

Part V: Sudden unexpected death in infancy

Chapter 12

This section provides information on the sudden deaths of infants under 1 year of age. Sudden unexpected death in infancy (SUDI) is an initial classification for infant deaths sharing similar characteristics. These deaths are later assigned an official cause of death (such as SIDS, respiratory illness or accidental asphyxiation) by a pathologist. This section therefore counts deaths which have also been included in the data for natural and other non-intentional injury-related deaths.

Chapter 12

Sudden unexpected deaths in infancy

*“Because such a high proportion of child deaths occur during infancy, the identification of causes and risk factors has potential to make substantial inroads into reducing the overall rate of child deaths”
(New South Wales Child Death Review Team 2005:1)*

Key issues

- Infant death rates are higher than for any other age group across the lifespan. Between 1 July 2005 and 30 June 2006, 263 infant deaths were registered in Queensland, a rate of 509.1 per 100,000 infants (5.1 per 1000 live births). This compares with an infant death rate of 612.3 per 100,000 infants in 2004–05 (6.1 per 1000 live births).
- Indigenous infants died suddenly and unexpectedly at 7 times the rate of non-Indigenous infants (351.6 deaths per 100,000 Indigenous infants, compared with 49.7 deaths per 100,000 non-Indigenous infants).
- In 19.4% of SUDI cases, the infants were known to the child protection system. Infants known to the Department of Child Safety died suddenly and unexpectedly at a rate of 134.9 deaths per 100,000 infants in the child protection population, compared with 52.3 deaths per 100,000 infants across Queensland.
- In the majority of infant deaths, multiple risk factors were evident in each case, such as smoking, unsafe shared sleeping environments, prone/side sleeping, chaotic social circumstances or evident use of drugs or alcohol.
- Low socio-economic circumstance continues to be an evident marker of these families, particularly Indigenous families.
- The Commission has again identified concerns in relation to unsafe sleeping practices such as smoking parents who share a sleep surface with their infant, or leaving young infants unattended on adult beds, and highlights this issue for parents, professionals working with families and caregivers.
- The Commission has observed that use of recent terminology such as ‘unclassified sudden infant death’ and ‘sudden unexpected infant death’ may have caused confusion among pathologists, coroners and health professionals. The Commission will work with Queensland Health and SIDS and Kids Australia to resolve ambiguities and confusion in relation to the appropriate use of these terms in identifying causes of death.

Deaths in infancy

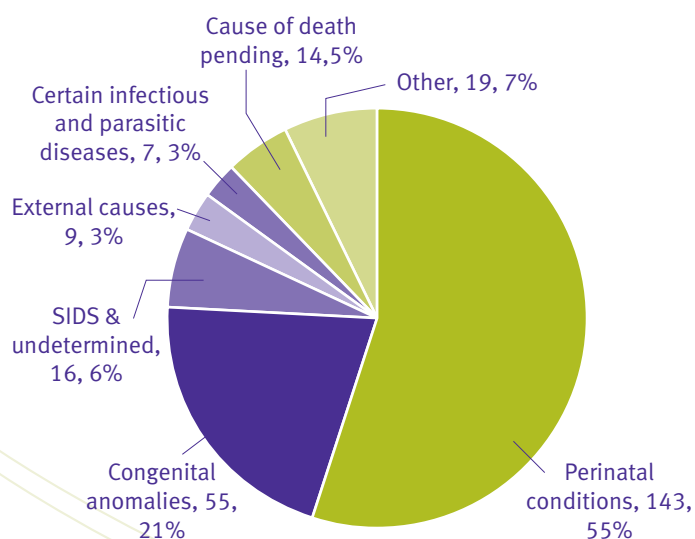
The rate of death during infancy is higher than at any other time of life, although the cause of many deaths in this period remains unclear. Infant mortality is widely considered a measure of social prosperity; as the standard of living rises, infant

mortality falls. Populations with more advanced social circumstances, education and income levels have considerably lower rates of infant mortality than those affected by more adverse conditions (Lin 2006:2138; Stanley 2001:368–69). The impact of social circumstances, particularly in relation

to sudden unexpected deaths in infancy, is well documented. For example, Fleming and colleagues (2000:xi) note that an infant born to a young mother who smokes and is welfare dependent is 40 times more likely to die than an infant of a 35 year old non-smoking mother in a home where she or her partner has a stable income. The high infant mortality rates among Aboriginal and Torres Strait Islander people and other marginalised groups, and the disparities in mortality between the rich and the poor in Australia, are therefore indicative of the life stressors faced by these groups, not only in the first year of life but throughout their entire life course.

Between 1 July 2005 and 30 June 2006, 263 infant deaths were registered in Queensland, a rate of 509.1 per 100,000 infants (5.1 per 1000 live births). Figure 12.1 shows the present distribution of the main causes of infant death. As discussed in Chapter 5, ‘Deaths Due to Diseases and Morbid Conditions’, for perinatal conditions and congenital anomalies (the most common causes of death) death usually occurs within the first week of life. In other categories where cause is explained, such as infectious and parasitic diseases and deaths due to external causes, deaths are distributed throughout the first 12 months.

Figure 12.1: Main categories of infant death in Queensland



Data source: Queensland Child Death Register (2005–06)

Sudden unexpected deaths

Of the total infant deaths each year, a significant proportion occur suddenly and unexpectedly. As indicated by the use of the term ‘unexpected’, infants have generally appeared either completely well or have been suffering from an apparently minor illness.²³³ In some of these unexpected deaths, a natural or external cause of death may be determined after a full investigation involving scrutiny of the circumstances and autopsy. For example, it may become apparent from the death scene examination that the baby died from accidental suffocation, or the autopsy may reveal a congenital abnormality that was not identified before death. More frequently, however, no clear cause can be established and the death is categorised as due to sudden infant death syndrome (SIDS) or an undetermined cause. SIDS comprises the largest category of deaths occurring in Queensland in the postneonatal period (between 28 and 364 days).

The classification of sudden unexpected deaths in infancy (SUDI)

The grouping for the deaths reported in this chapter – sudden unexpected deaths in infancy (SUDI) – is a research classification and does not correspond with any single medical definition, International Classification of Diseases (ICD) categorisation, or Australian Bureau of Statistics (ABS) categorisation. Rather, the aim of this grouping is to report on the deaths of that group of apparently normal infants who would be expected to thrive yet, for reasons often unknown, do not survive. It is hoped that such analysis will assist in the identification of possible risk factors and associations for sudden infant death, and, most significantly, those factors that may be preventable or may be amenable to change.

There is currently no internationally agreed definition of SUDI and researchers apply different criteria when grouping infant deaths for analysis. For example, different age ranges may be used, including birth to 52 weeks (infant deaths), 1 to 52 weeks (postperinatal deaths) or 4 to 52 weeks (postneonatal deaths). Studies have also extended

²³³ In this chapter an infant has been accepted as being well or only mildly unwell if the information contained in the Police Report of Death to a Coroner (Form 1) did not provide any evidence of serious disease such that before death the infant was hospitalised or required emergency treatment.

their reviews to include children aged over 1 year.²³⁴ The criteria currently used by the Commission have been based on the criteria developed by the Confidential Enquiry for Stillbirths and Deaths in Infancy's SUDI Studies 1993–96 (hereafter referred to as CESDI SUDI Studies) (Fleming et al. 2000).

The Commission classifies a death as SUDI using the Police Report of Death to a Coroner (Form 1), which includes a narrative providing a summary of the circumstances surrounding the death as initially reported.²³⁵ The Commission has adopted the following working criteria for the inclusion of cases in the SUDI grouping – deaths of infants less than 1 year of age that:

- were sudden in nature,²³⁶ and
- were unexpected, with no previously known condition that was likely to cause death, and
- have no immediately obvious cause of death.

The vast majority of these deaths occur after the infant has been placed to sleep, but although usual this is not invariable.²³⁷

The SUDI grouping therefore includes deaths associated with infections or anatomical or developmental abnormalities not recognised before death, sleep accidents due to unsafe sleep environments, and deaths which 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.²³⁸

All infant deaths that appeared on initial presentation to have occurred suddenly and unexpectedly are discussed in this chapter. Cases of SUDI that were explained at post-mortem (such as sleep accidents and deaths due to infections and congenital anomalies) are also counted and discussed in the chapter appropriate to their cause of death.²³⁹ Cases of SUDI that remained unexplained (that is, deaths from SIDS and undetermined causes and where cause of death was pending) are the subject of detailed analysis in this chapter.

The use of the grouping SUDI acknowledges the complex distinction between various causes of sudden unexpected deaths in infancy. The possibility of overlap in causes of death has given rise to the concern that a considerable proportion of deaths that would have been attributed to SIDS as recently as 10 years ago are now commonly labelled as cause of death undetermined or accidental suffocation (Kemp et al. 2000:42). Studying sudden unexpected infant deaths under the broader SUDI grouping therefore facilitates the recognition of factors common to a range of sudden unexpected infant deaths that may otherwise be missed because of the oftentimes arbitrary distinction between causes of death. It also acknowledges the finding that all cases within the SUDI grouping share similar epidemiological profiles, including the fact that all groups evidence markers of social disadvantage (Fleming et al. 2000:80).

234 Côté, Russo and Michaud's (1999:442) review of 623 cases of sudden unexpected infant death in the Canadian province of Quebec between 1987 and 1996 included children aged up to 18 months because "although sudden death is known to occur after one year of age, very little is known about the prevalence of the various causes of death in the 12 to 18 month age group".

235 In Queensland, section 8 of the *Coroners Act 2003* requires that 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 the clinical history.

236 The definition of 'sudden death' varies considerably in the research literature, with limits of between zero and 24 hours between the onset of symptoms and signs of illness and death (Byard 2004:3; Fleming et al. 2000:20). However, studies generally exclude infant deaths that occur within the first 24 hours after birth.

237 As stated above, the Commission's definition of SUDI is a working definition. The Commission modified the criteria used in the *Annual Report: Deaths of children and young people, Queensland, 2004–05*. The most notable change has been to remove the requirement that deaths be associated with sleep (that is, occur after the infant has been placed to sleep). The removal of this criterion ensures that cases where both parent and child are believed to have fallen asleep during feeding are included in the SUDI grouping. The Commission's criteria may be subject to further revision in the interests of national reporting consistency.

238 There are two fundamental differences between the CESDI and the Commission's criteria for SUDI. First, the age range for the CESDI SUDI Studies was limited to infants who die between 7 and 365 completed days. The Commission includes all infants (under 1 year) to capture the deaths of infants aged less than 7 days which occur suddenly and unexpectedly and may be later certified as SIDS. Second, the CESDI SUDI Studies included deaths resulting from any form of accident, trauma or poisoning. The Commission's criterion that no cause of death is obvious at the time of death excludes deaths where the cause of external injury is apparent, as is the case in transport accidents, drowning and fires.

239 Cases of SUDI found at autopsy to be due to accidental suffocation in bed are also counted in Chapter 9, "'Other' Non-Intentional Injury-Related Deaths'. Deaths found at autopsy to be due to previously unrecognised illnesses or congenital anomalies are also counted in Chapter 5, 'Deaths Due to Diseases and Morbid Conditions'.

SUDI has been a significant focus of the Commission’s child death research since 2005. A detailed review of the contemporary literature on the changing definitions of SIDS, potentially modifiable SIDS risk factors, and sleeping with an infant was provided in the *Annual Report: Deaths of children and young people, Queensland, 2004–05*.

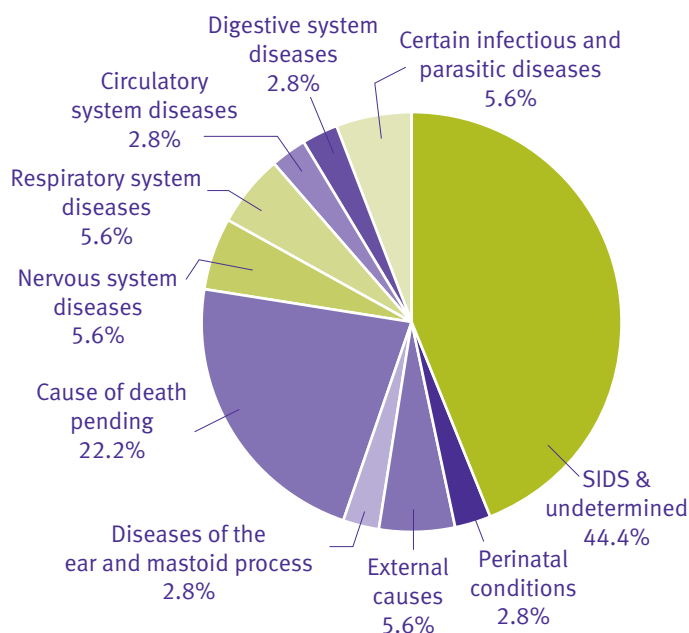
Sudden unexpected death in infancy: trends and patterns, 2005–06

Between 1 July 2005 and 30 June 2006, there were 36 cases of SUDI in Queensland,²⁴⁰ a rate of 69.7 deaths per 100,000 infants (0.7 per 1000 live births). This rate represents a decrease in the rate of SUDI from 2004–05, when there were 89.9 deaths per 100,000 infants (0.9 deaths per 1000 live births).

In the reporting period, 12 of the 36 infant deaths identified as meeting the criteria for SUDI were fully explained following a post-mortem examination (33.3%), most commonly as a consequence of previously unrecognised infections or sleep accidents. Additionally, 16 deaths were attributed to SIDS and undetermined causes (44.4%). Within the SUDI grouping, SIDS and undetermined deaths are generally considered to be a SUDI whose cause is unexplained. In the remaining 8 cases a cause of death was not available at the time of reporting (22.2%). In this chapter, cases where cause of death was pending have been analysed as unexplained SUDI.²⁴¹

Figure 12.2 shows the cause of death breakdown for cases of SUDI in the reporting period by ICD-10 chapter level.

Figure 12.2: Sudden unexpected deaths in infancy – causes of death



Data source: Queensland Child Death Register (2005–06)

Gender

Of the 36 infants who died, 21 were males (58.3%) and 15 were females (41.7%). Male deaths occurred between the ages of 2 days and 11 months, while female deaths occurred between the ages of 12 days and 10 months.

Male infants were significantly more likely to die suddenly and unexpectedly than females, with a rate of 79.2 deaths per 100,000 male infants, compared with 59.7 deaths per 100,000 female infants.

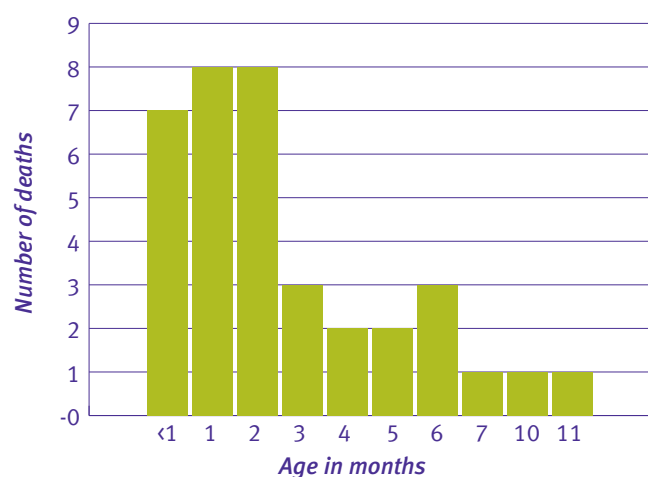
²⁴⁰ There are an additional 3 deaths that have not been accounted for in this chapter as they have not been registered with the Registry of Births, Deaths and Marriages (2 Indigenous and 1 non-Indigenous). The cause of death for 1 of these deaths was SIDS, while the causes of death for the other 2 infants were pending test results and coronial findings. Refer to Chapter 2, ‘Methodology’, for further details regarding registration.

²⁴¹ In the 2004–05 reporting period, of the 63 cases of SUDI, 23 were pending a cause of death at the time of reporting; 19 of these 23 cases were subsequently found at autopsy to be due to SIDS and undetermined causes (82.6%).

Age at death

Figure 12.3 shows SUDIs by age at death.

Figure 12.3: Sudden unexpected death in infancy by age at death



Data source: Queensland Child Death Register (2005–06)

The infants ranged in age from 2 days to 11 months when they died. Most were aged 2 months and under (63.9%). This is consistent with the Commission's findings presented in the *Annual Report: Deaths of children and young people, Queensland, 2004–05*.

Geographical distribution (ARIA+)

Seventeen infants who died lived in metropolitan Queensland (47.2%), 15 in regional areas (41.7%) and 4 in remote areas (11.1%).

The rate of sudden unexpected deaths in infancy in remote areas was more than one and a half times higher than the overall rate, with 118.1 deaths per 100,000 infants in remote areas, compared with 69.7 deaths per 100,000 infants in all areas.

The rate of SUDI in regional areas was also above the overall rate, with 79.5 deaths per 100,000 infants, while the metropolitan rate was 57.8 deaths per 100,000 infants.

Socio-economic status (SEIFA)

Of the 36 infants who died, 20 lived in low or very low socio-economic areas (55.6%), including 12 in the lowest socio-economic areas in Queensland; 11 infants were from high or very high socio-economic areas (30.6%), while 5 lived in a moderate area (13.9%).

The rate of sudden unexpected deaths in infancy in low socio-economic areas was considerably higher than the overall rate, with 97.7 deaths per 100,000 infants in low socio-economic areas, compared with 69.7 deaths per 100,000 infants in all areas.

The rate of SUDI in high socio-economic areas was 54.4 deaths per 100,000 infants, while the metropolitan rate was 45.6 deaths per 100,000 infants.

A growing body of literature demonstrates a strong, consistent inverse relationship between socio-economic status and death in infancy (Spencer & Logan 2004:366; Byard 2004:507; Hayes 2002:311).

Spencer and Logan's review of case-control and cohort studies (2004:366–70) found that, in 51 of 52 studies since 1965, the risk of infant death increased with greater exposure to adverse social circumstances. The review also found that socio-economic status has an effect on sudden infant death independent of other major risk factors such as maternal smoking in pregnancy, birth weight and infant sleeping position, which are also socially patterned.

Following the general decline in deaths attributed to SIDS in the early 1990s, the sociodemographic profile of families affected by SUDI has changed. Mitchell and colleagues (2000:313) found that a significant percentage of families that experience a SUDI have chaotic, itinerant lives characterised by social problems such as substandard housing,

unemployment, illicit drug use, multiple partners and domestic violence. Studies of social inequalities in SIDS before and after the 'Back to Sleep' campaign²⁴² have also found that social class inequalities in SIDS have widened since the campaign's introduction (Pickett, Lou & Lauderdale 2005:1979). It is possible that the disparity in SIDS rates reflects social inequalities in known and unknown risk factors for infant death that were previously masked by the prevalence of stomach-down sleep position.

There is some evidence that these inequalities are in part due to information about risk factors for infant death not being equally disseminated to women in disadvantaged social groups. Studies have also found that women in disadvantaged social groups are less receptive to advice about infant care practices, although further research is needed to elucidate how parents in high-risk groups come to make decisions contrary to the advice they have been given by health professionals (Pickett, Lou & Lauderdale 2005:1980). Such research points to the importance of cultural and institutional barriers in attempts to reduce the incidence of sudden infant death among disadvantaged groups.

Social and economic disadvantage is an important factor when considering the epidemiology of SUDI and should not be dismissed as an unmodifiable variable. Economic hardship can impact on those least able to protect themselves, such as infants, and is likely to result in deterioration in their health status. Preventative programs need to address the social circumstances into which infants are born, in addition to promoting parental behaviour change. Reducing death among this cohort of infants may require investigating the merits of targeting disadvantaged populations with specific interventions aimed at health promotion, as well as broader macroeconomic initiatives aimed at reducing relative poverty (Petrou et al. 2006:15). The Commission intends to research effective interventions for 'high-risk' infants more fully in the future.

Aboriginal and Torres Strait Islander status

Twelve²⁴³ of the 36 infants who died suddenly and unexpectedly were Indigenous (33.3%); 10 were Aboriginal, 1 was Torres Strait Islander and 1 infant was both Aboriginal and Torres Strait Islander. In 1 of these cases, the Police Report of Death to a Coroner (Form 1) indicated that the child was Aboriginal but the death registration data provided by the Registry of Births, Deaths and Marriages listed the child's Indigenous status as unknown.

Aboriginal and Torres Strait Islander infants died suddenly and unexpectedly at 7 times the rate of non-Indigenous infants, with 351.6 deaths per 100,000 Indigenous infants (3.3 deaths per 1000 Indigenous live births), compared with 49.7 deaths per 100,000 non-Indigenous infants (0.5 deaths per 1000 non-Indigenous live births).

Geographical distribution (ARIA+)

Seven of the 12 Aboriginal and Torres Strait Islander infants who died (58.3%) were living in regional areas and 2 of the infants were living in remote or very remote areas (16.7%). Three of the Aboriginal and Torres Strait Islander infants were living in metropolitan areas (25%).

By comparison, for non-Indigenous SUDI deaths, 33.3% involved infants living in regional areas, with 8.3% in remote areas and 58.3% in metropolitan areas.

The high concentration of Indigenous infants living in regional and remote areas (47.4% Indigenous) may in part account for the regional and remote bias in SUDI deaths.

Socio-economic status (SEIFA)

Ten of the 12 Aboriginal and Torres Strait Islander infants who died were living in low and very low socio-economic areas (83.3%) and 6 of these were living in the lowest socio-economic areas in Queensland (60%). Two Indigenous infants were living in moderate areas (16.7%). No Indigenous infants were living in high or very high socio-economic areas.

242 The 'Back to Sleep' campaign is the US and UK equivalent of the 'Reduce the Risk of SIDS' campaign initiated by SIDS and Kids Australia.

243 There are an additional 2 Indigenous deaths that have not been accounted for in this chapter as the death has not been registered by the Registry of Births, Deaths and Marriages. The cause of death for 1 of these deaths is SIDS, while the cause of death for the other infant is pending test results and coronial findings. Refer to Chapter 2, 'Methodology', for further details regarding registration.

By comparison, 41.7% of non-Indigenous SUDI deaths involved infants living in low or very low socio-economic areas, with 45.8% in high or very high socio-economic areas and 12.5% in moderate areas.

Aboriginal and Torres Strait Islander infants living in low or very low socio-economic areas were 9 times more likely to die suddenly and unexpectedly than their non-Indigenous counterparts (479.6 deaths per 100,000 Indigenous infants living in low socio-economic areas, compared with 54.4 deaths per 100,000 non-Indigenous infants).

Aboriginal and Torres Strait Islander people live in conditions of clear social and economic disadvantage and the health status of Indigenous peoples compares unfavourably with the rest of the population and with that of Indigenous groups in other countries such as New Zealand, the United States and Canada (Paradies & Cunningham 2002:11; AIHW & ABS 2005:73). Several reasons have been suggested for the higher mortality rates among Indigenous people, including social, economic, political and environmental factors. Compared with non-Indigenous Australians, Indigenous people remain disadvantaged across a range of areas of social concern. Specifically, Indigenous people experience lower levels of employment, lower levels of educational participation and attainment, lower levels of home ownership, and lower incomes than non-Indigenous people (AIHW & ABS 2005:xxi–xxii). Aboriginal and Torres Strait Islander people are more likely to be exposed to poor living conditions, poor nutrition, tobacco, excessive alcohol consumption, other drugs and harmful substances and violence (Paradies & Cunningham 2002:15). They also experience high levels of stress caused by factors such as separation (especially of children), trauma, grief, loss of culture and ongoing effects of poverty, discrimination and racism (HREOC 1997).

These factors interact to contribute to the disparity in health status between Indigenous and non-Indigenous peoples, as evidenced by an Indigenous infant mortality rate that is at least twice that of non-Indigenous infants (1025.4 deaths per 100,000 Indigenous infants, compared with 472.5 deaths per 100,000 non-Indigenous infants).

Child protection population

Seven of the 36 infants who died suddenly and unexpectedly were known to the Department of Child Safety (DChS) in the three years before their deaths (19.4%). The Department's involvement with these infants will be considered by the Child Death Case Review Committee (CDCRC).²⁴⁴ In a further 2 cases the Police Report of Death to a Coroner (Form 1) indicated that the family had a history of departmental involvement with the deceased infant's siblings only.²⁴⁵ Four of the 9 cases where the infants or their siblings were known to child protective services were Indigenous (44.4%).

Infants known to the DChS were significantly over-represented in SUDI deaths, accounting for 134.9 deaths per 100,000 infants in the child protection population, compared with 52.3 deaths per 100,000 infants in Queensland.

As this population is often characterised by chaotic and dysfunctional social circumstances which include many risk factors for infant death, the Commission considers this population to be 'at risk' for SUDI. The social conditions of these families make them difficult to reach through traditional public health education channels; therefore they may require more direct intervention to ensure that messages are understood and implemented (Office for Children 2004).

244 Since 1 August 2004, the DChS has been required to conduct a review of its involvement with a child if the child was known to the Department within the 3 years before death. The CDCRC is an independent committee responsible for considering the Department's review. The committee is multi-disciplinary and is chaired by the Commissioner.

245 These cases have not been considered by the CDCRC to date (refer to Chapter 4 for further information).

The Commission is concerned about the rate of SUDI for children known to the DChS. As a result of recommendations made by the DChS and endorsed by the CDCRC as an outcome of a child death case review, the Department is developing a Practice Paper focusing on high-risk infants.²⁴⁶ The Commission will work with the DChS to ensure that due consideration is given to risk factors for infant death in this cohort of children.²⁴⁷

Coronial findings

At the time of reporting, coronial findings were pending in 22 of the 36 cases of SUDI (61.1%). Coronial findings had been finalised in 14 cases (38.9%). Autopsy test results (cause of death) were also pending in 8 cases (22.2%).

Cause of death

In the reporting period, cases that presented as a SUDI when initially reported were subsequently classified into five categories of death:

- sudden infant death syndrome (SIDS)
- sleep accidents, including accidental suffocation and deaths caused by unsafe cots and bedding
- unrecognised morbid processes or congenital abnormalities, and
- deaths where the autopsy findings were insufficient to determine the cause of death (undetermined/unascertained).

Cases of SUDI for which a cause of death was pending at the time of reporting have also been counted in this chapter.

Table 12.1 shows the cause of death (as determined by a coroner and/or pathologist) for the 36 cases of SUDI in the reporting period.

Table 12.1: Sudden unexpected death in infancy by cause of death

Cause of death	Total
SIDS and other ill-defined causes of mortality	
Sudden infant death syndrome	11
Undetermined	5
External causes of accidental injury	
Accidental suffocation and strangulation in bed	2
Diseases and morbid conditions	
Acute bronchiolitis	1
Acute epiglottitis	1
Enteroviral encephalitis	1
Gastro-oesophageal reflux disease	1
Myocarditis	1
Otitis media	1
Sepsis of newborn due to <i>Staphylococcus aureus</i>	1
Streptococcal infection	1
Streptococcal meningitis	1
Other	
Anoxic brain damage (unknown cause)	1
Pending test results	
Total	36

Data source: Queensland Child Death Register (2005–06)

As discussed in Chapter 2, ‘Methodology’, the Commission has entered into an interim arrangement with the Registry of Births, Deaths and Marriages under which updated cause of death is provided to the Commission. In the *Annual Report: Deaths of children and young people, Queensland, 2004–05* the Commission did not have cause-of-death information for 36.5% of cases of SUDI registered between 1 January 2004 and 30 June 2005. A retrospective review of these cases is provided in Appendix 12.1. In the current reporting period, a cause of death was not provided for 8 of the 36 cases of SUDI (22.2%).

246 This paper is due to be finalised in June 2006.

247 The Victorian Child Death Review Committee (VCDRC) has noted the prevalence of SIDS in the child protection population and has expressed concern that SIDS deaths in this population have not decreased over time. The VCDRC has conducted a detailed group analysis of SIDS in the child protection population which is due to be released in the latter half of 2006.

Under section 48A of the *Births, Deaths and Marriages Registration Act 2003*, the Registrar must notify the Commission of, and provide information about, all registered child deaths, including the child's cause of death to the extent it is known to the Registrar. For reportable child deaths,²⁴⁸ the Registry of Births, Deaths and Marriages receives an Autopsy Certificate (in accordance with section 24A of the *Coroners Act 2003*) as soon as practicable after the completion of an autopsy, usually within 28 days of the death. However, updated cause-of-death information as provided on the Autopsy Certificate is not routinely sent on to agencies.

It is the Commission's view that cause-of-death data are provided to the Registry in its capacity to record life events accurately and securely, and to enable the provision of accurate, reliable data for planning and research to agencies such as the Australian Institute of Health and Welfare (AIHW), the ABS and other government authorities and research bodies. The Commission is therefore recommending that the Registry of Births, Deaths and Marriages provide updated cause-of-death information as detailed on the Autopsy Certificate to the Commission (see Chapter 2, 'Methodology', for further information on this recommendation). It is the Commission's view that the Registry should also give due consideration to sending these updates to other research agencies as a matter of course.

Unexplained sudden unexpected deaths in infancy

Unless otherwise stated, the following analyses data from the 16 unexplained SUDI (infant deaths from SIDS and undetermined causes and where cause of death was pending).

SIDS and undetermined causes

In 1969, American pathologist Bruce Beckwith formulated the definition of SIDS, introducing the term (partly for humanitarian reasons) as a recognised category of natural death (Fleming et al. 2000:2). Until 2004, SIDS was generally defined using the National Institute of Child Health and Human Development 1989 revision of Beckwith's original definition: "the sudden death of an infant

under one year of age, which remains unexplained after a thorough case investigation, including performance of a complete autopsy, examination of the death scene and review of the clinical history" (Willinger, James & Catz 1991:681).

In 2003, Beckwith proposed a re-examination of the definition of SIDS to include positive diagnostic criteria and to establish a distinction between typical and atypical SIDS cases. In response, an international expert panel of paediatric and forensic pathologists, paediatricians and epidemiologists convened the SIDS Redefinition Conference in San Diego in January 2004, at which a new definition of SIDS was developed:

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 (Krous et al. 2004:235).

It was agreed that stratifying cases of SIDS into subcategories would provide diagnostic guidelines, identify and include cases that had previously been excluded because of shared sleeping or stomach-down sleep position, and separate cases based on the degree of certainty with which a diagnosis of SIDS can be made (Krous et al. 2004:236–37). Thus the San Diego definition includes the following subcategories:

- **Category IA SIDS:** The classic features of SIDS are present and completely documented, including the typical age range of 21 days to less than 9 months. Cases in this category show no evidence of trauma, disease or lesions at autopsy and all toxicology results are negative. Normal clinical history growth and development and the death scene show nothing that could have contributed to the death
- **Category IB SIDS:** As above, except an investigation of death scenes was not performed and at least one the following analyses was not performed: toxicologic, microbiologic, radiologic, vitreous chemistry, or metabolic screening studies, and

²⁴⁸ Section 8 of the *Coroners Act 2003* defines a 'reportable death' as a death where the identity of the person is unknown; that occurred in violent, unnatural or suspicious circumstances; that was not the reasonably expected outcome of a health procedure; where a cause of death certificate was not issued nor likely to be issued; or where the death occurred in custody or care.

- **Category II SIDS:** Meets the criteria for IA or B, except the infant was outside the typical age range; had abnormal growth or development; an autopsy reveals an abnormality that appears significant, but whose precise role in the death is difficult to determine; or mechanical asphyxia due to overlay cannot be excluded.

In addition, the San Diego forum proposed that those cases that do not fall into the above categories, but in which “alternative diagnoses of natural or unnatural conditions are equivocal (including cases for which autopsies are not performed)”, be attributed to ‘unclassified sudden infant death’ (USID) (formerly undetermined or unascertained) (Krous et al. 2004:236).

Cases of SUDI should therefore be classified as undetermined if:

- natural disease processes were detected that are not considered sufficient to cause death but that preclude a diagnosis of SIDS
- there are signs of significant stress
- non-accidental but non-lethal injuries were present, or
- toxicologic screening detects non-prescribed but non-lethal drugs (Mitchell et al. 2000:311).

In March 2004, SIDS and Kids Australia (the peak non-government body on SIDS) hosted the first National SIDS Pathology Workshop. The workshop brought together paediatric and forensic pathologists from each state and territory with the aim of obtaining a national consensus for a common definition of SIDS and a recommended standard autopsy protocol for infant deaths. Participants agreed to implement the San Diego definition of SIDS.²⁴⁹ It was also agreed that the ill-defined terms ‘unascertained’ and ‘undetermined’ would be replaced by ‘unclassified sudden infant death (USID)’.

The Commission is concerned that the introduction of the acronym USID and the similarities between this and the terms ‘sudden unexpected deaths in infancy (SUDI)’ and ‘sudden infant death syndrome (SIDS)’ may cause unnecessary confusion among pathologists, coroners and health professionals. To demonstrate, the Commission notes that, since the First Australian Pathology Workshop, in addition to certifying deaths as due to SIDS or as undetermined or unascertained, pathologists in Queensland have certified the cause of infant deaths as ‘sudden unexpected infant death syndrome’ (2 deaths),²⁵⁰ ‘unclassified sudden infant death syndrome’ (1 death)²⁵¹ and ‘unclassified sudden infant death’ (1 death).²⁵²

The Commission intends to work with Queensland Health and SIDS and Kids Australia to resolve these ambiguities. In the interim, in the interests of clarity, the Commission will continue to use the term ‘undetermined’ to refer to those infant deaths where, following a post-mortem examination, a cause of death was unable to be ascertained.

Risk factors for SIDS

Many studies compare the epidemiological characteristics of infants who died from SIDS with other infants in an attempt to identify risk factors.²⁵³ Infant, parental and environmental factors have been associated with a statistically increased risk of SIDS.

Infant factors relate to the vulnerability of the infant and include:

- prematurity (less than 37 weeks gestation) and low birth weight (less than 2500 grams)
- multiple gestation (twins, triplets)
- neonatal health problems
- male sex, and

249 SIDS and Kids Australia also reports that extensive progress was made towards the development of an agreed Australian SIDS Autopsy Protocol.

250 One of these deaths was of an infant over the age of 1 year. This death was given the ICD-10 code ‘other and ill-defined causes of mortality’ (R99) as the definition of SIDS precludes its application to children over the age of 1 year. The other death was coded as ‘sudden infant death syndrome’ (R95) as the infant’s autopsy was unremarkable and the Commission considered this to be the pathologist’s intention when certifying the death.

251 This death was coded as ‘other and ill-defined causes of mortality’ (R99) because of the presence of the word ‘unclassified’.

252 This death was coded as ‘other and ill-defined causes of mortality’ (R99) in line with the outcomes of the First Australian Pathology Workshop.

253 Risk factors should not be conflated with causes. Keens (2002:3) defines the difference between risk factors and causes: “When risk factors are found in a population the statistical risk of SIDS occurring in that population increases. However, risk factors are not causes of SIDS. They may provide *clues* for researchers to the cause of SIDS. Therefore they are important for research. However, no risk factor, singly or in combination, is sufficiently precise to predict the baby who will die from SIDS” (emphasis included in original).

- history of minor viral respiratory infections and/or gastrointestinal illness in the days leading up to death.²⁵⁴

Parental factors include:

- 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, and
- high-risk lifestyles, including alcohol and illicit drug abuse.

These parental risk factors are similar to the risk factors associated with child abuse and neglect (VCDRC 2006:44).

Environmental factors include:

- poor socio-economic status (social disadvantage and poverty)
- sleeping on soft surfaces and loose bedding
- prone (on stomach) sleeping position and side sleeping position
- winter months
- over-wrapping/overheating, and
- some forms of shared sleeping.

(Alm et al. 1999; Alessandri et al. 1996; American Academy of Pediatrics 2000; Beal 1988; Beal 1989; Beckwith 2003; Byard 2004; Carroll-Pankhurst & Mortimer 2001; Golding 1997; Hoffman & Hillman 1992; Kandall et al. 1993; Keens 2002; Mesich 2005; Spencer & Logan 2004; Osmond & Murphy 1988.)

During the past two decades, research has identified several risk factors relating to parental behaviour and the environment (particularly an infant's sleep environment) that can be modified. Understanding risk factors for SIDS that can be reduced through

behavioural, social and environmental changes can help health professionals and public policy makers educate and support high-risk infants and families.

Incidence of SIDS and undetermined causes, 2005–06

Over the past decade, the rate of SIDS in Queensland has fallen slightly, although there have been more impressive reductions in other Australian jurisdictions since the introduction of the 'Reduce the Risks of SIDS' campaign in the early 1990s. While previously claiming one of the lowest SIDS rates, Queensland now has one of the highest rates in Australia.

Between 1 July 2005 and 30 June 2006 there were 24 infant deaths attributed to SIDS and undetermined causes and where cause of death was pending (11 SIDS, 5 undetermined, 8 cause of death pending), a rate of 46.5 deaths per 100,000 infants (0.5 deaths per 1000 live births). When considering SIDS alone, the rate of death was 21.3 per 100,000 infants.

As 82.6% of the deaths where 'cause of death was pending' in last year's Child Death Annual Report, 2004–05 were attributed to SIDS and undetermined causes, these deaths are analysed and discussed together with deaths attributed to SIDS and undetermined causes.

A number of known SIDS risk factors were found in these deaths.

Table 12.2 provides a summary of known risk factors for the 24 infants who died from SIDS and undetermined causes and where cause of death was pending. The information provided in the table and the analysis has been drawn from the Police Report of Death to a Coroner (Form 1), autopsy reports and coronial findings.

254 There is some conjecture surrounding reported symptoms of illnesses in the period preceding infant death, as 'sniffles' and other conditions (whether infections or physiologic) are common in this age group and are often reported by concerned family members after the unexpected death of an infant (Knight, Hunsaker & Corey 2005:30).

Table 12.2: Summary of SIDS risk factors for infants who died from SIDS and undetermined causes

Cause of Death	Indigenous	Shared sleeping	Sleep surface	Prone/side sleeping	Low birth weight	Pre-term birth	Young maternal age*	Smoking	Drugs/ alcohol	Chaotic social circumstances**	Living in low socio-economic areas
SIDS		✓	double bed				✓			✓	
SIDS		✓	double bed		✓	✓					
SIDS	✓	✓	double bed				✓	✓	N/A		✓
SIDS			cot	✓				✓	✓		✓
SIDS		✓	double bed					✓	✓		
SIDS		✓	double bed		✓	✓					✓
SIDS			lounge chair	N/A	N/A	N/A		✓	✓	✓	✓
SIDS		✓	double bed			N/A		✓			✓
SIDS		✓	double bed	✓	N/A			✓	✓	✓	
SIDS			bed (size unknown)	✓		N/A					
SIDS			mattress on floor	N/A	N/A	N/A		✓	✓	✓	✓
SIDS total (11)	1	7		3	2	2	2	7	5	4	6
Undetermined			double bed					✓		✓	
Undetermined	✓	✓	double bed				✓	✓	✓	✓	✓
Undetermined			cot	✓							
Undetermined		✓	double bed					✓			
Undetermined	✓	✓	double bed		✓	✓		✓	N/A		✓
Undetermined total (5)	2	3		1	1	1	1	4	1	2	2
Pending	✓	✓	double bed		N/A	N/A		✓	N/A	✓	✓
Pending	✓	✓	double bed	N/A	N/A	✓		✓	✓	✓	
Pending			single bed	N/A	N/A	N/A					
Pending		✓	lounge chair/parent's lap			N/A		✓		✓	✓
Pending			cot								
Pending			cot					N/A	N/A		✓
Pending		✓	double bed	✓					✓		
Pending	✓	✓	double bed		N/A		✓	✓		✓	✓
Pending total (8)	3	5		1		1	1	4	2	4	4
Total (24)	6	15		5	3	4	4	15	8	10	12

Data source: Queensland Child Death Register (2005–06)

✓ = SIDS risk factor present

* = < 20 years old

** = child or siblings known to the DChS and/or family have a history of criminal activities and/or domestic violence issues and/or mental health issues

N/A = information not recorded

Infant factors

Gender

Of the 24 infants who died from SIDS, from undetermined causes and where cause of death was pending, 14 were male (7 SIDS, 3 undetermined, 4 pending) and 10 were female (2 SIDS, 4 undetermined, 4 pending).

Males accounted for a significantly higher proportion of infants who died from SIDS and undetermined causes and where cause of death was pending (58.3%), and died at a higher rate than that of female infants (52.8 deaths per 100,000 male infants, compared with 39.8 deaths per 100,000 female infants).

Male sex has consistently been associated with a statistically increased risk of SIDS.

Preterm birth and low birth weight

Infant birth data were not available or incomplete for 10 of the 24 infants who died from SIDS and undetermined causes and where cause of death was pending. Therefore the figures presented here are likely to under-represent preterm and low birth weight infants.²⁵⁵

Four of the 24 infants who died from SIDS and undetermined causes and where cause of death was pending were preterm (less than 37 weeks gestation) (16.7%) and 3 were of low birth weight (weight of less than 2500 grams) (12.5%).²⁵⁶ Two of these were very low birth weight infants. (The 3 low birth weight infants were also born preterm).

Preterm birth and low birth weight are critical risk factors for infant mortality (Austin Ricketts, Murray & Schwalberg 2005:1952). Preterm birth is the most frequent cause of perinatal morbidity and mortality, generally accounting for more than 70% of perinatal mortality in foetuses without anomalies (Vintzileos et al. 2006:1254).

Low birth weight can be attributed to two major phenomena: preterm birth and intra-uterine growth restriction, usually due to problems with the placenta, maternal health or congenital anomalies. Any baby born prematurely is likely to be very small, but other factors that contribute to the risk of low birth weight include multiple births, non-white race, unmarried status, teenage motherhood and poor maternal health (women exposed to drugs, alcohol and cigarettes during pregnancy are significantly more likely to have low birth weight or very low birth weight babies). Low birth weight has also been associated with indicators of socio-economic disadvantage such as minimal education and low income, as well as with stress during pregnancy. Socially disadvantaged mothers are also more likely to have poor pregnancy nutrition, inadequate prenatal care and complications of pregnancy – all of which are factors that can contribute to low birth weight (Austin Ricketts, Murray & Schwalberg 2005:1952; McAnarney 1987:1054; Petrou et al. 2006:14–15).

A considerable body of research identifies the effectiveness of early, consistent prenatal care in preventing low birth weight and preterm birth, and program evaluations have found that low birth weights for specific high-risk populations can be reduced with enhanced psychosocial prenatal care programs (Austin Ricketts, Murray & Schwalberg 2005:1952).

Parental factors

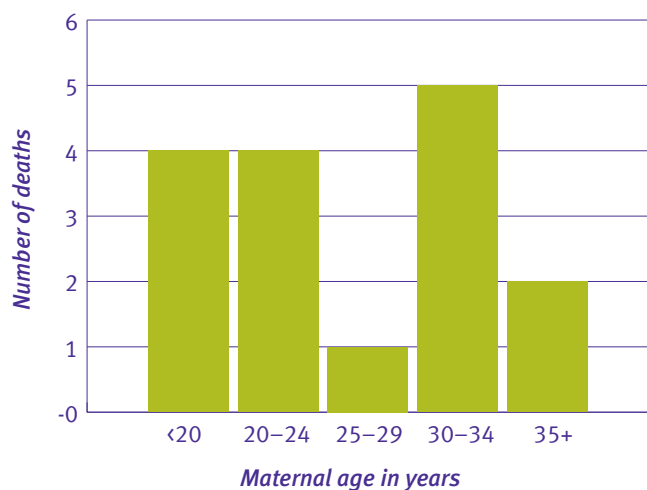
Young maternal age

Figure 12.4 shows the age range of mothers whose infants died of SIDS and undetermined causes and where cause of death was pending.

255 This information was not consistently recorded across all Police Reports of Death to a Coroner (Form 1). This information may not always be available to police when initially investigating the death, or before submitting the form to the coroner.

256 Low birth weight infants can be further subdivided into very low birth weight (< 1500g) and extremely low birth weight (< 1000g).

Figure 12.4: SIDS and undetermined causes and cause of death pending by maternal age



Data source: Queensland Child Death Register (2005–06)

Four of the 24 infants who died from SIDS and undetermined causes and where cause of death was pending were born to mothers less than 20 years of age (16.7%), 1 of whom was aged between 15 and 17 years. In an additional 3 cases, although the mother was over the age of 20 at the time of the infant’s birth, the infant had a sibling or siblings born before the mother’s 20th birthday.

Young maternal age is a marker for one or more other maternal risk factors known to be associated with adverse neonatal outcomes. Compared with infants born to older mothers, infants born to teenage mothers are at an increased risk of prematurity, low birth weight and death in the first year of life, with young (15–17 years) and very young (< 15 years) adolescents at the highest risk. Studies have also found this elevated risk to be consistent across racial and ethnic groups (Glennon Phipps, Blume & DeMonner 2002:481; McAnarney 1987:1053). Teenage mothers thus have a disproportionate share of all adverse outcomes of pregnancy.

The poor outcomes of teenage pregnancy can be partially attributed to two features of biologic immaturity: a young gynaecologic age (defined as conception within 2 years after the first menstrual period) and the effect of a girl becoming pregnant

before her own growth has ceased – adolescent mothers whose own growth continues during pregnancy may compete with the developing foetus for nutrients to the detriment of the foetus (Fraser, Brockert & Ward, 1995:1117).

In addition to the effect of biologic immaturity, studies indicate that the poor outcomes of young maternal age are also a result of the sociodemographic environment generally associated with adolescent pregnancy. Teenage mothers are more likely than older mothers to be non-white, poor, unmarried²⁵⁷ and have only minimal education. They are also less likely to have received early prenatal care. Babies born to mothers who have these risk factors are frequently preterm, low birth weight or small-for-gestational-age (Fraser, Brockert & Ward 1995:1113; Glennon Phipps, Blume & DeMonner 2002:481).

Efforts to improve the poor social conditions of pregnant teenagers may reduce their risk of poor reproductive outcomes.

Smoking

The Police Report of Death to a Coroner (Form 1) identifies whether there were “signs of habitual smoking at [the] location of [the] event” for all cases of unexpected infant death. However, the form does not require officers to identify which of the parents smoked, whether they smoked in the same room as the infant, whether the mother smoked during pregnancy, or the amount of smoke to which the infant was exposed.

There was evidence of habitual smoking in the homes of 15 of the 24 infants who died from SIDS and undetermined causes and where cause of death was pending (62.5%).

There have been numerous studies of the relationship between smoking and SIDS, and a strong, independent association between maternal smoking during pregnancy and SIDS has been established (Haglund & Cnattingius 1990; Malloy et al. 1988; McGlashan 1989 Golding 1997; Byard

257 Single marital status includes all mothers without a supportive partner, whereas married includes legally married and stable de facto relationships.

2004; Mitchell 1995). This finding is consistent over time and across jurisdictions. While it is not clear how SIDS occurs, the predominant effect of maternal smoking is generally attributed to in-utero exposure of the foetus – smoking may be responsible for reduction in the size of the infant’s body and the placenta. Impaired arousal is also found in infants exposed to tobacco smoke (Horne et al. 2002; Byard 2004:499).

Evidence suggests that exposure to cigarette smoke after birth further increases the risk of SIDS. Although there are methodological difficulties in identifying independent effects of postnatal exposure to tobacco smoke, studies examining paternal smoking where the mother is a non-smoker suggest that infants who are exposed to environmental cigarette smoke are almost one and a half times more likely to die of SIDS than other infants (Mitchell 2000).

Recent evidence also suggests that the risk of death doubles if an infant shares a bed with a mother who smokes (Byard 2004:501).

Byard (2004:499) reports that infants who have been exposed to cigarette toxins during pregnancy and after birth have a five times greater risk of SIDS.

Parental drug and/or alcohol use

The Police Report of Death to a Coroner (Form 1) identifies whether there was “any evidence of alcohol or drug use at [the] location of [the] event”. However, the form does not require officers to record the extent of alcohol or drug use.

There was evidence of drug and/or alcohol use in the homes of 8 of the 24 infants who died of SIDS or undetermined causes and where cause of death was pending (33.3%). In 4 cases, household drug and alcohol use was unknown.

A number of studies have consistently identified increased risks of infant death with parental substance abuse. For example:

- Maternal alcohol use during pregnancy has been associated with an increased risk of SIDS. Intake of alcohol by the mother after birth has also been

associated with an increased risk of infant death, particularly when combined with bedsharing (Alm et al. 1999; Byard 2004; Friend, Goodwin & Lipsitt 2004)

- Maternal abuse of opiates increases the risk of infant death, and breastfed infants exposed to opioids in breast milk have increased risks of apnoea, and
- Maternally ingested amphetamines may also contaminate breast milk and increase the risk of infant death (Byard 2004:503).

Prenatal care

Inadequate prenatal care has been identified as a ‘high-risk’ factor strongly associated with adverse outcomes. Mothers who do not receive early and consistent prenatal care have been found to be twice as likely to deliver low birth weight babies and nearly three times as likely to have premature babies (Fraser, Brockert & Ward 1995:1114; McAnarney 1987:1054; Vintzileos et al. 2006:1254).

The information currently contained in the Commission’s data sources does not identify the amount of prenatal care, if any, received by mothers during the course of their pregnancy.

Section 89ZG of the *Commission for Children and Young People and Child Guardian Act* provides that a government entity may enter into an arrangement to provide the Commissioner with information reasonably needed to perform the Commission’s child death research functions. The Commission has requested access under this section to valuable perinatal data held by Queensland Health. In addition to antenatal care details, Queensland Health’s perinatal data collection provides accurate data on the infant’s birth weight, gestation and suspected congenital abnormalities, as well as information on any maternal medical conditions likely to have affected the foetus. Queensland Health has agreed in principle to enter into an administrative arrangement to provide the Commission with this information. The Commission is currently liaising with Queensland Health to finalise this agreement.

Environmental factors

Sleeping practices

There is considerable evidence that some infant sleeping practices significantly increase the risk of SIDS, and that some sleep environments are unsafe and may cause fatal sleeping accidents.

Sleep surface

Four of the 24 infants who died from SIDS and undetermined causes and where cause of death was pending were sleeping in cots, cradles or bassinets (16.7%); 18 died on adult beds²⁵⁸ (75.0%) and 2 infants died while sleeping on a lounge chair. Fourteen of the 18 infants who died while sleeping on an adult bed were sharing the surface at the time of death (77.8%). One infant was sleeping in his father's arms on a lounge chair at the time of death.

Infant sleep position

Table 12.3 shows the position of infants who died of SIDS and undetermined causes and where cause of death was pending when placed for sleep and when found.

Table 12.3: SIDS and undetermined causes and cause of death pending by sleep position

Sleep position	SIDS	Undetermined	Pending	Total <i>n</i>
Position when placed to sleep				
Back	6	3	4	13
Side	1	1	0	2
Stomach	2	0	1	3
Other	0	1	1	2
Unknown	2	0	2	4
Total	11	5	8	24

Table 12.3 (cont.): SIDS and undetermined causes and cause of death pending by sleep position

Sleep position	SIDS	Undetermined	Pending	Total <i>n</i>
Position when found				
Back	7	1	2	10
Side	1	2	0	3
Stomach/face down	2	2	2	8
Other	0	0	1	1
Unknown	1	0	1	2
Total	11	5	8	16

Data source: Queensland Child Death Register (2005–06)

Of the 24 infants who died of SIDS and undetermined causes and where cause of death was pending, 13 were placed for sleep on their backs (54.2%), including 1 infant placed to sleep propped up against two pillows. Five infants were placed to sleep on their sides or stomachs (20.8%) (2 on their sides and 3 on their stomachs). One was lying on top of his mother breastfeeding when both mother and infant fell asleep. In another case the infant was being nursed by his father (in a lounge chair) when both infant and father fell asleep. Information on sleep position was not available in 4 cases.

Ten of the infants were found on their backs, including 1 infant who was found entirely covered by adult bedding (41.7%). Three of the infants were found on their sides, and 8 were found on their stomachs, including 1 infant found face down entirely covered by adult bedding and 2 infants found wedged between the bed and the wall. The position of the infant when found was not available in 2 cases.

It is now widely accepted that there is a causal association between stomach-down (prone) sleeping position and SIDS; numerous studies have found that infants who sleep stomach down are between 3.5 and 9.3 times more likely to die of SIDS.²⁵⁹ This association is maintained and in some studies

258 Deaths that occur on beds that are folded out from a couch (sofa beds) or on a mattress on the floor are categorised as occurring on adult beds.

259 The American Academy of Pediatrics Task Force on Infant Sleep Position and Sudden Infant Death Syndrome (2000:650) reports that odds ratios for SIDS when an infant is slept prone range from 1.7 to as high as 12.9. Henderson-Smart, Ponsonby and Murphy (1998:213) report odds ratios ranging from 1.4 to 14.1.

strengthened after adjusting for confounding variables (American Academy of Pediatrics 2000; Beal 1988; Beal 1991; Byard 2004; Dwyer et al. 1991; Gunn, Gunn & Mitchell, 2000; Henderson-Smart, Ponsonby & Murphy 1998; Mitchell et al. 1992).²⁶⁰

The introduction of the 'Reduce the Risk' campaign in Australia (and similar campaigns internationally) has seen a large decrease in the proportion of infants slept on their stomachs. However, evidence of a smaller but significant risk of SIDS associated with the side sleeping position has emerged in recent years (NSW Child Death Review Team 2005:59; Henderson-Smart, Ponsonby & Murphy 1998:214). Several studies have demonstrated that side sleep position confers an increased risk because of the instability of the position. The probability of an infant rolling onto their stomach from the side sleep position is significantly greater than rolling onto their stomachs from the back (American Academy of Pediatrics 2005:1246).

Shared sleeping

Fifteen of the 24 infants who died of SIDS and undetermined causes and where cause of death was pending were sharing a sleep surface with one or more people (7 SIDS, 3 undetermined, 5 pending) (62.5%). Four infants were sleeping with the mother only, 4 with the father only and 4 with both parents. Two infants were sleeping with their mother and an older sibling, and another infant was sleeping with both parents and an older sibling.

Evidence of habitual smoking was found in 11 of the 15 homes in which shared sleeping was reported (73.3%). Drug or alcohol use was noted in 5 of these homes (33.3%).

Ten of the 15 infants who were sharing a sleep surface were currently being breastfed (66.7%). Evidence of habitual smoking was found in 6 of these infants' homes.

The risk associated with shared sleeping is a vexed issue in the SIDS literature. Queensland studies have found that around 45% of infants share a bed with a parent or siblings, with shared sleeping reported to be significantly more common among Indigenous families than non-Indigenous families (Panaretto, Whitehall et al. 2002:137; Young, Battistutta & O'Rourke 2005). Research in the United States has also found the prevalence of shared sleeping to be increasing and that as many as 50% of infants routinely spend some time at night in an adult bed (Willinger et al. 2000:44).

Research indicates that sensory contact and proximity between mother and infant encourage potentially beneficial behavioural and physiological changes in infants. Mothers report less crying, more maternal and infant sleep and increased milk supply (due to the increased frequency of night-time breastfeeding) when sleeping close to their infant (McKenna & McDade 2005:135). Increasing evidence also indicates that infants who sleep near their parents have a reduced risk of SIDS, because of increased arousals. Infants experience more arousals and have less deep sleep (slow-wave sleep) when bed sharing than when sleeping alone (Byard 2004; McKenna & Mosko 1993; McKenna, Mosko & Richard 1997; McKenna & Mosko 2001; Mosko, Richard & McKenna 1996). In response to findings that extra stimulation may reduce deep sleep, alter breathing patterns and enhance neurological maturation, McKenna, Mosko and Richard (1997:218) suggest that bed sharing may protect infants against SIDS.²⁶¹ However, the social and biological connection between an infant and its caregiver is of critical importance if shared sleeping is to be protective to the infant.²⁶²

260 Although it is often assumed that stomach-down sleeping is dangerous because it causes suffocation, Byard (2004:498) warns that such an interpretation is overly simplistic. "Suffocation may certainly occur if an infant slips between a mattress and cot side and the upper airway obstructs, but whereas all infants placed in this position for long enough will die, 99% of infants who sleep prone will survive." The mechanism of death in stomach-down infant sleep position is therefore believed to be more complex than simple smothering, involving a number of factors.

261 Other postulated benefits of close contact between infants and parents include improved cardiorespiratory stability and oxygenation and better thermoregulation (Blair et al. 1999:1457).

262 According to McKenna and Mosko (2001:140, 141) co-sleeping takes place when a responsible adult and the infant use at least two senses (such as touch, sight, sound, smell) to communicate with each other. Safe co-sleeping occurs when the space is as safe as current knowledge permits, and when at least one adult is both physically capable of detecting and responding to changes in the infant's status, and also motivated to respond. Safe co-sleeping is therefore a proactive arrangement in which at least one responsible adult takes safety precautions unique to the shared sleep practice, regardless of the surface.

Controversy continues over whether shared sleeping increases the risk of SIDS because, while the number of SIDS cases has decreased, the number of deaths of infants while bed sharing has increased (Arnestad et al. 2001). However, most studies have found that there is an increased risk of SIDS only when mothers who smoke share a bed with their infant. For example, both the New Zealand Cot Death Study and the CESDI SUDI Studies revealed an interaction between smoking and bed sharing, with the relative risk from bed sharing only significantly increased when the mother smoked (Scragg et al. 1993; Fleming et al. 2000).²⁶³ Similarly, a case-control study by Blair and colleagues (1999) found no association between SIDS and shared sleeping for infants whose parents do not smoke, infants older than 14 weeks,²⁶⁴ or when an infant is returned to its cot after a period of bed sharing. This led the authors to conclude that “there is no evidence that bed sharing is hazardous for infants of parents who do not smoke”.

While there is strong evidence that shared sleeping increases the risk of SIDS in infants of smokers, “the data are currently insufficient to provide complete reassurance to non-smoking parents that bed sharing is safe” (Henderson-Smart, Ponsonby & Murphy 1998:216). The Commission considers that, given the known benefits of shared sleeping for the promotion of breastfeeding and maternal bonding, and the considerable hazards for infants and children associated with smoking, it would seem better to encourage smoking cessation rather than to discourage bed sharing (Eades, Read & the Bibbulung Gnarnep Team 1999:543).

Chaotic social circumstances and multiple risk factors

The Commission considers an infant to have been living in chaotic social circumstances if they or their siblings were known to the DChS and/or Form 1 information indicates that the family had a history of criminal activities (including drug abuse issues) and/or domestic violence and/or mental health issues.

Ten of the 24 infants who died from SIDS and undetermined causes and where cause of death was pending were living in chaotic social circumstances (41.7%), with 5 of these infants meeting two or more of the above criteria. Six of the infants living in chaotic social circumstances were also living in socio-economically disadvantaged areas (60.0%).

Twenty of the 24 infant deaths from SIDS and undetermined causes and where cause of death was pending had at least two known risk factors for infant death (83.3%). In 18 cases, three or more risk factors were present (75.0%), 12 cases had four or more risk factors (50.0%) and in a further 6 cases between five and six risk factors were evident (25.0%).

While SIDS is seen in all social groups, the syndrome is now largely confined to deprived families. Blair and colleagues’ (2006:318) 20-year population-based study reviewing the major epidemiological changes in SIDS noted that, while markers of socio-economic deprivation were seen at a higher frequency in SIDS families in the mid-1980s, all markers had become increasingly prevalent in SIDS families over the past 20 years.

It has also been noted elsewhere that, since the introduction of the ‘Back to Sleep’ and ‘Reduce the Risk’ campaigns, the sociodemographic profile of affected families has changed markedly. A significant percentage of families in which sudden infant deaths occur have chaotic, itinerant lifestyles characterised by poor living circumstances, multiple partners, frequent changes of address, intravenous drug use and a history of domestic violence (Krous et al. 2004; Mitchell et al. 2000).

Consistent with contemporary research, the Commission has found that a significant number of deaths since 1 January 2004 appear to have occurred in chaotic, poor households, characterised by significant social problems, where multiple independent SIDS risk factors converge.

263 The risk of infant death is reported to double if an infant sleeps with a mother who smokes (Byard 2004:501).

264 The risk linked with shared sleeping for younger infants appears to be associated with recent parental consumption of alcohol, overcrowded housing, parental tiredness, and the infant being under a duvet or other covers.

Aboriginal and Torres Strait Islander status

Six of the 24 infants who died from SIDS and undetermined causes and where cause of death was pending were Aboriginal (25.0%).

Aboriginal infants were over-represented in cases of unexplained SUDI (that is, deaths from SIDS and undetermined causes and where cause of death was pending), dying at a rate four times that of non-Indigenous infants (175.8 deaths per 100,000 Indigenous infants, compared with 37.3 deaths per 100,000 non-Indigenous infants).

In Queensland, Aboriginal and Torres Strait Islander infants have a statistically increased risk of SIDS. The rate of SIDS peaked in the late 1980s and fell significantly after the 'Reduce the Risk' campaign. However, the success of the campaign did not extend to Indigenous infants: the rate of SIDS in Indigenous infants remained high even after the campaign (Eades et al. 1999:541). Western Australian studies have found that the disparity between Indigenous and non-Indigenous infants in fact increased after the 'Reduce the Risk' campaign (Read 2002:122). The ABS estimates that the SIDS rate for Indigenous infants is almost six times higher than for non-Indigenous infants in Australia (ABS 2003:25). This raises the issue of why the intervention campaign was successful with non-Aboriginal children but did not decrease the prevalence of SIDS in Indigenous children.

As identified in the Child Death Annual Report, 2004–05, SIDS risk factors are reportedly more prevalent in the Indigenous population than in the non-Indigenous population. Compared with non-Indigenous mothers, Indigenous mothers:

- are at least two times more likely to smoke during pregnancy and after birth
- are 16 times more likely to consume high or risky levels of alcohol
- have a higher incidence of reported drug abuse
- are more likely to be under 20 years of age
- have more babies
- have lower levels of nutrition, leading to infant

- growth retardation in the early stages of gestation
- have poor antenatal care,²⁶⁵ and
- have low birth weight babies.²⁶⁶ (Panaretto, Whitehall et al. 2002:135; Panaretto, Smallwood et al. 2002:441; Australian Bureau of Statistics 2003:12; Queensland Health 2005:31–33; AIHW & ABS 2005:76, 104; Alessandri et al. 1996:241; Douglas, Buettner & Whitehall 2001.)

Gender

Of the 6 Aboriginal infants who died from SIDS and undetermined causes and where cause of death was pending, 2 were male and 4 were female.

Preterm and low birth weight

Infant birth data were not available or incomplete for 4 of the 6 Aboriginal infants who died from SIDS and undetermined causes and where cause of death was pending.

Two of the 6 Aboriginal infants who died from SIDS and undetermined causes and where cause of death was pending were preterm and one was both preterm and low birth weight.

Young maternal age

Three of the 6 Aboriginal infants who died from SIDS and undetermined causes and where cause of death was pending were born to mothers less than 20 years of age (50.0%). One mother was aged between 15 and 17 years. In an additional case, although the mother was over the age of 20 at the time of the infant's birth, the infant had a sibling or siblings born before the mother's 20th birthday.

Smoking

There was evidence of habitual smoking in the homes of all 6 of the Aboriginal infants who died from SIDS and undetermined causes and where cause of death was pending.

Parental drug and/or alcohol use

There was evidence of drug and/or alcohol use in the homes of 2 of the Aboriginal infants who died

265 Around 10% of Aboriginal and 6% of Torres Strait Islander mothers report fewer than two antenatal visits to a general practitioner, clinic or midwife.

266 Thirteen percent of Aboriginal mothers, compared with 6% of non-Indigenous mothers.

from SIDS and undetermined causes and where cause of death was pending. In 3 cases, household drug and alcohol use was unknown.

Sleep surface

All of the Aboriginal infants who died from SIDS and undetermined causes and where cause of death was pending were sleeping on adult beds.

Infant sleep position

Of the 6 Aboriginal infants who died of SIDS and undetermined causes and where cause of death was pending, 4 were placed for sleep on their backs. One infant was lying on top of his mother breastfeeding when both mother and infant fell asleep. The sleep position of 1 Aboriginal infant was unknown.

Shared sleeping

All 6 of the Aboriginal infants who died of SIDS and undetermined causes and where cause of death was pending were sharing a sleep surface with one or more people. Two infants were sleeping with the mother only, 1 with the father only, 1 with both parents, 1 with both parents and an older sibling, and 1 with the mother and an older sibling.

Evidence of habitual smoking was found in all Aboriginal homes in which shared sleeping was reported, and drug or alcohol use was noted in 2 of these homes.

Only 1 of the Aboriginal infants who died from SIDS and undetermined causes where cause of death was pending and was sharing a sleep surface was currently being breastfed.

Chaotic social circumstances and multiple risk factors

Four of the 6 Indigenous infants who died from SIDS and undetermined causes and where cause of death was pending were living in chaotic social circumstances (66.7%). One infant met three of the Commission's criteria for determining chaotic social circumstances and another infant met all of the Commission's criteria.

Five of the 6 Aboriginal cases had four or more known SIDS risk factors. The other infant had three known SIDS risk factors.

Explained sudden unexpected deaths in infancy

Unless otherwise stated, this analysis uses the data from the 12 explained SUDIs (2 sleep accidents, 9 deaths from unrecognised illness and 1 case of anoxic brain damage of unknown cause).

Sleep accidents

During the reporting period, 2 cases of SUDI were caused by accidental asphyxia. Neither of the infants was sharing a sleep surface at the time of death. Both infants were sleeping on an adult bed and both were found wedged, 1 between the mattress and the headboard and 1 between the mattress and the foot of the bed.

Research indicates that unsafe sleep environments can result in accidental suffocation, choking or strangulation. Use of unsafe cots, cot mattresses, infant bedding and sleeping places has been shown to lead to fatal infant sleeping accidents (VCDRC 2006:44). Scheers, Rutherford and Kemp (2003:883) found that the deaths of infants from suffocation on sleep surfaces other than those designed for infants were increasing. Results indicated that the risk of suffocation was approximately 40 times higher for infants in adult beds than in cots.

Infants are at risk of asphyxia if they sleep alone in unsafe situations, a major danger being entrapment due to wedging. Wedging deaths occur when an infant slips down into a gap between the side of an adult mattress and the wall, between a mattress and the side of a cot, or down the side of a drop-sided cot. In this situation asphyxiation may occur from covering of the face or compression of the chest. Deaths due to asphyxia have been reported in association with overhead-suspended rocking cradles, plastic pillow and mattress coverings, defective strollers, beanbags, U-shaped pillows, defective or badly constructed cots, seat or bouncinette harnesses, port-a-cots and partly filled waterbeds.

Unrecognised infant illness

During the reporting period, 9 of the 36 cases of SUDI were found at autopsy to be caused by an illness or disease that was not recognised before the infant's death (25.0%). Table 12.4 shows the breakdown of unrecognised infant illness by cause of death.

Table 12.4: Unrecognised infant illness, by cause of death

Cause of death	Total <i>n</i>
Acute bronchiolitis	1
Acute epiglottitis	1
Enteroviral encephalitis	1
Gastro-oesophageal reflux disease	1
Myocarditis	1
Otitis media	1
Sepsis of newborn due to <i>Staphylococcus aureus</i>	1
Streptococcal infection	1
Streptococcal meningitis	1
Total	9

Data source: Queensland Child Death Register (2005–06)

In 6 of the 9 cases, parents reported that the infant had been unwell within the fortnight before death (66.7%). Symptoms included cold- or flu-like symptoms, fever, sniffles, cough, wheezing, difficulty breathing, unusual lethargy, difficulties feeding, reflux and vomiting. In 4 of the 6 cases the infant had been seen by a doctor in the fortnight before death and in 2 of these cases the infant had been assessed by a health professional within the 48 hours preceding death. In no case was the infant considered to be unwell or seriously unwell at the time of assessment.

In an additional case, although the infant was not considered to be unwell in the days preceding death, she had been discharged from hospital with a possible heart murmur about a month earlier. A later assessment by a general practitioner did not detect any abnormalities and the infant died a day before she was due to attend a specialist appointment to assess her heart condition.

Six of the infants who died from an illness or condition that was not recognised before death were Indigenous (66.7%).

A striking finding of the CESDI SUDI Studies was that 44.3% of the infants who died from explained SUDI were retrospectively assessed to have been in need of medical attention in the 24 hours preceding the death, compared with only 2.8% of controls.²⁶⁷ Of significant concern, of the infants deemed to have been in need of medical attention, 7.4% had not been seen by a health professional in the week before death, while 36.0% who had been seen were assessed as being in good health (Fleming et al. 2000:19). These findings led the authors to conclude that improvement in parents' and health professionals' ability to recognise severity of illness in infants and subsequently seek or provide medical attention may result in a reduction of sudden infant death.

Infant illness is considered a potentially modifiable risk factor for sudden infant death. Consistent with the findings of the CESDI SUDI Studies, it appears that both parents and health professionals underestimated the severity of illness in the infants who died. The Commission is concerned about unrecognised infant illness and has identified it as a focus area for further research. The following case study is illustrative of health professionals' failure to recognise the severity of illness in an infant.

267 This proportion would have been greater if deaths from trauma had been excluded from analysis (Fleming et al. 2000:80).

Case study

A 3 month old Indigenous infant died from gastro-oesophageal reflux disease. The infant had been born prematurely (26 weeks gestation) and as a result had known respiratory, cardiovascular, gastrointestinal and neurological problems. The infant had been discharged from hospital in apparent good health 2 weeks before his death.

The infant's mother reported that the infant had experienced progressively worsening reflux since his discharge from hospital. On the Friday evening 2 days before his death, the infant's parents took him to hospital, where he was examined by nursing staff who reportedly found no sign of illness or injury. Hospital staff advised that the infant's health should be reviewed on the following Monday and the family were sent home. The infant died suddenly during sleep 2 days later.

The infant's mother was aged 18 and had experienced the death of another infant due to prematurity-related conditions a year earlier.

Other

One infant died as the result of global hypoxic brain damage. It is unknown what caused this damage. The infant was suffering neonatal withdrawal syndrome prior to death.

Initiatives and interventions

In the Child Death Annual Report, 2004–05 the Commission made recommendations in relation to the development and implementation of a state-wide policy to inform all new and expectant parents about safe sleeping practices, with a particular focus for those families identified as being at high risk. The Commission recommended Queensland Health develop and communicate the policy to all relevant health staff and develop a training and communication strategy to convey consistent and appropriate messages about safe infant sleeping and how to share a bed safely with an infant.

Queensland Health have accepted these recommendations and committed to their implementation. Queensland Health's written response can be viewed in full in Chapter 3: Monitoring previous Child Death Review Team Recommendations.