Sudden Infant Death Syndrome - Current Trends and Research

Sudden Infant Death Syndrome (SIDS) is defined as the sudden death of an infant younger than one year that remains unexplained after a thorough case investigation, including a complete autopsy, examination of the death scene, and review of clinical history. In the U.S., SIDS currently affects .57 per 1,000 live births, causing more than 2,200 deaths per year.[1]

Over the past forty years, physicians' and researchers' knowledge of SIDS has grown dramatically. A 1972 statement put forth by the American Academy of Pediatrics, the Committee on Infant and Preschool Child stated, "SIDS is a definite entity that cannot be predicted, and therefore, cannot be prevented." The objective of the statement was to provide guidance to physicians for *after* a SIDS death occurred. The only factors correlated to SIDS recognized in the paper were that SIDS occurred more frequently in the winter, in male babies, and in lower socioeconomic groups.[2]

Today, physicians and researchers recognize the factors that contribute to SIDS, make recommendations for creating safe sleep environments for babies, and are even adept at predicting if babies are likely to die of SIDS. They have observed that there is a significant discrepancy among racial and ethnic groups, with SIDS rates two to seven times the national average among Native Americans and blacks in the U.S.[3]

Current research supports a triple-risk model of occurrence. SIDS results when three factors simultaneously influence the infant: 1) an underlying vulnerability in the infant, b) a critical developmental period (ninety percent of SIDS cases occur before an infant reaches six months old[4]), and 3) an exogenous stressor (i.e. prone sleep position).[5]

Most cases of SIDS contain multiple risks, while risk-free and single-risk SIDS cases are rare. Essentially, SIDS death will occur only in an infant who is vulnerable as a result of an underlying abnormality.

Underlying, or non-modifiable, risks include prematurity, and upper respiratory infection. Modifiable, or extrinsic, risks are non-supine (belly-down) placement at last sleep; maternal and paternal smoking; bed sharing with an adult; scene risks (i.e., sofas, quilts, blankets, pillows); and presence of other children. A specific model that estimates risk for SIDS uses a combination of the following factors: marriage status, age, parity, smoking status, baby gender, gestational age, pre-term birth, and birth weight.[6]

A prevailing hypothesis states that SIDS originates with a brainstem abnormality in the neuroregulation of cardiorespiratory control and is triggered by a combination of the preceding risks. Three factors support this hypothesis:

1. The brainstem plays a critical role in respiratory and autonomic regulation, sleep, and arousal.
2. Reports of defects in cardiorespiratory control and/or arousal are consistent with brainstem dysfunction in infants;
3. Documented respiratory defects include impaired autorresuscitation (gasping), abnormal respiratory patterning, episodic obstructive apnea during sleep, and autonomic dysfunction with arousal deficits.[7]

For certain cases of SIDS, there is speculation that a developmental disorder of serotonin (known as 5-HT) in the medulla oblongata pathways and related neurotransmitter systems exists; in such cases, the problem is incurred prenatally but exerts its effects postnatally. Abnormalities in the medullary 5-HT system cause dysfunction in the

processes of laryngeal chemoreflex, sleep, arousal, temperature regulation, and autoresuscitation.[8] The most visible and robust neurochemical abnormality in SIDS is related to the medullary serotonin system, which is involved in approximately 70% of SIDS deaths.[9]

Given the understanding of physiological factors surrounding SIDS, physicians and health workers can now assist parents in decreasing chances for a SIDS death. Because of research and public health education, in the past forty years, the number of SIDS cases declined 80%. In 1992, the American Academy of Pediatrics began recommending that infants be placed to sleep on their backs in order to reduce the risk of SIDS. The "Back to Sleep" campaign initiated in 1994, under the leadership of the National Institute of Child Health and Human Development, further educated parents to put their infants to sleep on their backs. In the ten years following this major recommendation, the SIDS rate decreased 53%.[10] However, in the 2000's, the decrease in rate of SIDS has since leveled, which may be a result of physicians citing alternative diagnoses on death certificates, not any change in parent's behavior following recommendations.[11]

The public health education campaigns for mothers and families to avoid risks that lead to SIDS are effective and do lower rates of SIDS over time. Therefore, risk reduction campaigns, like Safe to Sleep, that emphasize avoiding multiple and simultaneous risks are essential to prevent SIDS.[12] Furthermore, sharing technical knowledge through a "train-the-trainer" model with a sudden infant death syndrome risk reduction curriculum is effective in improving the knowledge and practices of child care providers, resulting in lower rates of SIDS.[13]

In an effort to further decrease SIDS rates, the U.S. Department of Health and Human Services, National Institute of Child Health and Human Development, in September 2012, began a "Safe to Sleep Campaign" with education materials for mothers of infants.[14] The Institute advises eight points to create a safe sleep environment and reduce the risk of SIDS and other sleep related causes of infant death.

- Always place a baby on his or her back to sleep, for naps and at night
- Do not smoke or let anyone smoke around the baby
- Use a firm sleep surface, in a safety-approved crib
- Do not use pillows, blankets, or crib bumpers in the baby's sleep area
- Make sure nothing covers the baby's head
- Keep soft objects, toys and loose bedding out the baby's sleep area
- Dress the baby in light sleep clothing and do not use a blanket
- The baby should not sleep in an adult bed, on a couch or on a chair alone, with a parent, or with anyone else.

Further, evidence supports breastfeeding as a way to reduce the risk of SIDS by approximately 50%, and some physicians call for the advice to breastfeed through six months of age to be included in messages to reduce SIDS risk.[15] Other research shows a significant decrease of risk for babies who are given pacifiers to suck on when placed for sleep, supporting recommendations that parents should be encouraged to use pacifiers.[16]

Thousands of infants die before they reach their first birthday from SIDS in the US each year. By following recommendations to create a safe sleeping environment and refraining from certain unhealthy behavior, parents can remove these risks and decrease the chance of Sudden Infant Death Syndrome.

[1] Stephen M. Adams, MD, Matthe W. Good, MD, Gina M DeFranco, DO, "Sudden Infant Death Syndrome", *American Family Physician* Vol. 79, No. 10, (May 15, 2009,)

[2] Committee on Infant and Preschool Child, "The Sudden Infant Death Syndrome", *Pediatrics*, Vol. 50, No. 6, (December 1972)

[3] Hannah C. Kinney, MD, Bradley T. Thach MD, "The Sudden Infant Death Syndrome", *The New England Journal of Medicine,* 361:8 795-805 (August 20, 2009)

[4] ibid

[5] Filiano JJ, Kinney HC., "A Perspective on Neuropathologic Findings in Victims of the Sudden Infant Death Syndrome: the Triple-Risk Model", *Biol Neonat.* 65:194-197 (1994)

[6] Gordon C.S. Smith and Ian R. White, "Predicting the Risk for Sudden Infant Death Syndrome From Obstetric Characteristics: A Retrospective Cohort Study of 505,011 Live Births", *Pediatrics* 117;60 (2006)

[7] Hannah C Kinney, et al, "The Brainstem and Serotonin in the Sudden Infant Death Syndrome", *Annual Review of Pathology*, 4; 517-550 (2009)

[8] ibid

[9] Paterson DS, Trachtenberg FL, Thompson EG, Belliveau RA, Beggs AH, et al. Multiple Serotonergic Brainstem Abnormalities in Sudden Infant Death Syndrome*, JAMA*, 296:2124-32 (2006)

[10] Task Force on Sudden Infant Death Syndrome, "SIDS and Other Sleep-Related Infant Deaths: Expansion of Recommendations for a Safe Infant Sleeping Environment," *Pediatrics* 128;e1341 (2011)

[11] Hauck FR, Tanabe KO, "International trends in Sudden Infant Death Syndrome: Stabilization of Rates Requires Further Action", *Pediatrics* 122:660-6 (2008)

[12] Felicia L. Trachtenberg, PhD, Elisabeth A Haas, MPH, Hannah C. Kinney, MD, Christina Stanley, MD, and Henry F Krous, MD, "Risk Factor Changes of Sudden Infant Death Syndrome After Initiation of Back-To-Sleep Campaign", *Pediatrics,* 129; 630 (2012)

[13] Rachel Y. Moon, MD, Trisha Calabrese, BSc, Laura Aird, MSc, "Reducing the Risk of Sudden Infant Death Syndrome in Child Care and Changing Provider Practices: Lessons Learned from a Demonstration Project," *Pediatrics* Vol. 122, No. 4 (October 2008)

[14] "What does a safe sleep environment look like?", NIH Pub. No. 12-5759, September 2012

[15] M.M. Vennemann, MD, MPH, PD, T. Bajanowski, MD, PD, et al.; "Does Breastfeeding Reduce the Risk of Sudden Infant Death Syndrome?", *Pediatrics,* Vol. 123, No. 3, (March 2009)

[16] Fern R. Hauck, MD, MS, Olanrewaju O. Omajokun, MD, and Mir S. Siadaty, MD, MS; "Do Pacifiers Reduce the Risk of Sudden Infant Death Syndrome? A Meta-analysis", *Pediatrics*, Vol.116, No. 5., (November 2005)