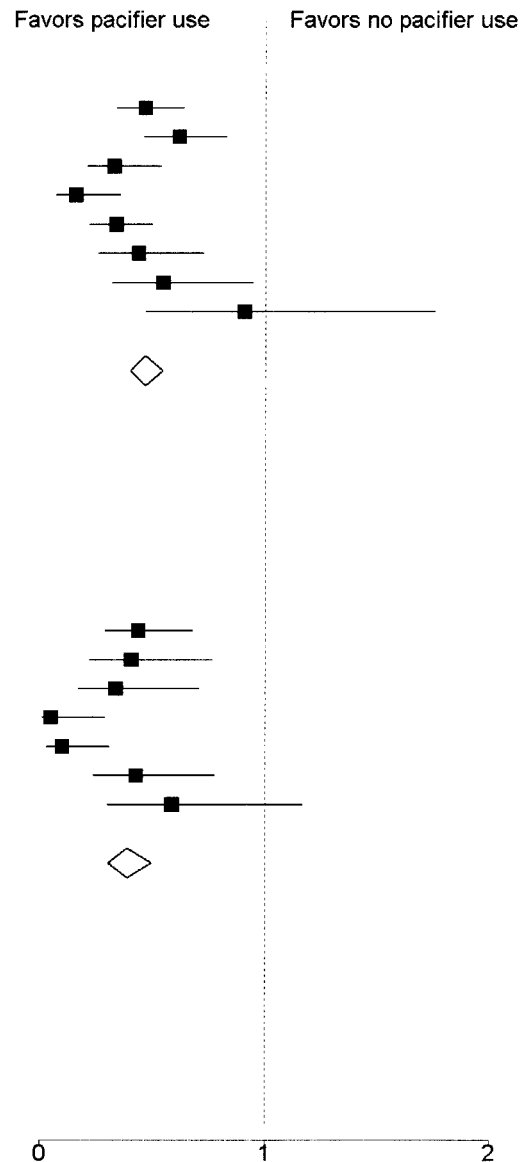


Fig 4. Meta-analysis of studies examining the relationship of a pacifier used during the last sleep in SIDS victims versus controls. (Reproduced with permission from Hauck FR, Omojokun OO, Siadaty MS. Do pacifiers reduce the risk of sudden infant death syndrome? A meta-analysis. *Pediatrics*. 2005;116:e716.)

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, because un-

accustomed prone sleep increases the risk of SIDS by 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 of the risks and benefits of various sleep positions. However, licensed child care centers seldom have adequate regulations regarding safe sleep for 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 still may 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 for preventing 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.”⁴ 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.^{83,84} Still, of 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} which 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} These results suggest that factors associated with breast-

feeding, 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 of whether there 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 per 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 campaign 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 infants in 1995–1998¹²⁷ disclosed that very low birth weight infants (birth weight of less than 1500 g) were almost twice as likely to be placed prone for sleep at 1 month after hospital discharge than were infants born in the next higher low birth weight category (birth weight of 1500–2500 g). Another study of infants 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 infants 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 while in the side position. Although there is no evidence that such fluid will be cleared more readily while 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 personnel can place the infants on their sides, propped up against the side of the bassinet for stability. However, the task force recommends that the infants 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 1 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 1 infant 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 seem 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 are not 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 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 midgestation 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 1 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.
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 blan-

kets are to be used, they should be tucked in around the crib mattress so that 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 infant 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 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 bed-sharing 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 bed sharing, 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 bed share 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 infant 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 infant'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 bed share 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 evidence dictates otherwise, the task force 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 infant falls asleep. If the infant 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:
 - 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 care-

givers (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-infant nurseries, should implement these recommendations well before an anticipated discharge.

TASK FORCE ON SUDDEN INFANT DEATH SYNDROME,
2005–2006

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