

## Chapter 8 — Sudden unexpected deaths in infancy

This chapter provides details of sudden unexpected infant deaths.

### *Key findings*

- Sudden unexpected death in infancy (SUDI) is a category of deaths where an infant (aged under one year) dies suddenly, usually during sleep, and with no immediately obvious cause. Deaths from SUDI are recorded as 'cause pending' until post-mortem examination or coroner's investigation provide an official cause of death.
- There were 32 SUDI cases in 2017–18, a rate of 51.2 deaths per 100 000 infants. The number of SUDI deaths has fluctuated over the last 14 years; ranging between 29 and 55 deaths each year (average rate across the 14 years of 70.2 per 100 000).
- Aboriginal and/or Torres Strait Islander infants are over-represented in SUDI deaths. Over the last 3 years, Indigenous infants died suddenly and unexpectedly at twice the rate of non-Indigenous infants.
- Children known to the child protection system had a SUDI rate four times that for all children over the last 3 years.
- An official cause of death was determined in 11 cases. Six were attributed to SIDS and undetermined causes. Official causes of death were still pending for 21 deaths.
- Five of the SUDI deaths were found to have an explained cause of death. All five of these infants died as a result of infant illnesses or conditions unrecognised prior to their deaths.
- In 2016–17, when all but three SUDI deaths had official causes of death, the rate of death for SIDS and undetermined causes was 24.0 per 100 000 infants (5.6% of infant deaths from all causes), representing the third highest cause of death after perinatal conditions and congenital anomalies.
- Compared to other explained causes, SIDS and undetermined causes are a much more common contributor to infant deaths in the post-neonatal period (28 days to 11 months), accounting for 22% of all deaths in this age group in 2016–17 (15 of 68 post-neonatal infant deaths).

## Sudden unexpected deaths in infancy 2015–18

An expanded version of Table 8.1 containing data since 2004 is available online at [www.qfcc.qld.gov.au](http://www.qfcc.qld.gov.au).

Table 8.1: Summary of SUDI in Queensland 2015–18

	2015–16		2016–17		2017–18		Yearly average
	Total <i>n</i>	Rate per 100 000	Total <i>n</i>	Rate per 100 000	Total <i>n</i>	Rate per 100 000	Rate per 100 000
<b>All sudden unexpected deaths in infancy (SUDI)</b>							
SUDI	29	46.7	30	48.0	32	51.2	48.6
<b>Sex</b>							
Female	17	56.0	17	55.7	13	42.6	51.3
Male	12	37.8	13	40.7	19	59.5	45.9
<b>Aboriginal and Torres Strait Islander status</b>							
Indigenous	4	72.5	3	*	9	158.2	93.7
Non-Indigenous	25	44.2	27	47.6	23	40.5	44.0
<b>Geographical area of usual residence (ARIA+)</b>							
Remote	1	*	0	0.0	0	0.0	*
Regional	12	58.3	14	68.4	17	83.0	70.0
Metropolitan	16	41.5	15	38.4	15	38.6	39.3
<b>Socio-economic status of usual residence (SEIFA)</b>							
Low to very low	19	75.5	17	68.1	15	60.1	68.1
Moderate	0	0.0	6	45.8	8	61.0	35.6
High to very high	10	41.7	6	24.6	9	36.9	34.2
<b>Known to the child protection system</b>							
Known to the child protection system	11	13.1	7	8.7	10	11.8	11.2
<b>Unexplained SUDI</b>							
SIDS and undetermined	20	32.2	15	24.0	6	9.6	21.9
<i>SIDS</i>	10	16.1	7	11.2	3	*	10.7
<i>Undetermined causes</i>	10	16.1	8	12.8	3	*	11.2
Cause of death pending	0	0.0	3	*	21	33.6	12.8
<b>Explained SUDI</b>							
Explained SUDI	9	14.5	12	19.2	5	8.0	13.9
<i>Unrecognised infant illness</i>	8	12.9	9	14.4	5	8.0	11.7
<i>Sleep accident</i>	1	*	2	*	0	0.0	*
<i>Fatal assault</i>	0	0.0	1	*	0	0.0	*

Data source: Queensland Child Death Register (2015–18)

\* Rates have not been calculated for numbers less than four.

1. Data presented here is current in the Queensland Child Death Register as at August 2018 and thus may differ from those presented in previously published reports.
2. Rates are based on the most up-to-date denominator data available and are calculated per 100 000 children (in the sex/age/Indigenous status/children known to child protection/ ARIA+ region/SEIFA region categories) in Queensland each year. Rates for 2015–16 use ERP data as at June 2015. The 2016–17 and 2017–18 periods use the ERP data as at June 2016.
3. ARIA+ and SEIFA exclude the deaths of children whose usual place of residence was outside Queensland.
4. The number of children known to the child protection system represents the number of children whose deaths were registered in the reporting period, who were known to the DCSYW within the one-year period prior to their death. The denominator for calculating rates is the number of children aged 0–17, instead of per 100 000 infants under the age of one year, who were known to the DCSYW, through either being subject to a child concern report, notification, investigation and assessment, ongoing intervention, orders or placement, in the one-year period prior to the reporting period.
5. Yearly average rates have been calculated using the ERP data as at June 2016.

## ***The classification of sudden unexpected deaths in infancy***

Sudden unexpected death in infancy is a research classification and does not correspond with any single medical definition or categorisation. Rather, the aim of this grouping is to report on 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.

The Police Report of Death to a Coroner (Form 1), which includes a summary of the circumstances surrounding the death as initially reported,<sup>56</sup> is used to identify SUDI deaths. The circumstances of the death must meet all of the following criteria to be included in the SUDI grouping:

- child less than one year of age
- sudden in nature
- unexpected, with no previously known condition which was likely to cause death, and
- no immediately obvious cause of death.

The SUDI grouping includes deaths found to be associated with infections or anatomical/developmental abnormalities not recognised before death, sleep accidents such as inhalation of gastric contents, and deaths that initially present as sudden and unexpected but are revealed by investigations to be the result of non-accidental injury. It also includes deaths due to SIDS and infant deaths where a cause could not be determined.<sup>57</sup>

### **Death certification**

A high proportion of SUDI cases (21 of 32 in 2017–18) were pending death certification at the time of reporting. Paediatric autopsies are amongst the most complex forms of autopsies undertaken, and the complexity contributes to the length of time required to undertake and report on autopsies. Following the development of a new definition of SIDS in 2004 (termed the San Diego definition), all cases of SUDI optimally require the performance of a complete autopsy (including toxicology, microbiology, radiology, vitreous chemistry and metabolic screening studies).<sup>58</sup>

There is also an additional focus on establishing there is no evidence of unexplained trauma, abuse or unintentional injury before a classification of SIDS can be assigned. This frequently involves more extensive gross and microscopic examination during autopsy than in cases of explained infant and child deaths.

## ***Sudden unexpected deaths in infancy: Findings 2017–18***

During 2017–18, there were 32 SUDI cases in Queensland, at a rate of 51.2 deaths per 100 000 infants. The number and rate of SUDI deaths have fluctuated over the last 14 reporting periods; however, the 2017–18 number of deaths is the third-lowest recorded since reporting began in 2004. The number of SUDI cases since reporting commenced in 2004 ranges from 29 to 55 per year, with an average of 42 per year (a rate of 70.2 per 100 000).<sup>59</sup>

### **Sex**

During 2017–18, there were 13 SUDI deaths of female infants, compared to 19 male infants. Over the last three years the average SUDI mortality rate for females was above that for males (51.3 deaths per 100 000 and 45.9 deaths per 100 000 respectively); however, over the 14 years since 2004 the rate of SUDI for males was higher than that for females (81.1 per 100 000 and 58.8 per 100 000 respectively).

<sup>56</sup> In Queensland, section 8 of the *Coroners Act 2003* requires all violent or unnatural/unusual deaths be reported to a coroner. All unexpected infant deaths fall within that description. All cases of SUDI require a comprehensive investigation, which should include a full autopsy, examination of the death scene and review of clinical history.

<sup>57</sup> Cases of SUDI that were explained at post-mortem are also counted and discussed in the chapter appropriate to their cause of death. Deaths found at autopsy to be caused by previously unrecognised illnesses or congenital anomalies are counted in Chapter 2, *Deaths from diseases and morbid conditions*. Deaths found at autopsy to be caused by accidental suffocation in bed are counted in Chapter 5, *Other non-intentional injury-related death*.

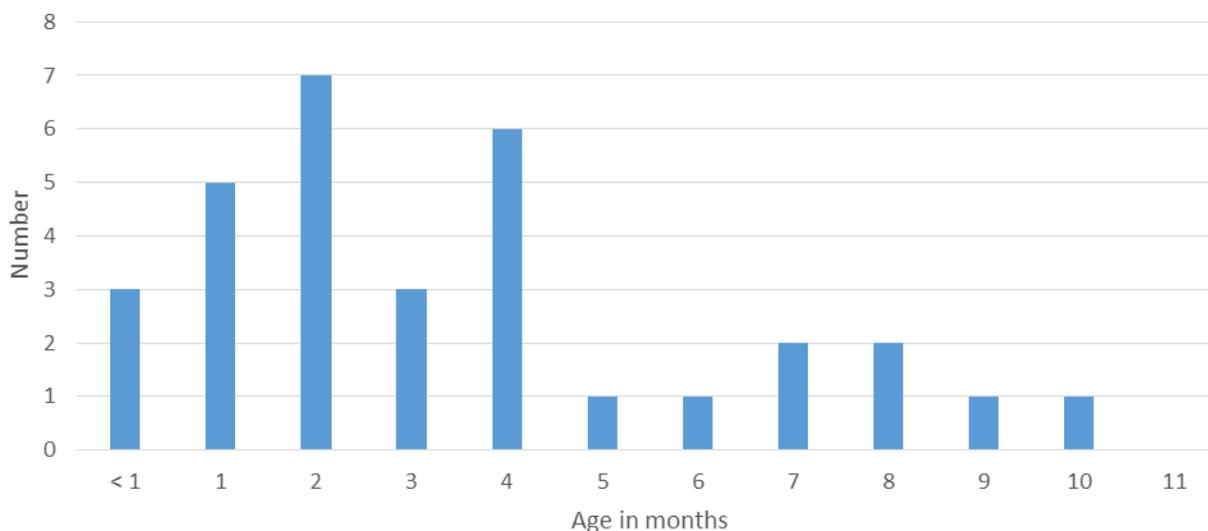
<sup>58</sup> Krous, HF, Beckwith, B, Byard, R, Rognum, TO, Bajjanowski, T, Corey, T, Cutz, E, Hanzlick, R, Keens, TG and Mitchell, EA (2004). 'Sudden infant death syndrome and unclassified sudden infant deaths: A definitional and diagnostic approach', *Paediatrics*, 114(1), 234–238.

<sup>59</sup> Tables with data for 2004–18 are available online at [www.qfccc.qld.gov.au](http://www.qfccc.qld.gov.au).

## Age

Figure 8.1 shows SUDI by age at death during 2017–18. Infants' age ranged from 1 day to 10 months. The majority (78%) of sudden unexpected deaths occurred among infants aged under 6 months (25 of the 32 deaths).

Figure 8.1: SUDI by age at death 2017–18



Data source: Queensland Child Death Register (2017–18)

## Aboriginal and Torres Strait Islander status

Of the 32 SUDI deaths during 2017–18, nine were of Aboriginal and/or Torres Strait Islander infants.

Over the last 3 years, the average annual SUDI rate of mortality for Indigenous infants was twice the rate for non-Indigenous infants (93.7 deaths per 100 000 Indigenous infants, compared to 44.0 deaths per 100 000 non-Indigenous infants).

## Geographical area of usual residence (ARIA+)

Of the 32 SUDI deaths during 2017–18, 17 were of infants from regional areas and 15 were of infants from metropolitan areas. There were no deaths of infants who resided in remote areas of Queensland.

## Socio-economic status of usual residence (SEIFA)

Of the 32 SUDI deaths during 2017–18, 15 were of infants who resided in Queensland areas of low to very low SES, eight were of infants from moderate-SES areas and nine were of infants from areas of high to very high SES.

Over the last 3 years, the average annual SUDI rate of mortality for infants from areas of low to very low SES was approximately 2 times the rate for children from areas of moderate and high to very high SES (68.1 deaths per 100 000 infants from low to very low SES areas, compared to 35.6 deaths per 100 000 infants from areas of moderate SES and 34.2 deaths from areas of high to very high SES).

## Children known to the child protection system

Of the 32 SUDI deaths during 2017–18, 10 were of infants known to the Queensland child protection system within the year before their death. Children known to the child protection system had a SUDI rate four times that for all Queensland children over the last 3 years (rates per 100 000 aged 0–17 years of 11.2 and 2.7 respectively).

## ***Cause of death 2016–17***

Predominantly, deaths from SUDI are recorded as ‘cause pending’ until the outcomes of post-mortem examinations or coroner’s investigations are concluded. At the time of reporting only 11 of the 32 SUDI cases in 2017–18 had an official cause of death. To present more detailed information on cases for which an official cause is available, the following sections provide data from the period 2016–17, when all but 3 SUDI deaths had a cause-of-death finding.

Cases of SUDI are grouped broadly into two categories:

- **Unexplained SUDI**—those infant deaths for which a cause could not be determined (including SIDS and undetermined causes and SUDI deaths pending a cause of death)
- **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 (including unrecognised infant illnesses, sleep accidents and non-accidental injury).

In 2016–17, 30 deaths were SUDI cases. Following post-mortem examinations, 12 deaths were found to have an explained cause (40%). The remaining 18 deaths were unexplained SUDI cases. For 15 deaths, the official cause was SIDS or undetermined causes (50%), and for three deaths the cause had not been ascertained at the time of reporting (10%).

### **Unexplained sudden unexpected deaths in infancy**

Unexplained SUDI cases includes deaths for which post-mortem examinations and coronial investigations indicate the causes to be SIDS or undetermined causes, as well as deaths which were pending the outcome of post-mortem examinations and coronial investigations.

#### ***Sudden Infant Death Syndrome and undetermined causes***

The definition of Sudden Infant Death Syndrome (SIDS) applied in this report is as follows:

*The sudden, unexpected death of an infant under one year of age, with onset of the fatal episode apparently occurring during sleep, that remains unexplained after a thorough investigation including performance of a complete autopsy and review of the circumstances of death and the clinical history.*<sup>60</sup>

Cases of SUDI are classified as having undetermined causes if:

- 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.

Further classification of the 18 unexplained SUDI cases in 2016–17 identified that seven deaths resulted from SIDS and eight from undetermined causes. Three deaths were pending outcomes of post-mortem examinations and coronial investigations.

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<sup>60</sup> Krous H et al, (2004) ‘Sudden infant death syndrome and unclassified sudden infant deaths: a definitional and diagnostic approach’, *Paediatrics*, vol 114, pp 234–8.

The rate of death for the grouping of SIDS and undetermined causes in 2016–17 was 24.0 per 100 000 infants (5.6% of infant deaths from all causes), representing the third highest cause of death after perinatal conditions and congenital anomalies. As noted in Chapter 2, compared to other explained causes, SIDS and undetermined causes are a much more common contributor to infant deaths in the post-neonatal period (28 days to 11 months). In 2016–17, SIDS and undetermined causes combined was the leading cause of infant death in the post-neonatal period (1–11 months) (14 deaths of 57 post-neonatal infant deaths).

Analysis of longer-term trends in SUDI deaths is problematic because of changes in classifications and, more importantly, changes to the pathological investigations carried out on SUDI deaths. In more recent years full autopsies are routinely carried out for SUDI deaths, which has enabled improved identification of underlying illness and other explained causes of death.

A grouping of deaths as SUDI is also not available prior to 2004; however ABS data is available on SIDS deaths.<sup>61</sup> In the period 1982–86 there were on average 66 SIDS deaths in Queensland each year, dropping to an average of 47 in 1992–96. Reductions in SIDS numbers in the late 1980s, both nationally and internationally, are attributed to public health campaigns such as Back-to-Sleep,<sup>62</sup> as well as increased awareness of the importance of a safe sleep environment. In the 11 years to 2014–15 the child death register indicates there were on average 46 SUDI each year, while the average number in the last three years has dropped to 30.

### ***Risk factors for SUDI deaths***

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

**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 (on stomach) sleeping position 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, high-risk lifestyles including alcohol and illicit drug abuse, and low SES (social disadvantage and poverty).

Safe sleeping programs specifically emphasise ways to minimise risk factors, and include some of the following prevention messages:<sup>63</sup>

- sleep infants on their back from birth
- ensure the infant's head and face remain uncovered
- keep baby smoke free before and after birth
- ensure infants have their own safe sleep environment (This means ensuring the cot meets the Australian safety standards and contains a firm mattress which is the appropriate size for the cot, and the environment is free from objects such as pillows, soft toys, and doonas.)
- sleep infants in the parents' bedroom for the first 6–12 months
- breastfeed infants.

<sup>61</sup> ABS (1998), Causes of Infant and Child Deaths, Australia, 1982–96, Cat. 4398.0.

<sup>62</sup> Red Nose Saving Little Lives. 2017. "Why back to sleep is the safest position for your baby." <https://rednose.com.au/article/why-back-to-sleep-is-the-safest-position-for-your-baby>.

<sup>63</sup> Red Nose Saving Little Lives. 2015. "Guidelines for new parents to reduce risk of SIDS." <https://rednose.com.au/news/guidelines-for-new-parents-to-reduce-risk-of-sids>.

## Infant sleep position

Table 8.2 shows the position when placed to sleep and when found, for the 18 infants whose deaths were classified as unexplained SUDI.

Table 8.2: Unexplained SUDI by sleep position and position when found 2016–17

Sleep position	SIDS <i>n</i>	Undetermined <i>n</i>	Cause of death pending <i>n</i>	Total <i>n</i>
<b>Position when placed to sleep</b>				
Back	5	4	2	11
Stomach	2	1	1	4
Side	0	1	0	1
Unknown	0	2	0	2
<b>Total</b>	<b>7</b>	<b>8</b>	<b>3</b>	<b>18</b>
<b>Position when found</b>				
Back	4	0	2	6
Stomach	2	5	1	8
Side	1	1	0	2
Unknown	0	1	0	1
Other	0	1	0	1
<b>Total</b>	<b>7</b>	<b>8</b>	<b>3</b>	<b>18</b>

Data source: Queensland Child Death Register (2016–17)

## Shared sleeping with other risk factors

Six of the 18 infants whose deaths were classified as unexplained SUDI were sharing a sleep surface with one or more people at the time of death (four SIDS, two undetermined).

Sharing a sleep surface with a baby increases the risk of SIDS and fatal sleep accidents in some circumstances.<sup>64</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, if the caregiver is excessively tired or there are multiple people in the bed with the infant.

## Expert panel review of SUDI cases

The Queensland Paediatric Quality Council Infant Mortality Sub-Committee is undertaking a retrospective records review of all post-neonatal deaths and sudden unexpected neonatal deaths occurring out of hospital in 2013, 2014 and 2015. Two conference papers and one conference presentation have been released with findings from the review of deaths in 2013.<sup>65</sup> The review was made up of a data set of 99 infant deaths (90 post-neonatal infant deaths, nine SUDI neonates). Of these 99 deaths, 49 had all of the documentation available at the time of review. A further two deaths were excluded as they were attributed to circumstances of fatal abuse, leaving 47 cases which were analysed.

<sup>64</sup> Blair, PS, Fleming, PJ, Smith, JJ, Platt, MW, Young, J, Nadin, P, Berry, PJ, Golding, J and the CESDI SUDI research group (1999). 'Babies sleeping with parents: case-control study of factors influencing the risk of the sudden infant death syndrome', *BMJ*, 319, 1457–61.

<sup>65</sup> Young, J, McEnery J and Cruice D. "SUDI: Infant Sleeping Position is still not reliably reported." Oral Presentation. *International Conference for Still Birth, SIDS and Baby Survival*, Glasgow, 2018; McEnery, J and Cruice, D. "Sudden Unexpected Death in Infancy: Comparison of neonatal and post-neonatal deaths Queensland Australia." Poster Presentation. *Perinatal Society of Australia and New Zealand Conference*, Auckland, 2018; McEnery J and Cruice D. "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, 2018.

One aspect of the review examined the reliability and consistency of information recorded in the Police Form 1. It found there were often inconsistencies around recording of information around the position the infant was placed to sleep and the position the infant was found in. This was often due to inconsistencies in witness statements, or differences in patterns of lividity noted in the autopsy when compared to the position the infant was recorded as being found in. Changes in the infant's position were also noted where the age of the infant would preclude rolling.

The review also examined family vulnerabilities and the sleeping environment. Of the SUDI deaths that were analysed, the following vulnerability characteristics were noted:

- pre- or post-natal exposure to smoking
- family known to the child protection system
- carer prescribed sedative medication and/or excess use of alcohol or illicit drugs
- accessed mental health services
- infants of Aboriginal or Torres Strait Islander descent.

Unsafe sleeping practices was also an issue. Of the 47 SUDI deaths analysed, 19 occurred when the infant was sharing a sleep surface and 16 of these shared with a person who smoked.

This research showed that infants who die suddenly and unexpectedly often experience a complex interplay of intrinsic and extrinsic social factors which, when combined with unsafe sleeping practices, compromise survival.

## Explained sudden unexpected deaths in infancy

In 2016–17, 12 of the 30 SUDI deaths were classified as having an explained cause of death following post-mortem examination. Nine infants died as a result of illnesses unrecognised prior to their deaths. Two infants died as a result of a sleep accident, and one died as a result of fatal assault and neglect. These 12 deaths are included in this chapter (as sudden and unexpected); however, they are also included in the chapters relating to the specific causes of death. Table 8.4 shows the breakdown of explained SUDI by cause of death.

Table 8.3: Explained SUDI by cause of death 2016–17

Cause of death	Total <i>n</i>
<b>Unrecognised infant illness</b>	<b>9</b>
Viral infection of unspecified site (B34)	1
Cerebral palsy (G80)	1
Other disorders of arteries and arterioles (I77)	1
Acute obstructive laryngitis [croup] and epiglottitis (J05)	1
Viral pneumonia, not elsewhere classified (J12)	1
Pneumonia due to <i>Haemophilus influenzae</i> (J14)	2
Pneumonia, organism unspecified (J18)	1
Congenital pneumonia (P23)	1
<b>Other non-intentional injury/sleep accident</b>	<b>2</b>
<b>Fatal assault</b>	<b>1</b>
<b>Total</b>	<b>12</b>

Data source: Queensland Child Death Register (2016–17)

1. ICD-10 underlying cause of death code included in parentheses.