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Infant Death Scene Investigation and the Assessment of Potential Risk Factors for Asphyxia: A Review of 209 Sudden Unexpected Infant Deaths

ABSTRACT: At the Wayne County Medical Examiner Office (WCMEO) in Detroit, Michigan, from 2001 to 2004, thorough scene investigations were performed on 209 sudden and unexpected infant deaths, ages 3 days to 12 months. The 209 cases were reviewed to assess the position of the infant at the time of discovery and identify potential risk factors for asphyxia including bed sharing, witnessed overlay, wedging, strangulation, prone position, obstruction of the nose and mouth, coverage of the head by bedding and sleeping on a couch. Overall, one or more potential risk factors were identified in 178 of 209 cases (85.2%). The increasing awareness of infant positions at death has led to a dramatic reduction in the diagnosis of sudden infant death syndrome at the WCMEO. This study suggests that asphyxia plays a greater role in many sudden infant deaths than has been historically attributed to it.

KEYWORDS: forensic science, sudden unexpected infant death, asphyxia, sleep position, death investigation

The diagnosis of sudden infant death syndrome (SIDS) in a sudden unexpected infant death (SUID) requires an autopsy to rule out lethal disease or injury, a review of the medical history and an examination of the death scene (1). Since late 2000, the Wayne County Medical Examiner Office in Detroit, Michigan and local police agencies have worked in cooperation with one public health nurse from the Michigan Institute of Public Heath to investigate SUID's. Depending on the police agency and nature of the case, an initial scene investigation by the police may or may not occur at the time of death. The public health nurse performs a subsequent site visit and elicits information about the medical and social history of the family as well as details about the circumstances surrounding the death. This supplemental information is made available to the medical examiner to be used in determining the cause of death.

From 2001 to 2004, the Wayne County Medical Examiner Office in Detroit, Michigan investigated a total of 266 infant deaths ranging from the age of 1 day up to and including 12 months. Homicides, motor vehicle-related deaths, house fires, drownings and accidental intoxications accounted for a total of 26 deaths. Twenty-six additional cases had previously diagnosed diseases for which they were acutely symptomatic immediately prior to death and died of their illnesses in the hospital, en route to the hospital or at home under non-suspicious circumstances. The remaining 214 cases were SUID's. Of these, a thorough scene investigation was performed in 209 cases, and doll reenactments were performed in 202 cases. Seven infant deaths had thorough scene investigations with a clear understanding of the infant's position upon discovery but lacked a doll reenactment either because the family declined to use a doll or one was unavailable. No scene investigation was performed in five SUID's because the family could not be located or refused any cooperation.

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Method

The infant death investigator initiated contact with the caretaker(s) and a site visit was performed within 1–2 days whenever possible. All people who were in the home at the time of the death were requested to be present at the scene investigation. At the scene, a complete medical and social history of the infant along with a pertinent medical and social history of the family/caretaker was taken, and a scene reconstruction using a doll and all of the original bedding and bed sharers was performed.

When reconstructing a scene, a weighted, newborn-size doll with movable arms, legs and head was used. A doll of a different race than that of the deceased infant was used in an effort to diminish the emotional impact. The doll was given to the caretaker who was asked to place the doll in the exact position the baby was last known to be alive. Accurate positioning of any people who might have been bed sharing with the infant as well as the location of any pillows, bedding or toys around the infant were also strongly emphasized during the reenactment. The doll was then given again to the caretaker with the request that the doll be placed in the exact position the baby was found, again emphasizing placement of bedding, objects and people. The two scenes representing how the infant was placed to sleep and how the infant was found as well as any other relevant findings were photographed.

In the meantime, each infant was examined by a forensic pathologist on the same day or day after death. A complete autopsy was performed and consisted of gross and microscopic examination of the head, the chest, and the abdominal organs. Toxicology tests were completed in every case. Blood and tissue cultures, metabolic screens and X-rays were performed at the discretion of the pathologists.

All sudden unexpected infant deaths with thorough scene investigations from 2001 to 2004 between the ages of 1 day and 12 months were reviewed retrospectively for age, race, clinical history, scene investigation findings, and cause and manner of death. The scene investigation findings were examined specifically to identify the location and position of the infant and assess potential risk factors for asphyxia including bed sharing, strangulation, entrapment (or "wedging"), prone position (± on soft bedding), obstruction of the nose and mouth or coverage of the head at the time the infant was found, and death occurring on a couch. Soft bedding was subjectively identified at the time of the scene investigation and included pillows, blankets, soft cushions, bumper pads, multilayered mattress pads (more than two layers) and pillow-topped adult mattresses. This information was then correlated with the clinical histories and autopsy results.

Results

Of 209 sudden unexpected infant deaths with thorough scene investigations, 125 were males and 84 were females. The ages ranged from 3 days to 12 months with a mean age of 3.5 months, median of 3 months and mode of 2 months. No infants with an age of 1 or 2 days were in the group. There were 151 black infants, 53 white infants, two Hispanic infants, two Arab infants and one Asian infant (Table 1).

Potential risk factors for asphyxia were identified in 178 (85.2%) infants (Table 2, A–J). A single potential risk factor was observed in 111 of 209 (53.1%). Two potential risk factors were observed in 61 (29.2%). Three potential risk factors were observed in 6 (2.9%). Conclusive evidence of asphyxiation included witnessed overlay, entrapment or strangulation and was established in 27 cases (12.9%). Bed sharing occurred in 114 deaths (54.5%). An infant position with complete obstruction of the nose and mouth upon discovery was demonstrated in 70 cases (33.5%); 64 of these were prone and face down and 6 had direct blockage of the nose and mouth from the side. Prone positions on soft bedding ±partial obstruction of the airway, general prone position and/or coverage of the head by bedding (with no other direct obstruction of the nose and mouth) were documented in an additional 30 cases (14.4%). Fifty-nine of the 178 infants (33.1%) with potential asphyxia risk factors had "cold" symptoms at the time that they died, had been given medication with sedating decongestants, had a history of prematurity and/or had a

TABLE 1—*Infant deaths from 2001 to 2004 in Wayne County, Michigan by age, race and sex.*

Age	BM	BF	WM	WF	HM	HF	ArM	AsF
3 days	—	1	—	—	—	—	—	—
1–2 weeks	4	4	3	—	—	—	—	—
3 weeks	1	—	—	—	—	1	—	—
1 month	7	5	1	1	—	—	—	—
6 weeks	2	2	1	—	—	—	—	—
2 months	30	19	11	5	—	—	1	—
3 months	6	10	6	3	—	—	1	—
4 months	12	7	1	4	1	—	—	—
5 months	8	6	4	4	—	—	—	1
6 months	5	3	3	—	—	—	—	—
7 months	3	1	4	1	—	—	—	—
8 months	1	1	—	—	—	—	—	—
9 months	4	1	1	—	—	—	—	—
10 months	2	2	—	—	—	—	—	—
11 months	1	1	—	—	—	—	—	—
12 months	1	1	—	—	—	—	—	—
Total	87	64	35	18	1	1	2	1

BM, black male; BF, black female; WM, white male; WF, white female; HM, Hispanic male; HF, Hispanic female; ArM, Arab male; AsF, Asian female.

TABLE 2—*Summary of age at death and varying combinations of potential risk factors for asphyxia.*

Age	A	B	C	D	E	F	G	H	I	J	K
3 days	—	—	—	—	—	—	—	1	—	—	—
1–2 weeks	2	3	2	1	1	—	1	1	—	—	—
3 weeks	—	—	—	—	1	—	—	—	—	—	1
1 month	1	1	1	—	—	1	3	4	—	—	3
6 weeks	1	1	2	—	—	—	—	1	—	—	—
2 months	7	14	16	2	2	3	10	5	2	2	3
3 months	—	5	6	2	2	1	5	—	2	—	3
4 months	5	3	3	2	1	1	3	1	3	—	3
5 months	3	3	4	—	—	—	4	1	—	—	8
6 months	3	2	1	—	—	—	—	2	1	—	2
7 months	2	2	2	—	—	—	2	—	1	—	—
8 months	1	—	—	—	—	—	—	—	—	—	1
9 months	—	1	1	1	—	—	—	—	—	—	3
10 months	1	—	—	—	1	—	1	—	—	—	1
11 months	—	—	—	—	—	—	—	—	—	—	2
12 months	1	—	—	—	—	—	—	—	—	—	1
Totals	27	35	38	8	8	6	29	16	9	2	31

A, witnessed overlay, wedging or strangulation. ±Bed sharing, soft bedding, obstruction of the nose/mouth and/or coverage of the head.

B, bed sharing with one or more persons on a bed or couch AND complete obstruction of the nose/mouth, coverage of the head, or both.

C, prone/face down or complete obstruction of the nose/mouth from the side in a crib, on a bed or on a couch. No bed sharing. ±Soft bedding, head coverage. Includes two cases with partial obstruction of the nose and mouth.

D, head covered (±prone position). No bed sharing. No direct mouth/nose obstruction other than head covering.

E, bed sharing on a couch with one or more persons. Supine or side position. No demonstrable obstruction of the nose/mouth.

F, bed sharing with one or more on a bed or couch in a prone position. No demonstrable obstruction of nose/mouth. ±Soft bedding.

G, bed sharing with more than one person in a bed. Supine or side position. No demonstrable obstruction of nose/mouth. ±Soft bedding.

H, bed sharing with one person in a bed or crib. Supine or side position. No demonstrable obstruction of nose/mouth or head coverage. ±Soft bedding.

I, prone on bed, crib or couch. No bed sharing. No demonstrable obstruction of nose/mouth or coverage of head. ±Soft bedding.

J, on a couch alone. Supine or side position. No demonstrable obstruction of nose/mouth.

K, no known asphyxia risk.

previously diagnosed medical condition for which they were not exhibiting acute symptoms.

The information gathered at the scene investigation regarding the infant's position when found was completely different from the initial death report in 26 of 209 cases (12.4%). Potential risk factors that were not identified in the initial death report were revealed by the doll reenactment in an additional 92 cases (44%).

Cribs

Sixty infants (28.7%) died in their cribs (includes bassinets and portable cribs such as play yards, or "pack-and-plays"). One infant was bed sharing with a twin. Twenty-five of these 60 (41.7%) were prone and had complete obstruction of the nose and mouth at the time they were found. A prone position with partial blockage of the nose and mouth was observed in two of the 60 infants, and a prone position with no direct blockage was seen in seven of the 60 (11.7%). Of the 34 infants who were prone in a crib, 29 were on bedding that was identified as "soft." Five of the infants who were prone in a crib were also found with their heads covered by blankets or pillows. Two infants were on their sides and had no blockage of the nose and mouth. A supine position was observed in 24 of 60 (40.0%). Five of the 24 infants who were supine had either their heads covered or their faces buried in soft bedding from the side.

Adult Beds

One hundred ten infants (52.6%) died after being placed to sleep on adult beds. Of these, 92 (83.6%) were bed sharing. Forty-one were bed sharing with one person, and 51 were sharing with more than one person. Nine infants on adult beds were either partially or completely under a bed sharing partner when discovered. Overlay was strongly suspected by the bed sharer and/or investigator at the time of the reenactment in an additional 26 cases. Eleven of the 110 (10.0%) were found entrapped between a bed and wall after being placed to sleep on an adult bed. After bed sharing on adult beds, 4 infants were found face down in either piles of clothes or plastic bags filled with clothes next to the bed, and 2 were found face down on the floor. Thirty of the 110 (27.3%) were found prone and face down on the bed. Ten (9.0%) were prone but had no direct obstruction of the nose or mouth. Seven infants (6.4%) were prone on soft bedding, and seven infants (6.4%) had their heads completely covered by blankets on the bed when found. No infant died while sleeping alone on an adult bed in a side or supine position with no obstruction of the nose or mouth and no coverage of the head.

Couches

Twenty-five infants (12.0%) died after being placed to sleep on couches (includes 1 on a reclining chair). Of these, 21 (84.0%) were bed sharing on couches. Seventeen were bed sharing with one person, and four were sharing with more than one person. Three of 25 (12.0%) infants on couches were either partially or completely under a bed sharing partner when discovered. Overlay was strongly suspected by the bed sharer and/or investigator at the time of the reenactment in an additional two cases. Three of 25 (12.0%) were found wedged between a person and the back of the couch. Five of the 25 (20.0%) infants on couches were found prone and face down on the couch cushions, pillows or blankets. One infant was prone on top of a pillow on a couch and had no direct obstruction of the nose or mouth. One infant had coverage of the head by blankets when found.

Car Seats

Five infants (2.4%) died in car seats. One of these was found accidentally strangled by a car-seat strap. One was found with the face turned and buried in soft cushions in the side of the seat. One 2-month-old infant died in a car seat, which had been stuffed with a blanket and was being used as a bassinet. The infant was found face down on the blanket in the seat approximately an hour after having been propped on its side with a bottle.

Other

Nine infants (4.3%) died in other locations. Three infants died after being placed on the floor. Two were supine with no blockage of the nose and mouth (autopsies revealed myocarditis and acute bronchitis, respectively), and one was prone and face down in a thick, quilted play mat (cause of death ruled undetermined). One infant died in a swing (congenital heart disease), and one died in an infant "bouncing" chair (cause of death ruled undetermined). Four died while being held. Two of these infants had been acutely ill with respiratory infections and had associated natural disease findings at autopsy. One infant experienced sudden seizure-like activity and expired while being held; previously undiagnosed heart disease was found at autopsy. The fourth was an 11-day-old infant who was born premature and had just come home from the hospital. The legally blind, obese mother had been attempting to breastfeed without assistance for the first time when the father walked in to find her holding the unresponsive infant with the face tightly pressed into the breast (nose and mouth completely obstructed). She was unaware that the infant had become unconscious during her attempt to breastfeed.

Thirty-one of 209 infants (14.8%) had no discernible risk factors for asphyxia (Table 2, K). Of these, 21 (67.7%) had symptoms of the flu or upper respiratory infection, medication with sedating decongestants, a history of prematurity and/or a previously diagnosed medical condition. Only 10 of 209 infants (4.8%) had neither potential risk factors for asphyxia nor symptoms of an illness or other significant medical history. Two of these 10 were ruled SIDS, and four were natural deaths with substantial heart or lung disease at autopsy. The causes of death of four were ruled undetermined. Of these undetermined four, one had an unexplained low level of ethyl alcohol in the vitreous fluid at autopsy, and one had substantial scene evidence to suggest that hyperthermia was the most likely cause of death. Overall, hyperthermia was suspected to play at least a contributing role in 12 of the 209 cases (5.7%).

Of the 209 infants, the cause of death of 49 (23.4%) was determined to be position-related asphyxia. Thirty-five (16.7%) were ruled "natural" with pneumonia/tracheobronchitis and congenital heart disease predominating. Sixty-seven (32.1%) were called SIDS; 40 of these were bed sharing and three were witnessed overlays. The cause of death in 57 (27.3%) was ruled undetermined. One case was ruled "accidental aspiration of food." This infant had been bed sharing with an obese babysitter who admitted she had been under the influence of alcohol when she inadvertently fell asleep with her arm resting on the infant's chest and abdomen, and both the investigator and babysitter suspected an asphyxial death. It is more likely that the presence of gastric contents in the airway was the result of agonal vomiting and aspiration (Table 3).

Discussion

If the witnessed overlays, entrapments, strangulations and infants found with their noses and mouths blocked and/or their heads

TABLE 3—*Age and cause of death.*

Age	SIDS	Asphyxia	Nat	Undet
3 days	—	1	—	—
1–2 weeks	—	3	2	6
3 weeks	1	—	—	1
1 month	4	4	2	4
6 weeks	1	3	—	1
2 months	25	13	9	19
3 months	14	3	1	8
4 months	10	6	2	8
5 months	5	5	8	4
6 months	3	4	1	3
7 months	3	3	3	—
8 months	—	1	1	—
9 months	1	—	2	3
10 months	—	3	1	—
11 months	—	—	2	—
12 months	—	1	1	—
Totals	67	50	35	57

Nat, natural; Undet, undetermined cause.

covered represent asphyxial deaths, then a minimum of 108 (51.7%) in this study died of asphyxia (see Table 2, A–D). Sixty-five of these scenarios with the greatest index of suspicion for asphyxia occurred in the 2–4 month age group with 39 occurring in the 2-month age group alone. This would represent a conservative estimate of asphyxial deaths, as it does not take into account infants who died in high-risk sleep situations such as bed sharing with more than one person on a bed or couch but had no witnessed overlay and no obstruction of the nose/mouth upon discovery of the infant.

A prone position with the face down and nose and mouth obstructed at the time of discovery was observed in 64 cases (30.6%). This position is temporarily adopted during the normal sleep cycle by many healthy infants (2–5), but has been shown to result in physiologic changes due to either rebreathing or complete airway obstruction in both infants (5–8) and animals (9,10). When infants have been observed sleeping in the face-straight-down position, each infant eventually terminates the position by turning the head or exhibiting some other airway-protective movement (5,6,8). Death in the face-straight-down position has been attributed to a failure to escape the hypoxic environment either due to inexperience in the prone position (7), ineffective reflexive movements (8) or abnormalities in the brain that may interfere with CO_2 sensory mechanisms (11,12).

In a few cases, the infant was prone but lacked any demonstrable obstruction of the nose and mouth, making asphyxia appear less likely. It has been shown that a prone position confers a greater risk of sudden death (13,14), particularly in the age group of 1–6 months (15–17), but these studies have either focused on the likelihood of a prone infant being found face down or have not addressed the mechanism of death in the prone position at all. Some of the prone infants in this study were on soft bedding, and a depression in the material associated with formation of a microenvironment conducive to rebreathing may have been a factor (18). However, the contribution of the prone position to sudden infant death in the absence of obstruction of the nose and mouth or other confounding asphyxial risk factors is not known.

A couch or sofa is an unsafe place for an infant to sleep (19), and this study also shows that the majority of infants who died on couches likely represent asphyxial deaths. Only two of the 25 infants who died on couches were alone, in a supine or side position and had no obstruction of the nose or mouth (Table 2, J), making asphyxia an unlikely event. Placing an infant to sleep on a couch, particularly with bed sharing, should continue to be discouraged.

The pathologists in this study were occasionally faced with apparent competing causes of death when the autopsy revealed a potentially lethal disease process and the scene strongly suggested asphyxia. For example, one 6-week-old male had a history of left heart hypoplasia for which he had reconstructive surgery. His surgery was successful, but he was still small for age. He had been sleeping in a crib with no signs of physical distress until his mother brought him to sleep in her bed, which was also covered by multiple blankets, pillows and stuffed animals. She said she propped him on a pillow on the bed with a bottle and awoke approximately 90 min later to find him expired. The mother admitted she had half of a "fifth" of liquor prior to going to sleep. During the reenactment, she insisted that the infant had been placed to sleep supine on a pillow and was found in the same position when she awoke. However, an examination of police photos taken of the infant at the scene showed a striking, parallel, linear pattern of alternating red–pink lividity and blanched pallor on the face, indicating the infant was prone with the face pressed into a patterned surface for a substantial period of time just after death. The lividity pattern shifted and was posterior and fixed by the time of the autopsy. No lethal mechanism of death was identified at autopsy to favor heart disease. The pathologist chose to leave the cause and manner of death undetermined in light of the coincident issues of congenital heart disease and evidence suggesting asphyxia.

In other cases, coexisting natural disease and asphyxial factors may have served as co-contributors in causing the death. "Cold" symptoms consisting of nasal congestion and associated airway inflammation at autopsy are common in this pediatric population, and internal plugging of the nasal passages by mucus combined with external obstruction of the mouth may further promote asphyxiation. Eight of 15 infants who were issued a cause of death relating to inflammation of the airway (including pneumonia, bronchitis, or tracheobronchitis) had complete external obstruction of the nose and mouth when they were found, and an additional two of the 15 were bed sharing in very crowded beds, raising the index of suspicion for asphyxia. In cases with competing natural and asphyxial causes of death, if asphyxia caused or contributed to the death, then it should take precedence when assigning the manner of death.

A careful doll reenactment arranged by the caretaker and photographed by the investigator allows for better evaluation of the relationship between the infant and objects/people in the immediate environment than verbal testimony alone. It also provides firm documentation of a version of events, which can later be compared with physical evidence. Investigator bias is limited by handing the doll to the caretaker and not touching the doll again until the placer and/or finder has finished reconstructing the scenario. Leading questions (e.g., "Was there a blanket over the head?") are discouraged because they may only serve to facilitate a false scene reconstruction, especially if one is trying to cover up a homicide. Rather, questions are kept nonspecific (e.g., "Where was this blanket when you placed/found the infant?"), and the caretaker is frequently asked, "Is this *exactly* how it was?" throughout the stages of the reenactment.

Limits to infant death investigations with doll reenactment include reliance on accurate recall and truthfulness of the caretaker(s). A key element of a successful scene investigation is performance within 1–2 days after death. Although this is a highly emotional time period, it facilitates more accurate scene investigations. It has been the experience of the investigator that, unless a person is intentionally trying to hide information (which often

becomes apparent during the course of the investigation), parents/caretakers are almost always extremely cooperative with an expedient and thorough investigation.

Honesty on the part of the caretaker(s) is less easily evaluated. Discrepancies between stories and evidence are the most useful tool. Astute recognition of subtle inconsistencies in stories is a skill that is honed by time and experience. Discrepancies must be challenged directly but with compassion. When the investigator in Wayne County has a strong suspicion of dishonesty or purposeful withholding of information relevant to the death, it is occasionally useful to increase the level of participation of law enforcement, such as utilizing or even simply suggesting a polygraph. Law enforcement should be fully involved as soon as there is any suspicion of foul play, if they are not already investigating the death.

The pattern of fixed lividity occasionally provided a means of correlation with a caretaker's scene reconstruction. If a caretaker demonstrated an infant on its back while at autopsy the lividity pattern was fixed over the front of the body, then the caretaker was gently challenged and informed that there was a discrepancy between the autopsy and scene findings (without providing any leading details) and the need for truth and accuracy was further emphasized. This generally led to an alternate scene confession, which more clearly and accurately explained the events surrounding the death and associated autopsy findings. Reasons for not providing a truthful story up front included feelings of guilt or embarrassment by the caretaker (e.g. "I didn't want it to be my fault," "I'd been told not to sleep with my baby") and fear relating to previous or potential child protective service involvement or other legal implications.

In rare cases it became apparent during the reenactment that the infant position had been unknowingly changed after lividity had begun to fix but before death was discovered, causing a discrepancy in the lividity pattern with the position in which the infant was found. This was more likely to occur when an infant was bed sharing in a crowded bed. In one case, a 1-month-old infant had originally been propped on her side with a bottle on top of a quilt in a play yard. The father came into the dark room early in the morning to check on the baby and found that she had rolled prone and was face down in the quilt. He rolled the baby onto her back without ever observing her cry or move. A short time later the grandmother found that the infant was expired, still on her back. At autopsy, fixed lividity was both anterior and posterior. It became clear to all parties that the infant had been dead long enough for lividity to begin to fix anteriorly prior to being moved by the father.

In this study, black infant deaths substantially outnumbered white infant deaths, and male infant deaths outnumbered female deaths in each of the two racial categories. The disparity does not correlate with the demographic distribution of race and sex in the population covered by the Wayne County Medical Examiner Office, which includes Wayne and Monroe Counties in southeastern Michigan and, when combined, is 42.0% black and 58.0% white (20). Black infants, followed by white male infants, in general, are known to have a higher rate of sudden infant death (21), and the racial disparity has widened since the initiation of the Back to Sleep campaign in 1994, with infants of more educated women experiencing the greatest decline in infant deaths (22). In the population in this study, socioeconomic factors and cultural practices may influence how an infant is placed to sleep. Still, there is no obvious reason that asphyxia should demonstrate a relative predilection for males. One must evaluate each case individually and continue to consider that multiple innate and environmental factors, working individually or synergistically, may cause sudden infant deaths.

Since improved scene investigations have led to an increased awareness of risk factors for asphyxia, the Wayne County Medical Examiner has seen a diagnostic shift with a reduction in the diagnosis of SIDS from 38 in 2000 to 2 in 2004 (94.7% decrease). In this same time period, the diagnosis of position-related accidental asphyxias in the 1-day to 12-month age group increased nearly threefold from 6 to 17, and undetermined causes of death increased ninefold from 3 to 27. In one sense, labeling more causes of death "undetermined" instead of "SIDS" has made little to no progress in defining the causes of sudden infant death. However, SIDS is routinely coded as a natural manner of death for statistical purposes. Based on reviews of cases and personal discussions with the signing pathologists, most cases that were ruled undetermined in this study were done so because asphyxia was a reasonable possibility that could not be ruled out. Therefore, "undetermined" is a more appropriate cause and manner of death than SIDS/natural.

Increased awareness of potential risks for asphyxia in varying sleep environments (23,24) has led the American Academy of Pediatrics to issue a policy statement recommending that infants be placed in a supine position in a crib on a firm mattress with no soft objects or loose bedding (25). This study also supports the concept that asphyxia likely plays a greater role in many sudden infant deaths than has been historically attributed to it. A thorough scene investigation with doll reenactment is an effective way to identify the potential risk factors. A better understanding of the importance of these factors is needed so that the causes of many sudden infant deaths can be determined and appropriate preventive measures reinforced.

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