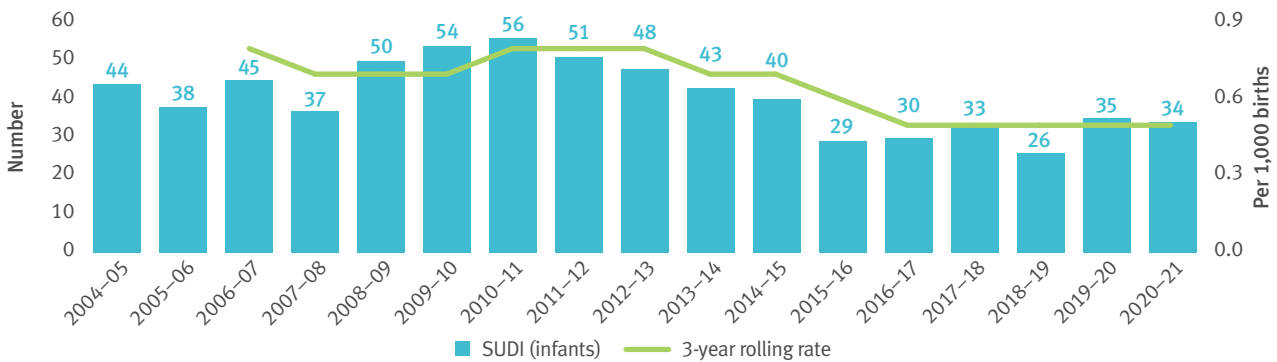


# 7 Sudden Unexpected Deaths in Infancy

## Overview

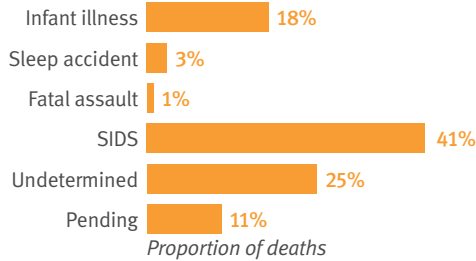
- Sudden Unexpected Death in Infancy (SUDI) is a category of deaths where an infant dies suddenly, usually during sleep, and with no immediately obvious cause.
- Sudden Infant Deaths Syndrome (SIDS) and undetermined causes, as a group, was the leading cause of post-neonatal infant death.
- SUDI numbers have plateaued in the last six years.
- Unsafe sleep factors were present for many SUDIs.

## SUDI in Queensland

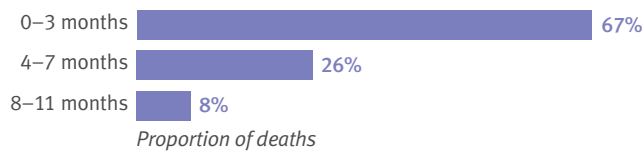


## Five-year summary (2016–21)

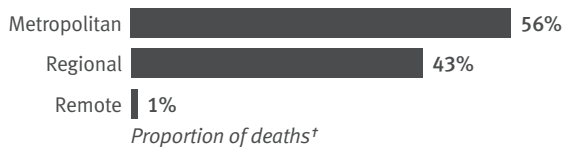
### Cause of death category



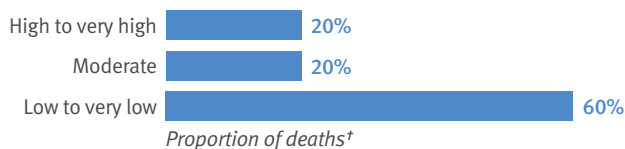
### Age



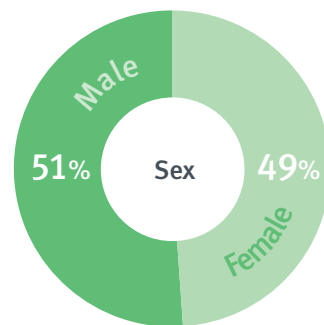
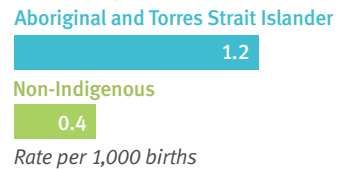
### Remoteness



### Socio-economic status



### Indigenous status<sup>^</sup>



Notes: Counting is by date of death registration. Percentages may not add to 100 due to rounding.

<sup>^</sup> 3-year average rates  
<sup>†</sup> of Qld resident deaths only  
<sup>\*</sup> in the 12 months prior to death

## Sudden Unexpected Death in Infancy (SUDI) classification

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. 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. Cases of SUDI with an official cause of death are grouped into the following categories and sub-categories:

**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 unrecognised at the time of death
- Sleep accidents
- Non-accidental injury (fatal assault)

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

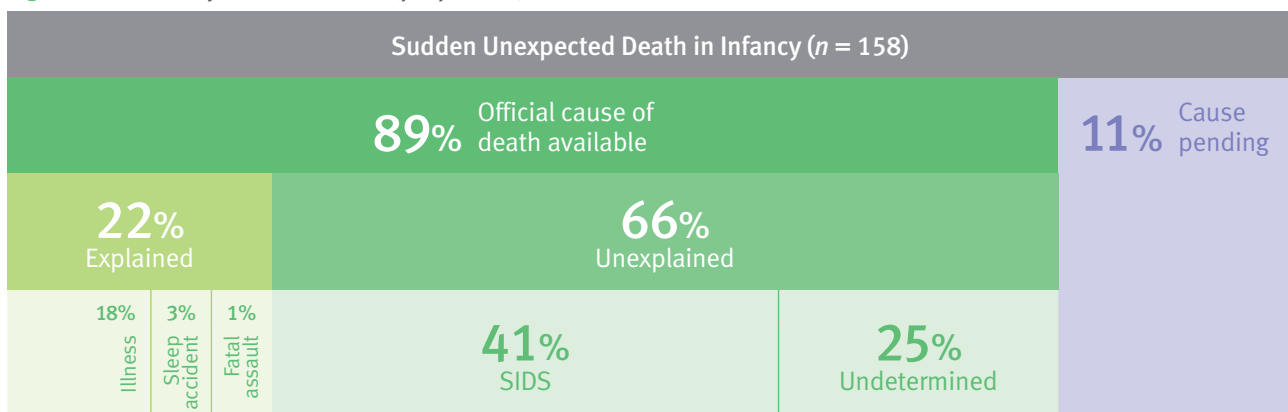
- Sudden Infant Death Syndrome (SIDS)<sup>45</sup>
- Undetermined causes<sup>46</sup>

## Key findings

During 2020–21, there were 34 SUDI cases in Queensland, of which 15 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. **Table A.11** in **Appendix A** provides summary data on SUDIs in the last 5 years. Explained SUDIs are also included in the chapter relating to the specific causes of death.

There were 158 SUDIs in the last 5 years and, as indicated in Figure 7.1, 66% were found to be unexplained SUDI while 22% were explained SUDI. The SUDI mortality rate was 0.5 per 1,000 live births (3-year average).

**Figure 7.1:** SUDI by cause of death (proportion), 2016–17 to 2020–21



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

45 Krous HF, Beckwith JB, Byard RW, Rognum TO, Bajjanowski T, Corey T, Cutz E, Hanzlick R, Keens TG, Mitchell EA (2004) 'Sudden infant death syndrome and unclassified sudden infant deaths: a definitional and diagnostic approach', *Pediatrics*, 114:234–8, [doi:10.1542/peds.114.1.234](https://doi.org/10.1542/peds.114.1.234).

46 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.

## Trends

SUDI deaths have fluctuated over the last 17 years, as indicated in the rolling average numbers presented in Figure 7.2. While overall SUDIs have decreased, annual numbers have plateaued in the most recent 6 years. SUDI numbers peaked across the periods 2008–10 to 2010–13.<sup>47</sup> While deaths from infant illness, undetermined causes and sleep accidents remained comparatively stable across the entire period, SIDS deaths rose and fell over the period with this driving the changes in SUDI totals.

However, some caution is warranted as assigning definitive causes for SUDIs remains complex and developments in cause of death classification are ongoing. 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.<sup>48</sup> The SIDS deaths were the group most commonly recoded, with the panel coding most as undetermined causes. The findings of the expert panel review; however, are not reflected in this report which relies on cause classification from official causes of death.

As further described at the end of this chapter, the Pépi-Pod<sup>®</sup> Program was introduced as a research initiative in Queensland in 2011 and is hypothesised to have had an effect on reducing infant mortality rates from 2014.

**Figure 7.2:** Cause of SUDI death (3-year rolling average number), 2004–07 to 2018–21

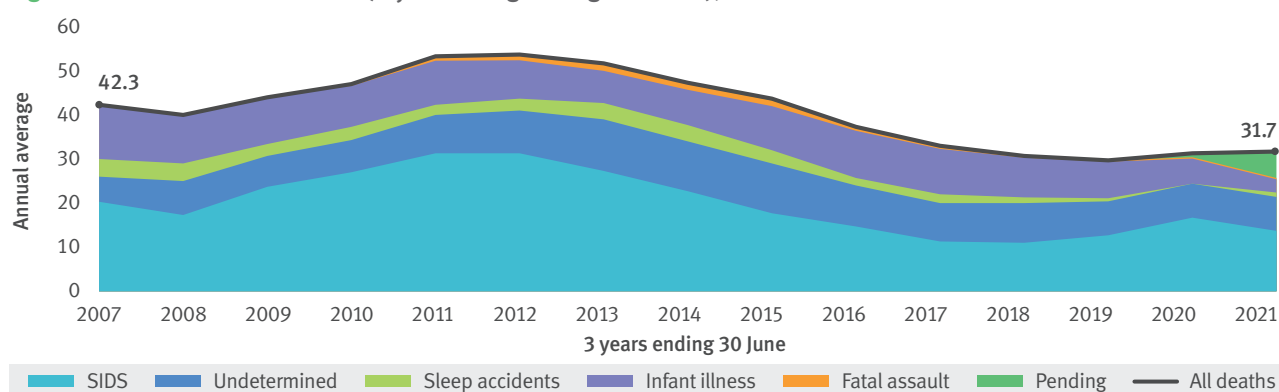


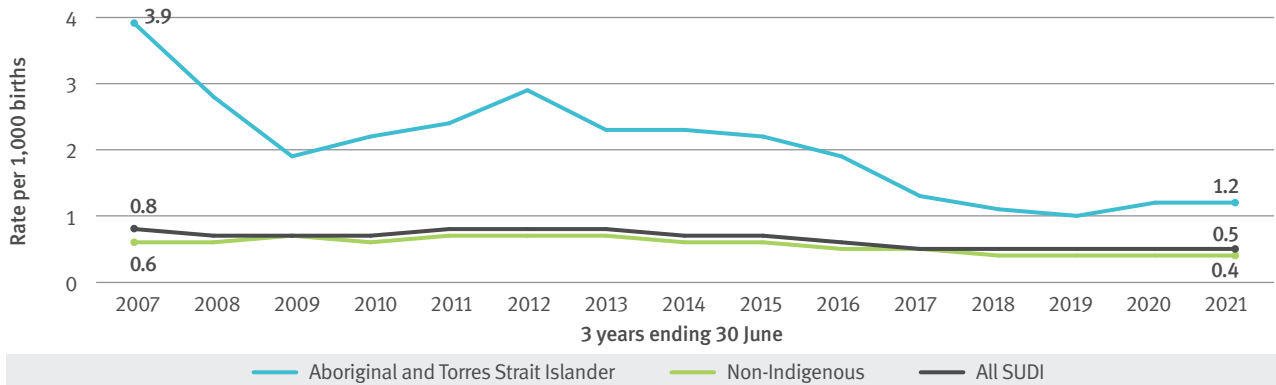
Figure 7.3 shows the declining rate of Aboriginal and Torres Strait Islander SUDI deaths over the last 17 years. The rate of Aboriginal and Torres Strait Islander SUDIs was particularly high in the first years of the Register. Over the period 2009–2016 the Aboriginal and Torres Strait Islander SUDI rate was around 4 times the non-Indigenous SUDI rate. Indigenous over-representation was still evident from 2016–2021; however, it had reduced to be just under 3 times the non-Indigenous rate.<sup>49</sup>

47 Tables with data from 2004 are available online at <http://www.qfcc.qld.gov.au/kids/preventing-child-injury-death>

48 McEnery 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, accessed 12 August 2021.

49 Data by Indigenous status may have changed from previous reports due to: QFCC audit of Indigenous status where source records are inconsistent; and, change in data analysis from 5-year to 3-year rolling average rate.

**Figure 7.3:** SUDI by Aboriginal and Torres Strait Islander status (3-year rolling rate), 2004–07 to 2018–21



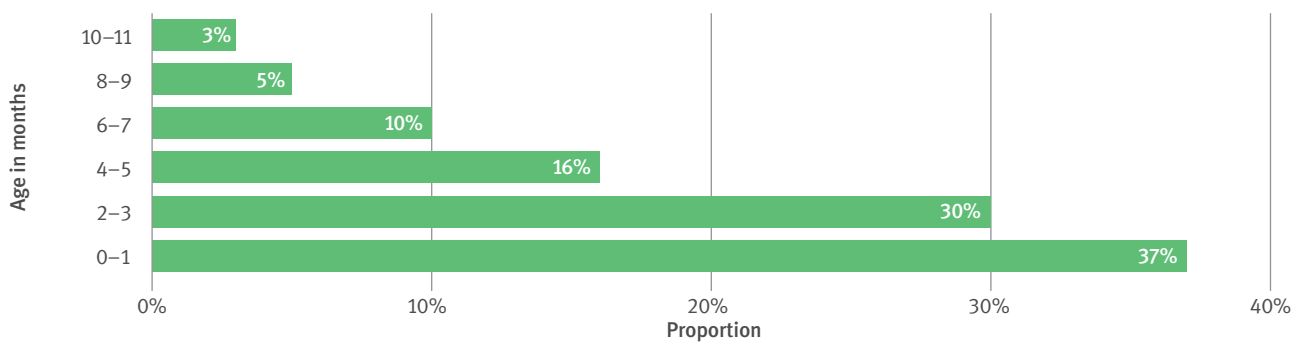
Notes: Data by Indigenous status may have changed from previous reports due to: QFCC audit of Indigenous status where source records are inconsistent; and, change in data analysis from 5-year to 3-year rolling rate.

### Sex and age

Of the 156 SUDIs in the last 5 years, 49% were female and 51% were male. However, over the full 17-year period from 2004, males made up a larger proportion (58%) compared to females (42%). These figures, and analysis in the rest of this chapter, exclude deaths from fatal assault.

Figure 7.4 shows SUDI by age at death in the last 5 years. Two-thirds of sudden unexpected deaths (67%) occurred among infants aged under 4 months.

**Figure 7.4:** SUDI by age in months (proportion), 2016–17 to 2020–21



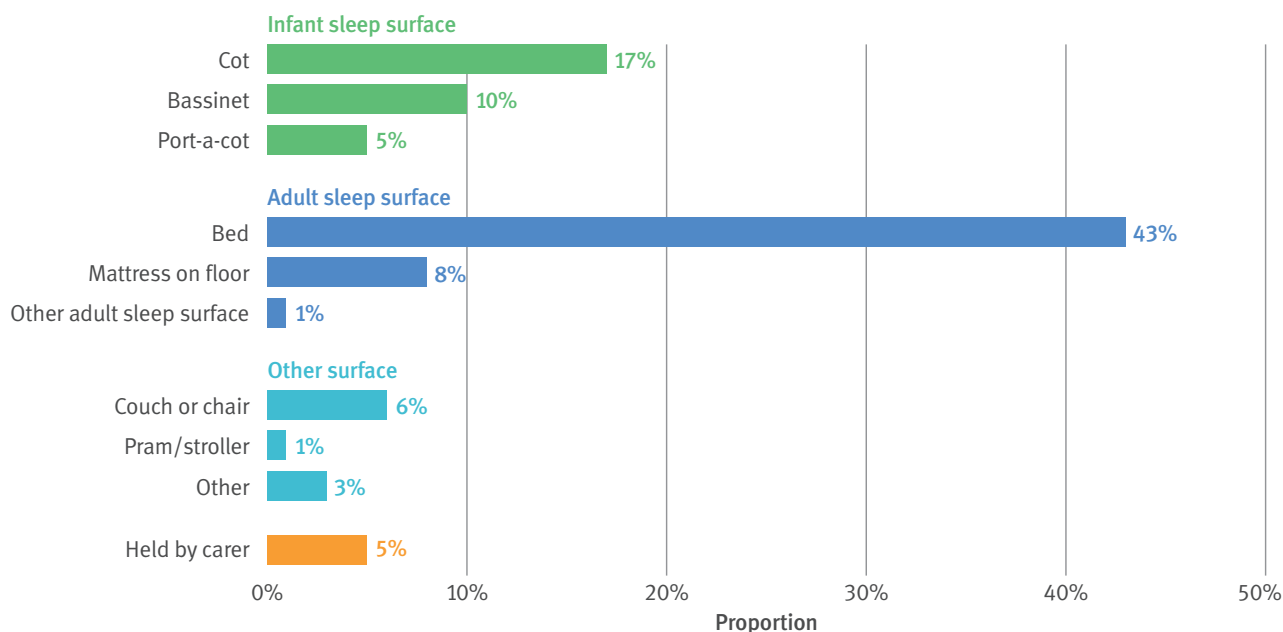
Notes: Excludes SUDIs from non-accidental injury. Percentages may not add to 100 due to rounding.

## Incident factors

### Sleep surface

As indicated in Figure 7.5, for half (51%) of the SUDIs in the last 5 years the infant was on an adult sleep surface at the time of the incident and a further 6% were on a couch or a sofa. Only 33% of the SUDIs occurred when an infant sleep product was being used. A further 5% occurred while the infant was being held by a carer.<sup>50</sup>

**Figure 7.5:** Sleep surface in SUDIs (proportion), 2016–17 to 2020–21



Notes: Excludes SUDIs from non-accidental injury. Percentages may not add to 100 due to rounding.

### Infant sleep position

Incident reports indicated some infants were placed to sleep in one position but were found in a different position, as shown in Table 7.1. While 57 in the last 5 years were placed and found on their back, a further 25 had moved from their back to stomach or side position when found. Of the infants placed to sleep, 65 were found on their stomach or side (or 42% of the 156 SUDIs excluding those from non-accidental injury).

**Table 7.1:** Infant sleep position when placed to sleep (number), 2016–17 to 2020–21

Position when placed to sleep	Position when found					Total
	Back	Stomach	Side	Other	Unknown	
Back (supine)	57	22	3	2	4	88
Stomach (prone)	0	20	1	0	0	21
Side	0	6	5	0	2	13
Held by carer	1	1	0	2	0	4
Other	0	1	0	1	0	2
Unknown	2	5	1	0	9	17
<b>Total</b>	<b>60</b>	<b>55</b>	<b>10</b>	<b>5</b>	<b>15</b>	<b>145</b>

Notes: Excludes SUDIs from non-accidental injury. Includes only SUDIs where the infant was placed to sleep (n = 145).

<sup>50</sup> Percentages by surface types in Figure 7.5 may not add to sub-totals 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.<sup>51</sup> Information in the Register indicates 11% of SUDIs 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 pram/stroller, infant swing and infant car seat.

## Shared sleeping

Around half (53%) of the infants whose deaths were sudden and unexpected were sharing a sleep surface with 1 or more people at the time of death. Sharing a sleep surface with a baby can increase the risk of SIDS and fatal sleep accidents in some circumstances.<sup>52</sup>

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, or if the caregiver is excessively tired or there are multiple people in the bed with the infant.

Of the 83 SUDIs with shared sleeping over the last 5 years, additional risk factors were identified in co-sleepers or co-sleeping environment including alcohol or substance use (34%); smoking (47%); extreme fatigue (17%); and obesity (8%).

## Risk factors for SUDI deaths

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

**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.

**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.

**Family factors:** Cigarette smoking during pregnancy and after birth, young maternal age ( $\leq 20$  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.

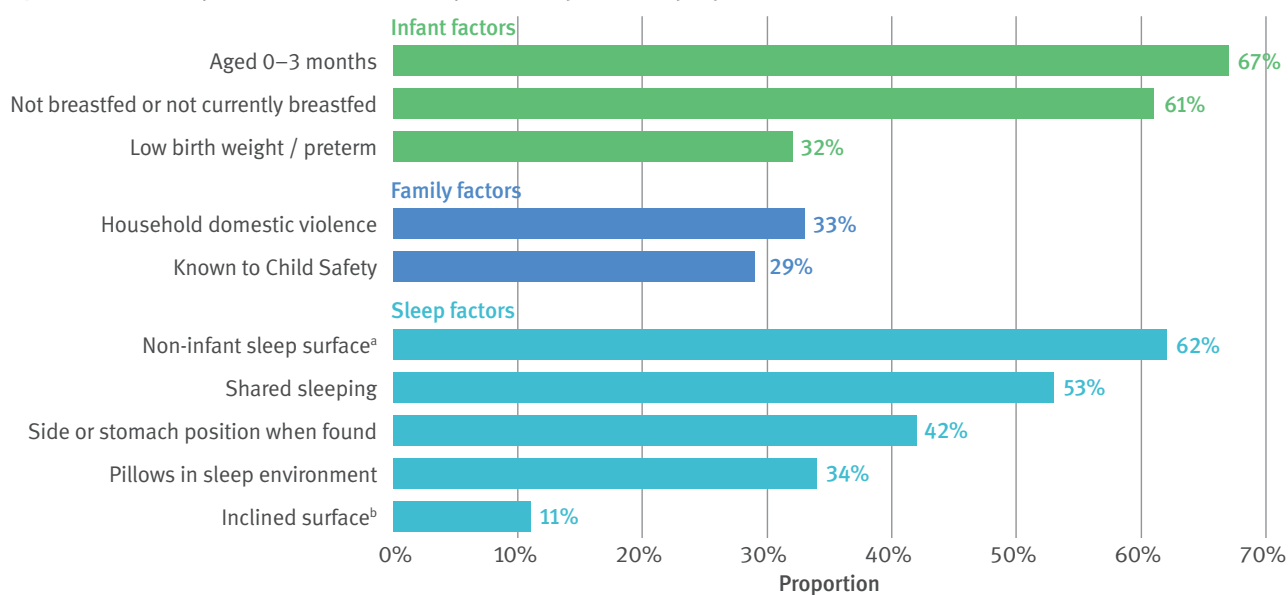
Selected characteristics of the infant and unsafe sleep factors in 156 SUDI deaths over the last 5 years are shown in Figure 7.6. These indicate increased risk in the first months and for infants born with low birth weight, and breastfeeding as a potentially protective factor.

Using non-infant sleep surfaces (62% of SUDIs), sharing a sleep surface (53%) and sleep position on side or stomach (42%) are all reported to increase the risk of sudden unexpected infant deaths, as are pillows (34%) and excess bedding in the sleep space.

51 Red Nose National Scientific Advisory Group (2017) *Information statement: Reflux: sleeping position for babies with gastro-oesophageal reflux (GOR)*, Red Nose website, accessed 19 August 2021.

52 Red Nose National Scientific Advisory Group (updated 2019) *Information statement. Sharing a sleep surface with a baby*, Red Nose website, accessed 19 August 2021.

Figure 7.6: SUDI by selected infant, family and sleep factors (proportion), 2016–17 to 2020–21



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

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

Notes: Excludes SUDIs from non-accidental injury.

## Adoption of safe sleep practices

Recent Queensland research indicated the majority of families were aware of sleep-related infant mortality although not all could recall safe sleep messages.<sup>53</sup> Further, care-giver practice did not always follow the safe sleep guidance. Survey respondents indicated following advice for reducing the risk of SUDI to:<sup>54</sup>

- keep baby smoke free before and after birth 83.7%
- sleep baby on back 83.0%
- breastfeed baby 77.2%
- safe sleeping environment night and day 33.6%
- no soft surfaces or bulky bedding 62.4%.

One in 2 infants were reported to sleep in environments that were not recommended for safe sleep. Cots and bassinets were the most common surfaces used for night and daytime sleeps, but adult beds were the second most common surface at night. The second most common surface in daytime sleeps was infant rockers, swings or bouncers, which are not recommended for safe infant sleep.

## 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](#)). Two deaths in 2020–21 were categorised as unexplained causes. Over the last 5 years, while 86% of unexplained deaths were infants, 9% were aged 1–4 years and 5% 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 inflicted.

<sup>53</sup> Cole R, Young J, Kearney L, Thompson JMD (2021) 'Awareness of infant safe sleep messages and associated care practices: findings from an Australian cohort of families with young infants', *BMJ Paediatrics Open* 5:e000972, [doi:10.1136/bmjpo-2020-000972](https://doi.org/10.1136/bmjpo-2020-000972).

<sup>54</sup> Cole R, Young J, Kearney L, Thompson JMD (2020) 'Infant care practices and parent uptake of safe sleep messages: a cross-sectional survey in Queensland, Australia', *BMC Paediatrics* 20:27, <https://doi.org/10.1186/s12887-020-1917-5>.

## Queensland Paediatric Quality Council update

### Measuring the effectiveness of the Pépi-Pod® Program in reducing infant mortality in Queensland

Reviews of the circumstances of Sudden Unexpected Death in Infancy (SUDI), conducted by the QFCC, the Queensland Paediatric Quality Council (QPQC), and researchers in other Australian<sup>i,iii,iii</sup> and international settings, have demonstrated the extremely high rate of unsafe sleep risk factors, both environmental and infant care related, associated with these deaths. The risk of SUDI is greatly increased in unsafe sleep circumstances whether the infant is sleeping alone or sharing a sleep surface. The majority of these deaths were experienced by families in the context of considerable challenges and socio-economic deprivation<sup>iii</sup> and are significantly more common in the Aboriginal and Torres Strait Islander populations.<sup>i</sup>

The Pépi-Pod® Program originated in New Zealand and was introduced into Queensland in early 2011 as a research initiative by University of the Sunshine Coast researchers, to address the need for culturally appropriate support strategies to reduce infant deaths. The Program provides a portable sleep space (Pépi-Pod®) embedded in safe sleep education, with a family commitment to share learnings about safe sleep within their family and social network. The Pépi-Pod® Program has been formally evaluated and has demonstrated a reduction in the proportion of infants sharing a sleep surface in the context of known risk factors. It was also shown to be culturally appropriate, feasible, accessible, and sustainable.<sup>iii,iv</sup> The QPQC in conjunction with researchers from the University of the Sunshine Coast and The University of Auckland have recently completed a project to evaluate the impact on infant mortality in Queensland of the Pépi-Pod® Program as implemented thus far.

The outcome examined in the project was Study Infant Mortality Rate (IMR), defined as all-cause post-neonatal infant mortality between one and six months of age. The age range covers the commonest age of SUDI, and the expected range that an infant would sleep in a Pépi-Pod®. The study compared outcomes within, and between, research location subgroups, and the whole of Queensland Study IMR before and after the research intervention. The Study IMR fell after the Pépi-Pod® Program intervention in two of the three research location subgroups, with the greatest fall being a 75% reduction. There was also a 22% statistically significant reduction in the Study IMR in the whole population of Queensland from 2014 onwards. These falls are substantial and of public health importance. The researchers hypothesise that the Pépi-Pod® Program is responsible for this notable reduction in mortality.

This Program presents a practical strategy to reduce infant mortality experienced by priority populations in Queensland. The Program also has a flexible delivery approach enabling it to be embedded into current models of maternal and child health delivery in both government and non-government organisations within metropolitan, regional, and rural/remote settings.<sup>v,vi</sup>

The QPQC has commenced a project to develop an implementation strategy to facilitate the use of the Pépi-Pod® Program across Queensland. This will link in with the new QPQC-developed Infant Safe Sleeping Guideline which offers a tiered, risk minimisation approach to working with families to improve infant safety at sleep time.

A copy of the report, once released, will be available at the QPQC website [Queensland Child and Youth Clinical Network | CHQ \(health.qld.gov.au\)](https://www.health.qld.gov.au/child-and-youth-clinical-network).

*The QPQC wishes to acknowledge the contributions of Professor Jeanine Young (University of the Sunshine Coast) and Professor John Thompson (University of Auckland) for their contributions to this project and report.*

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- i Shipstone R, Young J, Thompson JMD (2019) 'The real divide: the use of algorithm-derived Indigenous status to measure disparities in sudden unexpected deaths in infancy in Queensland', *Australian and New Zealand Journal of Public Health Online*, <https://doi.org/10.1111/1753-6405.12951>
  - ii Shipstone R, Young J, Kearney L, Thompson JMD (2020) 'Prevalence of risk factors for sudden infant death among Indigenous and non-Indigenous people in Australia: a retrospective cohort study', *Acta Paediatrica*, <https://doi.org/10.1111/apa.15274>
  - iii Shipstone R, Young J, Kearney L, Thompson JMD (2020) 'Applying a social exclusion framework to explore the relationship between Sudden Unexpected Deaths in Infancy (SUDI) and social vulnerability', *Frontiers in Public Health (Inequalities in Health)*, <https://www.frontiersin.org/articles/10.3389/fpubh.2020.563573>
  - iv Young J, Craigie L, Cowan S, Kearney L, Watson K (2018) *Reducing risk for Aboriginal and Torres Strait Islander babies: trial of a safe sleep enabler to reduce the risk of sudden unexpected deaths in infancy in high risk environments* (The Queensland Pépi-Pod Program), Final Research Project Report, University of the Sunshine Coast, Queensland, doi:10.25907/5c6b462922760.
  - v Young J, Watson K, Craigie L, Neville J, Hunt J (2019) 'Best practice principles for research with Aboriginal and Torres Strait Islander communities in action: Case study of a safe infant sleep strategy', *Women and Birth*, 32(5):460-465, doi:10.1016/j.wombi.2019.06.022
  - vi Young J, Cowan S, Kearney L, Watson K, Craigie L (2018) *A strategy to promote safe sleeping environments and reduce the risk of Sudden Unexpected Death in Infancy in Aboriginal and Torres Strait Islander communities*, Final Implementation Project Report for the Department of Child Safety, Youth and Women, Queensland Government, <https://doi.org/10.25907/00011>