



January 2009: VOLUME 6, NUMBER 5

Sudden Infant Death Syndrome: MODIFIABLE RISK FACTORS

In this Issue...

Sudden infant death syndrome (SIDS) is particularly common among infants born prematurely; therefore, before discharge, the NICU staff is responsible for educating parents regarding prevention. Such education must be based upon a thorough knowledge of factors causing SIDS and those related to reducing risk for SIDS. The most effective SIDS-related public health message over the past decade or so - and the primary teaching for many years - has been to put babies to sleep on their back rather than on their side or stomach. With further epidemiological research, additional modifiable factors to reduce SIDS risk have evolved.

In this issue, we focus on reports of modifiable environmental risk factors published in 2008 that are clearly associated with altering SIDS risks, including: sleep location at home, problems in day care centers, and other newly identified environmental issues.



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1.0 hours Physicians
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Release Date

January 29, 2009

Expiration Date

January 28, 2011

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GUEST AUTHORS OF THE MONTH



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Guest Faculty Disclosure

Edward E. Lawson, MD has indicated a financial relationship of grant/research support from the National Institute of Health (NIH). He also receives financial/material support from Nature Publishing Group as the Editor of the *Journal of Perinatology*.



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Christoph U. Lehmann, MD has received grant support from the Agency for Healthcare Research and Quality and the Thomas Wilson Sanitarium of Children of Baltimore City.

Unlabeled/Unapproved Uses

The authors have indicated that there will be no reference to unlabeled/unapproved uses of drugs or products in the presentation.

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LEARNING OBJECTIVES

At the conclusion of this activity, participants should be able to:

- Discuss how co-sleeping (bed sharing) is associated with increased risk for Sudden Infant Death Syndrome (SIDS)
- Explain why a disproportionate amount of SIDS occurs in day care centers
- Describe how preventing hyperthermia by avoiding head covering and providing a room fan may reduce SIDS risk

COMMENTARY

The leading hypothesis regarding sudden infant death syndrome (SIDS) etiology posits a "Triple Risk Model" where risk is related to: 1) a susceptible individual, 2) at a particular developmental stage, and 3) an intervening physiological stimulus. The physiological stimuli have been largely related to environmental circumstances. Research into mechanisms leading to SIDS has shown a remarkable association of abnormal brainstem serotonin metabolism in SIDS victims.¹ Deficient brainstem integration of afferent signals from arterial chemoreceptors would result in impaired autonomic nervous system – such as breathing and arousal – and may be a major physiological mechanism for SIDS. Abnormalities such as reduced arousal during hypoxia, reduced respiratory response to hypoxia, or hypercapnia are present in some infants who later succumb to SIDS, but these tests are not sufficiently discriminatory to serve as reliable clinical tools to prospectively predict SIDS risk. Prolonged QT syndrome, a channelopathy that results in ventricular fibrillation, has been proposed to account for up to 15% of SIDS victims.² Early studies seeking genetic markers to identify susceptible individuals are also an active area of research.³

The susceptible developmental stage may be considered as a period when these physiologic mechanisms are particularly important for sustaining respiratory or cardiac function or effecting arousal from sleep in response to an imperiling situation. Additionally, the susceptible developmental stage may be when motor mechanisms to physically escape from an imperiling situation have not yet sufficiently matured (eg, lifting one's head from a soft surface or arousal sufficient to remove something covering one's head).

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Fortunately, many large epidemiological studies have isolated numerous modifiable environmental risks for SIDS so that we may minimize risk for the population while waiting for specific markers of susceptible patients. Among these environmental risks, the prone sleeping position is now widely known to be a prime factor associated with SIDS.⁴ Large public health programs around the world (in the USA the “Back to Sleep” program is an example), supported by private (First Candle) and various governmental programs, have resulted in a remarkably reduced incidence of SIDS that began in 1992 and has continued to the present.⁵ The rate for SIDS among the Caucasian population has dropped from 2/1000 to less than 3/10,000 infants, in parallel with the decline in prone sleeping.⁴ Among African-Americans, the SIDS rate has also declined, but remains higher than in the Caucasian population, in parallel with higher proportion of prone sleeping position in African American infants.

Unfortunately, SIDS has not been eradicated and other factors, such as second-hand smoke exposure (especially from mothers who smoked during pregnancy and fathers smoking in the home), overheating during sleep, loose bedding, sleeping in a separate room from the parents, and sleeping on irregular sleep surfaces (eg, sofas) have been recognized as independent factors leading to increased SIDS incidence.⁴ In contrast, sleeping in one’s own crib in the room with the parents has been shown to be protective. Another factor that has been controversial is bedsharing (BS), a practice of co-sleeping of the baby in a bed with other children and/or the parent(s). On one hand, proponents of breast feeding have encouraged co-sleeping of infants with their mothers, as this enhances both the incidence and length of breast feeding during nighttime. However, the SIDS data clearly shows an approximate 10-fold increase in SIDS incidence for infants in co-sleeping situations. This rate increases with increasing numbers of people sleeping together in the bed.⁶ The increased SIDS risk due to bed sharing seems to disappear after about 3 months of age. Since breast feeding is independently shown to reduce all-cause deaths relative to bottle feeding, SIDS prevention advocates should be sensitive to overall outcomes rather than just the prevention of SIDS.⁷

Use of bassinets at home has increased, and the Pike and Moon article (reviewed herein) investigated reports of death in infants less than one year old when sleeping in bassinets. One observation of this study was “diagnosis creep”, wherein the SIDS diagnosis is replaced by others such as suffocation.⁴ Despite this, the causes of death are remarkably similar to those previously found to be perilous for cribs. Faces wedged between the mattress and the bassinet wall, prone sleeping position, and loose bedding were among the high risk factors identified.

Supine sleep practices have been the cornerstone of SIDS prevention for more than a decade. Non-parental caretakers have been identified as a source of adults who put babies to sleep in the prone position, but were not in the primary target groups educated regarding safe sleep conditions. The public health educational message to parents has been to be careful about instructing baby sitters, grandparents, and other caretakers to put the infant to sleep on its back. However, a large residual of SIDS deaths (perhaps as many as 20%) occur in day care centers; that some of this occurs in the first week of the infants being in the day care center may imply changes in sleep conditions as well as stress or environmental change as factors. Two articles (reviewed herein) are particularly valuable in highlighting this continuing area of increased SIDS risk.

Another modifiable practice that has clearly been shown to reduce SIDS risk is use of a pacifier at the time of putting an infant to sleep. Earlier meta-analysis reviews have shown that putting an infant to sleep with a pacifier is significantly protective for SIDS. However, many observers are concerned that pacifier usage interferes with breast feeding. Although a thorough review of this topic is too complex for this Commentary, the AAP has recommended that pacifier use be initiated following clear establishment of breast feeding (about 1 month of age), without interfering with subsequent breast feeding, while still having a significant effect on SIDS incidence.⁴ Of interest is the mechanism by which starting sleep with a pacifier is protective from SIDS. Most studies so far have not shown a physiologic change that would explain the protective effect; while changes in arousal patterns, encouraging supine sleep position, and changes in mandible position have been proposed, none has been proven. One 2008 paper, not included in this issue, also shows that arousals from sleep are not affected by pacifier use – so the mechanism for the protective effect remains unclear.⁸

Environmental conditions associated with hyperthermia have been recognized as increasing SIDS risk. The mechanism by which viral infections, one of the first associated risk factors for SIDS, causes SIDS may be at least partially through febrile effects. Studies from England have shown that insulation of the head by thick caps, and

placement near heat sources (radiators), were significant risk factors.⁶ This has also been supported by the observation that the seasonal relationship of SIDS is lost in countries that have introduced public health information relating to prevention of hyperthermia in winter. One emerging new risk factor for SIDS occurring later than several months of age has been identified as “head covering”, a scenario where the SIDS victim is found under bed covers. While the death mechanism may in part be rebreathing exhaled air, the papers by Mitchell et al. and Blair et al. (reviewed herein) identify that head covering is likely also to result in hyperthermia and its effects on inhibiting arousal. An important point of these papers is the apparent developmental ability of the infant to move itself such that loose blankets cover its head. Finally, the new identification of fan use in the sleep room as a protective effect is an important observation, also supporting the theme of hyperthermia prevention as a major modifiable environmental issue for SIDS prevention.

In summary, several articles published in 2008 have identified major factors that affect sudden unexpected deaths among infants under one year of age. Educating parents regarding SIDS prevention for their infants is important to assure that our NICU graduates and otherwise healthy newborns are not lost to this disorder.

Commentary References

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SLEEP LOCATION

Fu LY, Colson ER, Corwin MJ, Moon RY. **Infant sleep location: associated maternal and infant characteristics with sudden infant death syndrome prevention recommendations.** *J Pediatr.* 2008;153(4):503-508. Epub 2008 Jun 25.

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Bed-sharing (BS), despite its benefits on breastfeeding and parent child interaction, has been identified as a modifiable SIDS risk factor, especially when associated with one or more of the following: parental smoking, excessively soft surfaces, infant age between 2 - 3 months, multiple bed-sharers, prolonged (all night) BS, and overly tired bed-sharer (including use of alcohol and other depressants). About half of all SIDS deaths in the US occur in the context of BS. Conversely, room sharing (RS) without BS has been shown to reduce the risk for SIDS and is recommended by the AAP. Because the sleeping arrangements are critical in the risk for SIDS, the authors aimed to determine the maternal and infant factors associated with BS, RS without BS, and solitary sleeping (SS).

The investigators recruited 708 mothers of infants in the Women, Infants and Children program (WIC) centers in Dallas, New Haven, Atlanta, and Savannah for face-to-face interviews, which were conducted between June and August of 2005. Eligibility criteria for caregivers included receiving benefits from WIC, infant <8 months old, and English language skills. All interviews were conducted by trained, local research assistants. Eight-hundred-seventeen caregivers were enrolled, of which 723 (88.7%) were mothers;



median age was 23 years and 66% were African-American. Data were analyzed only for the 708 mothers who responded to a question on where their infant slept the last night. Participants were evenly distributed among the 4 study sites, and infants were equally divided between genders, with a median age of 3 months.

RS without BS was reported by 48.6% of mothers, compared to 32% who reported BS, and 18.9%, who reported SS. Teenage mothers were more likely to BS, and mothers who were at least 20 years old were more likely to report RS without BS ($P < 0.001$). RS without BS was the most common sleeping arrangement reported by all races, however infants of African-American mothers had a higher incidence of BS (37.2%, $p > 0.001$). Higher levels of maternal education were associated with both higher percentages reporting RS without BS, and lower percentages reporting BS ($p < 0.01$). Increasing infant age was associated with a decreasing percentage of infants RS without BS, and an increasing percentage of infants with SS. Thirty-eight to thirty-nine percent (38.6%) of infants sleeping non-supine were BS, whereas 51.5% of the infants sleeping supine were RS without BS ($p < 0.02$). There were no differences in sleeping arrangements by maternal smoking status, place of well-child care, or by usual infant feeding (breast milk or formula). With multinomial modeling, infants who RS without BS compared to SS were more likely to be Hispanic (OR, 2.58; 95% CI, 1.11-5.98). Infants at 0 to 1 month of age were 3.66 times more likely to RS without BS, and infants 2 to 3 months of age were 1.74 times more likely to RS without BS compared with infants 4 to 8 months of age.

This study showed that RS without BS (the recommended practice) is the predominant form of sleeping arrangement (48.6%). With 90% of SIDS occurring in the first 6 months, it was reassuring that younger age was associated with more RS without BS. It is of concern that 32.5% of infants were BS, which was found to be more common in African-American and teenage mothers. Other studies have linked BS to poor socio-economic conditions, which may explain why BS was more common in younger mothers: ie, lacking the funds to purchase a separate crib or bassinet may contribute to BS. Free crib distribution programs initiated by some states must be evaluated to determine their impact on BS and SIDS. This study did not find associations between breastfeeding and the infant's sleep location as other studies have. The authors also did not find an association between maternal smoking and BS. However, one-third of the mothers who smoked also bed-shared with their infants. Multiple studies have shown that BS is particularly hazardous if one or more parents smoke.

Because BS is a risk factor for SIDS, future studies must investigate parental reasons for BS to identify effective interventions to change BS practices.

BASSINET USE

Pike J, Moon RY. **Bassinet use and sudden unexpected death in infancy.** *J Pediatr.* 2008;153(4):509-512. Epub 2008 Jun 25.

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Between 1992 and 2006, the percentage of infants sleeping in bassinets doubled, to almost 20%. During the first 2 months of life > 45% of infants routinely sleep in bassinets; by age 5 to 6 months usage of bassinets has declined to <10% of infants. Despite this frequent use, little information on bassinet safety exists, and there are no government safety standards for bassinets or cradles. The Consumer Product Safety Commission (CPSC) developed bassinet stipulations that include: sturdy bottom and wide base; smooth surfaces without protruding hardware; locked legs to prevent collapse while in use; a firm tight fitting mattress; and adherence to the manufacturer's guidelines. In this study, data collected by the CPSC on individual infant deaths while in bassinets were examined to determine risks associated with SIDS.

The authors retrospectively reviewed and analyzed infant deaths occurring in bassinets between June 1990 and November 2004 that were voluntarily reported to the CPSC by police, fire, insurance investigators, coroners, medical examiners, health care personnel, manufacturers, retailers, and consumers. Demographic information, medical history, location of death, cause of death, and details about the death scene, including the position of the infant when placed to sleep and when discovered, and the presence of soft bedding, were abstracted.

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In the 53 cases, the mean age at death was 84 days (range, 9 to 277 days), with 90% of deaths occurring between age 30 and 180 days. Caucasians were the largest group with 34 (64.2%), followed by 11 African-Americans (20.8%), 3 Hispanics (5.7%), and 5 unspecified (9.4%). Almost 40% of infants had a history of recent illness and 15% had significant past medical problems. Thirteen percent of infants were exposed to tobacco. The cause of death was anoxia, asphyxiation, or suffocation in 45 cases (84.9%) and SIDS in 5 cases (9.4%). In the 3 remaining infants, the causes of death were "thermal burns," "anoxia and heat stress," and unspecified. Forty-four infants (83.0%) died in their home, 6 (11.3%) died in a child care setting, and 3 died in a homeless shelter. Twenty (37.7%) infants were placed for sleep in the prone position, 5 (9.4%) were placed on the side, and 9 (17%) were placed supine. At death, 30 (56.6%) infants were found prone, 3 (5.7%) on the side, and 2 (3.8%) supine.

Four infants were found in positions resulting from a mechanical failure of the bassinet, including on the floor face down in a blanket, in a bassinet lying on its side, hanging from the bassinet, and partially out of a tipped-over bassinet. In 56.6% of cases the mode of asphyxiation was described in detail, for example: "child's face wedged into depression formed by mattress and the edge of the bassinet wall". Six infants were found with their faces wedged against the side of the bassinet. Only 2 infants were found in the supine position. One was found in a corner of a collapsed bassinet; the other was asphyxiated by a beanbag pillow that had fallen from above. Of the 31 infants found in a non-supine position, 27 had other identifiable risk factors, including objects in the bassinet, parental smoking, or a mechanical problem with the bassinet. In 39 (74%) of the deaths, items other than a mattress, fitted sheet, and a pacifier/rattle were left (mostly intentionally) in the bassinet, including blankets, stuffed animals, bottles, plastic bags, and adult-sized pillows. In 35 (66%) deaths, soft bedding was found in the bassinet. Mechanical problems including broken legs or wooden slats and shifting of the mattress due to bending of stabilizing metal clips were noted in 9 (17%) cases. In 4 cases, the bassinet had a mechanical swing or pendulum.

The demographics of the infants were similar to those seen in SIDS, including a male predominance (60.3%). Further, the mean age at death was almost 3 months, and a large (11.3%) proportion of children died while in child care. However, the cause of death was determined to be SIDS in only 5 of these cases. The authors suggest that medical examiners have recently abandoned the diagnosis of SIDS for asphyxia, suffocation, or undetermined cause. Indeed, in many of the cases in this study, the diagnoses of anoxia, asphyxia, or suffocation were not supported other than by the prone position and soft bedding. Generally these cases were indistinguishable from SIDS cases. All of the infants placed on the side, and many placed supine, were found in the prone position at time of discovery. Seventy-four percent of those infants in which the position found was recorded were found in the prone position. It has been described that infants who roll into the prone position are at exceedingly high risk for SIDS. Soft or loose bedding was a contributing factor in >70% of the deaths. Several of the deaths were associated with mechanical problems unique to bassinets that could allow movement of the infant leading to a more vulnerable sleeping position. Mechanical swings may have contributed to death by migration of the infant.

The authors support the AAP infant sleep guidelines, including supine positioning, a firm surface, and elimination of soft objects and loose bedding. The small size of the bassinet may facilitate a "separate but proximate" sleep environment (room sharing without bed sharing – see Fu et al. reviewed herein). Bassinets may suffer mechanical failures and parents must be vigilant to detect safety hazards and instability. The authors suggest that a bassinet with vertical sides of air-permeable material, such as mesh, may be preferable (reducing the risk of asphyxiation when wedged between side and mattress); that parents follow manufacturers' recommendation for infant length and weight; and that items that could cause suffocation or asphyxia be removed from the bassinet and areas where they could fall into the bassinet. Further, health care professionals must be aware of the need for guidance regarding the unique risks of bassinets.

DAY CARE CENTERS

Kiechl-Kohlendorfer U, Moon RY. **Sudden infant death syndrome (SIDS) and child care centres (CCC)**. *Acta Paediatr*. 2008;97(7):844-845. Epub 2008 May 7.

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Moon RY, Calabrese T, Aird L. **Reducing the risk of sudden infant death syndrome in child care and changing provider practices: lessons learned from a demonstration project.** *Pediatrics*. 2008;122(4):788-798.

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In an opinion piece in *Acta Paediatrica* and a research paper in *Pediatrics*, Rachel Moon and her collaborators addressed the issue of SIDS in infant care.

Two-thirds of infants under one year of age are in child care by providers other than their parents. In 1997, a disproportionately large number of all SIDS deaths occurred while the infant was in child care (~20%), particularly in organized child care centers or family child care homes (where non-relatives care for infants in their homes). The incidence of SIDS in child care settings was about 3 times higher than expected by the US Census data. Most of the SIDS deaths occurred within the first week of child care and often on the first or second day.

The etiology for the increased risk for SIDS in child care was linked to two factors: 1) children that are not used to sleeping prone are at higher risk for SIDS if they are placed in a prone position, and 2) in nearly half (43%) of the child care centers surveyed in the greater Washington, DC area, employees were unaware of the association between SIDS and prone sleeping position, and 49% of centers positioned infants prone. The AAP's "Back to Sleep" campaign specifically targeted child care centers; however one follow-up study showed that still more than a quarter of centers placed infants prone. A survey of licensed child care centers (*eNeonatal Review* author's note: licensed centers considered more likely to be better informed than unlicensed) in 2003 showed that only a third placed infants exclusively supine.

In a recently published study, Moon et al. described the effectiveness of an AAP developed speaker's kit, with a training and evaluation effort that included direct observation of child care providers. The authors aimed to evaluate the effectiveness of this AAP curriculum and train-the-trainer model in changing knowledge, attitudes, and reported and observed behaviors of infant care providers with regard to safe sleep environments and positions.

Using a cross-sectional design, the authors developed a model where trainers were trained at a central location and then provided training to child care providers in local communities. Outcomes included child care provider behavior assessed through both questionnaires and direct observation. Between May 2006 and March 2007, child care centers were recruited in California, Louisiana, Montana, and Pennsylvania. States selected had to fulfill certain criteria, including absence of regulations mandating a non-prone sleep position, high absolute number of SIDS deaths or high SIDS rate, and absence of any SIDS risk reduction training/awareness efforts. Each state formed a team that identified professionals who volunteered to be trained to serve as trainers and/or observers. Training was extensive and observers achieved an interrater reliability of >95%.

The study subjects were child care providers. Child care centers were recruited from centers in nonresidential facilities providing child care and in (non-relative) homes providing care for <13 children. Centers were randomized into an intervention group (training between first and second observer visit) and control group (optional training only after the second observation). Observers were blinded to the center's status. After the initial observation, trainers provided SIDS risk reduction training using the AAP speaker's kit. Trainees completed surveys pre-/post- training to determine knowledge, attitudes, and stated practices regarding infant sleep positioning and environment. At a follow-up unannounced observational visit 3 months after the first visit (control) or the training (intervention), the same data were collected as during the first visit; in addition, in the intervention group, directors were surveyed on barriers to implementing safer sleep practices.

Of 343 recruited centers, 264 (77%) completed the study; of those, 190 were nonresidential facilities. The number of infants cared for ranged from 1 to 24. Eighty-five professionals were trained to be trainers and observers. A total of 1212 child care professionals (365 directors and 847 providers) participated. Providers had been caring for children for a mean of 8.8 years (range: 0-50 years; SD: 8.3 years). 91% had a high school diploma, including 23% who had 4-year college degrees. Control and intervention programs were similar in number of children and infants in care, provider years of experience and education, and racial/ethnic backgrounds of providers and children.

Sleep locations (crib, mattress, swing, etc) were not different in initial and follow-up visit in both groups. Infants were more likely to be prone if they were <3 months of age ($P < 0.02$) or cared for in a nonresidential center ($P < 0.001$). While there was mild improvement in the control group, where supine placement increased to 57.1% (not significant), side placement decreased to 3.9% (not significant), and prone placement decreased to 10.6% ($P = 0.05$), there was marked improvement in the intervention group. Supine placement increased to 62.1% ($P < 0.01$), side placement decreased to 4.4% ($P < 0.04$), and prone placement decreased to 5.9% ($P < 0.003$).

Surveys were used to ascertain provider knowledge and beliefs. When providers were surveyed initially, 65% used supine placement exclusively, 26.4% allowed side placement, and 19.6% prone placement. On the second survey, in the control group, exclusive supine placement increased to 70.4%, side placement decreased to 14.1%, and prone placement decreased to 15.5% ($P < 0.01$). The intervention group showed larger changes: exclusive supine placement increased to 87.8%, side placement decreased to 4.5%, and prone placement decreased to 7.7% ($P < 0.001$). Prone positioning was found to more likely occur with African-American providers ($P < 0.001$) or a majority of African-American infants ($P < 0.001$). Prone placement was also more likely if the program had a sleep policy that allowed side positioning ($P < 0.001$). Exclusive supine position was more likely if the provider or the majority of infants were Caucasian ($P < 0.001$ for both), or if the provider believed that prone positioning increased SIDS risk ($P < 0.001$) or had knowledge of the AAP recommendations or the "Back to Sleep" campaign ($P < 0.001$). Sleep policies increased the likelihood of supine positioning ($P < 0.001$). Providers' knowledge at the first survey was limited: 213 providers (27.3%) believed in a definite risk to the prone sleeping position; 242 (41%) believed in a possible risk; 144 (18.4%) were unsure; and 177 (22.6%) doubted or definitely did not believe that prone sleeping increases the risk of SIDS. In neither the control nor intervention groups did these beliefs change significantly. The use of pillows decreased in the control group ($P < 0.02$), and the use of blankets ($P < 0.05$), toys and stuffed animals ($P < 0.001$), and pillows ($P < 0.003$) decreased in the intervention group. Bib use (total number of bibs noticed was 106) increased in the control group ($P < 0.05$) and decreased in the intervention group ($P < 0.02$).

Moon and colleagues were able to demonstrate the effectiveness on sleeping position and provider knowledge of a SIDS risk reduction curriculum. The investigators noted that child care providers were less likely to believe in the benefits of supine positioning if they were African-American, had less education, or if the majority of children cared for were African-American. The percentage of providers who were unaware of SIDS risks associated with prone positioning and were unaware of the "Back to Sleep" campaign was significant, with many providers expressing shock and concern over prior practices during the training session. Supine placement was more common if the care center had a written sleep policy, protocols for informing parents and staff members, and required training encompassing sleep policies.

Bibs pose a strangulation risk, and the high number of bibs noted in this study was alarming. Future education programs must include this hazard. The authors conclude that child care provider training that includes observations and addresses barriers to changing practices is effective. Use of safe sleep policies, continued education, and training for child care professionals and parents, regulations and mandates, and increased monitoring should be future efforts in the fight to reduce the risk of SIDS in child care.

PREVENTING HYPERTHERMIA

Mitchell EA, Thompson JM, Becroft DM, Bajanowski T, Brinkmann B, Happe A, et al. **Head covering and the risk for SIDS: Findings from the New Zealand and German SIDS case-control studies.** *Pediatrics*. 2008;121(6):e1478-1483.

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As discussed by Mitchell et al., about a quarter of SIDS victims are found with their heads covered, whereas control infants uncommonly end their sleep with covered heads – hence head covering is a high relative risk for SIDS. Nevertheless, it is clear that as many as 30% of infants awake at some point with their heads covered, indicating that head covering does not necessarily result in death. Therefore, whether this is an agonal event or inherent to the causal pathway to death has been unclear.

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The authors performed a secondary analysis of SIDS cases in two population-based case control studies. The New Zealand study was performed over 3 years ending in 1990, and found 485 SIDS cases. The German study spanned 3 years ending in 2001, and enrolled 404 SIDS cases (all confirmed by forensic autopsy). Head covering information was available from 385 cases in the former study and 327 cases in the latter. Many variables were assessed, but particular attention was given to similar questions asked of the parents in both studies relating to type of head covering, sweatiness of the infant when found, and degree of petechial hemorrhages at different sites found on autopsy.

Sixty (16%) SIDS victims in the New Zealand study and 92 (28%) in the German study were found with their heads covered. The median age of the head covered victims was significantly older than non-covered victims in both studies (approximately 5-7 months compared with 2.5-3.5 months, respectively). In addition, the infant being found sweaty was significantly associated with head covering. Using either univariate or correcting with multivariate analyses, most other known risk factors were not associated with head covering, including: position put to sleep, position found, bed sharing with parents or siblings, sleeping in own bedroom, maternal smoking, not breast feeding, not using a pacifier, and socioeconomic risk. Duvet use was significant in only the German study. Also, head covering seemed to be associated with thymic petechiae.

The authors concluded that the older age of the victims suggests that becoming head covered is a function of the advanced motor capabilities that allow these infants to move under covers or kick them over their heads. They acknowledge a 2007 paper in *Pediatrics* by Baddock et al.¹ that found increased inadvertent head covering by parents of their infants when co-sleeping, and that the mother frequently facilitates uncovering. The "very sweaty" condition is taken to indicate that the head covering did not result in a rapid demise such as may be expected by airway occlusion, nor did it occur as some form of agonal activity. Rather a slower process involving hyperthermia, and its potential effects on inhibiting arousal, was considered most likely. The significance of the petechiae was unclear, but perhaps represents a unique quality of the death mechanism in the head covered infants.

The authors conclude that efforts to prevent head covering should be part of SIDS prevention strategies. While the investigators mention sleep sacks as a potential preventative measure, their data do not support this as a recommendation (sleep sacks were not commonly used by the infants in these studies); however, speculation that use of properly fitted sleep sacks could avoid use of any bed coverings, including blankets, seems as a logical conclusion. Readers are reminded that sleep sacks have only been in vogue for a short period, and may themselves present some as yet unidentified risk, perhaps including hyperthermia as the infant can not extract itself from the insulation.

References

1. Baddock SA, Galland BC, Taylor BJ, Bolton DP. [Sleep arrangements and behavior of bed-sharing families in the home setting.](#) *Pediatrics*. 2007;119(1):e200-207.

USE OF A FAN

Coleman-Phox K, Odouli R, Li D-K. **Use of a fan during sleep and the risk of Sudden Infant Death Syndrome.** *Arch Pediatr Adolesc Med*. 2008;162:963-968.

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Sleep conditions favoring rebreathing, such as face covering by soft bedding, or overheating, are proposed mechanisms for SIDS; conversely, pacifier usage may reduce SIDS risk due to the potential for prevention of rebreathing. The authors hypothesized that improving room ventilation by fan usage or open windows would also reduce SIDS risk.

This population-based case-control study in 11 Southern California counties covered a three-year period ending in 2000. All 396 SIDS cases that occurred during the study period were confirmed by autopsy, death scene examination, and case history review. Of these, the investigators enrolled and completed the study interview of 185 eligible SIDS cases, versus a similar interview performed on 312 matched controls. Statistical comparisons were made using adjusted odds ratios accounting for confounders.

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The authors report that mothers and sleeping conditions for the SIDS cases, compared with controls, were more likely to include most of the known risk factors for SIDS. While soft bedding and room temperature were not different, having a fan on in the room was associated with a 72% reduction in SIDS risk (AOR, 0.28; 95% CI, 0.10-0.77). Simply having the windows open was not associated with a significant effect. The fan effect achieved a 94% reduction in risk if the room temperature exceeded 21° C.

The authors attribute the fan effect to reduction in the effects of rebreathing due to air movement around the infant. Rebreathing, with CO2 narcosis, is a major hypothesis regarding the mechanism of death, especially when infants are prone on soft bedding, etc. Recall bias may be a factor, as the two interviews occurred at different times relative to the referent sleep periods (SIDS averaged several months after the event and controls were referenced to the previous night's sleep).

While some of the authors' conclusions are supported by differences that are not significant, the primary conclusion - fans are protective from SIDS – is clearly significant. It is possible, especially when considering the better protection in a warmer environment, to conclude with equal validity that the protective mechanism is related to improved infant cooling (ie, prevention of hyperthermia) or to prevention of rebreathing. In either case, the reported protection is impressive and, upon further replication, this easily used environment modifier may prove quite important in the future.

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Learning Objectives

At the conclusion of this activity, participants should be able to:

- Discuss how co-sleeping (bed sharing) is associated with increased risk for Sudden Infant Death Syndrome (SIDS)
- Explain why a disproportionate amount of SIDS occurs in day care centers
- Describe how preventing hyperthermia by avoiding head covering and providing a room fan may reduce SIDS risk

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- **Edward E. Lawson, MD** has indicated a financial relationship of grant/research support from the National Institute of Health (NIH). He also receives financial/material support from Nature Publishing Group as the Editor of the *Journal of Perinatology*.
- **Christoph U. Lehmann, MD** has received grant support from the Agency for Healthcare Research and Quality and the Thomas Wilson Sanitarium of Children of Baltimore City.
- **Lawrence M. Noguee, MD** has received grant support from the NIH.
- **Mary Terhaar, DNSc, RN** has indicated no financial relationship with commercial supporters.

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