# Maternal, Perinatal and Infant Mortality in South Australia 2008

Including the South Australian Protocol for Investigation of Stillbirths

November 2009

Government of South Australia
SA Health

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Including the South Australian Protocol for Investigation of Stillbirths



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# Twenty-Third Report of the Maternal, Perinatal and Infant Mortality Committee

on maternal, perinatal and
post-neonatal deaths in 2008
including the South Australian Protocol
for Investigation of Stillbirths

Government
of South Australia
SA Health

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| Professor Jeffrey Robinson | Obstetrician, Chairperson |
| Dr Elinor Atkinson | Obstetrician |
| Dr Vineesh Bhatia | Neonatal paediatrician |
| Dr Jonathan Hopkinson | Obstetric anaesthetist |
| Professor Marc JNC Keirse | Obstetrician |
| Professor T. Yee Khong | Pathologist |
| Dr George Kokar | General practitioner |
| Associate Professor Nicola Spurrier | Paediatrician |
| Dr Brian Wheatley | Obstetrician |
| Mrs Elizabeth Wood | Midwife |
| Associate Professor Annabelle Chan | Public health physician, Medical Secretary |

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| Associate Professor William Hague | Obstetric physician |
| Dr Elinor Atkinson | Obstetrician |
| Dr Jonathan Hopkinson | Obstetric anaesthetist |
| Professor T. Yee Khong | Pathologist |
| Dr George Kokar | General practitioner |
| Mrs Elizabeth Wood | Midwife |
| Associate Professor Annabelle Chan | Public health physician, Medical Secretary |

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| Professor Gustaaf Dekker | Obstetrician, Deputy Chairperson |
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| Dr Andrew Grieve | Paediatrician |
| Dr Bevan Headley | Neonatal paediatrician |
| Dr Jonathan Hopkinson | Obstetric anaesthetist |
| Professor T Yee Khong | Pathologist |
| Dr Nicholas Manton | Pathologist |
| Dr Linda McKendrick | Obstetrician |
| Dr Dee McCormack | Obstetrician |
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| Dr Harry Burnell | Paediatrician |
| Professor Roger Byard | Pathologist |
| Dr Lynette Moore | Pathologist |
| Dr Michael Smiley | Paediatrician |
| Associate Professor Neil Langlois | Pathologist |
| Ms Debra Jeffs | Community Nurse/midwife |
| Associate Professor Annabelle Chan | Public health physician, Medical Secretary |

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| Mrs Julia Ats | Midwife |
| Dr Darren Roberts | Obstetrician |
| Associate Professor Annabelle Chan | Public health physician, Medical Secretary |

## Committee staff

| | |
|---|---|
| Ms Robyn Kennare | Midwife / Minute secretary |

We would like to express our most sincere thanks to Mrs Margaret Hampton, Dr Jane Warland, Dr Geoff Matthews and Dr David Morris who retired from the Committee in 2009.

We welcome back Dr Michael Smiley and new members Dr Dee McCormack, Ms Debra Jeffs and Associate Professor Neil Langlois to the Committee.

# Acknowledgements

We gratefully acknowledge the valuable assistance of the following:

- Medical practitioners who completed confidential reports on maternal, perinatal or post-neonatal deaths and submitted autopsy reports;
- The pathology departments of teaching hospitals for providing autopsy reports;
- Ms Val Edyvean, Registrar of Births, Deaths and Marriages and staff of the Births, Deaths and Marriages Registration Division.
- Mr Mark Johns, State Coroner, and the staff of the Coroner's Office especially Ms Annemarie Van Putten;
- Ms Robyn Kennare for preparing the graphs and tables.

# Summary

This is the Twenty-third Annual Report of the Maternal, Perinatal and Infant Mortality Committee, for the year 2008:

1. There were no direct or indirect maternal deaths in South Australia in 2008. The maternal mortality ratio for direct and indirect deaths in the eight years 2001-2008 was 7.6 per 100,000 women who gave birth, which is low by international standards. It is slightly higher than in the preceding five-year period but the number of deaths was small (11 in eight years compared with six in five years).

2. The Committee reviewed the 202 perinatal deaths of babies born in South Australia in 2008. The perinatal mortality rate for all births (stillbirths of at least 400g or 20 weeks gestation and all live births) was 10.1 per 1,000 births. The stillbirth rate was 7.6 per 1,000 births and the neonatal mortality rate 2.6 per 1,000 live births. Declines have been seen particularly in the perinatal mortality rate used for international comparison, based on births of at least 1,000g birthweight and early neonatal deaths within the first 7 days of life. The early neonatal death rate for international comparison in 2008 was 0.6 per 1,000 live births and is the lowest ever recorded in South Australia.

3. Eighty percent of the perinatal deaths occurred in preterm babies (less than 37 weeks gestation). The leading cause of perinatal death in 2008 was again congenital abnormalities, which accounted for 30% of the deaths. Other leading causes were spontaneous preterm birth (15%), specific perinatal conditions (14%) and stillbirth of unknown cause (11%). There were 23 stillbirths of unknown cause, a rate of 1.2 per 1,000 births in 2008. This rate has fallen in recent years, compared with 2.0 per 1,000 births in 1995-1998. The Committee has distributed its protocol for the investigation of stillbirths to all obstetric units (Appendix 8). Thirty-one deaths were attributed to preterm birth. Preterm birth and poor fetal growth (which contributed 8% of deaths) have been associated with smoking during pregnancy. Women must be encouraged not to smoke during pregnancy. The proportion of women smoking during pregnancy has been steadily declining in the state and was 16% in 2008.

4. *Fifteen babies of Aboriginal mothers died during the perinatal period. The perinatal mortality rate of 23.5 per 1,000 births with Aboriginal mothers in 2008 was much higher than that of 9.7 per 1,000 with non-Aboriginal mothers. The rates of preterm, small-for-gestational-age and low birthweight births with Aboriginal mothers also remain much higher. The proportion of Aboriginal women who smoked during pregnancy was 57.4% compared with 14.5% for non-Aboriginal women.*

5. The Committee also reviewed the 22 post-neonatal deaths in 2008 among babies born in South Australia, *one of which was the baby of an Aboriginal mother.* The post-neonatal mortality rate remained very low at 1.1 per 1,000 live births. Although there were no post-neonatal deaths attributed to SIDS (Sudden Infant Death Syndrome), the numbers of 'sudden unexpected deaths in infancy' (SUDIs) have not fallen in recent years. These include deaths from 'SIDS', 'accidents, poisonings and violence including accidental asphyxiation', 'medical conditions' and 'undetermined cause'. Three subcategories of these deaths, 'SIDS', 'accidental asphyxiation' and 'undetermined cause', often have similar associated factors including unsafe sleeping practices.

6. The infant mortality rate in 2008 was 3.7 per 1,000 live births. *The infant mortality rate for babies of Aboriginal mothers of 8.0 per 1,000 live births remained higher than that of 3.5 for babies of non-Aboriginal mothers, but is much lower than in recent years.*

7. From the review of maternal, perinatal and post-neonatal deaths, the Committee makes the following **recommendations**:

### Antenatal

- Caring for pregnant women should be undertaken in a setting which is appropriate for the level of risk the pregnancy presents for the mother and/or the baby.
- Women with current or previous serious medical conditions should be reviewed by a physician early in pregnancy.
- A previous caesarean section is a contraindication for home birth.
- Pregnant women travelling in motor vehicles need to wear seat belts at all times for safety.
- Pregnant women with a Body Mass Index (BMI) greater than 35 are at higher risk from anaesthesia. A timely referral for an anaesthetic consultation should be considered for women with a high BMI. South Australia is developing a policy for care of bariatric patients.
- Effective strategies should be pursued to reduce smoking in pregnancy, *including culturally appropriate smoking cessation interventions for Aboriginal women.*
- Testing the antibody status of Rhesus D negative women before the first administration of Anti-D is important. A measurable titre of Anti-D antibodies is an indicator of potential alloimmunisation and always requires investigation and a specialist opinion.

- Early ultrasound determination of chorionicity is advised for twin pregnancies, followed by further surveillance for twin-twin transfusion in monochorionic pregnancies.
- Vigilance to ensure that fetal growth restriction is not missed.
- The institution of streamlined arrangements between rural/level I hospitals and their regional level II/III maternity service in situations where there is a lack of on-site CTG expertise; this includes easier access of rural practitioners to the consultant on call.

### Labour and birth

- When induction of labour is deemed necessary in the presence of a uterine scar and an unripe cervix, careful consideration should be given to alternative options such as postponing the induction or caesarean section.
- Once a decision to perform an emergency caesarean section has been made, it is recommended that fetal monitoring should continue until the commencement of surgery.
- When feto-maternal haemorrhage is suspected, flow cytometry should be considered to estimate the volume as it is more precise than the Kleihauer test.
- Appropriate detection and antibiotic treatment for carriers of Group B Streptococcus and for women with risk factors such as prolonged rupture of membranes.

### Postnatal

- If a diagnosis of pre-eclampsia has been made, the blood pressure should be monitored until it has settled and any abnormalities of renal or liver function or blood counts have been appropriately managed.
- Non-steroidal anti-inflammatory drugs should be avoided post-partum and post-operatively in women with pre-eclampsia. Low dose aspirin remains an effective drug for prevention of pre-eclampsia.
- Use of the recently-revised protocol for investigating stillbirths, which has been sent to all maternity units in South Australia (Appendix 8).
- Seeking parental permission for autopsy, which may provide information most valuable in the counselling of parents and in the management of future pregnancies. The State Perinatal Autopsy Service (telephone 08-8161-7333) is available at no cost to the parents, including those in country areas. Certain categories of death have to be reported to the State Coroner (see page 57).
- Sending placentas for histological examination with all relevant clinical information in all cases of perinatal death (see Appendix 9).

### Professional

- Appropriate training and maintenance of competence in cardiotocograph (CTG) interpretation for all levels of medical and midwifery staff.
- Ongoing development and implementation of statewide perinatal protocols is recommended (www.health.sa.gov.au/ppg).

### Infant

- An effective system of appropriate and ongoing support, supervision and referral should be offered to families with known risk factors for adverse child outcome, such as substance abuse, psychiatric illness, extreme youth of the mother or violence in the household. This should be continued at least throughout the first year of life, if not for a longer period of time.
- Monitoring growth in children, which can be undertaken using the weight percentiles in the child's Personal Health Record (Blue Book), and investigating why a child is not thriving.
- Immunisation of children to prevent infectious disease.
- Vigilance to ensure that potential hazards in the home are removed from the infant's environment.
- Vigilance to ensure safe feeding in children under four years of age. Foods that can break off into pieces should not be given, as accidental asphyxiation may occur.
- Consideration should be given to better ways of identifying serious underlying illness in children presenting to clinicians, for example, Medic Alert bracelets.
- Systems to facilitate referral by community nurses of high-risk children to paediatricians or tertiary hospitals for urgent appointments need to be considered.
- Hospitals with high paediatric throughput need provision of 24 hour paediatric expertise.
- Appropriate paediatric protocols need to be available in all hospitals.
- Professional advice should be sought for infants who are excessively drowsy or irritable. These infants should be considered seriously ill unless proven otherwise.
- Professional advice should be sought for infants who are feeding poorly, as these infants can become dehydrated very quickly.

- > Further research needs to be undertaken in relation to the incidence of community acquired Methicillin Resistant Staphylococcus aureus (MRSA) infections, to help guide clinical practice with regard to antibiotic choice in sick children. This may include setting up systems to make hospital and community acquired MRSA infection a notifiable communicable disease.

8. The Committee has previously recommended that a major public health campaign needs to be undertaken to promote safe sleeping and prevent sudden unexpected death in infancy. The Committee notes that SA Health has funded a health promotion strategy to address this isssue.

# I. Introduction

This is the Twenty-third Annual Report of the South Australian Maternal, Perinatal and Infant Mortality Committee.

The Committee was established in 1985 under the South Australian Health Commission Act.

Its terms of reference under Section 15 (formerly Section 16) of the Act are as follows:

To advise the Chief Executive of SA Health on:

1. The pattern and causation of maternal, perinatal and infant deaths in the state;
2. The avoidability of any factors associated with such deaths and any measures which could be taken to assist with the prevention of such deaths, including improvements in health services in the state;
3. Education and training for members of the medical, midwifery and nursing professions and for the community generally in order to assist in the reduction of maternal, perinatal and infant morbidity and mortality in the state.

The terms of reference of the Subcommittees (Maternal, Perinatal, Post-neonatal and Education) are provided in Appendix 1. Under the provisions of the new Health Care Act 2008, members of the Committee and its Subcommittees are authorised, under strict confidentiality rules, to conduct research into the causes of mortality and morbidity in the state, and legal protection is given to notifiers who provide information.

The Subcommittees receive notifications of deaths from the following sources:

1. The Births, Deaths and Marriages Registration Division, from medical certificates of cause of perinatal death (Appendix 2a) and death certificates of children under 1 year of age and pregnancy-related deaths (Appendix 2b);
2. The Coroner's Office, from Coroner's findings;
3. Hospitals and medical practitioners, in cases of maternal death.

Legislation governing the registration of births, deaths and marriages in South Australia was revised on 3 June 1996. The revised form of medical certificate of cause of death (Appendix 2b) identifies pregnancy within three months before death and *whether the deceased was of Aboriginal or Torres Strait Islander origin.*

Further information is obtained from practitioners identified as having been in charge of clinical care through the completion of confidential medical reports, and these are supplemented by autopsy information from the Coroner's Office and hospital pathology services. Case summaries are prepared by the Committee's senior midwife and the medical secretary for discussion by the Subcommittees. These do not contain any identifying information but the members are made aware of the type of health services available in each case, for example, location (metropolitan or country) and hospital category. Where certain aspects of a case require clarification, a member of the Subcommittee may seek clarification from the practitioner concerned. In the Post-neonatal Subcommittee a paediatrician acts as the consultant for each case and obtains detailed clinical information where necessary. The discussions aim to identify the factors associated with the death, and to assign a cause or causes of death in each case. Comments or recommendations made by the Subcommittees are included in the Committee Report.

Definitions used by the Committee are provided in Appendix 3 of this Report. The Committee receives notifications of maternal, perinatal and post-neonatal deaths occurring in South Australia. However, statistics presented for perinatal and post-neonatal deaths relate only to those occurring in babies born in South Australia. Deaths of South Australian born babies occurring in other states are also included in the statistics where information is available for them. This Twenty-third Report of the Committee incorporates information on maternal, perinatal and post-neonatal deaths in South Australia in the year 2008.

*Findings relating to Aboriginal mothers and babies have been italicised for easy identification in response to the request of the Aboriginal Health Council of South Australia. The Aboriginal Health Division of SA Health has had a nominee on the Committee to address areas of concern in relation to Aboriginal maternal, perinatal and infant health. In 2009 the Committee has been in the process of finding a new nominee.*

# II. Maternal mortality 2008

## 1. Maternal mortality statistics 2008

The World Health Organization (WHO) defines maternal death as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.[1] This definition includes both direct and indirect maternal deaths (see Appendix 3). In Australia, incidental deaths, where the pregnancy is unlikely to have contributed significantly to the death, have been included in the past, because of difficulty in classification between indirect and incidental deaths.

The Australian Institute of Health and Welfare National Advisory Committee on Maternal Mortality complies with international reporting protocols[2] and reports a maternal mortality ratio (see Appendix 3) which only includes pregnancy-related deaths, that is, direct and indirect maternal deaths, per 100,000 women who gave birth. The South Australian Maternal, Perinatal and Infant Mortality Committee will continue to review incidental deaths to ensure that indirect deaths are not missed. It will, however, report only maternal mortality ratios for pregnancy-related deaths, to be consistent with national and international protocols. Pregnancy-related deaths of women occurring from 42 days to within a year of the end of pregnancy ('late maternal deaths') are also reviewed, but these are not included in the South Australian statistics on maternal deaths or maternal mortality ratios.

There was one incidental maternal death in 2008. Maternal deaths in South Australia for the three categories of deaths from 1961 to 2008 are presented in Table 1 by five-year periods except for the most recent period of eight years (2001-2008). Maternal mortality ratios have been calculated for direct and indirect deaths (Table 1 and Figure 1). The maternal mortality ratio for the last eight-year period 2001-2008 was 7.6 deaths per 100,000 women who gave birth. This was lower than the ratio of 8.4 for Australia for 2003-2005 [2] but higher than the ratio for South Australia for the preceding five-year period 1996-2000 which was 6.6 deaths per 100,000 women who gave birth. However, the number of deaths in both periods in South Australia was small (11 in eight years, compared with six in five years).

[1] World Health Organization. International Statistical Classification of Diseases and Related Health Problems. Tenth Revision. Volume 2. Geneva: WHO, 1993.

[2] Sullivan EA, Hall B, King JF 2007. Maternal Deaths in Australia 2003-2005. Maternal Deaths Series no. 3. Cat . no. PER 42. Sydney: AIHW National Perinatal Statistics Unit.

*Of a total of 39 pregnancy-related maternal deaths in the period 1986-2008, 17 were direct deaths and 22 were indirect deaths. Three of the 17 direct deaths and two of the 22 indirect deaths were of Aboriginal women. As Aboriginal women accounted for only 2%- 3% of women who gave birth in South Australia during this period, this represents a high maternal mortality ratio for pregnancy-related deaths among Aboriginal women when compared with non-Aboriginal.*

Table 1: Maternal mortality by category of death, in 5-year periods, South Australia, 1961–2008

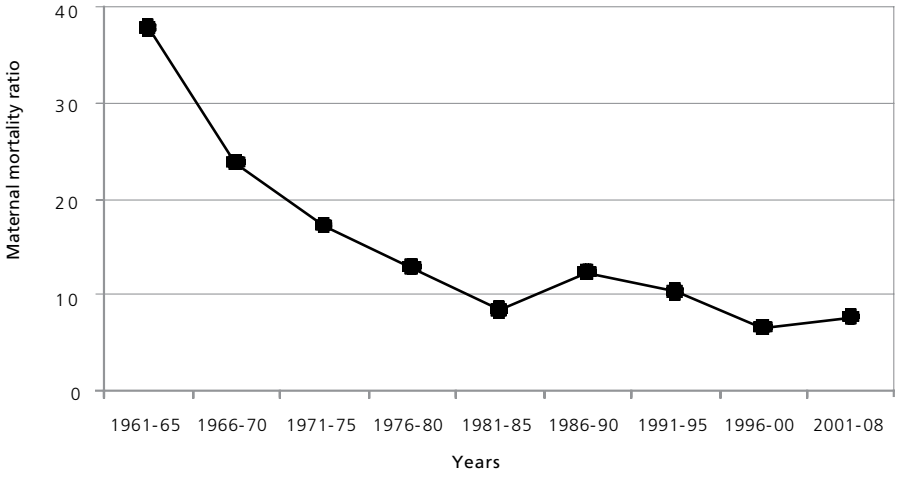
| Years | Direct deaths | Indirect deaths | Incidental deaths | Total deaths | Direct and indirect maternal deaths | |
|---|---|---|---|---|---|---|
| | Number | Number | Number | Number | Number | Maternal mortality ratio* |
| 1961 – 1965 | 34 | 6 | 13 | 53 | 40 | 37.8 |
| 1966 – 1970 | 21 | 4 | 8 | 33 | 25 | 23.7 |
| 1971 – 1975 | 17 | 1 | 6 | 24 | 18 | 17.2 |
| 1976 – 1980 | 6 | 6 | 2 | 14 | 12 | 12.9 |
| 1981 – 1985 | 3 | 5 | 3 | 11 | 8 | 8.3 |
| 1986 – 1990 | 4 | 8 | 4 | 16 | 12 | 12.3 |
| 1991 – 1995 | 4 | 6 | 5 | 15 | 10 | 10.2 |
| 1996 - 2000 | 2 | 4 | 5 | 11 | 6 | 6.6 |
| 2001 – 2008** | 7 | 4 | 3 | 14 | 11 | 7.6 |

* Expressed as deaths per 100,000 women who gave birth

** Eight-year period

Figure 1: Maternal Mortality Ratio, South Australia 1961–2008

Direct and Indirect Deaths per 100,000 women who gave birth




## 2. Causes of maternal deaths 2008

There were no direct or indirect maternal deaths in 2008. There was one incidental maternal death from substance abuse. This pregnant woman had pre-existing medical conditions.

## 3. Maternal Subcommittee recommendations

There were no new recommendations in 2008.

### Recommendations from earlier years

The year in which the recommendation was first made is provided in parentheses.

1. The care of women with current or previous serious conditions during pregnancy should only be undertaken in settings which are equipped to deal appropriately with such situations (2002).
2. Strong consideration should be given for review by a physician early in pregnancy of women with current or previous serious medical conditions (2003).

3. Pregnant women travelling in motor vehicles need to wear seat belts at all times for safety (1991, renewed in 2001). The South Australian Department of Transport, Energy and Infrastructure recommends that the lap part of the seat belt should be worn as low as possible, below the unborn child. It should be over the upper thighs and across the pelvis. The sash part of the seat belt passes above the stomach and between the breasts[3]. The seat belt should be worn at all times when the vehicle is in motion.
4. If a diagnosis of pre-eclampsia has been made, blood pressure should be monitored after birth until it has settled and any abnormalities of renal or liver function or blood counts have been appropriately managed (2007).
5. In women with pre-eclampsia non-steroidal anti-inflammatory drugs should be avoided post-partum and post-operatively. Low dose aspirin remains an effective drug for the prevention of pre-eclampsia (2007).

[3] South Australian Department for Transport, Energy and Infrastructure. Seat belts and pregnancy. Adelaide. November 2006. www.stopthink.sa.gov.au

# III. Perinatal mortality 2008

## 1. Perinatal mortality statistics

In 2008 there were 19,970 births in South Australia. These included live births of any gestation and stillbirths of at least 400g birthweight or 20 weeks gestation. There were 151 stillbirths and 19,819 live births. Fifty-one live births died within 28 days of birth (neonatal deaths). Table 2 shows the numbers of stillbirths and neonatal deaths for specified birthweights or gestations.

The perinatal mortality rate for all births in 2008 was 10.1 deaths per 1,000 births. The stillbirth rate was 7.6 per 1,000 births and the neonatal mortality rate 2.6 per 1,000 live births. Fifty-two of the 202 perinatal deaths (25.7%) were terminations of pregnancy and their exclusion would have resulted in a perinatal mortality rate of 7.5 deaths per 1,000 births.

Perinatal mortality for international comparison includes only stillbirths and early neonatal deaths within the first seven days of life for births of at least 1,000g birthweight (or 28 weeks gestation if birthweight unavailable). This perinatal mortality rate was 3.4 deaths per 1,000 births, with a stillbirth rate of 2.8 per 1,000 births and an early neonatal mortality rate of 0.6 per 1,000 live births.

Table 2: Perinatal mortality, South Australia, 2008

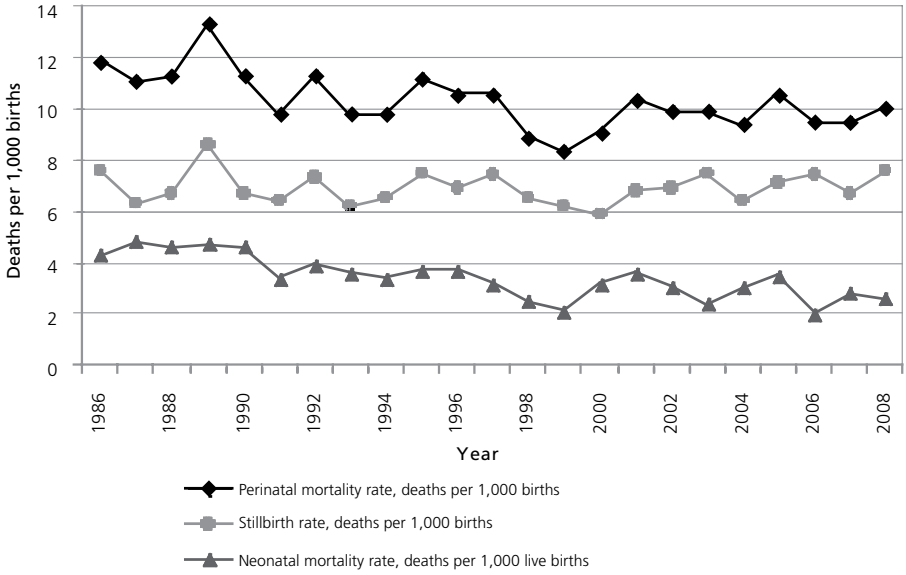
| Specified birthweight/ gestation | Total births | Live births | Stillbirths | | Neonatal deaths | | Perinatal deaths | |
|---|---|---|---|---|---|---|---|---|
| | | | Number | Deaths per 1,000 births | Number | Deaths per 1,000 live births | Number | Deaths per 1,000 births |
| ≥400g/20 weeks (all livebirths included) | 19,970 | 19,819 | 151 | 7.6 | 51 | 2.6 | 202 | 10.1 |
| ≥500g/22 weeks* | 19,878 | 19,797 | 81 | 4.1 | 34 | 1.7 | 115 | 5.8 |
| | | | | | 25** | 1.3 | 106** | 5.3 |
| ≥1,000g/28 weeks* | 19,774 | 19,718 | 56 | 2.8 | 18 | 0.9 | 74 | 3.7 |
| | | | | | 11** | 0.6 | 67** | 3.4 |

* For national statistics as recommended by WHO, only fetuses and infants of at least 500g birthweight, or, when birthweight is unavailable, the corresponding gestational age (22 weeks) or body length (25cm crown-heel), are included. For international comparison, only fetuses and infants of at least 1,000g birthweight, or when birthweight is unavailable, the corresponding gestational age (28 weeks) or body length (35cm crown-heel) are included.

** This number includes only neonatal deaths occurring within the first 7 days of life, as recommended by WHO for national and international comparison. All other numbers for neonatal deaths refer to deaths within the first 28 days of life. Rates for neonatal deaths are expressed as deaths per 1,000 live births.

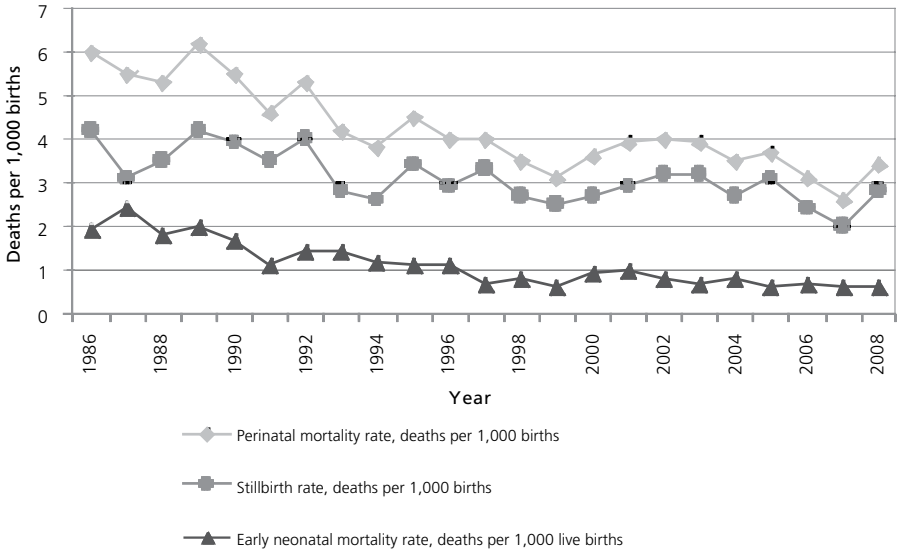
South Australian perinatal mortality rates, including stillbirth and neonatal mortality rates, for 1986–2008 from Committee data are presented in Figure 2 for all births. Rates for births of at least 1,000g birthweight (or when birthweight was unavailable, 28 weeks gestation) are presented in Figure 3. Figure 3 includes only early neonatal deaths, ie, occurring within the first seven days of life (WHO recommendation for international statistics). The graphs demonstrate that the fall in the perinatal mortality rate has received a greater contribution from the fall in the neonatal mortality rate than from changes in the stillbirth rate. The stillbirth rate for all births (Figure 2) has not decreased over the last two decades. However, if only births of at least 1,000g birthweight are considered, a decrease is evident from 4.2 deaths per 1,000 births in 1986 to 2.8 deaths per 1,000 births in 2008 (Figure 3).

Figure 2: Perinatal mortality rate (live births of any gestation and stillbirths >=400g / 20 weeks gestation), South Australia 1986–2008




Live births of any gestation and stillbirths of at least 400g birthweight or 20 weeks gestation

Figure 3: Perinatal mortality rate (births >=1,000g / 28 weeks gestation), South Australia 1986–2008




Births of at least 1,000g birthweight or 28 weeks gestation if birthweight is unknown, early neonatal deaths (within the first 7 days of life), as recommended by WHO for international comparison

## Comparisons of perinatal mortality rates among Australian states by the Australian Bureau of Statistics (ABS)

Table 3 shows that the perinatal mortality rate for South Australia over the years has generally tended to be lower than the national rate. In 2006 and 2007 South Australia recorded the lowest rates in Australia. These rates for South Australia and Australia for 1999–2007 from the ABS are presented graphically in Figure 4. The South Australian rates provided by the ABS differ from those provided by the Committee. The Committee's rates are based on births and deaths that occurred in the state in the year. Those of the ABS are based on births and deaths registered in Australia in the year for mothers usually resident in South Australia, irrespective of where and when they occurred. The ABS also excludes births and deaths with a birthweight less than 400g; if birthweight is unavailable, the gestational age has to be at least 20 weeks for inclusion.

## Table 3: Perinatal mortality rate* by State or territory of usual residence of mother, Australian states, 1999–2007

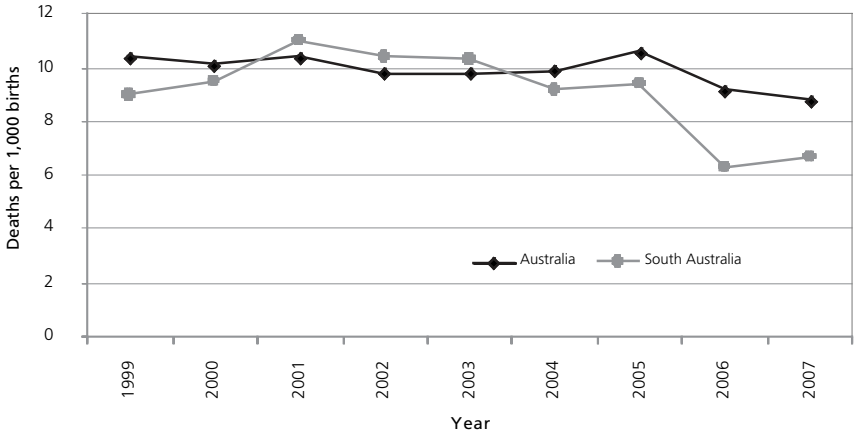
| Year | NSW | VIC | QLD | SA | WA | TAS | NT | ACT | Australia |
|---|---|---|---|---|---|---|---|---|---|
| 1999 | 9.4 | 11.5 | 10.1 | 9.0 | 10.4 | 12.5 | 18.5 | 13.3 | 10.4 |
| 2000 | 9.0 | 10.0 | 10.9 | 9.5 | 11.2 | 13.2 | 17.7 | 9.5 | 10.1 |
| 2001 | 9.6 | 10.7 | 11.5 | 11.0 | 10.0 | 7.3 | 14.0 | 9.3 | 10.4 |
| 2002 | 8.7 | 10.5 | 10.7 | 10.4 | 8.5 | 14.5 | 13.1 | 7.5 | 9.8 |
| 2003 | 8.1 | 11.2 | 9.4 | 10.3 | 10.4 | 14.3 | 18.0 | 11.3 | 9.8 |
| 2004 | 8.6 | 11.3 | 10.4 | 9.2 | 9.9 | 10.1 | 13.1 | 11.9 | 9.9 |
| 2005 | 9.2 | 12.0 | 11.1 | 9.4 | 10.1 | 10.4 | 17.0 | 13.2 | 10.6 |
| 2006 | 9.3 | 8.4 | 10.3 | 6.3 | 9.2 | 9.1 | 15.8 | 12.4 | 9.2 |
| 2007 | 8.7 | 8.6 | 10.6 | 6.7 | 6.9 | 9.2 | 12.7 | 9.4 | 8.8 |

* Rates are expressed as stillbirths and neonatal deaths within the first 28 days of life per 1,000 births for births of at least 400g birthweight (or if birthweight is unavailable, 20 weeks gestation), based on registered births according to the usual residence of the mother.

Source: Australian Bureau of Statistics. Catalogue No 3304.0 – Perinatal Deaths, Australia, 2007, November 2009.

## Figure 4: Perinatal Mortality Rates, South Australia and Australia 1999–2007

Deaths per 1,000 births (of at least 400g birthweight or 20 weeks gestation if birthweight unavailable)




Source: Australian Bureau of Statistics, Cat. No. 3304.0 – Perinatal Deaths, Australia, 2007, November 2009

### (2) Birthweight-specific perinatal mortality

The birthweight-specific rates of stillbirths, neonatal deaths and perinatal deaths for 2008 are provided in Table 4. Of the 202 perinatal deaths, 166 (82.2%) were of low birthweight (<2,500g) and 161 (79.7%) were preterm births (<37 weeks gestation, Table 6). Fifty-eight perinatal deaths (28.7%) were less than 400g birthweight and the birthweight of one stillbirth born at 30 weeks gestation was not known.

There were 151 stillbirths, accounting for 74.8% of the perinatal deaths in 2008. Of the 65 intrapartum deaths, 58 were under 750g birthweight (Table 5) and 41 were terminations of pregnancy. Of the 51 neonatal deaths, 42 (82.4%) were low birthweight babies and 10 resulted from terminations of pregnancy.

Table 4: Perinatal mortality by birthweight, South Australia, 2008, (live births of any gestation and stillbirths of at least 400g or 20 weeks gestation)

| Birthweight (grams) | Total births | Live births | Stillbirths | | Neonatal deaths | | Perinatal deaths | |
|---|---|---|---|---|---|---|---|---|
| | | | Number | Deaths per 1,000 births | Number | Deaths per 1,000 live births | Number | Deaths per 1,000 births |
| <400 | 58 | 11 | 47 | 810.3 | 11 | 1,000.0 | 58 | 1,000.0 |
| 400-499 | 34 | 11 | 23 | 676.5 | 6 | 545.5 | 29 | 852.9 |
| 500-749 | 51 | 32 | 19 | 372.5 | 11 | 343.8 | 30 | 588.2 |
| 750-999 | 53 | 47 | 6 | 113.2 | 5 | 106.4 | 11 | 207.5 |
| 1,000-1,499 | 117 | 109 | 8 | 68.4 | 2 | 18.3 | 10 | 85.5 |
| 1,500-1,999 | 274 | 266 | 8 | 29.2 | 2 | 7.5 | 10 | 36.5 |
| 2,000-2,499 | 804 | 791 | 13 | 16.2 | 5 | 6.3 | 18 | 22.4 |
| 2,500-2,999 | 3,049 | 3,042 | 7 | 2.3 | 3 | 1.0 | 10 | 3.3 |
| 3,000-3,499 | 7,195 | 7,182 | 13 | 1.8 | 3 | 0.4 | 16 | 2.2 |
| 3,500-3,999 | 6,091 | 6,086 | 5 | 0.8 | 2 | 0.3 | 7 | 1.1 |
| 4,000-4,499 | 1,932 | 1,931 | 1 | 0.5 | 0 | 0 | 1 | 0.5 |
| 4500+ | 308 | 308 | 0 | 0 | 1 | 3.2 | 1 | 3.2 |
| Unknown | 4 | 3 | 1 | na | 0 | 0 | 1 | na |
| Total | 19,970 | 19,819 | 151 | 7.6 | 51 | 2.6 | 202 | 10.1 |

na: not applicable

Table 5: Time of perinatal death by birthweight, South Australia, 2008 (live births of any gestation and stillbirths of at least 400g birthweight or 20 weeks gestation)

| Birthweight (grams) | Stillbirths | | | Neonatal deaths | Total |
|---|---|---|---|---|---|
| | Antepartum | Intrapartum | Uncertain if antepartum or intrapartum | | |
| <500 | 20 | 46 | 4 | 17 | 87 |
| 500-749 | 7 | 12 | 0 | 11 | 30 |
| 750-999 | 5 | 1 | 0 | 5 | 11 |
| 1,000-1,499 | 8 | 0 | 0 | 2 | 10 |
| 1,500-1,999 | 5 | 2 | 1 | 2 | 10 |
| 2,000-2,499 | 12 | 1 | 0 | 5 | 18 |
| 2,500-2,999 | 5 | 1 | 1 | 3 | 10 |
| 3,000-3,499 | 12 | 1 | 0 | 3 | 16 |
| 3,500-3,999 | 4 | 1 | 0 | 2 | 7 |
| 4,000-4,499 | 1 | 0 | 0 | 0 | 1 |
| 4,500+ | 0 | 0 | 0 | 1 | 1 |
| Unknown | 1 | 0 | 0 | 0 | 1 |
| Total | 80 | 65 | 6 | 51 | 202 |

### (3) Gestation-specific perinatal mortality

The distribution of perinatal deaths by gestational age is provided in Table 6.

**Table 6: Perinatal mortality by gestational age at birth, South Australia, 2008 (live births of any gestation and stillbirths of at least 400g or 20 weeks gestation)**

| Gestational age at birth (weeks) | Total births | Live births | Stillbirths | | Neonatal deaths | | Perinatal deaths | |
|---|---|---|---|---|---|---|---|---|
| | | | Number | Deaths per 1,000 births | Number | Deaths per 1,000 live births | Number | Deaths per 1,000 births |
| <24 | 106 | 26 | 80 | 754.7 | 24 | 923.1 | 104 | 981.1 |
| 24-27 | 89 | 77 | 12 | 134.8 | 8 | 103.9 | 20 | 224.7 |
| 28-31 | 157 | 146 | 11 | 70.1 | 3 | 20.5 | 14 | 89.2 |
| 32-36 | 1,359 | 1,343 | 16 | 11.8 | 7 | 5.2 | 23 | 16.9 |
| 37-41 | 18,180 | 18,148 | 32 | 1.8 | 9 | 0.5 | 41 | 2.3 |
| 42+ | 79 | 79 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 19,970 | 19,819 | 151 | 7.6 | 51 | 2.6 | 202 | 10.1 |

## 2. Causes of perinatal deaths 2008

### (1) Classification of perinatal deaths

The Perinatal Subcommittee classified each of the 202 perinatal deaths which occurred in 2008 according to the Perinatal Society of Australia and New Zealand – Perinatal Death Classification (PSANZ-PDC). This classification, together with the Australian birthweight/gestation percentile charts (for singletons as well as twins), is available on the PSANZ website (www.psanz.org.au) and will be updated regularly by the PSANZ Perinatal Mortality Special Interest Group. The classification of perinatal deaths in 2008 according to PSANZ-PDC is as follows (Table 7):

Table 7: Classification of perinatal deaths, PSANZ-PDC, South Australia, 2008

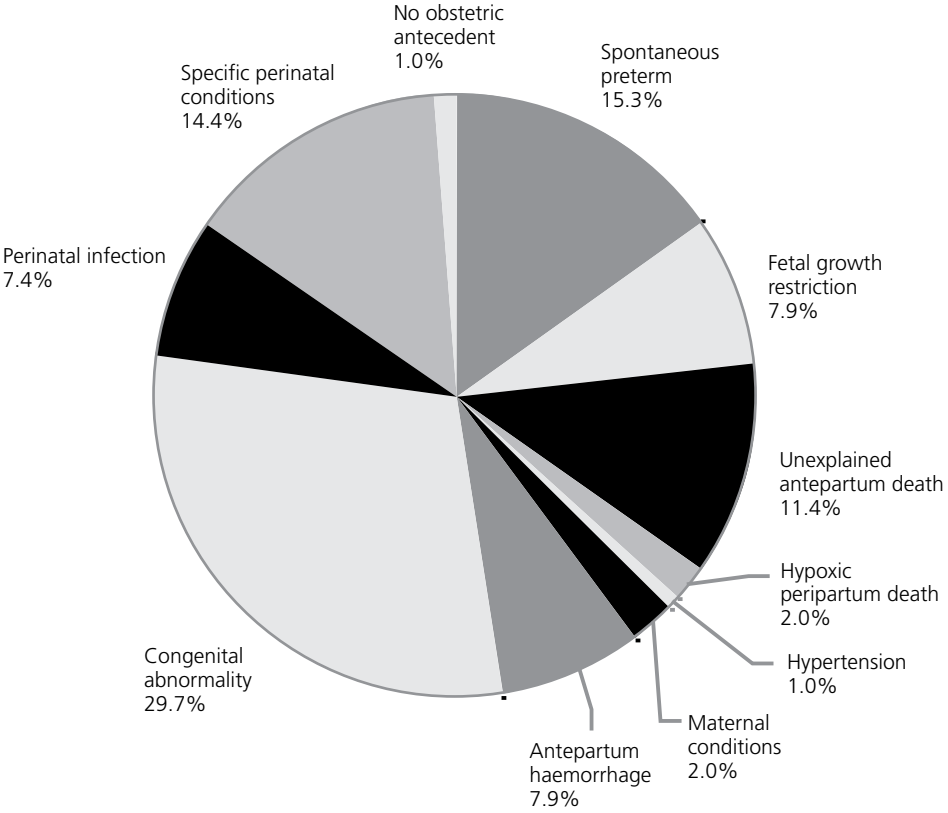
| PSANZ-PDC | | Number | Percent | Deaths per 1,000 births |
|---|---|---|---|---|
| 1. | Congenital abnormality | 60 | 29.7 | 3.0 |
| 2. | Perinatal infection | 15 | 7.4 | 0.8 |
| 3. | Hypertension | 2 | 1.0 | 0.1 |
| 4. | Antepartum haemorrhage (APH) | 16 | 7.9 | 0.8 |
| 5. | Maternal conditions | 4 | 2.0 | 0.2 |
| 6. | Specific perinatal conditions | 29 | 14.4 | 1.5 |
| 7. | Hypoxic peripartum death | 4 | 2.0 | 0.2 |
| 8. | Fetal growth restriction | 16 | 7.9 | 0.8 |
| 9. | Spontaneous preterm | 31 | 15.3 | 1.6 |
| 10. | Unexplained antepartum death | 23 | 11.4 | 1.2 |
| 11. | No obstetric antecedent | 2 | 1.0 | 0.1 |
| Total | | 202 | 100.0 | 10.1 |

The PSANZ-PDC for perinatal deaths in 2008 is shown graphically in Figure 5 and its breakdown by subgroups and birthweight groups is provided in Appendix 4 and Appendix 5.

Congenital abnormalities were again the leading cause of perinatal death in 2008, accounting for 29.7% of all deaths. The next leading causes were preterm birth due to spontaneous labour or pre-labour rupture of membranes (15.3%), followed by specific perinatal conditions (14.4%) and unexplained antepartum death (11.4%).

The death rate due to unexplained stillbirth remained relatively low at 1.2 per 1,000 births compared with 2.0 per 1,000 births in 1995-1998. The contribution of spontaneous preterm birth remains high while that of specific perinatal conditions was slightly higher in 2008 than in previous years.

Figure 5: Perinatal deaths in South Australia 2008, by PSANZ-PDC (N=202)



A brief description of each of the 11 groups follows.

### 1. Congenital abnormality – 60 deaths

This group of 60 deaths includes 42 terminations of pregnancy at 20 weeks gestation or more for fetuses with congenital abnormalities. The types of abnormalities were as follows:

| | |
|---|---|
| Central nervous system | 7 |
| Cardiovascular | 8 |
| Gastrointestinal tract | 1 |
| Chromosomal | 23 |
| Metabolic | 2 |
| Multiple | 9 |
| Other | 10 |
| Total | 60 |

**Central nervous system** – Of the seven babies with central nervous system abnormalities, one had a neural tube defect and two had hydrocephalus. One baby had cerebellar hypoplasia and two had agenesis of the corpus callosum. One baby had congenital myotonic dystrophy.

**Cardiovascular** – The eight infants with cardiovascular abnormalities had the following:

- hypoplastic left heart syndrome – four babies, three of whom also had other cardiovascular abnormalities
- atrioventricular septal defect with other cardiovascular abnormalities – two babies
- endocardial fibroelastosis
- ventricular non-compaction, a form of cardiomyopathy.

**Gastrointestinal tract** – One baby had an ano-rectal malformation.

**Chromosomal** – Twenty-three babies had chromosomal abnormalities, which were as follows:

- Trisomy 21 – six babies
- Trisomy 13 – two babies, one of whom had a hypoplastic left heart

- Trisomy 18 – 10 babies
- Turner syndrome – one baby
- mosaic trisomies – two babies
- other autosomal abnormalities – two babies.

Metabolic – Two babies had metabolic abnormalities. One had Smith-Lemli-Opitz syndrome, with elevated dehydrocholesterol and another had hyperinsulinaemic hypoglycaemia associated with nesidiodysplasia of the pancreas.

Multiple – There were nine babies with multiple congenital abnormalities.

Other – Ten babies had 'other' fetal abnormalities, as follows:

- diaphragmatic hernia – four babies
- musculo-skeletal abnormalities – three babies: two of these had thanatophoric skeletal dysplasia type 1 and one had Pierre-Robin syndrome
- a vascular hepatic tumour associated with hydrops, coagulopathy and features of overgrowth syndrome
- acute megakaryoblastic leukaemia associated with Trisomy 21 and
- amniotic band syndrome with limb defects.

2. Perinatal infection – 15 deaths

- Group B Streptococcus infections were noted in three stillbirths and two neonatal deaths born at 20-30 weeks gestation. Both neonatal deaths followed spontaneous preterm labour. Associated factors were substance use, obesity and placental abnormalities.
- Escherichia coli sepsis – one death.
- Other bacterial infections – four deaths. Two deaths were attributed to Enterococcus infection. Other factors present were smoking, fetal thrombotic vasculopathy and small placentas. One death was attributed to infection with Klebsiella pneumoniae: in this case there was preterm labour, chorioamnionitis, funisitis and the blood cultures were positive. One death from congenital pneumonia was possibly due to Streptococcus pneumoniae (Pneumococcus). This was associated with preterm labour.
- There were three deaths from Cytomegalovirus infection. Two were terminations of pregnancy and one was a fetal death in utero.
- There were two deaths from infections due to unspecified organisms. One was associated with placental abruption and the other with pre-labour rupture of membranes and thrombophilia.

Several of the perinatal infections were associated with vaginosis.

### 3. Hypertension – two deaths

There were two deaths related to pre-eclampsia. One was associated with placental abruption, oligohydramnios, fetal death in utero and maternal pulmonary embolism in the postnatal period. The other was associated with placental insufficiency, oligohydramnios, thrombophilia and placental abruption.

### 4. Antepartum haemorrhage – 16 deaths

- Twelve deaths were due to placental abruption.
- Two deaths were associated with placenta praevia and two were associated with other types of antepartum haemorrhage. One was from the edge of the placenta and the other was a subchorionic haemorrhage.

### 5. Maternal conditions – four deaths

- One death was attributed to maternal diabetes. This mother, who had poorly controlled diabetes, experienced an antepartum haemorrhage and fetal death. The infant was macrosomic.
- One antepartum death was attributed to maternal antiphospholipid syndrome.
- One mother suffered recurrent antepartum haemorrhage associated with a circumvallate placenta and oligohydramnios was also a complication. This pregnancy was terminated.
- There was a termination of pregnancy for maternal mental health reasons.

### 6. Specific perinatal conditions – 29 deaths

These deaths were due to the following:

- Twin-twin transfusion – 13 deaths, including three sets of twins;
- Feto-maternal haemorrhage – two deaths;
- Antepartum cord complications – seven deaths. There were three cases of true cord knots with evidence of occlusion. Another cord was tightly around the fetal neck. There were two umbilical haematomas, one with a thrombosis in the umbilical vein. There was also a hypercoiled cord inserted velamentously and associated with a chorangioma.
- Birth trauma – one death, following attempted ventouse delivery and difficulty in delivery of the fetal head during caesarean section.
- Idiopathic hydrops fetalis – two deaths;

- Other specific perinatal conditions – four deaths. One death occurred following prolonged pre-labour rupture of membranes after amniocentesis and was associated with chorioamnionitis and preterm labour. Another was a fetus with anaemia of undetermined cause. Another case was associated with cervical cerclage, prolonged preterm pre-labour rupture of membranes, and chorioamnionitis. A fourth case was attributed to placental chronic intervillous histiocytosis, a condition associated with intrauterine growth restriction and poor fetal outcome.

### 7. Hypoxic peripartum death – four deaths

A woman with a previous caesarean section experienced pre-labour rupture of membranes at term and was induced with Syntocinon. Uterine rupture occurred with abnormalities of the fetal heart rate. Despite emergency caesarean section, the baby died of hypoxic ischaemic encephalopathy. In two other cases there was also evidence of abnormalities of the fetal heart rate during labour. One of these women had threatened preterm labour and went into labour two days later. The placenta showed fetal thrombotic vasculopathy. Another woman developed pre-eclampsia late in pregnancy. The cord was tightly around the fetal neck. The placenta had a marginal cord insertion and high grade villitis. There was also an intrapartum death of a breech baby born at home.

### 8. Fetal growth restriction – 16 deaths

Eleven of the 16 growth-restricted babies were preterm. There were two neonatal deaths and 14 stillbirths.

There was evidence of reduced placental vascular perfusion in 12 growth-restricted babies. Seven of their mothers had laboratory evidence of thrombophilia or were smokers.

In the remaining four deaths there was evidence of chronic villitis in one placenta and other pathology in two placentas. There was no pathology in one placenta.

### 9. Spontaneous preterm (<37 weeks gestation) – 31 deaths

In eight of the 31 deaths the membranes were intact or ruptured less than 24 hours before delivery. Of these, three had evidence of chorioamnionitis on placental histopathology and four had no such evidence. In the remaining case there were no clinical signs of chorioamnionitis and the placenta was not examined.

In 22 of the 31 deaths the membranes had been ruptured 24 hours or more before birth. Of these, 20 had evidence of chorioamnionitis on placental histopathology and two had no such evidence.

In one other case, in which the duration of ruptured membranes was not known, there were no clinical signs of chorioamnionitis and the placenta was not examined.

### 10. Unexplained antepartum death – 23 deaths

There was evidence of reduced vascular perfusion in the placentas in eight unexplained antepartum deaths, with laboratory evidence of thrombophilia in two of these. One placenta showed chronic villitis and there was other placental pathology in nine other cases. Five placentas showed no pathology.

### 11. No obstetric antecedent – two deaths

One of these deaths was a sudden unexpected neonatal death of undetermined cause associated with co-sleeping. The other neonatal death was a mildly preterm baby who may have succumbed to environmental causes.

### Whitfield Classification of perinatal deaths[4]

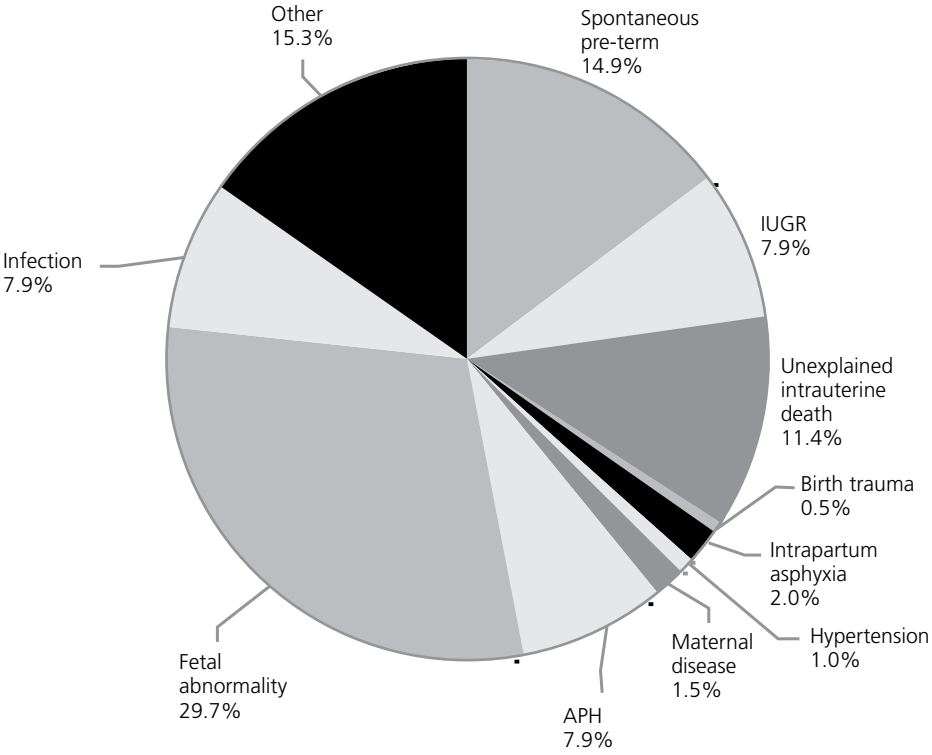
The classification of the 202 perinatal deaths into the 12 groups of the amended Whitfield Classification is presented in Table 8 and Figure 6. Subgroups of the classification are also included in Appendix 6.

**Table 8: Amended Whitfield Classification of perinatal deaths, South Australia, 2008**

| Amended Whitfield Classification | | Number of deaths | % | Deaths per 1,000 births |
|---|---|---|---|---|
| 1. | Spontaneous preterm | 30 | 14.9 | 1.5 |
| 2. | Intrauterine growth restriction (IUGR) | 16 | 7.9 | 0.8 |
| 3. | Unexplained intrauterine death | 23 | 11.4 | 1.2 |
| 4. | Birth trauma | 1 | 0.5 | 0.1 |
| 5. | Intrapartum asphyxia | 4 | 2.0 | 0.2 |
| 6 | Hypertension | 2 | 1.0 | 0.1 |
| 7. | Maternal disease | 3 | 1.5 | 0.2 |
| 8. | Antepartum haemorrhage (APH) | 16 | 7.9 | 0.8 |
| 9. | Fetal abnormality | 60 | 29.7 | 3.0 |
| 10. | Haemolytic disease | 0 | 0 | 0 |
| 11. | Infection | 16 | 7.9 | 0.8 |
| 12. | Other | 31 | 15.3 | 1.6 |
| Total | | 202 | 100.0 | 10.1 |

[4] Whitfield CR, Smith NC, Cockburn F, Gibson AAM. Perinatally related wastage – a proposed classification of primary obstetric factors. Br J Obstet Gynaecol 1986;93: 694-703.

Figure 6: Causes of perinatal deaths, amended Whitfield Classification, South Australia 2008




### Perinatal Society of Australia and New Zealand – Neonatal Death Classification

The classification of the 51 neonatal deaths according to the Perinatal Society of Australia and New Zealand – Neonatal Death Classification (PSANZ-NDC), formerly called the Australia and New Zealand Neonatal Death Classification (ANZNDC) is provided in Appendix 7. This classification is also available, together with PSANZ-PDC, on the PSANZ website.

*(2) Aboriginal perinatal deaths*

*There were 15 perinatal deaths (11 stillbirths and four neonatal deaths) among the 637 births to Aboriginal mothers. Eleven were born in teaching hospitals and four in country hospitals. Ten were preterm births. Some factors associated with these deaths were maternal smoking and substance use, diabetes, anaemia and infections, obesity and lack of antenatal care. The causes of the 15 deaths were as follows:*

- *Congenital abnormalities - three deaths (two stillbirths and one neonatal death).*

  *Two had chromosomal abnormalities (Trisomy 18) and one had multiple abnormalities.*
- *Perinatal infection – one stillbirth.*

  *This death was due to Cytomegalovirus infection.*
- *Antepartum haemorrhage – one stillbirth.*

  *This pregnancy was complicated by recurrent severe haemorrhage from placental abruption and also by oligohydramnios.*
- *Maternal conditions – two stillbirths.*

  *One stillbirth was a macrosomic baby of a mother with poorly controlled type 2 diabetes, whose pregnancy was also complicated by antepartum haemorrhage. The other was a termination for maternal mental health reasons.*
- *Specific perinatal conditions – one stillbirth.*

  *This twin died in utero and was shown to have a hypercoiled umbilical cord with a velamentous insertion and a chorangioma. The baby also had a congenital abnormality which was not considered to have caused the death.*
- *Fetal growth restriction – one stillbirth.*

  *This mother experienced fetal death in utero at term. There had been pre-labour rupture of membranes and the cord was coiled tightly round the fetal neck The baby was found to be growth restricted and the placenta showed evidence of insufficiency.*
- *Spontaneous preterm – three stillbirths and two neonatal deaths.*

  *All the babies were born at 20-26 weeks gestation following spontaneous preterm labour or preterm pre-labour rupture of membranes and chorioamnionitis was a complication in several cases.*
- *No obstetric antecedent – one neonatal death.*

  *This infant was a sudden unexpected death from an undetermined cause while co-sleeping with family.*

*In 2008, the perinatal mortality rate for births to Aboriginal mothers was 23.5 per 1,000 births compared with 9.7 per 1,000 births for non-Aboriginal mothers.*

*The proportion of Aboriginal women who smoked during pregnancy in 2008 remained much higher than among non-Aboriginal women (57.4% compared with 14.5%).*

*The proportions of preterm live births and small-for-gestational-age live births for Aboriginal mothers were also considerably higher than for non-Aboriginal mothers (14.1% v 7.8% and 16.5% v 8.0% respectively). As in previous years, the proportion of low birthweight live births for Aboriginal mothers remained much higher than that for non-Aboriginal mothers (16.3% v 6.0%).*

### (3) Autopsies in perinatal deaths

Autopsies were performed in 109 of the 202 perinatal deaths (54.0%), which is a slight improvement compared with recent years. Five of the autopsies were limited, which is defined as autopsies that include a detailed external examination of the body and growth parameters, radiological survey, placental histology, and examination and dissection of one or more cavities (such as chest and/or abdomen) or organs, but not the whole body. Microbiology and/or cytogenetic studies may have been undertaken with consent. Before 2004 a small number of cases which had external examination of the body and growth parameters, radiological survey and placental histology only were included as having autopsies. In 2008, such examinations were performed in 12 perinatal deaths which did not have autopsy. All of these were undertaken in metropolitan level III hospitals.

The distribution of autopsies by place of death is presented in Table 9.

**Table 9: Autopsy status* of perinatal deaths by place of death, South Australia, 2008**

| Place of death | Deaths | Autopsies performed* | |
|---|---|---|---|
| | Number | Number | Percent of deaths |
| Metropolitan Level III** hospitals (teaching) | 146 | 71* | 48.6 |
| Other metropolitan teaching hospitals | 21 | 12 | 57.1 |
| Metropolitan private hospitals | 16 | 15 | 93.8 |
| Country hospitals | 15 | 9 | 60.0 |
| Home | 3 | 2 | 66.7 |
| Interstate hospitals | 1 | 0 | 0 |
| Total | 202 | 109 | 54.0 |

* Includes 5 autopsies with limited dissection

** Levels as defined in 'Operational Policy, Guidelines and Standards for Maternal and Neonatal Services in South Australia. Adelaide: Department of Human Services, January 2000'.

Placental histological examination was undertaken in 183 perinatal deaths (90.6%) in 2008.

The low proportion of autopsies in perinatal deaths remains a concern. A good quality autopsy is invaluable in confirming antenatal diagnoses, eliciting other findings of clinical significance, particularly significant negative ones, and determining the time course of events leading to death.[5, 6] It may thus be invaluable in alleviating parental guilt, helping with the grieving process and parental counselling, and gaining understanding of the patterns and evaluation of fetal and neonatal disease. Parental permission should therefore be sought as often as possible.

Medical practitioners are advised that the **State Perinatal Autopsy Service** is available at no cost to the parents and this includes transportation and return of the body from the place of death, including country regions. This Service may be contacted by telephone. The number is **(08) 8161-7333**.

[5] Gordijn SJ, Erwich JJ, Khong TY. Value of the perinatal autopsy: critique. Pediatr Dev Pathol 2002;5:480-488.

[6] Becher JC, Laing IA, Keeling JW, McIntosh N. Restoring high neonatal autopsy rates. Lancet 2004;364: 2019-2020.

All hospitals with maternity services will have received a folder with information on the Service. The Department of Health has produced an Autopsy Request and Authority form for use for all non-coronial autopsy examinations together with a booklet entitled "The Hospital Autopsy Process. When a person dies --- information for family and friends." These forms should be used and are available from the Perinatal Autopsy Service (Phone (08) 8161-7333)

## 3. Perinatal Subcommittee recommendations

There were no new recommendations in 2008.

**Recommendations made in earlier years remain pertinent.**
The year in which the recommendation was first made is provided in parentheses.

### Antenatal

1. It is important to care for pregnant women in a setting that is appropriate for the level of risk the pregnancy presents for the mother and/or the baby. For example, women with severe hypertension or insulin-dependent diabetes should be managed in at least a level II hospital with 24 hour on-site medical cover (2002). Planned home birth for twins, breech presentations and post-term infants is associated with unacceptably high risks.[7,8] (2004). A previous caesarean section is a contradiction for home birth (2007). Women with serious maternal conditions should be cared for in hospitals with adequate comprehensive adult services (2006).

2. Pregnant women with a Body Mass Index (BMI) greater than 35 are at higher risk from anaesthesia.[9] A timely referral for an anaesthetic consultation should be considered for women with a high BMI (2005).

3. Implementation of effective strategies to reduce smoking in pregnancy[10] remains important (2002), *including culturally appropriate smoking cessation interventions for Aboriginal women* (2004).

4. Testing the antibody status of Rhesus D negative women before the first administration of Anti-D is important. A measurable titre of Anti-D antibodies is an indicator of potential alloimmunisation and always requires investigation and a specialist opinion (2006).

5. Early ultrasound determination of chorionicity is advised for twin pregnancies, followed by further surveillance for twin-twin transfusion in monochorionic pregnancies (2005).

[7] Bastian H, Keirse MJNC, Lancaster PAL. Perinatal death associated with planned home birth in Australia: population based study. BMJ 1998; 317: 384-388.

[8] Mehl-Madrona L, Mehl-Madrona M. Physician- and midwife-attended home births. Effects of breech, twin, and post-dates outcome data on mortality rates. J Nurse Midw 1997; 42:91-98

[9] Confidential Enquiries into Maternal and Child Health. Why mothers die 2000-2002. The Sixth Report of the Confidential Enquiries into Maternal Deaths in the United Kingdom. London: RCOG Press, CEMACH 2004: http://www.cemach.org.uk (accessed November 13 2008).

[10] Lumley J, Oliver SS, Chamberlain C, Oakely L. Interventions for promoting smoking cessation during pregnancy. Cochrane Database of Systematic Reviews 2004, Issue 4.Art. No.: CD001055. DOI:10.1002/14651858.CD001055.pub2.

6. Vigilance is required in the recognition of fetal growth restriction. Fetal growth restriction was considered the cause of death for 7.9% of perinatal deaths in 2008 compared with 11.2% in 2007. Practitioners are asked to remain vigilant so that fetal growth restriction is not missed (2002).

7. The Subcommittee also recommends the use of the birthweight for gestational age percentile charts for singletons[11] and twins[12] prepared using national perinatal data, which are available on the PSANZ website with the PSANZ perinatal death classifications (www.psanz.org.au) (1998). The singleton charts have been reproduced in Appendix 10 with the permission of the Medical Journal of Australia.

8. The institution of streamlined arrangements between rural/level I hospitals and their regional level II/III maternity service in situations where there is a lack of on-site CTG expertise (2000). This includes easier access of rural practitioners to the consultant on call (2005).

### Labour and birth

9. When induction of labour is deemed necessary in the presence of a uterine scar and an unripe cervix, careful consideration should be given to alternative options, such as postponing the induction or caesarean section (2005).

10. Once a decision to perform an emergency caesarean section has been made, it is recommended that fetal monitoring should continue until the commencement of surgery (2007).

11. When feto-maternal haemorrhage is suspected, flow cytometry should be considered to estimate the volume as it is more precise than the Kleihauer test (2007).

12. Appropriate antibiotic treatment for carriers of Group B Streptococcus and for women with risk factors, such as prolonged rupture of membranes (2004).

### Postnatal

13. The Committee recommends use of the South Australian protocol for investigating stillbirths, including a systematic approach to investigate the potential involvement of thrombophilias (Appendix 8) (protocol published in 1998, recommendation made after revision in 2002). This statewide protocol for the investigation of all stillbirths has been sent to all maternity units in South Australia (2000).

[11] Roberts CL, Lancaster PAL. Australian national birthweight percentiles by gestational age. Med J Aust 1999; 170:114-118.

[12] Roberts C, Lancaster P. National birthweight percentiles by gestational age for twins born in Australia. J Paediatr Child Health 1999; 35:278-282.

14. Autopsy often provides considerable information that is not available otherwise and should be strongly recommended (1992). The low autopsy rate in perinatal deaths over the past few years remains a serious concern. When parents decline autopsy, we recommend that photographic and X-ray documentation be obtained (2003). It is also important to document the clinical appearance of the infant in the case record in all cases of perinatal death (2004). **The State Perinatal Autopsy Service is available at no cost to parents, including parents in country areas, and may be contacted on (08) 8161-7333** (2006).

15. Placentas should be sent for examination in all cases of perinatal death (2003) and **should be accompanied with all relevant clinical information.** (See Appendix 9) (2006).

Professional

16. Appropriate training and maintenance of competence in cardiotocograph (CTG) interpretation for all levels of medical and midwifery staff (2000).

17. Ongoing development and implementation of the statewide perinatal protocols is recommended (www.health.sa.gov.au/ppg) (2000).

# IV. Post-neonatal and infant mortality 2008

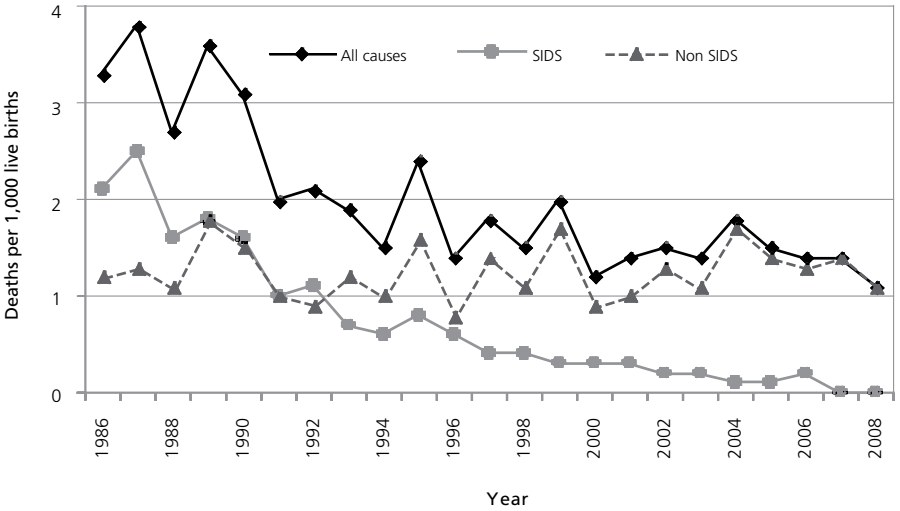
## 1. Post-neonatal mortality statistics

There were 22 post-neonatal deaths in 2008 among babies born in South Australia, resulting in a post-neonatal death rate of 1.1 deaths per 1,000 live births. No deaths were attributed to Sudden Infant Death Syndrome (SIDS), but there were ten Sudden Unexpected Deaths in Infancy (SUDIs). This relatively new term includes all unexpected infant deaths, both explained and unexplained. Our Committee recognises four subcategories of SUDIs: deaths attributed to 'SIDS' (see definition, Appendix 3); 'accidents, poisonings and violence' including 'accidental asphyxiation'; 'medical conditions'; and 'deaths where a definite cause of death cannot be determined'. The current definition of 'SIDS' has become more stringent, such that some deaths which were attributed to SIDS in earlier years would now be classified as SUDIs in the 'undetermined' group. For example, the death scene investigation of some of these SUDIs has identified unsafe infant sleeping and bedding practices and as such would not meet the criteria for SIDS. This issue is discussed in greater detail in page 53, where there is a list of the risk factors associated with three subcategories of SUDIs: 'SIDS', accidental asphyxiation' and 'undetermined cause.' The numbers and rates of post-neonatal deaths for South Australia for 1986 to 2008 are presented in Table 10 and the rates in Figure 7, together with the relative contributions from SIDS and non-SIDS deaths.

Table 10: Post-neonatal deaths and death rates, South Australia, 1986–2008

| Year | Post-neonatal deaths, all causes | | Post-neonatal deaths from SIDS | | Post-neonatal deaths from non-SIDS causes | |
|---|---|---|---|---|---|---|
| | Number | Deaths per 1,000 live births | Number | Deaths per 1,000 live birthsv | Number | Deaths per 1,000 live births |
| 1986 | 65 | 3.3 | 41 | 2.1 | 24 | 1.2 |
| 1987 | 74 | 3.8 | 49 | 2.5 | 25 | 1.3 |
| 1988 | 53 | 2.7 | 32 | 1.6 | 21 | 1.1 |
| 1989 | 71 | 3.6 | 36 | 1.8 | 35 | 1.8 |
| 1990 | 61 | 3.1 | 31 | 1.6 | 30 | 1.5 |
| 1991 | 39 | 2.0 | 19 | 1.0 | 20 | 1.0 |
| 1992 | 41 | 2.0 | 23 | 1.1 | 18 | 0.9 |
| 1993 | 37 | 1.9 | 13 | 0.7 | 24 | 1.2 |
| 1994 | 30 | 1.5 | 11 | 0.6 | 19 | 1.0 |
| 1995 | 46 | 2.4 | 15 | 0.8 | 31 | 1.6 |
| 1996 | 26 | 1.4 | 11 | 0.6 | 15 | 0.8 |
| 1997 | 34 | 1.8 | 8 | 0.4 | 26 | 1.4 |
| 1998 | 27 | 1.5 | 7 | 0.4 | 20 | 1.1 |
| 1999 | 36 | 2.0 | 5 | 0.3 | 31 | 1.7 |
| 2000 | 21 | 1.2 | 5 | 0.3 | 16 | 0.9 |
| 2001 | 24 | 1.4 | 6 | 0.3 | 18 | 1.0 |
| 2002 | 26 | 1.5 | 3 | 0.2 | 23 | 1.3 |
| 2003 | 24 | 1.4 | 4 | 0.2 | 20 | 1.1 |
| 2004 | 31 | 1.8 | 1 | 0.1 | 30 | 1.7 |
| 2005 | 27 | 1.5 | 2 | 0.1 | 25 | 1.4 |
| 2006 | 27 | 1.4 | 3 | 0.2 | 24 | 1.3 |
| 2007 | 28 | 1.4 | 0 | 0 | 28 | 1.4 |
| 2008 | 22 | 1.1 | 0 | 0 | 22 | 1.1 |

Figure 7: Post-neonatal death rates, South Australia, 1986–2008

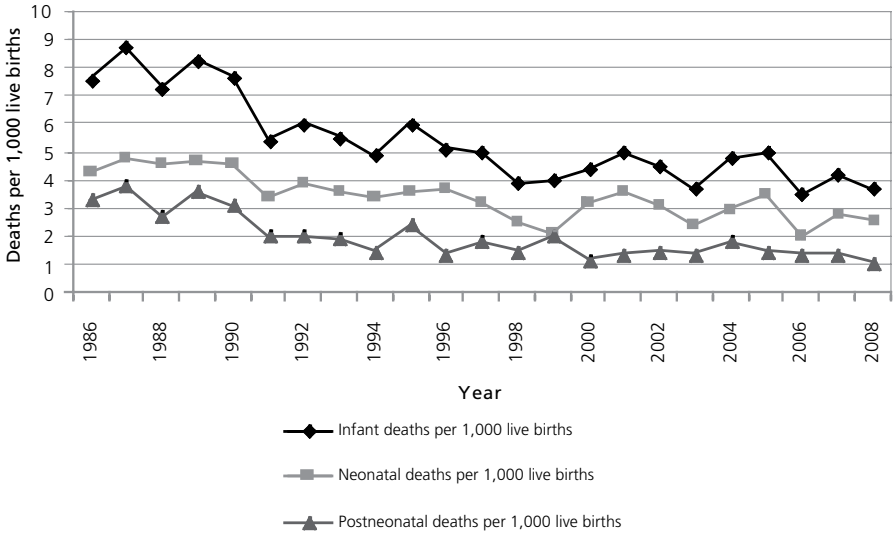



The infant mortality rate for South Australia for 2008 was 3.7 deaths per 1,000 live births. This includes all 73 deaths of infants under 1 year of age, ie, the 51 neonatal deaths and the 22 post-neonatal deaths (Appendix 3). *The infant mortality rate for babies of Aboriginal mothers (with one post-neonatal death and four neonatal deaths out of 626 live births) was 8.0 deaths per 1,000 live births, compared with the infant mortality rate of 3.5 deaths per 1,000 live births for babies of non-Aboriginal mothers.* Infant mortality rates with the component post-neonatal and neonatal death rates for South Australia for 1986-2008 are presented in Table 11 and Figure 8.

## Table 11: Infant deaths (neonatal and post-neonatal) and death rates, South Australia, 1986–2008

| Year | Neonatal deaths | | Post-neonatal deaths | | Infant deaths | |
|---|---|---|---|---|---|---|
| | Number | Deaths per 1,000 live births | Number | Deaths per 1,000 live births | Number | Deaths per 1,000 live births |
| 1986 | 85 | 4.3 | 65 | 3.3 | 150 | 7.6 |
| 1987 | 93 | 4.8 | 74 | 3.8 | 167 | 8.7 |
| 1988 | 89 | 4.6 | 53 | 2.7 | 142 | 7.3 |
| 1989 | 93 | 4.7 | 71 | 3.6 | 164 | 8.3 |
| 1990 | 92 | 4.6 | 61 | 3.1 | 153 | 7.7 |
| 1991 | 66 | 3.4 | 39 | 2.0 | 105 | 5.4 |
| 1992 | 79 | 3.9 | 41 | 2.0 | 120 | 6.0 |
| 1993 | 72 | 3.6 | 37 | 1.9 | 109 | 5.5 |
| 1994 | 66 | 3.4 | 30 | 1.5 | 96 | 4.9 |
| 1995 | 71 | 3.6 | 46 | 2.4 | 117 | 6.0 |
| 1996 | 70 | 3.7 | 26 | 1.4 | 96 | 5.1 |
| 1997 | 59 | 3.2 | 34 | 1.8 | 93 | 5.0 |
| 1998 | 46 | 2.5 | 27 | 1.5 | 73 | 3.9 |
| 1999 | 38 | 2.1 | 36 | 2.0 | 74 | 4.0 |
| 2000 | 57 | 3.2 | 21 | 1.2 | 78 | 4.4 |
| 2001 | 64 | 3.6 | 24 | 1.4 | 88 | 5.0 |
| 2002 | 54 | 3.1 | 26 | 1.5 | 80 | 4.5 |
| 2003 | 42 | 2.4 | 24 | 1.4 | 66 | 3.7 |
| 2004 | 52 | 3.0 | 31 | 1.8 | 83 | 4.8 |
| 2005 | 63 | 3.5 | 27 | 1.5 | 90 | 5.0 |
| 2006 | 38 | 2.0 | 27 | 1.4 | 65 | 3.5 |
| 2007 | 55 | 2.8 | 28 | 1.4 | 83 | 4.2 |
| 2008 | 51 | 2.6 | 22 | 1.1 | 73 | 3.7 |

Figure 8: Infant mortality rates, South Australia, 1986–2008




* Infant deaths include post-neonatal and neonatal deaths

### Comparisons of infant mortality rates for all Australian states for 1986–2007 from the Australian Bureau of Statistics

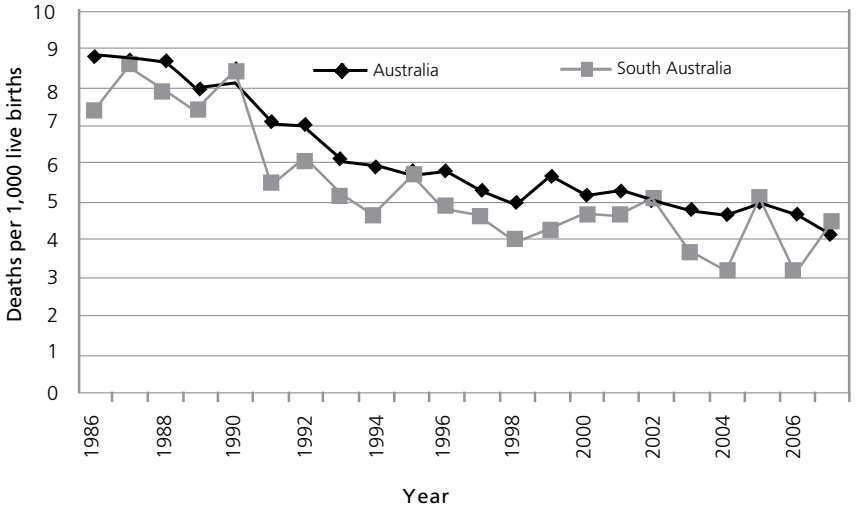
These are presented in Table 12: the rates for 2008 are not yet available. Rates for South Australia compared with Australia for 1986–2007 are shown in Figure 9. The South Australian infant mortality rate has been comparable with most of the other states and was the lowest of all the states in 2003, 2004 and 2006. **Please note that the ABS includes only registered births and deaths in any year of at least 400g birthweight (or 20 weeks gestation if birthweight unavailable) and adjusts for state of usual residence. Hence, rates reported may differ slightly from those reported by this Committee, eg in Table 11.**

Table 12: Comparison of infant mortality rates (deaths per 1,000 live births), across Australian states using ABS data, 1986–2007

| Year | NSW | Vic | Qld | SA | WA | Tas | NT | ACT | Australia |
|---|---|---|---|---|---|---|---|---|---|
| 1986 | 9.0 | 8.6 | 8.7 | 7.4 | 8.8 | 11.4 | 16.0 | 8.5 | 8.8 |
| 1987 | 8.5 | 8.1 | 9.3 | 8.6 | 8.4 | 10.0 | 15.6 | 9.0 | 8.7 |
| 1988 | 9.2 | 7.8 | 8.4 | 7.9 | 8.5 | 9.6 | 19.2 | 8.1 | 8.7 |
| 1989 | 8.7 | 6.5 | 8.5 | 7.4 | 7.8 | 10.6 | 14.5 | 6.5 | 8.0 |
| 1990 | 8.1 | 7.8 | 7.7 | 8.5 | 8.6 | 8.9 | 15.2 | 9.4 | 8.2 |
| 1991 | 7.2 | 6.5 | 7.6 | 5.5 | 7.2 | 9.0 | 14.2 | 7.6 | 7.1 |
| 1992 | 7.4 | 5.6 | 7.9 | 6.1 | 7.0 | 6.6 | 15.5 | 6.3 | 7.0 |
| 1993 | 6.2 | 5.4 | 7.0 | 5.2 | 5.9 | 5.9 | 15.3 | 4.3 | 6.1 |
| 1994 | 6.3 | 5.1 | 6.2 | 4.7 | 5.6 | 7.5 | 11.3 | 4.7 | 5.9 |
| 1995 | 5.7 | 4.9 | 6.3 | 5.8 | 5.1 | 5.8 | 13.3 | 4.8 | 5.7 |
| 1996 | 5.8 | 5.0 | 6.4 | 4.9 | 6.5 | 4.5 | 11.5 | 5.7 | 5.8 |
| 1997 | 5.2 | 4.9 | 5.8 | 4.7 | 5.3 | 6.5 | 12.5 | 3.8 | 5.3 |
| 1998 | 4.3 | 4.7 | 6.4 | 4.0 | 5.0 | 5.7 | 12.4 | 6.0 | 5.0 |
| 1999 | 5.8 | 5.6 | 5.7 | 4.3 | 4.7 | 7.6 | 11.7 | 5.6 | 5.7 |
| 2000 | 5.2 | 4.5 | 6.2 | 4.6 | 4.3 | 5.8 | 11.7 | 4.2 | 5.2 |
| 2001 | 5.3 | 4.8 | 5.9 | 4.6 | 5.1 | 6.2 | 10.7 | 3.0 | 5.3 |
| 2002 | 4.6 | 5.0 | 5.8 | 5.1 | 4.3 | 6.2 | 11.3 | 3.4 | 5.0 |
| 2003 | 4.6 | 5.1 | 4.8 | 3.7 | 4.1 | 7.0 | 8.4 | 5.8 | 4.8 |
| 2004 | 4.6 | 4.5 | 5.2 | 3.2 | 3.9 | 3.6 | 10.7 | 6.9 | 4.7 |
| 2005 | 4.9 | 5.1 | 5.1 | 5.1 | 4.6 | 3.5 | 9.6 | 5.5 | 5.0 |
| 2006 | 4.9 | 4.3 | 5.3 | 3.2 | 4.9 | 3.9 | 8.9 | 5.1 | 4.7 |
| 2007 | 4.3 | 3.8 | 5.0 | 4.5 | 2.4 | 4.2 | 8.5 | 3.8 | 4.2 |

Source: Australian Bureau of Statistics. Catalogue No 3302.0 – 2007 Deaths Australia, November 2008

Figure 9: Infant mortality rates, South Australia and Australia, 1986–2007




Source: Australian Bureau of Statistics. Catalogue No. 3302.0 - 2007 Deaths Australia, November 2008

## 2. Causes of post-neonatal deaths 2008

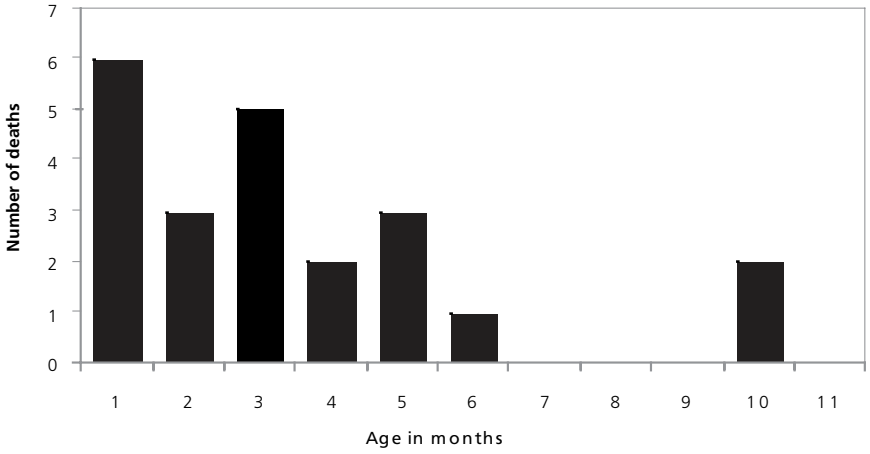
In 2008 there were 22 post-neonatal deaths notified of infants born in South Australia. Autopsies were performed in 10 of the 11 coronial cases (90.9%). Only one limited autopsy was performed in the remaining 11 non-coronial cases. The autopsy rate was thus 50.0% (11 out of 22 cases) for post-neonatal deaths in 2008. The causes of death are presented in Table 13, together with comparative statistics for 1986–2007. There are now significantly more deaths classified as due to 'other' cause. In addition to a true reduction in SIDS deaths over time, this also probably reflects the way the Committee is now applying a more stringent definition of SIDS to the classification of infant deaths.

Table 13: Causes of post-neonatal deaths, South Australia, 1986–2008

| Causes of death | 1986–2007 | | 2008 | |
|---|---|---|---|---|
| | Number | Percent | Number | Percent |
| SIDS | 323 | 38.1 | 0 | 0 |
| Congenital abnormalities | 183 | 21.6 | 9 | 40.9 |
| Conditions originating in the perinatal period | 111 | 13.1 | 5 | 22.7 |
| Accidents, poisonings and violence | 84 | 9.9 | 3 | 13.6 |
| Infections | 66 | 7.8 | 0 | 0 |
| Other | 81 | 9.6 | 5 | 22.7 |
| Total | 848 | 100.0 | 22 | 100.0 |

Among the 22 post-neonatal deaths in 2008, there were 12 males and 10 females. One infant was a triplet. Five infants (22.7%) were born preterm. The distribution by age at death of the 22 infants (Figure 10) shows that most of the deaths occurred in the earlier months of the post-neonatal period. *One of the 22 post-neonatal deaths was the child of an Aboriginal mother.*

Figure 10: Age distribution of post-neonatal deaths, South Australia, 2008



### (1) Congenital abnormalities

Congenital abnormalities accounted for nine post-neonatal deaths (40.9%) in 2008. All nine infants were born at term. *One was the child of an Aboriginal mother. The abnormalities were as follows:*

- Congenital myotubular myopathy (sex-linked)
- Congenital respiratory chain complex I deficiency
- Spinal muscular atrophy Type 1 – two cases
- Endocardial fibroelastosis with dilated cardiomyopathy. Death from cardiac failure was likely to have been precipitated by Cytomegalovirus infection.
- Congenital cardiac abnormality: anomalous coronary artery. Death occurred from post-operative complications after corrective surgery.
- Trisomy 18
- Trisomy 21 with congenital heart disease
- CHARGE syndrome with complex congenital heart disease. Death occurred from post-operative complications after corrective surgery.

### (2) Conditions originating in the perinatal period

There were five deaths in this group. All were extremely preterm births at 24-26 weeks gestation.

One infant was born preterm by emergency caesarean section following severe pre-eclampsia and died of necrotising enterocolitis. Another infant was delivered because of placental abruption and died of intracranial haemorrhage.

Three other infants were born following preterm labour or preterm pre-labour rupture of membranes and died of the complications of prematurity. All three infants developed necrotising enterocolitis and in one case this was associated with bronchopulmonary dysplasia.

### (3) Accidents, poisonings and violence

There was one death from accidental asphyxiation of a one month old infant who was sleeping with an adult on a couch.

There were two other deaths in this group. One was a three month old infant who was co-sleeping with parents.

The other infant died of hypoxic brain injury following non-accidental suffocation.

(4) Other causes

There were five sudden deaths of undetermined cause.

The infants were aged from one month to five months and all were either co-sleeping with siblings or parents or were found in unsafe sleeping environments. This included prams, sleeping bags and parental beds with pillows and doonas.

In 2008, there were no deaths attributed to SIDS. One of the reasons for this may be that in more recent years the Committee has not attributed deaths to SIDS where unsafe sleeping arrangements were present. In some of the deaths attributed to SIDS in the past, there may have been circumstances such as co-sleeping, which raise the possibility that some of these deaths may have been due to accidental asphyxiation. As the autopsy findings in cases of asphyxiation in infants may be identical to those found in SIDS, differentiation of these entities may be extremely difficult.

For this reason comprehensive death scene examination and parental interview by trained personnel have become essential features in the assessment of unexpected infant death. Cases have occurred in South Australia where both accidental and non-accidental asphyxiation have been initially incorrectly diagnosed as SIDS due to the non-specificity of autopsy pathology. Pertinent information may assist in formulating the correct diagnosis.

## Sudden Unexpected Deaths in Infancy (SUDIs)

'Sudden Unexpected Deaths in Infancy' include all sudden unexpected infant deaths, explained or unexplained. Our Committee recognises four subcategories of SUDIs: 'SIDS', 'accidents, poisonings and violence' including 'accidental asphyxiation', 'medical conditions' and 'undetermined cause'. Over the last few years there have been about 10 sudden unexpected post-neonatal deaths each year. There has been no reduction in these deaths between 1998 and 2008.

The distinction between three sub-categories of SUDIs ('SIDS', 'accidental asphyxiation' and 'undetermined cause') is difficult and can be arbitrary. In 2008, there were 10 SUDIs in South Australia. There were 6 deaths classified in the three subcategories of 'SIDS', 'accidental asphyxiation' and 'undetermined cause':

- SIDS - no deaths
- Accidental asphyxiation - one death
- Undetermined cause - five deaths during sleep

The following were some risk factors identified with these 6 deaths:

- Unsafe bedding – six deaths
- Prone position – four deaths
- Co-sleeping – three deaths
- Parental mental health problems – one death
- Teenage mother – one death
- Smoking among close family members - two deaths
- Not breast fed at time of death – three deaths
- Child living with one biological parent – two deaths
- Heavy consumption of alcohol by family members – one death.

These deaths are potentially preventable. The Committee has previously recommended the renewal of a major public health campaign about safe sleeping practices and prevention of sudden unexpected deaths of infants. The Committee notes that SA Health has funded a health promotion strategy to address this issue.

### Deaths of babies born interstate

There were two post-neonatal deaths in South Australia in 2008 of infants born interstate, which are not included in our statistics. *One was the child of an Aboriginal mother.* Both infants lived with their families interstate. One eight month old infant was retrieved to Adelaide after it was found to have evidence of raised intracranial pressure following a fall. The infant required hospital care for over two months with many procedures to treat recurrent intracerebral haemorrhages but died despite all efforts. It was considered that a vascular malformation may have been the original cause of bleeding, because the fall itself was relatively minor compared to the frequency and volume of bleeding. Another infant aged eleven months died of head injuries in a motor vehicle accident in which the vehicle was not fitted with an approved child restraint.

## 3. Post-neonatal Subcommittee recommendations

There were no new recommendations in 2008.

### Recommendations made in earlier years

The year in which the recommendation was first made is provided in parentheses.

1. Health professionals providing care both in the antenatal and postnatal period should ensure that all parents and carers are provided with information about safe infant sleeping practices and prevention of sudden unexpected deaths in infancy (1996).

   > Babies should be placed on their backs to sleep. Sleeping supine is not contraindicated in babies with gastro-oesophageal reflux (1998).

   > Falling asleep with the infant at the breast may be hazardous (1996). Other forms of co-sleeping or bed sharing may be hazardous, particularly if the adults are intoxicated or sedated (see Appendix 11) (1993).

   > Potential hazards must be removed from the infant's sleeping environment. Babies must not be placed in cots with pillows, U-pillows, cot bumpers, large soft toys, thick blankets or quilts or any other items which may overheat or suffocate the infant (1993).

   > Infants should not be left to sleep unattended in stroller-prams or bouncinettes (1993).

   > Ensure that all new cots meet Australian Standards and only use old ones which do. Mattresses which do not fit cots properly should not be used, especially in cots that have unsupported webbing. Do not use very soft mattresses or inflatable mattresses which may vary in their firmness and present spaces in which an infant's head or face may be trapped (1993).

> Care should be taken when placing infants to sleep on mattresses on the floor as infants may roll off and become wedged (2006).

The Committee is concerned about the number of sudden unexpected infant deaths in the last few years, many of which are associated with excessive or inappropriate bedding or other unsafe sleeping practices. We have previously recommended a repeat major public health campaign on safe infant sleeping and prevention of sudden unexpected deaths of infants. We note that SA Health has funded a health promotion strategy to address this issue.

2. An effective system of appropriate and ongoing support, supervision and referral should be offered to families with known risk factors for adverse child outcome, such as parental substance abuse, parental psychiatric illness, household violence, maternal age less than 20 years and poor social circumstances. This should be continued at least throughout the first year of life, if not for a longer period of time (1997).

3. Recording and charting of child's weight.
   The Subcommittee stresses the importance to both parents and health professionals of recording the child's weight in the Personal Health Record (Blue Book) and charting the weight on the percentile growth charts to identify children who are not thriving. It is important to investigate why a child is not thriving (2001). Any child who is not thriving should be referred to a medical practitioner (2003).

4. The Subcommittee stresses the importance of immunisation in the prevention of infectious disease in children (2001). There is some evidence that there is a reduced rate of SIDS in immunised compared with non-immunised children[13].

5. Vigilance is needed to ensure that potential hazards in the home are removed from the infant's environment. These include long hanging curtain cords, which may catch around the neck, and water in containers or baths in which an infant may drown (1998). Infants should never be left unattended in a bath or near water, even for a minute (1993). This applies also to water features in gardens (2005). Parents should not be reassured by the presence of an older sibling in the bath with the infant (2004). This warning also applies to infants placed in devices such as ring bath seats (2002). These devices have been banned in some Australian states due to deaths from drowning associated with their use.

[13] Mitchell EA, Stewart AW, Clements M, Ford RPK, on behalf the New Zealand Cot Death Study Group. Immunisation and the sudden infant death syndrome. Arch Dis Child 1995;73:498-501.

6. Vigilance is always needed to ensure safe feeding for children under four years of age. Foods which can break off into pieces and cause choking should not be given, e.g. raw carrot, celery sticks, grapes, pieces of apple, cherry tomatoes, sausages, frankfurts, popcorn, nuts, hard lollies and corn chips. Food for toddlers should be finely chopped. Children should be supervised while eating. If they run, play, laugh or cry while eating, they are more likely to choke on their food (2001). The Committee was pleased to note that there were no deaths in 2008 from feeding accidents.
7. Consideration should be given to better ways of identifying serious underlying illness in children presenting to clinicians, for example, by Medic Alert bracelets (2005).
8. Systems to facilitate referral by community nurses of high risk children to paediatricians or tertiary hospitals for urgent appointments need to be considered (2006).
9. Hospitals with high levels of paediatric throughput need provision of 24-hour paediatric expertise. Appropriate protocols regarding management of potentially life-threatening paediatric conditions need to be developed, reviewed, distributed to and supported by all hospitals treating children (2004).
10. Urgent medical advice should be sought for all infants who are excessively drowsy, irritable and/or are feeding poorly. These infants, who may not be showing the classical signs of infection, should be considered seriously ill until proven otherwise. Small infants also become dehydrated very rapidly (1992). Health professionals are reminded that intravenous fluids are lifesaving for any sick infant. Infants with cyanotic heart disease are more prone to the complications of dehydration and specialist advice should be sought (2004). Urgent retrieval may be necessary for any infant who is thought to be suffering from a significant bacterial infection (2003).
11. The Committee recommends that further research be undertaken on the incidence of community acquired Methicillin Resistant Staphylococcus aureus (MRSA) infections to help guide clinical practice in terms of antibiotic choice in sick children. This may include setting up systems to make hospital and community acquired MRSA infection a notifiable communicable disease (2005).

### Reporting of deaths to the State Coroner

The following are some categories of death which must be reported to the State Coroner under The Coroner's Act 2003 (www.austlii.edu.au/):

- a death by unusual, unexpected, unnatural, violent or unknown cause.
- a death during, as a result of or within 24 hours of a surgical, invasive or diagnostic procedure including the administration of an anaesthetic for the carrying out of the procedure.
- a death within 24 hours of being discharged from a hospital or having sought emergency treatment at a hospital.
- a death in a hospital or treatment facility for the treatment for a drug addiction.
- a death of a child subject to a custody or guardianship order under the Children's Protection Act 1993.
- a patient death in an approved treatment centre under the Mental Health Act 1993.

**The Committee would like to draw attention once again to the importance of autopsy in eliciting the cause of death. This cause of death should always be carefully recorded in the maternal medical record for future pregnancies.**

There have been several cases in which autopsy has identified a previously unsuspected cause of death. This is most valuable in the management of future pregnancies and counselling of parents, including grief counselling. A detailed examination of the death scene by appropriately trained personnel in cases of unexpected death is also essential in eliciting causative or potentially contributory factors. Standard protocols such as those developed by SAPOL (South Australian Police) and SIDS and Kids South Australia should be used in those circumstances.

**The Maternal, Perinatal and Infant Mortality Committee would also like to draw attention to four websites that offer important information:**

- The South Australian Pregnancy Information website of the Department of Health: www.health.sa.gov.au/pregnancy
- The South Australian Perinatal Practice Guidelines website: www.health.sa.gov.au/ppg
- The SIDS website is www.sidsandkids.org from which hospital staff may print information in different languages.
- The South Australian Parenting and Child Health website www.cyh.com.au of Child and Youth Health.

This Committee report is also available on the Department of Health Pregnancy Outcome Unit's website: www.health.sa.gov.au/pehs/pregnancyoutcome.htm.

# V. Education Subcommittee Report

The thirteenth annual educational meeting, organized by the Education Subcommittee of the Maternal, Perinatal and Infant Mortality Committee, was held on the evening of 27th October 2009.

Since 2007 the meetings have been named "The Annual Dr Brian Pridmore Perinatal Forum" in memory of the late Dr Brian Pridmore. Dr Pridmore chaired the first meetings which commenced in 1997 to facilitate a recommendation that private perinatal units in the metropolitan area be involved in some form of regular peer review and continuing professional education for their midwifery and medical staff. The enthusiastic response to the meetings from midwives and medical practitioners led to their expansion to include personnel from all the perinatal services within the state.

The desire to conduct these meetings on a regular basis led to the formation of the Education Subcommittee. The intention was also to allow a forum for dissemination of findings and recommendations from the Maternal, Perinatal and Infant Mortality Committee to practitioners.

The topic of the thirteenth meeting was obesity in pregnancy and was titled 'Obesity in pregnancy – a sizeable problem'. The level of concern about this issue amongst health professionals was reflected in the near capacity audience of 123 people who attended the meeting at the Women's and Children's Hospital. A case scenario was used to highlight the issues associated with obesity during childbearing: pre-pregnancy, antenatal screening, fetal monitoring, labour and birth, anaesthesia and breast feeding. A major problem discussed was the equipment requirements and costs involved in caring for obese women, which have led to the establishment of bariatric expertise in a few hospitals, to which women can be referred. The panel members gave short presentations and participated in the interactive discussion with the audience. The panel members were Dr Michelle Wellman (gynaecologist and fertility specialist), Ms Michelle Marsh (midwife), Dr Geoff Matthews (obstetrician), and Dr Jonathan Hopkinson (anaesthetist). The audience included obstetricians, obstetric registrars, midwives working in a range of settings, general practitioners, scientists, nurses, a paramedic, a psychologist and midwifery students.

Dr Darren Roberts, a member of the Education Subcommittee, coordinated the evening, gave a presentation of obesity statistics to start the forum and entertained the audience with quiz questions.

The Subcommittee thanks the panel and participants for their continued support of what we hope will continue to be an important part of perinatal services within South Australia.

# Appendices

## Appendix 1:

### Terms of reference, Subcommittees of the Maternal, Perinatal and Infant Mortality Committee

#### Maternal Subcommittee

1. To review the causes of death associated with pregnancy and childbirth; to determine whether these may have been preventable, and to establish what were the avoidable factors, if any, presented in the case history.
2. To report to the Maternal, Perinatal and Infant Mortality Committee.
3. To undertake review, educational and advisory roles as appropriate from time to time, by initiation or by invitation.

#### Perinatal Subcommittee

1. To review each perinatal death from an obstetric, paediatric and pathological perspective and to collate this information.
2. To determine and monitor the epidemiology of perinatal deaths in South Australia.
3. To identify avoidable factors and confidentially provide feedback information to clinicians.
4. To identify areas which need special study and/or action.
5. To liaise with other national and international perinatal mortality study groups.
6. To report to the Maternal, Perinatal and Infant Mortality Committee.

#### Post-neonatal Subcommittee

1. To review the causation of post-neonatal deaths in South Australia.
2. To prepare education commentaries for inclusion in the Annual Report of the Maternal, Perinatal & Infant Mortality Committee.
3. To report to the Maternal, Perinatal and Infant Mortality Committee.
4. To liaise with other national and international mortality study groups.
5. To set priorities for special studies into causes of death in this age group.

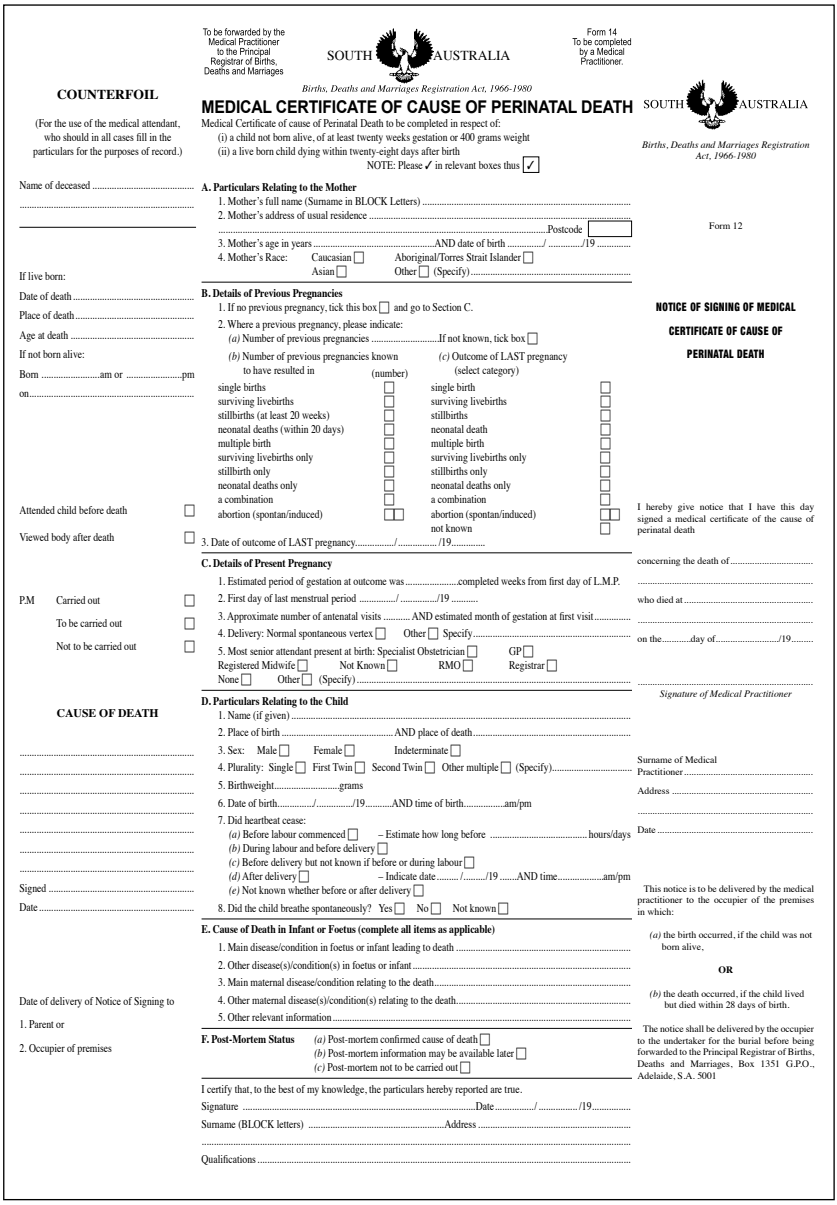
### Education Subcommittee

1. To provide an annual interactive forum for the continuing education of midwives and medical practitioners involved in the provision of perinatal services within metropolitan and regional South Australia.
2. To act as an additional means of communication to the above providers, other health professionals and the community generally from the other subcommittees of the Maternal, Perinatal and Infant Mortality Committee.
3. The membership and chairperson will be nominated by the chairperson of the Maternal, Perinatal and Infant Mortality Committee.
4. The membership shall consist of:

> An obstetrician in metropolitan private practice.
> A neonatal paediatrician in metropolitan private practice.
> A midwife from the metropolitan private hospital services.
> An epidemiologist / medical secretary from the Pregnancy Outcome Unit.

5. The Subcommittee may co-opt members as required.

# Appendix 2a:
## Medical Certificate of Cause of Perinatal Death



To be forwarded by the Medical Practitioner to the Principal Registrar of Births, Deaths and Marriages

SOUTH AUSTRALIA

Form 14
To be completed by a Medical Practitioner.

*Births, Deaths and Marriages Registration Act, 1966-1980*

**MEDICAL CERTIFICATE OF CAUSE OF PERINATAL DEATH**

Medical Certificate of cause of Perinatal Death to be completed in respect of:
(i) a child not born alive, of at least twenty weeks gestation or 400 grams weight
(ii) a live born child dying within twenty-eight days after birth
NOTE: Please ✓ in relevant boxes thus ☑

**COUNTERFOIL**

(For the use of the medical attendant, who should in all cases fill in the particulars for the purposes of record.)

Name of deceased .....

.....

**A. Particulars Relating to the Mother**

1. Mother's full name (Surname in BLOCK Letters) .....
2. Mother's address of usual residence .....
.....Postcode ☐
3. Mother's age in years .....AND date of birth ...../ ...../19 .....
4. Mother's Race: Caucasian ☐ Aboriginal/Torres Strait Islander ☐
Asian ☐ Other ☐ (Specify).....

If live born:

Date of death .....

Place of death.....

Age at death .....

If not born alive:

Born .....am or .....pm

on.....

**B. Details of Previous Pregnancies**

1. If no previous pregnancy, tick this box ☐ and go to Section C.
2. Where a previous pregnancy, please indicate:
*(a)* Number of previous pregnancies .....If not known, tick box ☐

| *(b)* Number of previous pregnancies known to have resulted in | (number) | *(c)* Outcome of LAST pregnancy (select category) | |
|---|---|---|---|
| single births | ☐ | single birth | ☐ |
| surviving livebirths | ☐ | surviving livebirths | ☐ |
| stillbirths (at least 20 weeks) | ☐ | stillbirths | ☐ |
| neonatal deaths (within 20 days) | ☐ | neonatal death | ☐ |
| multiple birth | ☐ | multiple birth | ☐ |
| surviving livebirths only | ☐ | surviving livebirths only | ☐ |
| stillbirth only | ☐ | stillbirths only | ☐ |
| neonatal deaths only | ☐ | neonatal deaths only | ☐ |
| a combination | ☐ | a combination | ☐ |
| abortion (spontan/induced) | ☐☐ | abortion (spontan/induced) | ☐☐ |
| | | not known | ☐ |

3. Date of outcome of LAST pregnancy...../ ...../19.....

Attended child before death ☐

Viewed body after death ☐

**C. Details of Present Pregnancy**

1. Estimated period of gestation at outcome was .....completed weeks from first day of L.M.P.

P.M Carried out ☐

To be carried out ☐

Not to be carried out ☐

2. First day of last menstrual period ...../ ...../19 .....
3. Approximate number of antenatal visits ..... AND estimated month of gestation at first visit.....
4. Delivery: Normal spontaneous vertex ☐ Other ☐ Specify.....
5. Most senior attendant present at birth: Specialist Obstetrician ☐ GP ☐
Registered Midwife ☐ Not Known ☐ RMO ☐ Registrar ☐
None ☐ Other ☐ (Specify) .....

**CAUSE OF DEATH**

.....

.....

.....

.....

.....

.....

.....

.....

Signed .....

Date .....

**D. Particulars Relating to the Child**

1. Name (if given) .....
2. Place of birth .....AND place of death.....
3. Sex: Male ☐ Female ☐ Indeterminate ☐
4. Plurality: Single ☐ First Twin ☐ Second Twin ☐ Other multiple ☐ (Specify).....
5. Birthweight.....grams
6. Date of birth...../...../19.....AND time of birth.....am/pm
7. Did heartbeat cease:
*(a)* Before labour commenced ☐ – Estimate how long before .....hours/days
*(b)* During labour and before delivery ☐
*(c)* Before delivery but not known if before or during labour ☐
*(d)* After delivery ☐ – Indicate date ...../...../19 .....AND time.....am/pm
*(e)* Not known whether before or after delivery ☐
8. Did the child breathe spontaneously? Yes ☐ No ☐ Not known ☐

**E. Cause of Death in Infant or Foetus (complete all items as applicable)**

1. Main disease/condition in foetus or infant leading to death .....
2. Other disease(s)/condition(s) in foetus or infant .....
3. Main maternal disease/condition relating to the death.....
4. Other maternal disease(s)/condition(s) relating to the death.....
5. Other relevant information .....

Date of delivery of Notice of Signing to

1. Parent or

2. Occupier of premises

**F. Post-Mortem Status**
*(a)* Post-mortem confirmed cause of death ☐
*(b)* Post-mortem information may be available later ☐
*(c)* Post-mortem not to be carried out ☐

I certify that, to the best of my knowledge, the particulars hereby reported are true.

Signature .....Date...../...../19.....

Surname (BLOCK letters) .....Address .....

.....

Qualifications .....

SOUTH AUSTRALIA

*Births, Deaths and Marriages Registration Act, 1966-1980*

Form 12

**NOTICE OF SIGNING OF MEDICAL CERTIFICATE OF CAUSE OF PERINATAL DEATH**

I hereby give notice that I have this day signed a medical certificate of the cause of perinatal death

concerning the death of .....

.....

who died at .....

.....

on the.....day of...../19.....

.....
*Signature of Medical Practitioner*

Surname of Medical Practitioner .....

Address .....

.....

Date .....

This notice is to be delivered by the medical practitioner to the occupier of the premises in which:

*(a)* the birth occurred, if the child was not born alive,

**OR**

*(b)* the death occurred, if the child lived but died within 28 days of birth.

The notice shall be delivered by the occupier to the undertaker for the burial before being forwarded to the Principal Registrar of Births, Deaths and Marriages, Box 1351 G.P.O., Adelaide, S.A. 5001

# Appendix 2b:
## Doctor's Certificate of Cause of Death - page 1



DOCTOR'S RECORD OF ISSUING "NOTICE OF DEATH" AND "DOCTOR'S CERTIFICATE OF CAUSE OF DEATH"

Name of deceased.....

.....

Age.....

Died on / /19

at.....

.....

CAUSE OF DEATH

A.....

B.....

C.....

D.....

E.....

Signed.....

.....

SURNAME IN BLOCK LETTERS

Date / /19

Funeral director to whom "Doctor's Certificate of Cause of Death" given.....

.....

Births, Deaths and Marriages Registration Act 1996 (Section 36)

07326

DOCTOR'S CERTIFICATE OF CAUSE OF DEATH

[ Not to be issued if a coroner or police officer is required to be notified of the death under the Coroners Act 1975]

DETAILS OF DECEASED

Surname ( BLOCK LETTERS )

Given names .....

Sex MALE ☐ FEMALE ☐

Of Aboriginal or Torres Strait Islander origin - NO ☐ YES - Aboriginal ☐ T.S.I. ☐

Date of death / /19 Age at death .....

Place of death .....

Was a post mortem conducted? YES ☐ NO ☐

Does the body contain a cardiac pacemaker, cardiovascular defibrillator, drug infusion pump or similar device, or radio-active injectable solutions ? YES ☐ NO ☐

If Yes, give details .....

.....

CAUSE OF DEATH

Part I

Conditions leading to death and duration between onset and death :

(Show direct cause first followed by antecedent causes, stating the underlying condition last. PLEASE USE BLOCK LETTERS AND DO NOT ABBREVIATE)

Disease — Duration

A ..... .....

B ..... .....

C ..... .....

D ..... .....

E ..... .....

Part II

Other significant conditions and duration:

.....

.....

CONTINUE ON REVERSE

Births, Deaths and Marriages Registration Act 1996 (Section 36)

07326

NOTICE OF DEATH

[ Not to be given if a coroner or police officer is required to be notified of the death under the Coroners Act 1975 ]

To the Registrar of Births, Deaths and Marriages

Surname (BLOCK LETTERS) .....

Given names .....

Sex MALE ☐ FEMALE ☐

Died on / /19 Age at death .....

at .....

I have completed a Doctor's Certificate of Cause of Death in respect of the deceased and I have given or will give that Certificate to the funeral director or other person who will be arranging for disposal of the remains

.....

Signature of doctor

.....

Surname of doctor in BLOCK LETTERS

Address .....

.....

Post code .....

Date / /19

This Notice of Death must be forwarded to:

The Registrar of Births, Deaths and Marriages, GPO Box 1351, ADELAIDE 5001 / 91 Grenfell Street, ADELAIDE 5000 within 48 hours after the death

# Appendix 2b:
## Doctor's Certificate of Cause of Death - page 2

-2-

Was an operation performed on the deceased within four weeks before death? YES ☐ NO ☐

If Yes, state date of operation and condition for which performed .....

.....

Was the deceased pregnant within three months before death? YES ☐ NO ☐

If an injury was involved in the death, please answer the following questions :

Date of injury / /19

Injury at work YES ☐ NO ☐

Description of injury .....

.....

Place where injury occurred .....

.....

**Certification**

I certify that - *I was responsible for the deceased's medical care immediately before death
*I examined the body of the deceased after death
*I have made a *post mortem* examination of the remains of the deceased

and that the particulars and cause of death written above are true to the best of my knowledge and belief.

Signature ..... Date / /19

Surname and initials in BLOCK LETTERS .....

Address .....

.....Post code.....

Telephone (business hours) .....

( * Strike out those which are not applicable)

**This Certificate is to be given to the funeral director or other person who will be arranging for the disposal of the human remains. That person will in due course give it to the Registrar with the Death Registration Statement.**

# Appendix 3:
## Definitions

**Live birth:** the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy, which after such separation breathes or shows any other evidence of life, such as beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached.

**Stillbirth:** birth of a fetus at or after 20 weeks gestation and/or with a birthweight of 400g or more, with no signs of life at birth.

**Women who gave birth**: women who gave birth after a pregnancy ending with the birth of one or more live births and/or stillbirths.

**Maternal death** is defined as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.[14]

Maternal deaths are classified as follows:

1. Direct obstetric deaths: those resulting from obstetric complications of the pregnant state (pregnancy, labour and puerperium), from interventions, omissions, incorrect treatment, or from a chain of events resulting from any of the above.
2. Indirect obstetric deaths: those resulting from previous existing disease or disease that developed during pregnancy and which was not due to direct obstetric causes, but which was aggravated by physiologic effects of pregnancy.
3. Incidental deaths in pregnancy: examples of incidental deaths are deaths from drowning and road accidents, where the pregnancy is unlikely to have contributed significantly to the death, although it may be possible to postulate a remote association.

In order to avoid missing indirect deaths which may be difficult to distinguish from incidental deaths occurring in pregnant women, the Maternal, Perinatal and Infant Mortality Committee reviews all deaths in pregnancy and within 42 days of the end of pregnancy. However, only direct and indirect deaths (pregnancy-related deaths) are included in the calculation of the maternal mortality ratio.

[14] World Health Organization. International Statistical Classification of Diseases and Related Health Problems. Tenth Revision. Volume 2. Geneva: WHO, 1993.

Maternal mortality ratio:

$$= \frac{\text{Number of direct and indirect maternal deaths in a year}}{\text{Number of women who gave birth in the same year}} \times 100{,}000$$

Stillbirth rate:

$$= \frac{\text{Number of stillbirths in a year}}{\text{Number of livebirths and stillbirths in the same year}} \times 1{,}000$$

Neonatal death: death of a liveborn infant within 28 days of birth

Neonatal death rate:

$$= \frac{\text{Number of neonatal dealths in a year}}{\text{Number of livebirths in the same year}} \times 1{,}000$$

Perinatal death: includes stillbirth and neonatal death.

Perinatal mortality rate:

$$= \frac{\text{Number of stillbirths + neonatal dealths in a year}}{\text{Number of stillbirths + livebirths in the same year}} \times 1{,}000$$

Post-neonatal death: death of a liveborn infant occurring between 28 days and the first birthday

Post-neonatal death rate:

$$= \frac{\text{Number of post-neonatal deaths in a year}}{\text{Number of livebirths in the same year}} \times 1{,}000$$

Infant death: death of a liveborn infant within the first year of life

Infant deaths include neonatal and post-neonatal deaths.

Infant mortality rate:

$$= \frac{\text{Number of infant dealth in a year}}{\text{Number of livebirths in the same year}} \times 1{,}000$$

Sudden Infant Death Syndrome (SIDS): The sudden unexpected death of an infant less than 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.[15]

[15] Krous HF, Beckwith JB, Byard RW, Rognum TO, Bajanowski T, Corey T et al. Sudden infant death syndrome and unclassified sudden infant deaths: a definitional and diagnostic approach. Paediatrics 2004;114(1):234-8.

# Appendix 4

## Perinatal Society of Australia and New Zealand-Perinatal Death Classification (PSANZ-PDC), SA perinatal deaths, 2008

| | | No. | % |
|---|---|---|---|
| 1. | Congenital Abnormality (including terminations for congenital abnormalities) | 60 | 29.7 |
| | 1.1 Central nervous system | 7 | 3.5 |
| | 1.2 Cardiovascular system | 8 | 4.0 |
| | 1.3 Urinary tract | 0 | 0 |
| | 1.4 Gastrointestinal tract | 1 | 0.5 |
| | 1.5 Chromosomal | 23 | 11.4 |
| | 1.6 Metabolic | 2 | 1.0 |
| | 1.7 Multiple/ non chromosomal syndromes | 9 | 4.5 |
| | 1.8 Other | 10 | 5.0 |
| | 1.81 Musculoskeletal | 3 | |
| | 1.82 Respiratory | 0 | |
| | 1.83 Diaphragmatic hernia | 4 | |
| | 1.84 Haematological | 1 | |
| | 1.85 Tumours | 1 | |
| | 1.88 Other specified congenital abnormality | 1 | |
| | 1.9 Unspecified | 0 | 0 |
| 2. | Perinatal Infection | 15 | 7.4 |
| | 2.1 Bacterial | 10 | 5.0 |
| | 2.11 Group B Streptococcus | 5 | |
| | 2.12 E coli | 1 | |
| | 2.13 Listeria monocytogenes | 0 | |
| | 2.14 Spirochaetal, e.g. Syphilis | 0 | |
| | 2.18 Other bacterial | 4 | |
| | 2.19 Unspecified bacterial | 0 | |

Appendix 4 continued

| | No. | % |
|---|---|---|
| 2.2 Viral | 3 | 1.5 |
| 2.21 Cytomegalovirus | 3 | |
| 2.22 Parvovirus | 0 | |
| 2.23 Herpes simplex virus | 0 | |
| 2.24 Rubella virus | 0 | |
| 2.28 Other viral | 0 | |
| 2.29 Unspecified viral | 0 | |
| 2.3 Protozoal e.g. Toxoplasma | 0 | 0 |
| 2.5 Fungal | 0 | 0 |
| 2.8 Other specified organism | 0 | 0 |
| 2.9 Other unspecified organism | 2 | 1.0 |
| **3. Hypertension** | **2** | **1.0** |
| 3.1 Chronic hypertension: essential | 0 | 0 |
| 3.2 Chronic hypertension: secondary, e.g. renal disease | 0 | 0 |
| 3.3 Chronic hypertension: unspecified | 0 | 0 |
| 3.4 Gestational hypertension | 0 | 0 |
| 3.5 Pre-eclampsia | 2 | 1.0 |
| 3.51 With laboratory evidence of thrombophilia | 0 | |
| 3.6 Pre-eclampsia superimposed on chronic hypertension | 0 | 0 |
| 3.61 With laboratory evidence of thrombophilia | 0 | |
| 3.9 Unspecified hypertension | 0 | 0 |
| **4. Antepartum Haemorrhage (APH)** | **16** | **7.9** |
| 4.1 Placental abruption | 14 | 6.9 |
| 4.11 With laboratory evidence of thrombophilia | 2 | |

Appendix 4 continued

Appendix 4 continued

| | No. | % |
|---|---|---|
| 4.2 Placenta praevia | 0 | 0 |
| 4.3 Vasa praevia | 0 | 0 |
| 4.8 Other APH | 2 | 1.0 |
| 4.9 APH of undetermined origin | 0 | 0 |
| **5. Maternal Conditions** | **4** | **2.0** |
| 5.1 Termination of pregnancy (other than for congenital fetal abnormality) | 1 | 0.5 |
| 5.2 Diabetes / Gestational diabetes | 1 | 0.5 |
| 5.3 Maternal injury | 0 | 0 |
| 5.31 Accidental | 0 | |
| 5.32 Non-Accidental | 0 | |
| 5.4 Maternal sepsis | 0 | 0 |
| 5.5 Lupus obstetric syndrome | 1 | 0.5 |
| 5.6 Obstetric cholestasis | 0 | 0 |
| 5.8 Other specified maternal conditions | 1 | 0.5 |
| **6. Specific Perinatal Conditions** | **29** | **14.4** |
| 6.1 Twin-twin transfusion | 13 | 6.4 |
| 6.2 Feto-maternal haemorrhage | 2 | 1.0 |
| 6.3 Antepartum cord complications (e.g. cord haemorrhage, true knot with evidence of occlusion) | 7 | 3.5 |
| 6.4 Uterine abnormalities, eg bicornuate uterus, cervical incompetence | 0 | 0 |
| 6.5 Birth trauma (typically infants of >24 weeks gestation or >600g birthweight) | 1 | 0.5 |
| 6.6 Alloimmune disease | 0 | 0 |
| 6.61 Rhesus | 0 | |
| 6.62 ABO | 0 | |

Appendix 4 continued

Appendix 4 continued

| | | No. | % |
|---|---|---|---|
| | 6.63 Kell | 0 | |
| | 6.64 Alloimmune thrombocytopenia | 0 | |
| | 6.68 Other | 0 | |
| | 6.69 Unspecified | 0 | |
| | 6.7 Idiopathic hydrops | 2 | 1.0 |
| | 6.8 Other specific perinatal conditions (includes iatrogenic conditions such as rupture of membranes after amniocentesis, termination of pregnancy for suspected but unconfirmed congenital abnormality) | 4 | 2.0 |
| 7. | **Hypoxic Peripartum Death** (typically infants of >24 weeks gestation or > 600g birthweight) | 4 | 2.0 |
| | 7.1 With intrapartum complications | 1 | 0.5 |
| | 7.11 Uterine rupture | 1 | |
| | 7.12 Cord prolapse | 0 | |
| | 7.13 Shoulder dystocia | 0 | |
| | 7.18 Other | 0 | |
| | 7.2 Evidence of non-reassuring fetal status in a normally grown infant (e.g. abnormal fetal heart rate, fetal scalp pH/lactate, fetal pulse oximetry without intrapartum complications) | 3 | 1.5 |
| | 7.3 No intrapartum complications and no evidence of non-reassuring fetal status | 0 | 0 |
| | 7.9 Unspecified hypoxic peripartum death | 0 | 0 |
| 8. | Fetal Growth Restriction (FGR) | 16 | 7.9 |
| | 8.1 With evidence of reduced vascular perfusion on Doppler studies and/or placental histopathology (e.g. significant infarction, acute atherosis, maternal and/or fetal vascular thrombosis or maternal floor infarction) | 12 | 5.9 |

Appendix 4 continued

Appendix 4 continued

| | | No. | % |
|---|---|---|---|
| | 8.11 With placental or laboratory evidence of thrombophilia | 5 | |
| | 8.12 With smoking | 2 | |
| | 8.13 With substance abuse | 0 | |
| | 8.14 With alcohol abuse | 0 | |
| | 8.15 With diabetes / gestational diabetes | 0 | |
| | 8.2 With chronic villitis | 1 | 0.5 |
| | 8.3 No placental pathology | 1 | 0.5 |
| | 8.4 No examination of placenta | 0 | 0 |
| | 8.8 Other specified placental pathology | 2 | 1.0 |
| | 8.9 Unspecified or not known whether placenta examined | 0 | 0 |
| 9. | Spontaneous Preterm (<37 weeks gestation) | 31 | 15.3 |
| | 9.1 Spontaneous preterm with intact membranes, or membrane rupture <24 hours before delivery | 8 | 4.0 |
| | 9.11 With chorioamnionitis on placental histopathology | 3 | |
| | 9.12 Without chorioamnionitis on placental histopathology | 4 | |
| | 9.13 With clinical evidence of chorioamnionitis, no examination of placenta | 0 | |
| | 9.17 No clinical signs of chorioamnionitis, no examination of placenta | 1 | |
| | 9.19 Unspecified or not known whether placenta examined | 0 | |
| | 9.2 Spontaneous preterm with membrane rupture ≥24 hours before delivery | 22 | 10.9 |
| | 9.21 With chorioamnionitis on placental histology | 20 | |
| | 9.22 Without chorioamnionitis on placental histology | 2 | |

Appendix 4 continued

Appendix 4 continued

| | No. | % |
|---|---|---|
| 9.23 With clinical evidence of chorioamnionitis, no examination of placenta | 0 | |
| 9.27 No clinical signs of chorioamnionitis, no examination of placenta | 0 | |
| 9.29 Unspecified or not known whether placenta examined | 0 | |
| 9.3 Spontaneous preterm with membrane rupture of unknown duration before delivery | 1 | 0.5 |
| 9.31 With chorioamnionitis on placental histology | 0 | |
| 9.32 Without chorioamnionitis on placental histology | 0 | |
| 9.33 With clinical evidence of chorioamnionitis, no examination of placenta | 0 | |
| 9.37 No clinical signs of chorioamnionitis, no examination of placenta | 1 | |
| 9.39 Unspecified or not known whether placenta examined | 0 | |
| **10. Unexplained Antepartum Death** | **23** | **11.4** |
| 10.1 With evidence of reduced vascular perfusion on Doppler studies and/or placental histopathology (e.g. significant infarction, acute atherosis, maternal and/or fetal vascular thrombosis or maternal floor infarction) | 8 | 4.0 |
| 10.11 and thrombophilia | 2 | |
| 10.12 and smoking | 0 | |
| 10.13 and substance abuse | 0 | |
| 10.14 and alcohol abuse | 0 | |
| 10.15 and diabetes / gestational diabetes | 0 | |
| 10.2 With chronic villitis | 1 | 0.5 |
| 10.3 No placental pathology | 5 | 2.5 |
| 10.7 No examination of placenta | 0 | 0 |

Appendix 4 continued

Appendix 4 continued

| | | No. | % |
|---|---|---|---|
| | 10.8 Other specified placental pathology | 9 | 4.5 |
| | 10.9 Unspecified unexplained antepartum death or not known whether placenta examined | 0 | 0 |
| 11. | No Obstetric Antecedent | 2 | 1.0 |
| | 11.1 SIDS | 0 | 0 |
| | 11.11 SIDS Category IA: Classic features of SIDS present and completely documented. | 0 | |
| | 11.12 SIDS Category IB: Classic features of SIDS present but incompletely documented. | 0 | |
| | 11.13 SIDS Category II: Infant deaths that meet Category I except for one or more features. | 0 | |
| | 11.2 Postnatally acquired infection | 0 | 0 |
| | 11.3 Accidental asphyxiation | 0 | 0 |
| | 11.4 Other accident, poisoning or violence (postnatal) | 0 | 0 |
| | 11.8 Other specified | 1 | 0.5 |
| | 11.9 Unknown / Unexplained | 1 | 0.5 |
| | 11.91 Unclassified Sudden Infant Death | 1 | |
| | 11.92 Other Unknown / Undetermined | 0 | |
| | Total | 202 | 100.0 |

# Appendix 5:

## Perinatal Society of Australia and New Zealand-Perinatal Death Classification (PSANZ-PDC), SA perinatal deaths by birthweight, 2008

| PSANZ-PDC | | Birthweight (g) | | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | <500 | 500 -749 | 750 -999 | 1,000 -1,499 | 1,500 -1,999 | 2,000 -2,499 | 2,500+ | No. | % |
| 1 | Congenital abnormality | 37 | 6 | 1 | 3 | 4 | 4 | 5 | 60 | 29.7 |
| 2 | Perinatal infection | 7 | 2 | 0 | 0 | 0 | 0 | 6 | 15 | 7.4 |
| 3 | Hypertension | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 1.0 |
| 4 | Antepartum haemorrhage | 4 | 4 | 0 | 1 | 1 | 2 | 4 | 16 | 7.9 |
| 5 | Maternal conditions | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 4 | 2.0 |
| 6 | Specific* perinatal conditions | 13 | 3 | 2 | 0 | 0 | 2 | 8 | 29* | 14.4 |
| 7 | Hypoxic peripartum death | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 4 | 2.0 |
| 8 | Fetal growth restriction | 6 | 3 | 1 | 0 | 1 | 4 | 1 | 16 | 7.9 |
| 9 | Spontaneous preterm | 15 | 9 | 5 | 1 | 1 | 0 | 0 | 31 | 15.3 |
| 10 | Unexplained antepartum death | 3 | 2 | 2 | 4 | 2 | 4 | 6 | 23 | 11.4 |
| 11 | No obstetric antecedent | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 1.0 |
| Total | | 87 | 30 | 11 | 10 | 10 | 18 | 35 | 202* | 100 |
| % | | 43.1 | 14.9 | 5.4 | 5.0 | 5.0 | 8.9 | 17.3 | 100 | % |

* includes one stillbirth at 30 weeks gestation of unknown birthweight

# Appendix 6:

## Obstetric cause-specific classification of perinatal deaths, SA perinatal deaths, 2008 (Amended Whitfield)

| | | No. | % |
|---|---|---|---|
| 1. | **Spontaneous Preterm** <37 weeks, normally formed, appropriately grown. | 30 | 14.9 |
| | 1.1 Multiple pregnancy | 2 | |
| | 1.2 Previous bleeding | 2 | |
| | 1.3 Previous spontaneous rupture of membranes >12 hours before labour | 19 | |
| | 1.4 Cervical incompetence | 0 | |
| | 1.5 Other, eg uterine malformation | 0 | |
| | 1.6 Idiopathic | 7 | |
| 2. | **Intrauterine Growth Restriction (IUGR)** <10th percentile for gestational age | 16 | 7.9 |
| 3. | **Unexplained Intrauterine Death** Normally formed fetuses without IUGR where fetal death is known to have preceded labour in the absence of any other primary complication | 23 | 11.4 |
| 4. | **Birth Trauma ≥1,500g,** with evidence of lethal trauma at autopsy even when labour and delivery were not complicated by mechanical difficulty | 1 | 0.5 |
| | 4.1 Cord complication | 0 | |
| | 4.2 Breech delivery | 0 | |
| | 4.3 Caesarean section | 1 | |
| | 4.4 Forceps delivery | 0 | |
| | 4.5 Ventouse delivery | 0 | |
| | 4.6 Other delivery | 0 | |

Appendix 6 continued

Appendix 6 continued

| | | No. | % |
|---|---|---|---|
| 5. | **Intrapartum Asphyxia** ≥1,500g with evidence of intrapartum hypoxia and/or confirmed by hypoxic changes at autopsy | 4 | 2.0 |
| | 5.0 Vaginal | 2 | |
| | 5.1 Cord complication | 0 | |
| | 5.2 Breech delivery | 1 | |
| | 5.3 Caesarean section | 1 | |
| | 5.4 Forceps delivery | 0 | |
| | 5.5 Ventouse delivery | 0 | |
| | 5.6 Other delivery & unspecified | 0 | |
| 6. | Hypertension | 2 | 1.0 |
| | 6.0 Unspecified | 0 | |
| | 6.1 Pre-existing hypertension | 0 | |
| | 6.2 Pre-eclampsia | 2 | |
| | 6.3 Pre-existing hypertension and pre-eclampsia | 0 | |
| 7. | Maternal Disease | 3 | 1.5 |
| | 7.0 Unspecified | 0 | |
| | 7.1 Maternal injury | 0 | |
| | 7.2 Abdominal operation | 0 | |
| | 7.3 Diabetes/Gestational diabetes | 1 | |
| | 7.4 Malignancy | 0 | |
| | 7.5 Infection | 0 | |
| | 7.8 Maternal death | 0 | |
| | 7.9 Other | 2 | |
| 8. | Antepartum Haemorrhage (APH) | 16 | 7.9 |
| | 8.1 Placental abruption | 14 | |
| | 8.2 Placenta praevia | 0 | |

Appendix 6 continued

Appendix 6 continued

| | | No. | % |
|---|---|---|---|
| | 8.3 APH undetermined origin | 2 | |
| | 8.4 Vasa praevia | 0 | |
| 9. | Fetal Abnormality | 60 | 29.7 |
| | 9.1 Central nervous system | 7 | |
| | 9.2 Cardiovascular system | 8 | |
| | 9.3 Urinary tract | 0 | |
| | 9.4 Gastrointestinal tract | 1 | |
| | 9.5 Chromosomal | 23 | |
| | 9.6 Metabolic | 2 | |
| | 9.7 Multiple | 9 | |
| | 9.9 Other | 10 | |
| 10. | Haemolytic Disease | 0 | 0 |
| | 10.1 Rhesus incompatibility | 0 | |
| | 10.2 Other feto-maternal blood group incompatibility (eg Kell) | 0 | |
| | 10.3 Haemoglobinopathy | 0 | |
| 11. | **Infection** Pathological evidence of infection required. Infections occurring as primary factors including deaths with chorioamnionitis or congenital pneumonia preceding membrane rupture. | 16 | 7.9 |
| | 11.0 Unspecified | 3 | |
| | 11.1 Streptococcus, Group B | 5 | |
| | 11.2 Escherichia coli | 1 | |
| | 11.3 Other bacterial | 3 | |
| | 11.4 Toxoplasma | 0 | |
| | 11.5 Syphilis | 0 | |
| | 11.6 Cytomegalovirus | 3 | |

Appendix 6 continued

Appendix 6 continued

| | | No. | % |
|---|---|---|---|
| | 11.7 Other viral | 0 | |
| | 11.8 Fungal | 0 | |
| | 11.9 Other | 1 | |
| 12. | Other | 31 | 15.3 |
| | 12.1 Non-immune hydrops | 2 | |
| | 12.2 Feto-maternal haemorrhage | 2 | |
| | 12.3 Twin-twin transfusion | 13 | |
| | 12.4 Accident, poisoning or violence (Postnatal) | 0 | |
| | 12.5 SIDS | 0 | |
| | 12.8 Unknown / unexplained | 2 | |
| | 12.9 Other | 12 | |
| | Total | 202 | 100.0 |

# Appendix 7:

## Perinatal Society of Australia and New Zealand-Neonatal Death Classification (PSANZ-NDC), SA neonatal deaths, 2008

| | | No. | % |
|---|---|---|---|
| 1. | Congenital Abnormality | 19 | 37.3 |
| | 1.1 Central nervous system | 2 | 3.9 |
| | 1.2 Cardiovascular system | 3 | 5.9 |
| | 1.3 Urinary tract | 0 | 0 |
| | 1.4 Gastrointestinal tract | 0 | 0 |
| | 1.5 Chromosomal | 6 | 11.8 |
| | 1.6 Metabolic | 1 | 2.0 |
| | 1.7 Multiple/ non chromosomal syndromes | 3 | 5.9 |
| | 1.8 Other congenital abnormality | 4 | 7.8 |
| | 1.81 Musculoskeletal | 1 | |
| | 1.82 Respiratory | 0 | |
| | 1.83 Diaphragmatic hernia | 2 | |
| | 1.84 Haematological | 0 | |
| | 1.85 Tumours | 1 | |
| | 1.88 Other specified congenital abnormality | 0 | |
| | 1.9 Unspecified congenital abnormality | 0 | 0 |
| 2. | Extreme Prematurity (typically infants of <=24 weeks gestation or <=600g birthweight) | 15 | 29.4 |
| | 2.1 Not resuscitated | 13 | 25.5 |
| | 2.2 Unsuccessful resuscitation | 2 | 3.9 |
| | 2.9 Unspecified or not known whether resuscitation attempted | 0 | 0 |
| 3. | Cardio-Respiratory Disorders | 3 | 5.9 |
| | 3.1 Hyaline membrane disease / Respiratory distress syndrome (RDS) | 1 | 2.0 |

Appendix 7 continued

Appendix 7 continued

| | | No. | % |
|---|---|---|---|
| | 3.2 Meconium aspiration syndrome | 0 | 0 |
| | 3.3 Primary persistent pulmonary hypertension | 0 | 0 |
| | 3.4 Pulmonary hypoplasia | 2 | 3.9 |
| | 3.5 Chronic neonatal lung disease (typically, bronchopulmonary dysplasia) | 0 | 0 |
| | 3.8 Other | 0 | 0 |
| 4. | Infection | 4 | 7.8 |
| | 4.1 Bacterial | 4 | 7.8 |
| | 4.11 Congenital bacterial | 4 | |
| | 4.12 Acquired bacterial | 0 | |
| | 4.2 Viral | 0 | 0 |
| | 4.21 Congenital viral | 0 | |
| | 4.22 Acquired viral | 0 | |
| | 4.3 Protozoal e.g. Toxoplasma | 0 | 0 |
| | 4.4 Spirochaetal e.g. Syphilis | 0 | 0 |
| | 4.5 Fungal | 0 | 0 |
| | 4.8 Other | 0 | 0 |
| | 4.9 Unspecified organism | 0 | 0 |
| 5. | Neurological | 8 | 15.7 |
| | 5.1 Hypoxic ischaemic encephalopathy / Perinatal asphyxia (typically infants of >24 weeks gestation or >600g birthweight) | 3 | 5.9 |
| | 5.2 Intracranial haemorrhage | 5 | 9.8 |
| | 5.8 Other | 0 | 0 |
| 6. | Gastrointestinal | 0 | 0 |
| | 6.1 Necrotising enterocolitis | 0 | 0 |
| | 6.8 Other | 0 | 0 |

Appendix 7 continued

Appendix 7 continued

| | | No. | % |
|---|---|---|---|
| 7. | Other | 2 | 3.9 |
| | 7.1 Sudden Infant Death Syndrome (SIDS) | 0 | 0 |
| | 7.11 SIDS Category IA: Classic features of SIDS present and completely documented. | 0 | |
| | 7.12 SIDS Category IB: Classic features of SIDS present but incompletely documented. | 0 | |
| | 7.13 SIDS Category II: Infant deaths that meet category I except for one or more features. | 0 | |
| | 7.2 Multi-system failure - only if unknown primary cause or trigger event | 0 | 0 |
| | 7.3 Trauma | 0 | 0 |
| | 7.8 Other specified | 1 | 2.0 |
| | 7.9 Undetermined / Unknown | 1 | 2.0 |
| | 7.91 Unclassified Sudden Infant Death | 1 | |
| | 7.92 Other Unknown / Undetermined | 0 | |
| | Total | 51 | 100.0 |

# Appendix 8:
## South Australian Protocol for investigation of stillbirths

Working party members:

- Dr R Watson (Chair)
- Professor MJNC Keirse
- Professor G Dekker
- Professor TY Khong
- Associate Professor W Hague

### Introduction

The perinatal mortality rate for South Australia in 2008 of 3.4 deaths per 1,000 births for infants of at least 1,000g birthweight or 28 weeks gestation is low by international standards. The rate for infants of at least 400g birthweight or 20 weeks gestation was 10.1 deaths per 1,000 births that year. Seventy-five percent of these perinatal deaths were stillbirths. The Perinatal Subcommittee of the South Australian Maternal, Perinatal and Infant Mortality Committee seeks, amongst other roles, to identify patterns and avoidable factors in perinatal deaths within the state. In 2008, 15% of stillbirths had no cause identified, possibly, in part due to the lack of a systematic and up-to-date approach to the investigation of stillbirths for which there is no immediate obvious cause. Currently protocols for investigating such cases vary markedly between hospitals and generally have not kept pace with advances in obstetric knowledge, particularly in the area of vasculopathies.

A working party was set up in 1997 by the Perinatal Subcommittee to address this issue. It is hoped that the result will facilitate a more systematic and uniform approach to the investigation of stillbirths, resulting not only in a greater understanding of the demographics and underlying pathology, but the possibility of more accurate diagnosis and counselling, and potentially a reduction in recurrences.

In order to adequately assess causative and contributing factors in cases of stillbirth, certain investigations will be required in all cases, while others can be directed to discovering underlying factors for an obvious cause of death. Lastly, some investigations are best suited to those cases in which no cause of death is apparent. The following protocol attempts to provide a logical approach to each of these areas.

**Core investigations** (to be performed in all cases of stillbirth):

- **A detailed history and examination of the mother** along with a careful review of the antenatal record can often provide clues to intercurrent infection, previously undiagnosed pre-eclampsia, drug use or intra-hepatic cholestasis of pregnancy.
- **Autopsy of the stillbirth.** With parental consent, autopsy should be conducted by the State Perinatal Autopsy Service.
- G**uthrie card.** Where permission for an autopsy has been declined, parents should be asked if blood can be taken for the Newborn Screening Guthrie Card that is requested for all babies in Australia. This blood could be drawn from a heel prick or from the cut end of the umbilical cord of the placenta.
- **Histopathology of placenta.** Whether or not an autopsy is performed the placenta should be placed in a dry sterile container (no formalin or saline), the container surrounded in ice and forwarded to the State Perinatal Autopsy Service. Histopathological examination combined with other investigations can provide a diagnosis for a current pregnancy and information that can be helpful in planning another pregnancy.
- **Maternal blood** should be drawn for a Kleihauer test and sent along with a sample of maternal serum with the placenta with or without the baby. A slide for Kleihauer will be prepared but only examined if required.
- **External examination of the baby.** In cases where parental consent for autopsy cannot be obtained, external examination of the baby by a pathologist experienced in this area, where possible, should be sought. If this is not possible an **X-ray of the baby** and/or a **clinical photograph** should be taken and sent to a major centre for review.

Genetic termination of pregnancy

In cases where a termination of pregnancy has been carried out for fetal malformation, **an autopsy may still be desirable** to confirm the diagnosis or discover unexpected associated malformations.

### Congenital anomaly

Investigations to be performed when an intrauterine fetal death occurs in conjunction with a known fetal abnormality:

- Karyotype - preferably on amniotic fluid obtained by amniocentesis since this provides the least contaminated sample, but if maternal consent for this cannot be obtained then on cord blood (if obtainable) or fetal skin. The sample should be obtained, but karyotyping should only proceed if an anomaly which is indicative of a chromosomal abnormality is found at birth or autopsy.
- Maternal serology for syphilis, CMV, Toxoplasma, Herpes and Parvovirus. Serum should be taken and forwarded with the baby. Investigation for congenital infection should be pursued if anomalies indicative of infection are found (for example, hydrocephalus, hepatomegaly, cataracts, calcification of brain or placenta).
- Maternal antibody screen - serum forwarded with baby for later investigation if hydrops is evident at autopsy.

### Vasculopathies

Pre-eclampsia/hypertension, placental abruption and intrauterine growth restriction.

### All should have a thrombophilia screen comprising –

1. At time of delivery:
   - Anti-cardiolipin antibody.
   - Lupus anticoagulant.
   - Activated Protein C Resistance.
2. At three months post-partum:
   - Activated Protein C Resistance if previous result low or borderline (<2.5).
   - Homocysteine - may be done earlier if follow-up uncertain.
   - Protein S.

### Pre-eclampsia or non-proteinuric hypertension

Attention is drawn to those investigations for monitoring maternal welfare published by the Australasian Society for the Study of Hypertension in Pregnancy.[16]

[16] Brown MA, Hague WM, Higgins J, Lowe S, McGowan L, Oats J, Peek MJ, Rowan JA, Walters BNJ. Consensus Statement. The detection, investigation and management of hypertension in pregnancy. Aust NZ J Obstet Gynaecol 2000;40:133-138.

**Those with early onset pre-eclampsia** (<28 weeks) should also have

- Anti-nuclear antibody
- Fetal karyotype (see "Congenital anomaly")

In cases of **placental abruption** a history of trauma, including domestic or other violence, should be sought. The Kleihauer slide (see "Core investigations") should be examined if the diagnosis is in doubt and in all Rhesus negative women to determine the required dose of anti-D.

Where intrauterine growth restriction is evident without further evidence of a vasculopathy (hypertension, abruption), the following should be performed in addition to the thrombophilia screen:

- Maternal serology for CMV, Toxoplasma and Rubella (if not immune) on held maternal serum (see "Core investigations ")
- Fetal karyotype (see "Congenital anomaly")
- Maternal urinary drug screen as well as a drug related history

**Intrapartum deaths which are associated with hypertension, abruption or intrauterine growth restriction** should be investigated as such, but in the absence of these and when the fetus is over 1,000g: -

- Kleihauer slide examined (See "Core investigations")
- Cord (or heart) blood (haemoglobin, platelets, nucleated red blood cells)

### Unexplained stillbirths

In the absence of discernible factors pertaining to fetal demise, or any obvious congenital anomaly, in addition to the "Core investigations": -

- Maternal serum bile acids - cord blood bile acids if possible.
- Maternal serum glucose.
- Thrombophilia screen (see "Vasculopathies").
- Maternal serology - syphilis, CMV, Toxoplasma, Herpes, Parvovirus.
- Microbiology - fetal throat swab, placental intermembranous swab.
- Drug history and urine drug screen.
- Cord or heart blood - haemoglobin, platelets, nucleated red blood cells, blood group (for anti-D if mother Rhesus negative).
- Maternal antibody screen.
- Kleihauer slide examined.

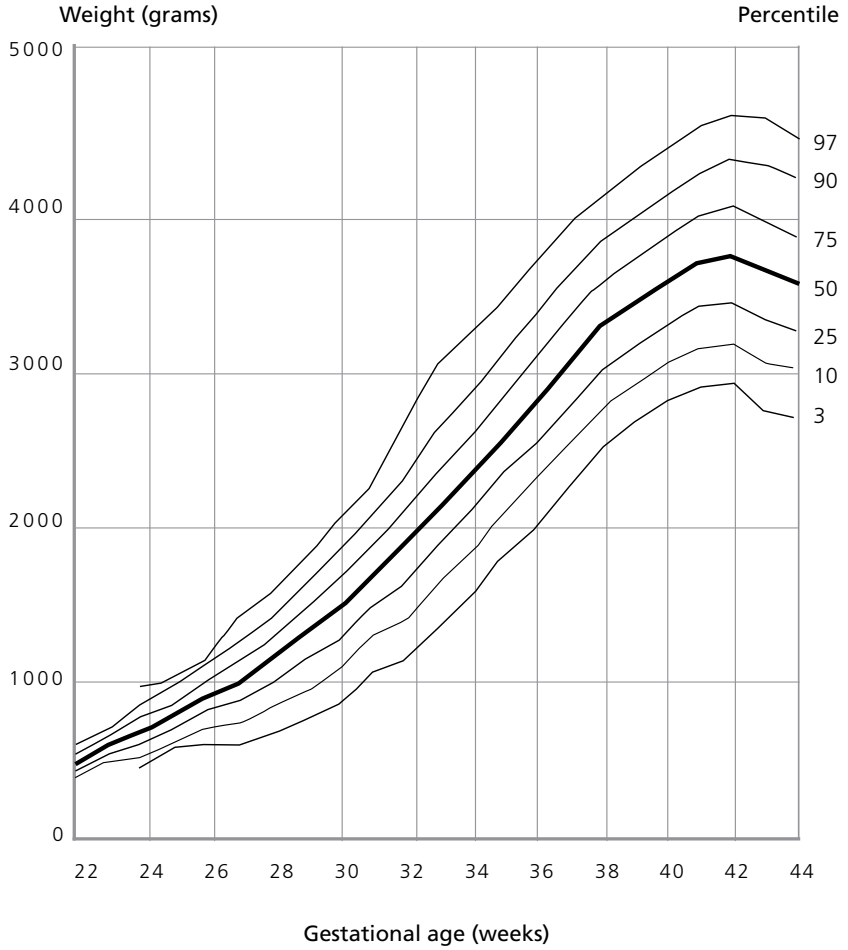
# Appendix 9:
## Placental histology guidelines

Histological examination of the placenta provides additional information about perinatal deaths and placentas should be sent for examination where possible.

As a guide, placentas and all **relevant clinical information** should be sent to Pathology at least from:

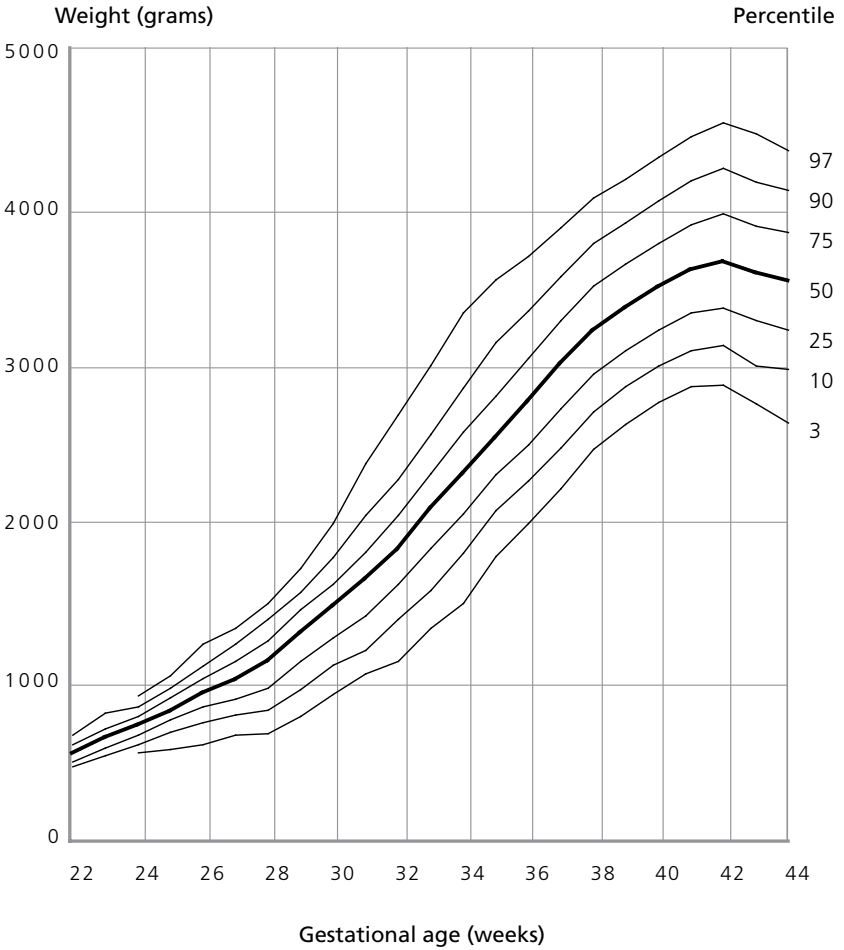
- All stillborn infants, early neonatal deaths and mid-trimester miscarriages.
- All multiple pregnancies with same sex infants.
- All triplet and higher order multiple pregnancies.
- All cases of discordant twin growth with greater than 20% weight difference.
- All cases of prolonged rupture of membranes or suspected chorioamnionitis or maternal fever (any cause).
- All preterm deliveries.
- All cases where birthweight is less than the 10th percentile or greater than the 95th percentile for gestational age.
- All cases of fetal malformation.
- All cases of pregnancy complicated by oligohydramnios, polyhydramnios or placental abnormalities detected prenatally (vascular channels, chorioangioma, etc).
- All cases with a physical abnormality in the placenta (eg. a mass, abnormal colour, malodour).
- All cases subjected to chorion villus sampling or amniocentesis, if complications occur.
- All cases of pre-existing diabetes, pre-eclampsia, systemic lupus erythematosus and documented thrombophilias known to be associated with fetal hazard.
- All cases of placental abruption.
- All cases where the infant is transferred to a Level III nursery or the infant is severely depressed at birth (Apgar score <5 at five minutes).
- All instances where either mother or baby is retrieved shortly after birth.
- All cases of maternal death.

# Appendix 10
## Australian birthweight percentiles for singleton boys




From: Roberts CL & Lancaster PAL. Australian national birthweight percentiles by gestational age. MJA 1999; 170: 114-118.© Copyright 1999. *The Medical Journal of Australia* -reproduced with permission.

# Appendix 10
## Australian birthweight percentiles for singleton girls




From: Roberts CL & Lancaster PAL. Australian national birthweight percentiles by gestational age. MJA 1999; 170: 114-118. © Copyright 1999. *The Medical Journal of Australia* -reproduced with permission.

## Table 14: Birthweight percentile values (g) for live singleton males, Australia, 1991–1994

| Gestation (weeks) | No. births | Mean (gm) | Standard Deviation | Percentile (gm) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1st | 3rd | 5th | 10th | 25th | 50th | 75th | 90th | 95th | 97th | 99th |
| 20 | 27 | 385 | 76 | | | | | 330 | 380 | 430 | | | | |
| 21 | 43 | 447 | 66 | | | | | 410 | 440 | 490 | | | | |
| 22 | 74 | 495 | 80 | | | | 400 | 440 | 490 | 540 | 600 | | | |
| 23 | 95 | 607 | 92 | | | 470 | 500 | 550 | 610 | 660 | 710 | 780 | | |
| 24 | 135 | 690 | 129 | | 470 | 480 | 520 | 610 | 680 | 780 | 860 | 930 | 990 | |
| 25 | 180 | 791 | 132 | | 560 | 580 | 620 | 700 | 785 | 870 | 980 | 1000 | 1030 | |
| 26 | 235 | 921 | 158 | | 610 | 620 | 720 | 840 | 920 | 1020 | 1130 | 1160 | 1170 | |
| 27 | 284 | 1017 | 209 | | 610 | 650 | 740 | 900 | 1000 | 1140 | 1280 | 1350 | 1440 | |
| 28 | 361 | 1157 | 240 | 570 | 670 | 720 | 850 | 1000 | 1170 | 1300 | 1440 | 1550 | 1600 | 1790 |
| 29 | 397 | 1316 | 261 | 670 | 760 | 840 | 950 | 1170 | 1340 | 1480 | 1640 | 1740 | 1810 | 1900 |
| 30 | 571 | 1477 | 313 | 730 | 860 | 960 | 1080 | 1270 | 1490 | 1680 | 1860 | 1950 | 2050 | 2270 |
| 31 | 743 | 1682 | 311 | 910 | 1070 | 1130 | 1310 | 1490 | 1670 | 1870 | 2070 | 2170 | 2280 | 2450 |
| 32 | 1117 | 1875 | 378 | 1020 | 1150 | 1230 | 1400 | 1640 | 1890 | 2100 | 2320 | 2470 | 2690 | 2980 |
| 33 | 1471 | 2142 | 415 | 1210 | 1360 | 1450 | 1640 | 1900 | 2120 | 2370 | 2650 | 2920 | 3060 | 3300 |
| 34 | 2657 | 2358 | 418 | 1310 | 1560 | 1670 | 1840 | 2100 | 2350 | 2600 | 2870 | 3080 | 3250 | 3530 |
| 35 | 4092 | 2610 | 413 | 1600 | 1830 | 1960 | 2110 | 2360 | 2590 | 2850 | 3140 | 3330 | 3490 | 3770 |
| 36 | 8788 | 2835 | 432 | 1780 | 2020 | 2150 | 2320 | 2560 | 2820 | 3100 | 3380 | 3570 | 3730 | 3960 |
| 37 | 18660 | 3089 | 442 | 2030 | 2270 | 2380 | 2550 | 2800 | 3080 | 3370 | 3660 | 3840 | 3960 | 4200 |

Table 14 continued

Table 14 continued

| Gestation (weeks) | No. births | Mean (gm) | Standard Deviation | Percentile (gm) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1st | 3rd | 5th | 10th | 25th | 50th | 75th | 90th | 95th | 97th | 99th |
| 38 | 51404 | 3317 | 431 | 2310 | 2520 | 2620 | 2780 | 3030 | 3310 | 3600 | 3870 | 4050 | 4160 | 4390 |
| 39 | 72871 | 3471 | 426 | 2500 | 2690 | 2790 | 2940 | 3180 | 3460 | 3750 | 4020 | 4200 | 4310 | 4520 |
| 40 | 141553 | 3610 | 432 | 2630 | 2830 | 2920 | 3070 | 3320 | 3600 | 3890 | 4170 | 4340 | 4460 | 4680 |
| 41 | 55946 | 3739 | 443 | 2730 | 2930 | 3030 | 3180 | 3440 | 3730 | 4030 | 4310 | 4490 | 4600 | 4820 |
| 42 | 14781 | 3787 | 463 | 2730 | 2950 | 3040 | 3210 | 3470 | 3780 | 4090 | 4390 | 4570 | 4680 | 4910 |
| 43 | 1267 | 3698 | 501 | 2510 | 2770 | 2910 | 3080 | 3360 | 3680 | 4000 | 4360 | 4580 | 4670 | 4970 |
| 44 | 409 | 3612 | 474 | 2620 | 2720 | 2850 | 3050 | 3290 | 3590 | 3900 | 4270 | 4440 | 4530 | 4790 |

From: Roberts CL & Lancaster PAL. Australian national birthweight percentiles by gestational age. MJA 1999; 170: 114-118.

## Table 15: Birthweight percentile values (g) for live singleton females, Australia, 1991–1994

| Gestation (weeks) | No. births | Mean (gm) | Standard Deviation | Percentile (gm) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1st | 3rd | 5th | 10th | 25th | 50th | 75th | 90th | 95th | 97th | 99th |
| 20 | 12 | 418 | 184 | | | | | | 345 | | | | | |
| 21 | 25 | 414 | 55 | | | | | 400 | 420 | 440 | | | | |
| 22 | 71 | 485 | 85 | | | | 400 | 430 | 480 | 540 | 600 | | | |
| 23 | 79 | 591 | 103 | | | | 470 | 520 | 580 | 640 | 740 | | | |
| 24 | 115 | 661 | 95 | | 490 | 500 | 540 | 600 | 660 | 720 | 780 | 830 | 850 | |
| 25 | 136 | 760 | 116 | | 510 | 560 | 620 | 700 | 750 | 840 | 900 | 960 | 980 | |
| 26 | 188 | 865 | 158 | | 540 | 550 | 680 | 780 | 865 | 960 | 1040 | 1130 | 1180 | |
| 27 | 231 | 944 | 183 | | 600 | 620 | 730 | 830 | 950 | 1070 | 1180 | 1250 | 1280 | |
| 28 | 287 | 1060 | 228 | | 610 | 700 | 760 | 900 | 1070 | 1200 | 1340 | 1400 | 1440 | |
| 29 | 325 | 1233 | 247 | 630 | 720 | 810 | 890 | 1070 | 1250 | 1400 | 1510 | 1580 | 1660 | 1820 |
| 30 | 440 | 1403 | 275 | 740 | 860 | 945 | 1045 | 1220 | 1420 | 1560 | 1730 | 1885 | 1950 | 2100 |
| 31 | 548 | 1581 | 336 | 800 | 990 | 1050 | 1140 | 1360 | 1590 | 1765 | 2000 | 2130 | 2330 | 2560 |
| 32 | 877 | 1797 | 383 | 920 | 1070 | 1170 | 1340 | 1560 | 1780 | 2000 | 2230 | 2470 | 2640 | 2970 |
| 33 | 1200 | 2038 | 403 | 1135 | 1280 | 1385 | 1520 | 1790 | 2040 | 2265 | 2515 | 2755 | 2955 | 3150 |
| 34 | 2086 | 2282 | 439 | 1260 | 1440 | 1570 | 1760 | 2010 | 2260 | 2530 | 2810 | 3090 | 3290 | 3510 |
| 35 | 3418 | 2523 | 433 | 1520 | 1740 | 1840 | 2030 | 2260 | 2490 | 2760 | 3100 | 3340 | 3500 | 3710 |
| 36 | 7320 | 2738 | 433 | 1740 | 1950 | 2060 | 2220 | 2450 | 2720 | 3000 | 3300 | 3505 | 3650 | 3860 |
| 37 | 16105 | 2967 | 432 | 1940 | 2170 | 2280 | 2430 | 2680 | 2960 | 3240 | 3520 | 3700 | 3830 | 4050 |
| 38 | 47809 | 3187 | 419 | 2220 | 2420 | 2520 | 2660 | 2900 | 3170 | 3460 | 3730 | 3900 | 4020 | 4220 |

Table 15 continued

Table 15 continued

| Gestation (weeks) | No. births | Mean (gm) | Standard Deviation | Percentile (gm) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1st | 3rd | 5th | 10th | 25th | 50th | 75th | 90th | 95th | 97th | 99th |
| 39 | 68846 | 3329 | 412 | 2390 | 2580 | 2670 | 2820 | 3050 | 3320 | 3600 | 3860 | 4030 | 4140 | 4340 |
| 40 | 137570 | 3463 | 414 | 2530 | 2720 | 2810 | 2950 | 3180 | 3450 | 3730 | 4000 | 4170 | 4280 | 4490 |
| 41 | 53260 | 3577 | 421 | 2630 | 2820 | 2910 | 3050 | 3290 | 3560 | 3850 | 4130 | 4300 | 4410 | 4620 |
| 42 | 13318 | 3627 | 442 | 2630 | 2830 | 2930 | 3080 | 3320 | 3610 | 3920 | 4210 | 4370 | 4500 | 4700 |
| 43 | 1285 | 3539 | 463 | 2460 | 2710 | 2770 | 2950 | 3240 | 3540 | 3840 | 4120 | 4320 | 4430 | 4620 |
| 44 | 433 | 3490 | 448 | 2420 | 2590 | 2720 | 2930 | 3180 | 3490 | 3800 | 4070 | 4230 | 4320 | 4470 |

From: Roberts CL & Lancaster PAL. Australian national birthweight percentiles by gestational age. MJA 1999: 170: 114-118.

# Appendix 11

## Co-sleeping while breastfeeding: advice to health professionals

Bed sharing while breastfeeding has been associated in some studies with unexpected infant death. This was usually when the mother was very fatigued or under the influence of alcohol or drugs and therefore difficult to arouse once asleep. The mechanism is not thought to be the mother physically compressing the infant but rather the breast interfering with the infant's airflow. Some infants are particularly susceptible to respiratory arrest from minor airway occlusion. Bed sharing with a parent who smokes (even if not smoking in bed and not breastfeeding) increases the risk of Sudden Infant Death Syndrome (SIDS).

### Recommendations

1. Mothers are encouraged to sit up, in or out of bed, with a light on while breastfeeding at night. When a mother is unable to sit up unassisted, breastfeeding should be supervised.
2. Mothers who are taking medication which is sedating or who are excessively fatigued are to be supervised while breastfeeding.
3. A pre-requisite to unattended breastfeeding is a verbal assurance from the mother that clarifies to the staff that the mother is in no significant discomfort, is lucid and feels competent to breastfeed.
4. Infants should sleep in a cot next to their mother's bed when she is sleeping.
5. Pregnant women should receive written information antenatally about the risks when breastfeeding and sedated or fatigued, and about co-sleeping especially if a parent is a smoker. This information should be included in any breastfeeding information, which is distributed in antenatal clinics or antenatal classes.

NOTE: Adapted from Flinders Women and Children Department of Flinders Medical Centre, Adelaide, 2002, with permission.

### Advice to parents on sleeping in the same bed as your baby

Bed-sharing while breastfeeding has been associated in some studies with unexpected infant death. This has usually been when the mother was very fatigued or under the influence of alcohol or drugs and therefore difficult to arouse once asleep. The mechanism is not thought to be the mother physically compressing the infant but rather the breast interfering with the infant's airflow. Some infants are particularly susceptible to respiratory arrest from minor airway occlusion. Bed sharing with a parent who smokes (even if not smoking in bed and not breastfeeding) increases the risk of Sudden Infant Death Syndrome (SIDS).

### Recommendations

1. If you plan to bring your baby to bed, sit up with a light on while breastfeeding.
2. If you are unable to sit up, are taking medication that sedates you, or are excessively tired, it would be a good idea to have someone else in the room while you are breastfeeding.
3. When you plan to go to sleep, it may be better to put your baby in a cot next to your bed.
4. If you decide to keep your baby in your bed, the mattress should be firm, soft quilts or pillows should not be placed under your baby, he/she should be placed on his/her back and waterbeds should not be used.
5. If you smoke or have smoked during pregnancy, it would be better if you didn't bed-share with your baby, as this has been associated with an increased risk of SIDS.

NOTE: Adapted from Flinders Women and Children Department of Flinders Medical Centre, Adelaide, 2002, with permission.

## For more information

**SA Health**
**Maternal, Perinatal and Infant Mortality Committee**
**Pregnancy Outcome Unit**
**PO Box 6, Rundle Mall, Adelaide**
**South Australia  5000 Australia**

**Telephone (08)  8226 6371 or (08)  8226 6357**
**Fax  (08) 8226 6291**

**Web: www.health.sa.gov.au/pehs/pregnancyoutcome.htm**

Non-English speaking: for information in languages other than English, call the interpreting and Translating Centre and ask them to call The Department of Health. This service is available at no cost to you, contact (08) 8226 1990.

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