Annual Report

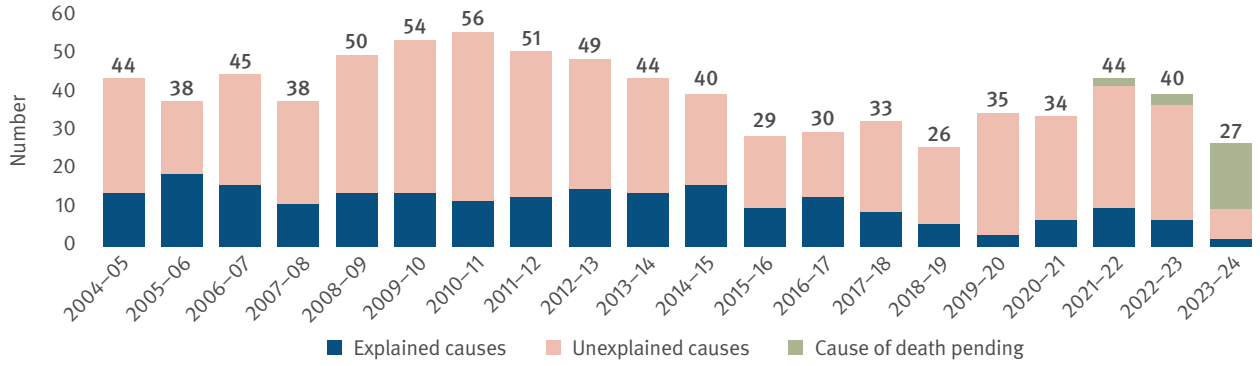
Deaths of children and young people Queensland 2023–24

Queensland Family & Child Commission

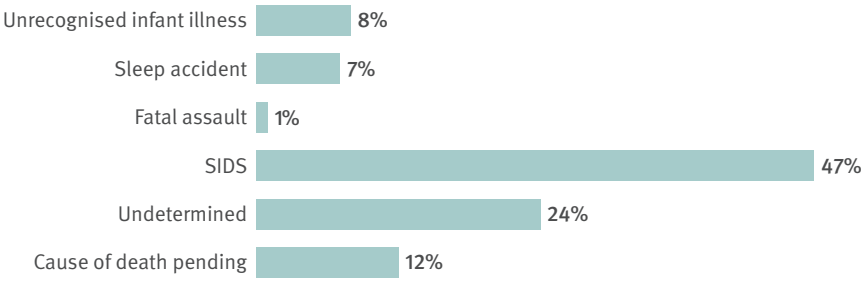
Queensland Government

8 Sudden unexpected deaths in infancy (SUDI)

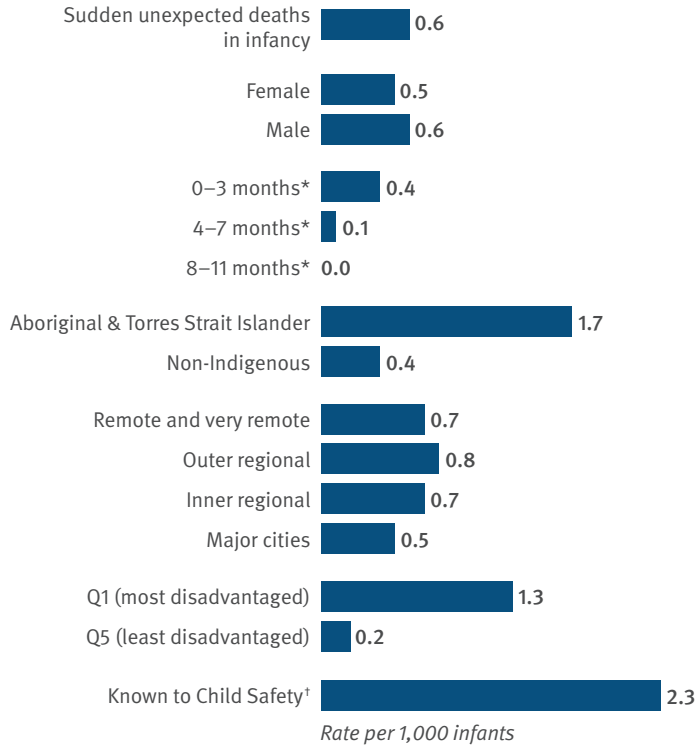
2004 to 2024



5-year summary (2019–24) | Cause of death category



Demographics



Key points

SUDI

Infants who die suddenly, usually during sleep, with no immediately obvious cause

36 SUDI per year

on average in last 5 years

SIDS and undetermined causes

Cause remains unexplained after investigation

Leading cause of death for infants 1–11 months

Unsafe sleep factors

present for many SUDI

Notes: Counting is by date of death registration. Percentages may not add to 100 due to rounding.
** rate per 1,000 births.*
† in the 12 months prior to death.

Key findings

Sudden unexpected death in infancy (SUDI) is a research classification which groups together the deaths of apparently well infants who would be expected to thrive, yet, for reasons often unknown, die suddenly and unexpectedly. It does not correspond with any single medical definition or categorisation. Identifying deaths in this way assists in the identification of possible risk factors for and associations with sudden infant death and, most significantly, those factors which may be preventable or amenable to change.

SUDI is defined as the death of an infant aged less than 12 months, that is sudden and unexpected and where the cause was not immediately apparent at the time of death.

During 2023–24, there were 27 SUDI cases in Queensland, the lowest number of SUDI in the last 6 years. Of the 27 SUDI, 17 were pending a cause at the time of reporting—this reflects the longer timeframes for SUDI cases due to the complexity of the post-mortems and coronial investigation.

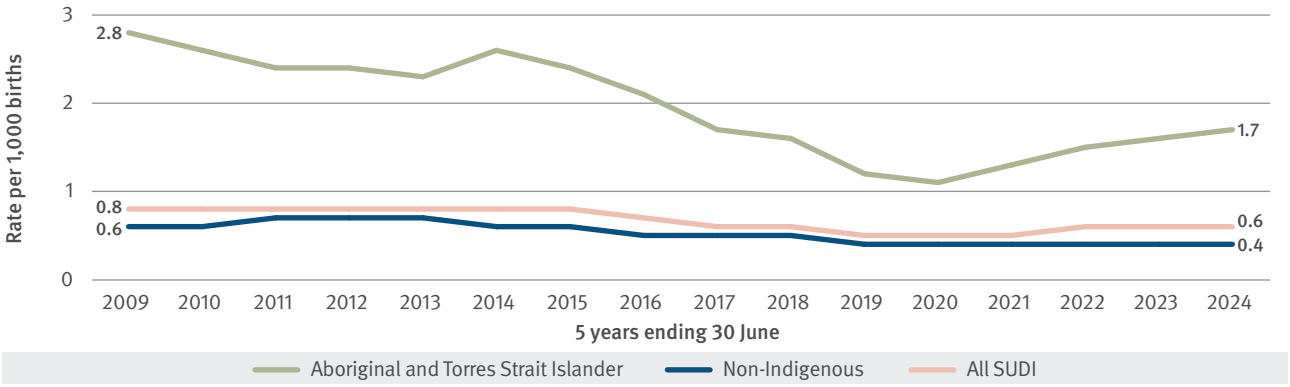
The SUDI mortality rate was 0.6 per 1,000 live births (5-year average).

Table A.11 in Appendix A provides summary data on SUDI in the last 5 years. Explained SUDI are also included in the chapter relating to the specific causes of death.

Aboriginal and Torres Strait Islander infants

Figure 8.1 shows the trends in the 5-year rolling rates of Aboriginal and Torres Strait Islander SUDI, non-Indigenous SUDI and all SUDI in Queensland. The SUDI rate for Aboriginal and Torres Strait Islander infants was around 4 times the non-Indigenous SUDI rate between 2009 and 2016. Rates of Aboriginal and Torres Strait Islander SUDI dropped considerably between 2014 and 2020, reducing from 4.1 to 2.5 times the non-Indigenous rate in 2020.[75] In more recent periods the rates of Aboriginal and Torres Strait Islander SUDI have been increasing.

Figure 8.1: SUDI by Aboriginal and Torres Strait Islander status (5-year rolling rate), 2004–09 to 2019–24



75 Tables with data for 2004–2024 are available online at www.qfcc.qld.gov.au/sector/child-death/child-death-reports-and-data

Cause of death category

Cases of SUDI with an official cause of death are grouped into the following categories and sub-categories. Deaths with an explained cause will also be counted within the relevant chapter, namely Chapter 2 for illnesses, Chapter 5 for sleep accidents, and Chapter 7 for non-accidental injury.

Explained SUDI—infant deaths for which a cause was not immediately obvious; but for which post-mortem examinations were able to identify a specific reason:

- Infant illnesses or condition unrecognised at the time of death
- Sleep accidents (threats to breathing)
- Non-accidental injury (fatal assault).

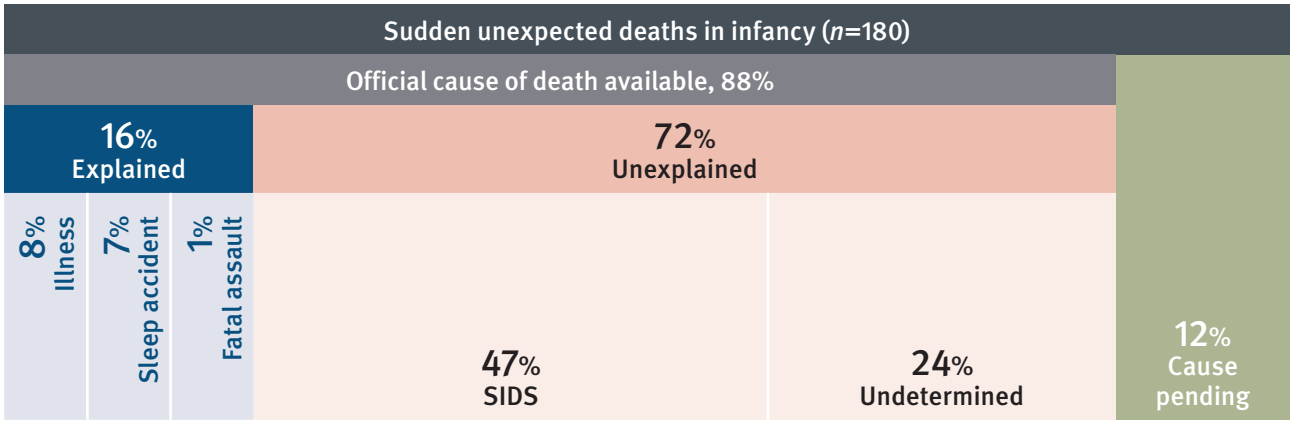
Unexplained SUDI—those infant deaths for which a cause could not be determined:

- Sudden infant death syndrome (SIDS)[76]
- Undetermined causes.[77]

It should be noted that postmortem examinations of SUDI cannot distinguish between undetermined causes and suffocation on the basis of the physiological findings.[78] This is known to contribute to an under classification of suffocation in official cause of death records.[79] Nonetheless in many of the infant deaths considered sudden and unexpected, one or more aspects of the sleep environment were not consistent with a safe sleep environment.[80]

There were 180 SUDI in the last 5 years and, as indicated in Figure 8.2, 72% were found to be unexplained SUDI (SIDS and undetermined causes) while 16% were explained SUDI (illness, sleep accident and fatal assault). A further 12% were pending a cause at the time of reporting.

Figure 8.2: SUDI by cause of death (proportion), 2019–20 to 2023–24



Notes: Percentages may not add to 100 due to rounding.

76 Krous HF, Beckwith JB, Byard RW, et al (2004) 'Sudden infant death syndrome and unclassified sudden infant deaths: a definitional and diagnostic approach', *Pediatrics*, 114:234–8, https://doi:10.1542/peds.114.1.234

77 A finding where: natural disease processes are detected and are not considered sufficient to cause death but preclude a diagnosis of SIDS; there are signs of significant stress; non-accidental, but non-lethal, injuries are present; toxicology testing detects non-prescribed but non-lethal drugs; or a full autopsy has not been performed and a cause is not otherwise identified.

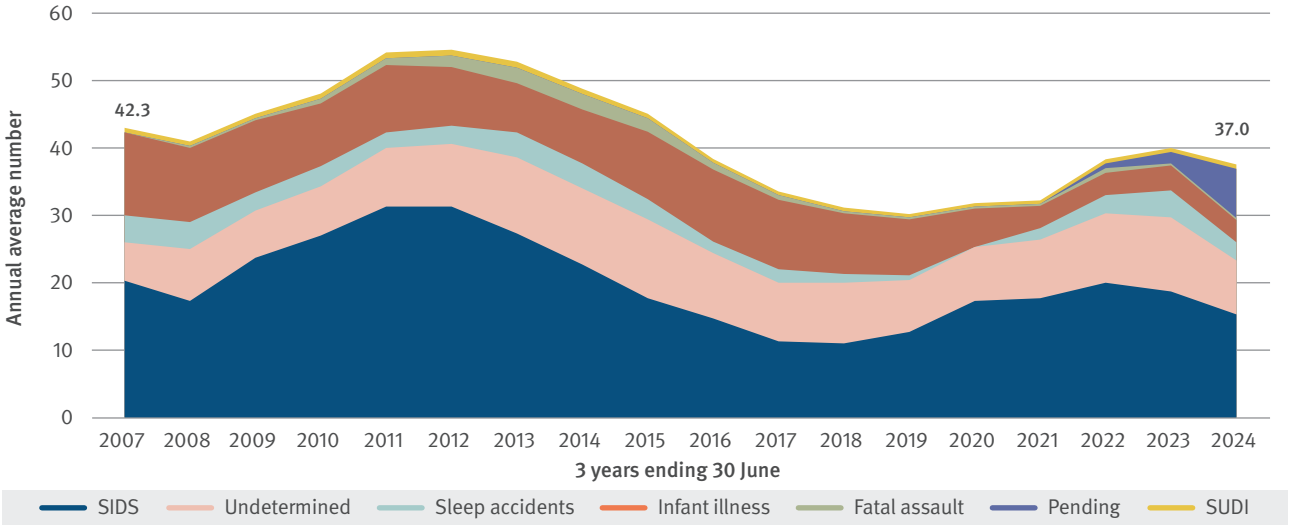
78 Byard RW, Jensen L (2007) 'Fatal asphyxia episodes in the very young – Classification and diagnostic issues.' *Forensic Science Medicine and Pathology* 3, 177-181; Byard RW (2018) "The autopsy and pathology of Sudden Infant Death Syndrome." In Duncan, JR & Byard, RW (eds.) *SIDS, sudden infant and early childhood death: the past, the present and the future*, pp.497-538. Adelaide: University of Adelaide Press.

79 Shapiro-Mendoza CK et al (2014) 'Classification system for the Sudden Unexpected Infant Death Case Registry and its application.' *Pediatrics*, 134(1), e210–e219. https://doi.org/10.1542/peds.2014-0180; Shipstone RA et al (2020) 'An evaluation of pathologists' application of the diagnostic criteria from the San Diego definition of SIDS and unclassified sudden infant death.' *International Journal of Legal Medicine*, 134(3), 1015–1021. https://doi.org/10.1007/s00414-019-02126-w

80 Factors in safe and unsafe sleep environments are described in the *Best practice guide for the design of safe infant sleeping environments*, available at www.productsafety.gov.au/about-us/publications/best-practice-guide-for-the-design-of-safe-infant-sleeping-environments

Fluctuations in the number and causes of SUDI (rolling average) are shown in Figure 8.3. While the number of SUDI has decreased since 2011, average annual numbers have increased again since 2020.[81] Deaths from infant illness, undetermined causes and sleep accidents remained comparatively stable across the entire period; in contrast, SIDS deaths rose and fell. However, some caution is warranted as assigning definitive causes for SUDI remains complex and developments in cause of death classification are ongoing.[82]

Figure 8.3: SUDI by cause of death (3-year rolling average number), 2004–07 to 2021–24



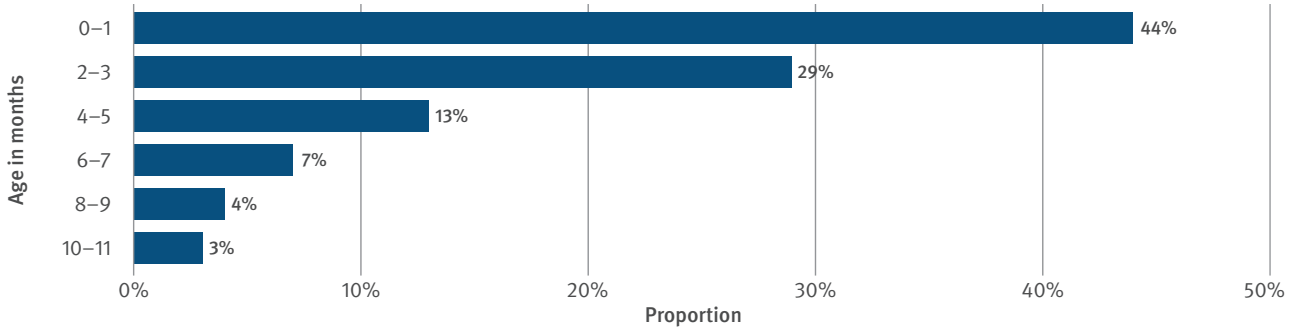
SUDI later found to be the result of fatal assault or neglect are excluded from the analyses presented throughout the remainder of this chapter.

Sex and age

A slightly larger proportion of SUDI in the last 5 years were males (56% male compared with 44% female), but there was not a significant difference in rates at 0.6 per 1,000 male births compared to 0.5 per 1,000 female births.

Figure 8.4 shows SUDI by age at death in the last 5 years. Almost three-quarters of sudden unexpected deaths (73%) occurred among infants aged 0–3 months.

Figure 8.4: SUDI by age in months (proportion), 2019–20 to 2023–24



Notes: Excludes SUDI from fatal assault and neglect. Percentages may not add to 100 due to rounding.

81 An expanded table on SUDI since 2004 is available on the report web page.

82 An expert panel review of Queensland post-neonatal SUDI deaths from 2013 recoded around half of the deaths to a different cause, with shifts occurring from explained to unexplained causes and vice versa. McEniery J, Cruice D (2018) **'The voice of the infant: Cause of death coding does not always reflect what really mattered in the life of the infant who died suddenly and unexpectedly'** [poster presentation], *Perinatal Society of Australia and New Zealand Conference*, Auckland. **www.childrens.health.qld.gov.au/chq/health-professionals/qpqc/**

Risk factors for SUDI

A number of factors have been associated with an increased risk of SUDI.[83] These can be classified according to whether they are associated with the infant, the family or the sleep environment.

Infant factors: Prematurity and low birth weight, multiple gestation (twins, triplets), neonatal health problems, male sex and recent history of minor viral respiratory infections and/or gastrointestinal illness.

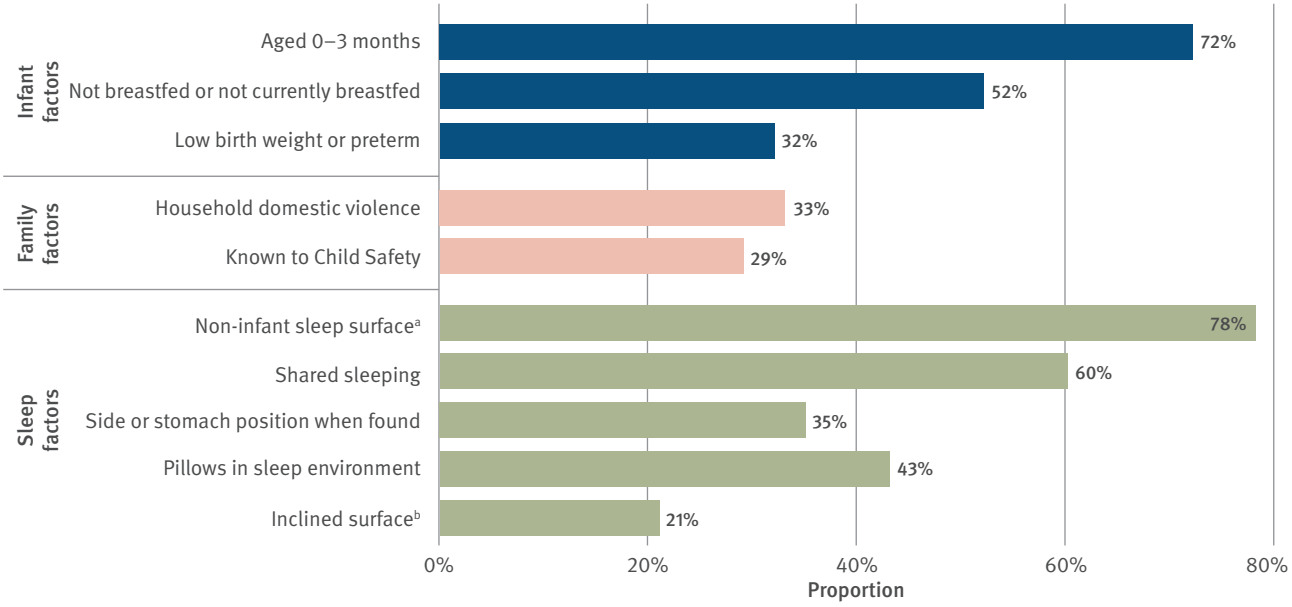
Family factors: Cigarette smoking during pregnancy and after birth, young maternal age (≤ 20 years), single marital status, high parity (number of births by mother) and short intervals between pregnancies, poor or delayed prenatal care, abuse or family violence, high-risk lifestyles including alcohol and illicit drug abuse, and social disadvantage and poverty.

Sleep environment factors: Sleeping on soft surfaces and loose bedding, prone (stomach) and side sleeping position, some forms of shared sleeping, and overwrapping or overheating.

Selected characteristics of the infant, family and unsafe sleep factors in SUDI deaths over the last 5 years are shown in Figure 8.5.[84] These indicate increased risk in the first months and for infants born with low birth weight.

Using non-infant sleep surfaces (78% of SUDI), sharing a sleep surface (60%) and sleep position on side or stomach (35%) are all reported to increase the risk of sudden unexpected infant deaths, as are pillows (43%) and excess bedding in the sleep space.

Figure 8.5: SUDI by selected infant, family and sleep factors (proportion), 2019–20 to 2023–24



a Includes adult sleep surfaces and other surfaces such as a couch/chair or infant product not primarily for sleep (e.g. pram/stroller, baby capsule).

b Includes infants propped on pillows or other items, and products with an inclined surface: pram/stroller; infant swing/rocker; baby capsule/car seat.

Notes: Excludes SUDI from fatal assault and neglect.

83 The Triple Risk Model proposes SUDI risk increases with combined factors of vulnerable infant; critical development period; and external stressors https://rednose.org.au/article/why-are-safe-sleeping-recommendations-so-important

84 Analysis based on the 178 SUDI deaths in the last 5 years, excluding 2 deaths found to be from fatal assault and neglect.

Clinical guidelines: Safer infant sleep

The Queensland Health ***Safer infant sleep clinical guideline***, released in late 2022, highlights infant care practices that are associated with promoting airway protection for infants, which in turn reduces the risk of SUDI.[85]

Co-designed with key stakeholders including parent consumers, the guideline contains a clearly articulated risk minimisation approach to safer infant sleep. A risk minimisation approach ensures that caregivers receive information that includes benefits and risks, together with strategies to increase safety, in a range of diverse infant sleep environments, including shared sleeping. Evidence demonstrates risk minimisation approaches better equip families with the practical information they need to meet the needs of their infant within their family circumstances and the resources they have available.

Understanding infant vulnerabilities and removing as many factors as possible in the infant's environment which place them at increased risk for SUDI is a key message of the guideline. The new guideline also highlights the importance of communication between clinicians and families regarding implementation of these messages by families. Listening to and respecting family choices should shape how the information is shared so that families trust these messages and understand the relevance to their infant care decisions.[86]

Improving caregiver understanding of how infants breathe and the importance of protecting airways when sleeping helps families to understand why the safer sleep messages are relevant to their infant. It also creates the opportunity to assess risks in the infant sleep environment, consider infant vulnerabilities and make safer sleep plans which consider the family's unique circumstances.

The new guideline also describes the importance of having conversations about safer infant sleep repeatedly over multiple time points and involving a wide range of potential carers (e.g. fathers, grandparents etc.).

Applying this simple message:

Easier to breathe – Safer to sleep, every time an infant sleeps is critical

85 Queensland Health (2022) *Queensland Clinical Guidelines, Safer infant sleeping*. Guideline No. MN22.71-V1-R27 www.health.qld.gov.au/__data/assets/pdf_file/0025/1166353/g-safer-sleep.pdf

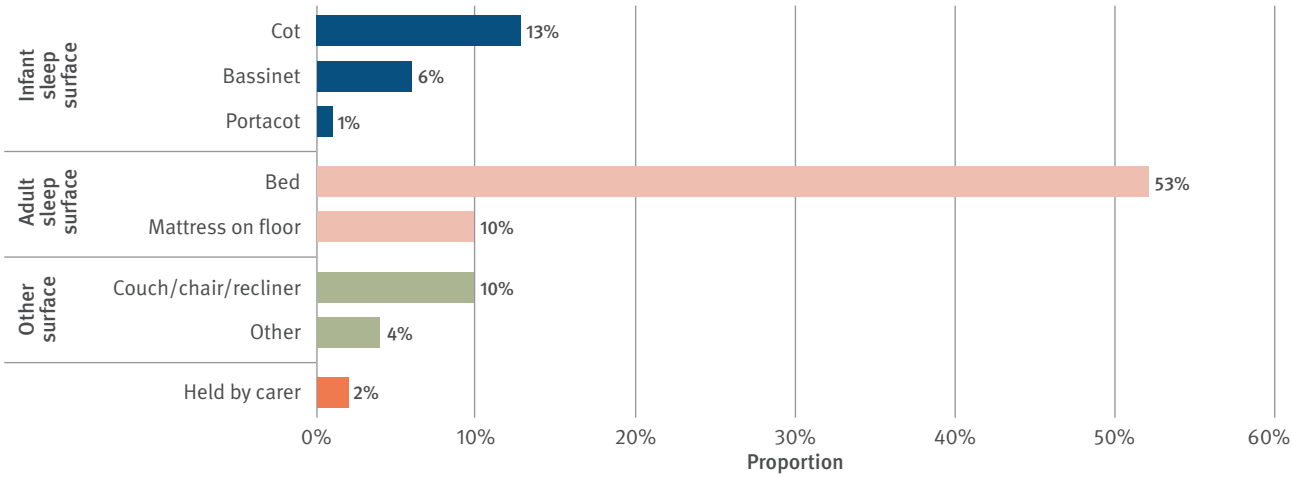
86 Pease A, Garstang JJ, Ellis C, Watson D, Ingram J, Cabral C, et al (2021) 'Decision-making for the infant sleep environment among families with children considered to be at risk of sudden unexpected death in infancy: a systematic review and qualitative metasynthesis'. *BMJ Paediatrics Open* https://bmjpaedsopen.bmj.com/content/5/1/e000983

Sleep environment factors

Sleep surface

As indicated in Figure 8.6, in over half the SUDI (63%) in the last 5 years the infant was on an adult sleep surface at the time of the incident and a further 10% were on a couch or recliner. Only 20% of SUDI occurred when an infant sleep product was being used.[87]

Figure 8.6: SUDI by sleep surface (proportion), 2019–20 to 2023–24



Notes: Excludes SUDI from fatal assault and neglect. Percentages may not add to 100 due to rounding.

Infant sleep position

Safer infant sleep advice is to place infants on their backs to sleep (supine). Once infants can roll of their own accord it remains important that the sleep surface is firm and flat—the infant's face/nose may be obstructed if the surface is too soft.

Information from incident reports on infant sleep position is shown in Table 8.1. While 77 deceased infants in the last 5 years were placed and found on their back, a further 24 had moved from their back to stomach or side position when found. Of the 178 infants dying suddenly and unexpectedly, 63 were on their stomach or side when found (35% of SUDI excluding those from non-accidental injury).

Table 8.1: Infant sleep position when placed and found (number), 2019–20 to 2023–24

Position when placed	Position when found						Total
	Back	Stomach	Side	Other	Held by carer	Unknown	
Back (supine)	77	19	5	1	0	6	108
Stomach (prone)	2	12	0	0	0	1	15
Side	2	9	9	0	0	1	21
Held by carer	2	4	0	2	5	1	14
Other	0	2	0	1	0	0	3
Unknown	4	3	0	2	0	8	17
Total	87	49	14	6	5	17	178

Notes: Excludes SUDI from fatal assault and neglect.

87 Percentages by surface types in Figure 8.6 may not add to subtotals presented in this paragraph due to rounding.

Inclined surface

A firm, flat sleeping surface (not tilted or elevated) is recommended to reduce the risk of SUDI, including for babies with reflux.[88] Information in the Child Death Register indicates 21% of SUDI in the last 5 years were placed on an inclined surface. Most of these involved propping infants on pillows or other items. Some incidents involved an infant product with an inclined surface, including a hammock and infant car seat.

Shared sleeping

Over half (107, 60%) of the infants whose deaths were sudden and unexpected were sharing a sleep surface with one or more people at the time of death. Not all shared sleeping was planned—in some incidents the carer has fallen asleep while nursing the infant.

Sharing a sleep surface with a baby can increase the risk of SIDS and fatal sleep accidents in some circumstances.[89] Some studies have found there is an increased risk of SIDS only when mothers who smoke share a bed with their infant, although such findings are insufficient to enable complete reassurance that bed sharing is safe for non-smokers.

Risks are also associated with shared sleeping if infants are sharing a sleep surface with a caregiver who is under the influence of alcohol or drugs which cause sedation, if the caregiver is excessively tired or there are multiple people in the bed with the infant.

Of the 107 SUDI in a shared sleep environment over the last 5 years, the following additional risk factors were identified:

- position in sleep environment, such as placed between 2 people or on top of a co-sleeping person (32%)
- alcohol or substance use (24%)
- tobacco (40%)
- extreme fatigue (21%)
- obesity (7%).

88 Queensland Health (2022) *Queensland Clinical Guidelines. Safer infant sleep*, Guideline No. MN22.71V1-R27, www.health.qld.gov.au/__data/assets/pdf_file/0025/1166353/g-safer-sleep.pdf

89 Queensland Health (2022) *Queensland Clinical Guidelines. Safer infant sleep*, Guideline No. MN22.71V1-R27, www.health.qld.gov.au/__data/assets/pdf_file/0025/1166353/g-safer-sleep.pdf

Queensland Paediatric Quality Council update

Infant maturity and development and risk of SUDI

The Queensland Paediatric Quality Council (QPQC) seeks to identify opportunities for SUDI risk reduction and prevention by conducting detailed retrospective reviews of SUDI deaths in Queensland using the expertise of the Infant Mortality Subcommittee (IMSC) multidisciplinary panel. Reviews of SUDI patterns at different infant ages have shown that, as infants mature and develop, there is also a change in their interaction with their sleep environment, thus prevention strategies also need to change over time, as identified in the Queensland Health *Safer infant sleep clinical guideline*.[i]

Infant neurological maturity and motor development at the time of death are particularly relevant to the risk of SUDI in sleep; a risk which changes as an infant dynamically develops during the first year of life. For example, young infants aged 0–3 months typically cannot yet roll nor lift their heads and may be at risk for impaired breathing if their mouth and nose become covered or obstructed during sleep. In contrast, older infants who are more mobile during sleep are more likely to interact with objects in their sleep environment by rolling, pivoting or even crawling; resulting in entanglement or entrapment if they are not yet coordinated enough to free themselves.

The QPQC review of all SUDI occurring in Queensland in 2013 to 2016 (n=159) found that after investigation, 127 deaths which occurred in a sleep setting remained unexplained (ICD-10 R95–R99) or were determined to be the result of accidental suffocation (ICD-10 W75). In almost all of these cases, aspects of the sleep setting were determined as unsafe.

Infant developmental progress is unique for each infant, with variation dependent on factors such as gestational age, growth, medical or developmental conditions and the external environment. The developmental ability of the deceased infant was rarely described sufficiently in the investigations of cases reviewed. Instead, expected developmental progress was approximated by the QPQC based on average milestones using the corrected age of the infant adjusted for gestation (chronological age reduced by the number of weeks born before 40 weeks of gestation).

Table 1 categorises the 127 SUDI which occurred in a sleep setting into three developmental stages relevant to sleep safety (as described in the Queensland Health, *Safer infant sleep clinical guideline*) using both chronological age and corrected age. The high number in the 0–3 months corrected age group reflects the impact of correcting for gestation prior to 40 weeks. In the SUDI cohort, 87% (110 of 127) of infants were born before 40 weeks gestation. This is higher than expected, given the incidence of birth before 40 weeks for all Australian births is reported to be between 61% (in 2011) and 72% (in 2021).[ii] This finding supports the contribution of developmental immaturity as a risk factor.

Continued over page...

Queensland Paediatric Quality Council update *(continued)*

Infant maturity and development and risk of SUDI

Table 1: Developmental stage grouping of unexplained SUDI infant deaths reviewed occurring in a sleep setting (n=127)

Age range	Broad ability level	Number of deaths Chronological age	Number of deaths Corrected age
Up to and including 3 months	Most infants cannot roll. They can move their head side to side when placed on their back and begin to be able to lift their head for short periods of time if placed on their stomach for 'tummy time'.	82	90
4–5 months	Most infants learn to roll from front to back. Arm and leg movement become stronger, and they push with legs more often. They can change position but not extricate themselves if they become trapped or their airway is compromised.	28	23
6 months and older	Motor skills rapidly develop as infants learn to roll supine to prone, pivot laterally, sit, crawl and pull to stand. They are unlikely to stay stationary during sleep and may wake, move or play and then fall back asleep.	17	14

Of the 127 SUDI cases reviewed, younger infants (0–3 months corrected age who cannot roll) were more likely to die in a shared sleep environment (61%) than in a non-shared (solo) sleep space (39%). In contrast, for infants of 4–5 months corrected age (who are beginning to roll and move around in the sleep environment) there were fewer deaths in shared sleep environments (39%) than in a solo sleep space (61%). Infants of 6 months corrected age or older were more likely to die in a solo sleep space (79%). It is unlikely that this is because fewer older infants share a sleep surface. Several reviews suggest that the incidence of infants older than 6 months of age sharing sleep surfaces remains similar across ages or may even increase with age.[iii,iv] Instead, we hypothesise that the decreased apparent risk of shared sleep spaces for older infants is due to evolving neurological maturity and development of motor skills, which result in an improved infant arousal response when breathing is compromised in sleep, and sufficient motor skills to move themselves into positions where breathing is easier, consistent with findings of Blair and colleagues (2014).[v]

Soft bedding (including doonas, blankets, and soft sleep surfaces such as soft foam mattresses or sofas) in the sleep environment poses a risk at all infant ages; notably information was not always reported in enough detail for reviewers to assess (data available for 101/127 deaths). The risk of soft bedding was especially evident for infants of 6 months corrected age or older, with soft bedding identified as an environmental risk contributing to 100% of these deaths (data available in 13 of 14 deaths). For infants in the 0–3 months corrected age group, soft bedding was a likely contributor in the majority of deaths (81%, with data available in 56 of 90 deaths), and also contributed to the majority of deaths in the 4–5 months corrected age group (69%, with data available in 19 of 23 deaths). Although carers may assume that infants older than 6 months are safe to sleep in the presence of pillows, blankets and doonas, the reviews demonstrated that infants can become tangled in the bedding and when this happens, some infants cannot maintain the safety of their airway.

Continued over page...

Queensland Paediatric Quality Council update *(continued)*

Infant maturity and development and risk of SUDI

Key points for risk reduction and prevention

The maturity and development of an infant should be considered in safe sleep planning.

- Include infant developmental age and ability and how this may interact with the sleep environment during safe sleep conversations and planning.
- The new Queensland Health *Safer infant sleep clinical guideline* provides detailed information on considerations for risk minimisation as the infant grows and develops.[i]
- Soft bedding (pillows, blankets, doonas) is a risk factor for SUDI occurring at every age.

Consideration of the developmental ability of an infant at the time of the incident should be included in the investigation of SUDI. The QPQC, QFCC, Forensic Pathology & Coronial Services and Coroners Court of Queensland are currently working towards an infant health interview format, which includes questions around developmental ability, to be conducted as part of the investigation of SUDI.

i Queensland Health (2022) *Queensland Clinical Guidelines. Safer infant sleep*, Guideline No. MN22.71V1-R27, www.health.qld.gov.au/__data/assets/pdf_file/0025/1166353/g-safer-sleep.pdf

ii Australian Institute of Health and Welfare (2024) *Australia's mothers and babies*. Australian Government. https://www.aihw.gov.au/reports-data/population-groups/mothers-babies/overview

iii Cole, R. Young, J. Kearney, L. Thompson, J.M.D. (2022) 'Infant Care Practices, Caregiver Awareness of Safe Sleep Advice and Barriers to Implementation: A Scoping Review' *Int. J. Environ. Res. Public Health*, 19, 7712. https://doi.org/10.3390/ijerph19137712

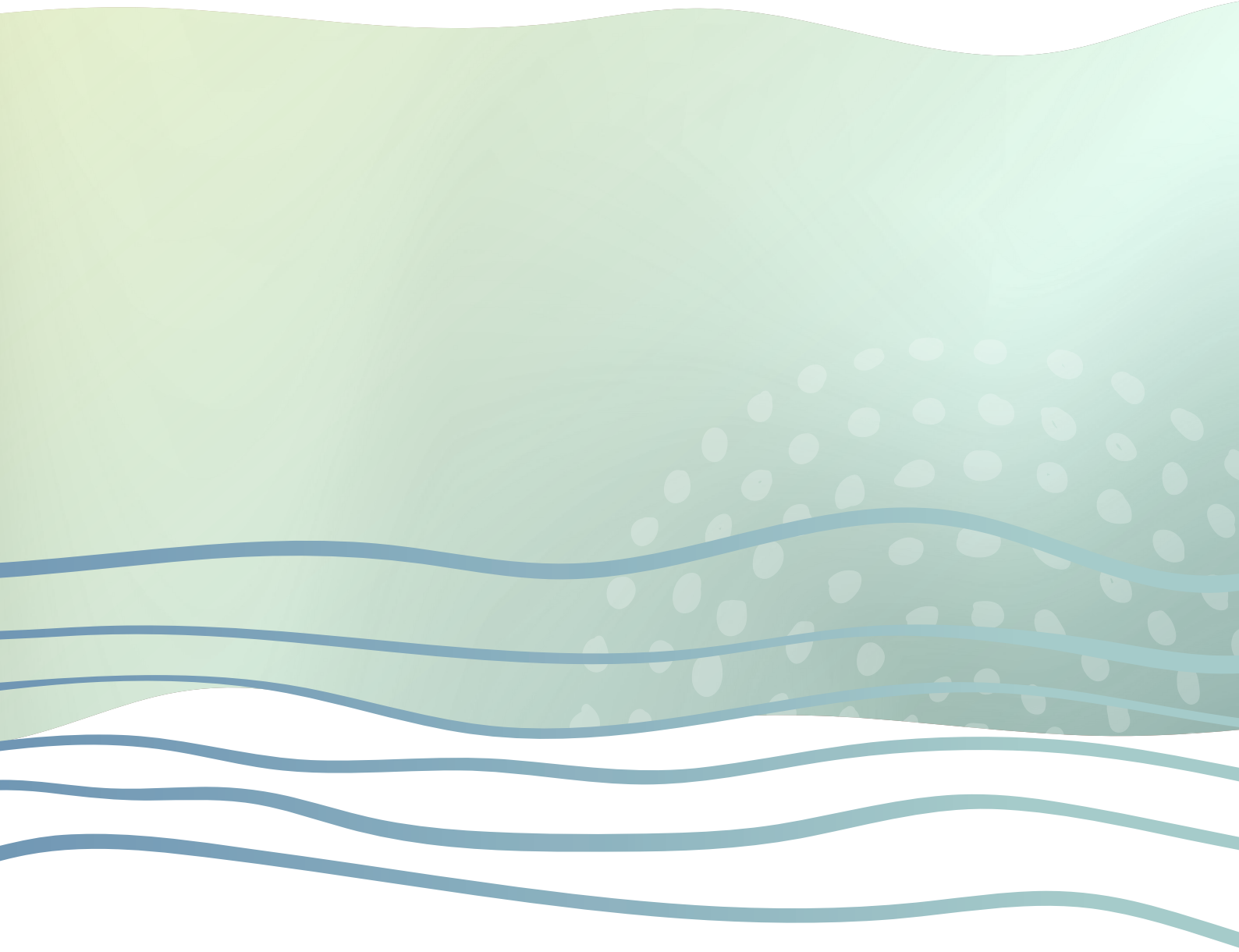
iv Garrido, F. Gonzalez-Caballero, JL., Garcia, P., Gianni, ML., Garrido, S., Gonzalez, L., Atance, V., Raffaeli, G., Cavallaro, G. (2024) 'Association between co-sleeping in the first year of life and preschoolers sleep patterns' *European Journal of Pediatrics* 183:2111–2119 https://doi.org/10.1007/s00431-024-05429-2

v Blair PS, Sidebotham P, Pease A, Fleming PJ. (2014) 'Bed-sharing in the absence of hazardous circumstances: is there a risk of sudden infant death syndrome? An analysis from two case-control studies conducted in the UK' *PLoS One*;9(9):e107799. https://journals.plos.org/plosone/article?id=10.1371%2Fjournal.pone.0107799

Unexplained deaths of children aged 1–17 years

While this chapter primarily examines sudden unexpected deaths of infants, a smaller proportion of unexplained-cause deaths were of children aged 1 year and over (see **Table A.10**, **Appendix A**). Over the last 5 years, while 85% of unexplained deaths were infants, 9% were aged 1–4 years and 6% were aged 5–17 years.

Some deaths in the younger age group show similarities to SUDI deaths in that they occurred during sleep with SUDI risk factors present. In some unexplained deaths, investigations have found the cause of death to be injury; however, it cannot be determined whether the cause of the injury was accidental or intentional.



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