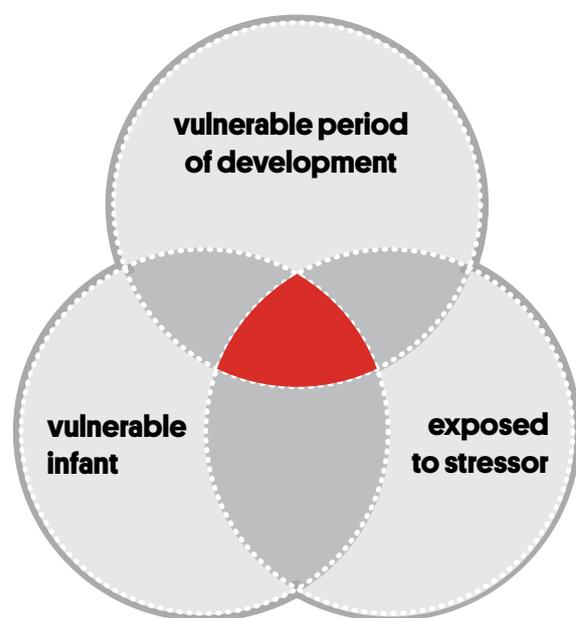


# information statement

## the triple risk model

### key points

- The Triple Risk Model is a useful model to understand how the risk factors for SIDS interact and may lead to an infant dying suddenly and unexpectedly
- The Triple Risk Model poses that a **vulnerable baby** at a **critical period in development**, when **exposed to an external stressor** with which they are unable to cope, may die from SIDS
- No one risk factor in isolation is likely to be sufficient to cause death
- Providing the infant survives the first year of life, the risk factors may no longer be of any major significance



Ongoing research has contributed to the progress that has been made in recent years in understanding what happens when a baby dies suddenly and unexpectedly. As a result of this research, we have proactive steps in the form of public health Safe Sleeping Recommendations<sup>1,2,3</sup> that parents and caregivers can take to help reduce their baby's risk.

While awareness of Safe Sleeping recommendations has increased, sometimes parents don't always understand why these recommendations are important to follow or how they make a difference<sup>4,5</sup>. Many parents and grandparents have stated 'I slept my babies on their tummies, and they were fine' or 'I smoked around my babies and they are all grown up and ok, and didn't die of SIDS!'

### historical development of the triple risk model

In the 1950s an infant dying suddenly and unexpectedly from no known cause became accepted by the medical and scientific establishment. Two international conferences were organised in Seattle in 1963 and 1969 to address what was known about the aetiology of SIDS. A working definition of 'sudden infant death syndrome' was derived from the second of these conferences:

'The sudden death of any infant or young child, which is unexpected by history, and in which a thorough post-mortem examination fails to demonstrate an adequate cause of death'.<sup>6</sup>

This definition was modified in 2004<sup>7</sup> to “the sudden unexpected death of an infant less than 1 year of age, with onset of the fatal episode apparently occurring during sleep, that remains unexplained after thorough investigation, including performance of a complete autopsy and review of circumstances of death and clinical history.”

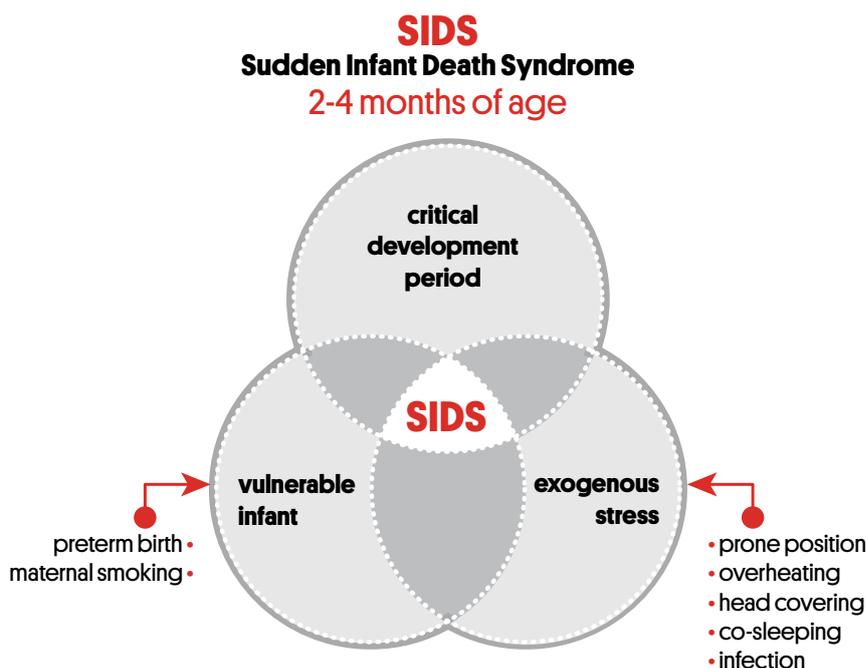
A degree of diagnostic stability and focused research was achieved with this definition. During the last forty years, researchers in the fields of pathology, physiology, epidemiology, and health promotion have attempted to prove or disprove a plethora of hypotheses, and to answer key questions about developmental maturation and potential vulnerability.

Guntheroth and Spiers<sup>8</sup> have documented the historical development of **the Triple Risk Model** or **Triple Risk Hypothesis** that underpins current understanding of the phenomenon of sudden infant death as outlined below.

Bergman [1970]<sup>9</sup> argued that SIDS did not depend on any ‘single characteristic that ordains an infant for death, but on an interaction of risk factors with variable probabilities’. Wedgwood [1972]<sup>10</sup> agreed, grouping risk factors into the first ‘triple risk hypothesis’ consisting of general vulnerability, age-specific risks and precipitating factors, while Raring [1975]<sup>11</sup> concluded that SIDS was a random process with multifactorial causation, based on a bell-shaped curve of age of death. In 1983 John Emery proposed the ‘inter-related causal spheres’ model to explain the interaction of factors that may predispose to sudden infant death.<sup>12,13</sup> Ten years later in 1993, Rognum and Saugstad<sup>14</sup> developed a ‘fatal triangle’ hypothesis, which included similar groupings to Wedgwood, but included mucosal immunity under a vulnerable developmental stage of the infant. These concepts have been advanced by the Triple Risk Model or Triple Risk Hypotheses in describing the sequence of events leading to the death of an infant, and provide the basis for our current understanding of the multifactorial mechanisms for sudden and unexpected infant death, including SIDS. A number of scientists have applied this model in their search for a cause[s] of SIDS.<sup>8,15</sup>

## the triple risk model

The Triple Risk Model illustrated in **Figure 1** proposes that a sudden infant death only occurs if three conditions are present and occur at the same time. These conditions are: a vulnerable infant; a critical period of development; and exposure to a stressor with which the infant is unable to cope.<sup>8,13,15</sup> Variations on this model have been posed by several authors, however, general vulnerability, age-specific risks and precipitating factors are common to the models recorded in the literature.<sup>8,16</sup>



**Figure 1: triple risk**

## vulnerable infant:

Epidemiological and pathology studies have suggested that affected infants may appear normal in development, but possess underlying vulnerabilities that put them at risk for SUDI. The first key element of the Triple-Risk Model describes an infant with an underlying weakness or abnormality, which makes the baby vulnerable. This intrinsic vulnerability may only affect the baby in early life and may only become apparent when the baby is exposed to stress. It is still unknown exactly what this factor is, and there may be multiple factors. Theories include certain pathophysiological factors [e.g., defects and/or dysfunction in the parts of the brain that control respiration or heart rate], a genetic factor, or a problem with the baby’s arousal mechanism].<sup>15,17,18,19</sup> Babies born pre-term, of low birth weight, or exposed to tobacco smoke or illicit drugs in utero are intrinsically more vulnerable and experience a higher rate of SUDI.<sup>20</sup>



## critical developmental period:

The second element of the Triple-Risk Model refers to the baby's first year, but particularly the first 6 months of life. During this critical developmental period, babies are growing and developing rapidly, and changes in homeostatic controls take place. These changes may be evident (e.g., sleeping and waking patterns), or they may be more subtle (e.g., variations in breathing, heart rate, blood pressure, and body temperature). It may be that some of these changes may temporarily or periodically destabilise the baby's internal systems, particularly if the baby has an underlying vulnerability. There is a consistent age distribution for SIDS with 90% of deaths occurring in the first 6 months of life, with a peak at 2-4 months and few babies dying in the first month.<sup>4,15,20,21,22</sup>

## external stressor(s) (outside or environmental challenges):

The third key element of the Triple Risk Model involves outside stressors. These may include environmental factors (e.g. prone sleep position, sleeping on a soft surface, pillow use under a baby's head that causes chin-to-chest positioning, bed-sharing or an upper respiratory infection) that most babies can experience and survive, but that an already-vulnerable baby may not be able to overcome. In and of themselves, these stressors do not cause infant deaths. Most babies can experience external stressors

and survive. However, in an already vulnerable infant, these external stressors, "may tip the balance against an infant's chances of survival",<sup>15</sup> and trigger a sudden and unexpected death.

Trachtenberg and colleagues [2012] reported that 99% of infants whose deaths were attributed to SIDS had at least 1 risk factor, 57% had at least 2 extrinsic and 1 intrinsic risk factor, and only 5% had no extrinsic risk in their study examining infant deaths during the period 1991-2008.

What is now understood is that SUDI is believed to be multifactorial in origin. No one risk factor in isolation is likely to be sufficient to cause death, and provided the infant survives the first year of life, may no longer be of any significance. However, when a vulnerable or compromised infant is confronted with one or more stressful situations, several of which are now clearly identified as risk factors, and from which the majority of infants normally escape, the combination may prove fatal.

Given that the stressor must match the infant's vulnerability, the model also helps to explain why the same stressor is not present in every case, i.e. babies can die in prone, side and supine positions, and the overwhelming majority of infants who sleep prone do not die of SIDS. We know many babies seem to have no known risk factors, and others survive even with many risk factors.

Byard [2004] proposes that SIDS victims form a heterogeneous group of physiologically vulnerable infants who do not all exhibit the same kinds of functional impairment or developmental delays. The interrelation of the various predisposing factors may be extremely complex with great individual variability in the susceptibility of different organ system to a variety of stresses. The system that is compromised to the point of initiating a lethal episode may vary from infant to infant, resulting in variability in the mechanisms responsible for death.

In summary, our Safe Sleeping recommendations focus on removing as many of these risk factors as possible from a baby's environment during that critical first year of life. As we cannot currently identify all vulnerable babies, we must assume that all babies are vulnerable and ensure all parents and caregivers use Safe Sleeping strategies to provide safe sleep, every sleep.

**The term Sudden Unexpected Death in Infancy (SUDI) is now used as this term refers to all cases of sudden and unexpected death in infancy and includes deaths from Sudden Infant Death Syndrome (SIDS) and fatal sleeping accidents.**

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The Red Nose Safe Sleeping program is based on scientific evidence and was developed by Australian SUDI researchers, paediatricians, pathologists, and child health experts with input from overseas experts in the field. The 80% drop in SIDS deaths and the more than 9,000 lives that have been saved is testament to the effectiveness of the program.



## to reduce the risks of SIDS and fatal sleep accidents

1. Sleep **baby on the back from birth**, not on the tummy or side
2. Sleep baby with **head and face uncovered**
3. Keep baby **smoke free** before birth and after
4. Provide a **safe sleeping environment** night and day
5. Sleep baby in their **own safe sleeping place** in the **same room as an adult care-giver** for the first six to twelve months
6. **Breastfeed** baby

**red  
nose**  
saving little lives

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