What protects infants from sudden infant death syndrome?

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The sudden, unexpected and medically unexplained death of an infant during sleep, sudden infant death syndrome (SIDS), is not yet fully understood. A European research group has now presented a new explanatory model in an article published in the current issue of the scientific journal *Human Nature*.

This model focuses primarily on the exciting question of what role the innate and acquired protective factors of infants might play. "The resilience of infants to SIDS is a previously unanswered question. We are presenting an explanatory model for this," says lead author and pediatrician Herbert Renz-Polster, affiliated with the Health Services Research at the Department for General Pediatrics, Pediatric Cardiology and Neonatology at University Hospital Düsseldorf.

So far, SIDS has been explained primarily by the influence of risk factors to which infants are exposed. For example, being placed prone for sleep, cigarette smoking by parents, overly heavy bedding or an unfavorable sleeping surface. In fact, such risk factors play an important role in the development of SIDS, as the team of authors of the new study makes clear.

"Of course the risks count. SIDS cases without at least one of the known risk factors are extremely rare. In most cases, these tragic events involve several risks at the same time. Nevertheless, this is not enough for a comprehensive explanation," says Prof. Dr. Freia De Bock, Head of the Department of Health Services Research in Childhood and Adolescence, Department of General Pediatrics, Neonatology and Pediatric

Cardiology and Center for Health and Society (chs) at the University Hospital Düsseldorf.

For example, it is unclear why the risk of SIDS only increases so significantly after the neonatal period: Why should a 3-month-old baby be more susceptible to the typical SIDS risks than a 3-week-old baby, the researchers ask in their article. The same applies to the fact that male babies are apparently more susceptible to SIDS. The protective effect of breastfeeding against SIDS has also not yet been conclusively explained.

In the current publication, the scientists point out the limitations of the risk-based explanatory model. An analysis of the SIDS data shows that this alone is extremely poor at predicting sudden infant death syndrome.

"Over 99 percent of infants with certain risks do NOT die of SIDS," says Dr. Renz-Polster. In order to answer this question, the multidisciplinary group analyzed previous studies on sudden infant death syndrome based on interdisciplinary research in SIDS epidemiology, in sleep research, anthropology, developmental pediatrics and pediatric public health, with a particular focus on the results of experimental infant research.

According to these findings, infants develop a rich protective repertoire as part of their normal and healthy development, which helps them to react competently and efficiently to adverse influences. The children who die of sudden infant death syndrome were apparently unable to build up their protective repertoire properly. This is supported by the fact that the vast majority of SIDS victims can be shown to have developmental disadvantages—for example due to maternal smoking during pregnancy or severe prematurity.

Looking at the protective factors could be particularly fruitful for explaining the "relative grace period" at the beginning of life. "Early infant research showed 100 years ago that infants are equipped with

powerful protection in the first weeks of life: their innate neonatal reflexes. These ensure that they can breathe freely, for example. However, this 'supplied' protective shield must then be gradually replaced by an acquired and also downright 'trained' protective program," says Professor De Bock.

Earlier SIDS researchers had already pointed out that this transition occurs between the second and fourth month of life—precisely in the developmental phase in which SIDS is most common.

Babies with developmental problems seem to have a particularly difficult time with this transitional phase. However, the infant's everyday experiences also appear to play an important role. The team of authors refers to the theory of evolution, according to which the care experiences typical of the species were always also learning and training opportunities for the infant to practice protective behavior.

Drinking at the mother's breast is described in detail in the paper as an example of this, and in fact, observations as early as the 1960s showed that this probably also involves practicing and expanding skills to ensure free breathing.

Based on these findings and considerations, the scientists have now developed a comprehensive model for the development of SIDS, which they call the "evolutionary-developmental model." According to this model, vulnerability to SIDS is based on an imbalance between risk factors and protective factors that form during the infant's development.

"For us, SIDS represents a fatal imbalance between the current physiological challenges and the protective capabilities acquired during the course of development," says Dr. Renz-Polster.

More information: Herbert Renz-Polster et al, Death from Failed

Protection? An Evolutionary-Developmental Theory of Sudden Infant Death Syndrome, *Human Nature* (2024). DOI: 10.1007/s12110-024-09474-6