



**Government of South Australia**

Department of Health

# Maternal, Perinatal and Infant Mortality in South Australia 2004

Including  
The South Australian Protocol  
for the Investigation of Stillbirths

**FEBRUARY 2006**

**NINETEENTH REPORT OF THE MATERNAL,  
PERINATAL AND INFANT MORTALITY COMMITTEE**

on maternal, perinatal and post-neonatal deaths in 2004  
including the South Australian Protocol for investigation of Stillbirths

**DEPARTMENT OF HEALTH**

**Adelaide**

**February 2006**

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## Committees

### Maternal, Perinatal and Infant Mortality Committee

Professor Jeffrey Robinson	<i>Obstetrician, Chairperson</i>
Dr Aileen F. Connon	<i>Obstetrician, Deputy Chairperson</i>
Dr Brian Wheatley	<i>Obstetrician</i>
Dr Scott Simmons	<i>Obstetric anaesthetist</i>
Dr Nicola Spurrier	<i>Paediatrician</i>
Dr James Harvey	<i>Obstetrician</i>
Associate Professor Ross Haslam	<i>Neonatal paediatrician</i>
Professor Marc JNC Keirse	<i>Obstetrician</i>
Associate Professor T. Yee Khong	<i>Pathologist</i>
Dr George Kokar	<i>General practitioner</i>
Mrs Elizabeth Wood	<i>Midwife</i>
Mrs Jane Warland	<i>Midwife</i>
Dr Annabelle Chan	<i>Public health physician, Medical Secretary</i>

### Maternal Subcommittee

Professor Jeffrey Robinson	<i>Obstetrician, Chairperson</i>
Dr Scott Simmons	<i>Obstetric anaesthetist</i>
Dr William Hague	<i>Obstetric physician</i>
Dr James Harvey	<i>Obstetrician</i>
Associate Professor T. Yee Khong	<i>Pathologist</i>
Mrs Elizabeth Wood	<i>Midwife</i>
Dr George Kokar	<i>General Practitioner</i>
Dr Annabelle Chan	<i>Public health physician, Medical Secretary</i>

### **Perinatal Subcommittee**

Professor Marc JNC Keirse	<i>Obstetrician, Chairperson</i>
Professor Gustaaf Dekker	<i>Obstetrician, Deputy Chairperson</i>
Dr Elinor Atkinson	<i>Obstetrician</i>
Associate Professor Ross Haslam	<i>Neonatal paediatrician</i>
Associate Professor T. Yee Khong	<i>Pathologist</i>
Ms Jackie Kitschke	<i>Midwife</i>
Dr Jill Lipsett	<i>Pathologist</i>
Dr Brian Peat	<i>Obstetrician</i>
Ms Margaret Hampton	<i>Manager, Aboriginal health service</i>
Mrs Jane Warland	<i>Midwife</i>
Dr Andrew Grieve	<i>Paediatrician</i>
Dr Scott Simmons	<i>Obstetric anaesthetist</i>
Dr Scott Morris	<i>Neonatal paediatrician</i>
Dr Jeffrey Hillen	<i>Obstetrician</i>
Dr Annabelle Chan	<i>Public health physician, Medical Secretary</i>

### **Post-neonatal Subcommittee**

Dr Aileen F. Connon	<i>Obstetrician, Chairperson</i>
Dr Susan M. Beal	<i>Paediatrician</i>
Dr Harry Burnell	<i>Paediatrician</i>
Professor Roger Byard	<i>Pathologist</i>
Dr Vineesh Bhatia	<i>Neonatal paediatrician</i>
Dr Nicola Spurrier	<i>Paediatrician</i>
Dr Lynette Moore	<i>Pathologist</i>
Associate Professor Victor Nossar	<i>Community paediatrician</i>
Dr Annabelle Chan	<i>Public health physician, Medical Secretary</i>

## Education Subcommittee

Dr Brian Wheatley	<i>Obstetrician, Chairperson</i>
Dr David Morris	<i>Obstetrician</i>
Dr Chris Barnett	<i>Neonatal paediatrician</i>
Mrs Julia Ats	<i>Midwife</i>
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Ms Robyn Kennare	<i>Senior midwife / Minute secretary</i>
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We would like to express our most sincere thanks to the following members who retired from the Perinatal Subcommittee in 2005:

- Dr Jill Lipsett
- Dr Geoffrey Matthews
- Dr Scott Simmons

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## Summary

This is the Nineteenth Annual Report of the Maternal, Perinatal and Infant Mortality Committee, for the year 2004:

1. There were no maternal deaths in South Australia in 2004, but the Committee was advised of a late maternal death in 2003 which had not been previously identified by the Committee. The maternal mortality ratio for direct and indirect deaths in the four years 2001-2004 was 11.5 per 100,000 confinements, which is higher than in the preceding five-year period. The number of deaths was small (eight) and the Committee has examined all the deaths and found no recurring causes for concern.
2. The Committee reviewed the 165 perinatal deaths (113 stillbirths and 52 neonatal deaths) occurring among South Australian born babies in 2004. The perinatal mortality rate for all births (of at least 400g or 20 weeks gestation) was 9.4 per 1,000 births, and the neonatal mortality rate 3.0 per 1,000 live births. The early neonatal mortality rate used for international comparisons remained very low at 0.8 per 1,000 live births.
3. The leading cause of perinatal death in 2004 was congenital abnormality, which accounted for a third of the deaths (33%). Other important causes were stillbirths of unknown cause (12%), specific perinatal conditions (11%), spontaneous preterm labour or rupture of membranes (10%), fetal growth restriction (8%) and perinatal infection (8%). Seventy-five percent of the perinatal deaths occurred in preterm babies (less than 37 weeks gestation). There were 19 stillbirths of unknown cause, a rate of 1.1 per 1,000 births in 2004, compared with 2.0 in 1995-1998. The Committee has distributed its protocol for the investigation of stillbirths to all obstetric units (Appendix 8). Fourteen deaths were attributed to fetal growth restriction. Poor fetal growth and preterm birth have been associated with smoking during pregnancy. Nineteen percent of women who gave birth in South Australia in 2004 smoked during pregnancy.
4. *Eleven babies of Aboriginal mothers died during the perinatal period, of which eight were stillbirths and three were neonatal deaths. The perinatal mortality rate of 22.4 per 1,000 births for Aboriginal mothers in 2004 was much higher than that of 9.0 per 1,000 for non-Aboriginal mothers. Preterm and small-for-gestational-age births are twice as high among births to Aboriginal mothers compared with non-Aboriginal mothers. The proportion of low birthweight births was nearly three times as high. These births are associated with a higher rate of smoking during pregnancy of 58% among Aboriginal women compared with 19% among non-Aboriginal women.*
5. The Committee also reviewed the 31 post-neonatal deaths among South Australian born babies in 2004. The post-neonatal mortality rate was 1.8 per 1,000 live births, slightly higher than the previous four years. However, the

rate of 0.1 per 1,000 live births due to SIDS (Sudden Infant Death Syndrome) was the lowest ever recorded in the state. This rate declined dramatically following the introduction in 1990 of the educational campaign aimed at reducing the prevalence of risk factors for SIDS, including prone sleeping. In 2001-2004 there was an annual average of 3 or 4 post-neonatal deaths from SIDS compared with 40 in 1986-1989. The infant mortality rate in 2004 was 4.8 per 1,000 live births. *There were six post-neonatal deaths of babies of Aboriginal mothers. The 2004 infant mortality rate for babies of Aboriginal mothers of 18.6 per 1,000 live births was substantially higher than that of 4.4 for babies of non-Aboriginal mothers.*

6. From reviewing perinatal deaths in 2004, the Committee recommends
  - caring for pregnant women in a setting which is appropriate for the level of risk the pregnancy presents for the mother and/or the baby: home birth is not appropriate for twins, breech presentations and post-term pregnancies;
  - vigilance to ensure that fetal growth restriction is not missed;
  - that health professionals implement effective strategies to reduce smoking in pregnancy, including culturally appropriate smoking cessation interventions for Aboriginal women.
  - screening for Group B Streptococcus in late pregnancy and giving intrapartum antibiotic prophylaxis to carrier mothers.
7. From reviewing maternal and perinatal deaths in recent years, the Committee also recommends
  - review by a physician early in pregnancy of women with current or previous serious medical conditions;
  - appropriate training and maintenance of competence in cardiotocograph (CTG) interpretation for all levels of medical and midwifery staff;
  - the institution of streamlined arrangements between rural/level I hospitals and their regional level II/III maternity service in situations where on-site CTG expertise in the rural/level I hospital is insufficient;
  - the development of statewide protocols for level I, II and III maternity services with an emphasis on timely recognition and proactive management of fetal growth restriction, preterm rupture of membranes, meconium-stained liquor, antepartum haemorrhage and 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; and of sending placentas for

histological examination (see Appendix 9). The **State Perinatal Autopsy Service** (telephone on **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 37).

8. From the review of the post-neonatal deaths in 2004, the Committee recommends the following:
  - health professionals providing care in the antenatal or postnatal period should ensure that women are provided with information about safe infant sleeping practices and prevention of SIDS. Parents should ensure that cots meet safety standards. Co-sleeping or bed-sharing may be hazardous for the infant, especially when a parent is under the influence of drugs or alcohol (see Appendix 11). Care should be taken with the use of blankets, pillows and other items in cots which may cause suffocation. Infants should not be allowed to sleep unattended in stroller-prams and bouncinettes.
  - babies should never be left alone or with a sibling in a bath with water, with or without a device such as a ring bath seat.
  - 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 until the end of infancy, if not for a longer period of time.
  - professional advice should be sought for infants who are excessively drowsy or irritable. These infants should be considered seriously ill unless proved otherwise.
  - professional advice should be sought for infants who are feeding poorly, as these infants can become dehydrated very quickly.
  - peripheral hospitals with high paediatric throughput need adequate provision of paediatric expertise.
  - appropriate paediatric protocols need to be distributed to all hospitals.
9. In reviewing infant deaths in recent years, the Committee recommends
  - 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.
  - 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.



## I Introduction

This is the Nineteenth 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 the South Australian Department of 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 Health Commission Act, members of the Committee and its Subcommittees are authorized, 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.

New legislation governing the registration of births, deaths and marriages in South Australia came into operation on 3 June 1996, and with it a revised form of medical certificate of cause of death (Appendix 2B), which identifies pregnancy within three months before death and assists in identifying maternal deaths. *The new form requires identification as to whether the deceased was of Aboriginal or Torres Strait Islander origin.*

Further information is obtained from medical 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, eg 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 Nineteenth Report of the Committee incorporates information on maternal, perinatal and post-neonatal deaths in South Australia in the year 2004.

*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 Services Division of the Department of Health has a nominee on the Committee to address areas of concern in relation to Aboriginal maternal, perinatal and infant health.*

## II Maternal, Perinatal and Infant Mortality Statistics 2004

### 1. Maternal mortality 2004

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.<sup>1</sup> 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 now complies with international reporting protocols<sup>2</sup> 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 confinements. 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. At the request of this national committee, 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 were no direct or indirect maternal deaths in 2004. The Committee was advised of the death in 2004 of a woman 12 weeks after the end of pregnancy. The Committee reviewed this death and attributed its cause to homicide in the context of domestic violence. This death was not related to pregnancy (incidental death) and occurred outside the 42 day limit. The Committee was also advised of a death in 2003, which occurred about seven weeks after an early surgical termination of pregnancy, which it had not previously reported. This was considered to be due to obstetric causes, that is, a late direct maternal death, but has not been included in the 2003 maternal mortality statistics as it occurred outside the 42 day limit.

Maternal deaths in South Australia for the three categories of deaths from 1961 to 2000 are presented in Table 1 by 5-year periods, and for four years for the

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<sup>1</sup> World Health Organization. International Statistical Classification of Diseases and Related Health Problems. Tenth Revision. Volume 2. Geneva: WHO, 1993.

<sup>2</sup> Slaytor EK, Sullivan EA, King JF. Maternal Deaths in Australia 1997-1999. Canberra:AIHW, 2004.

most recent period 2001-2004. Maternal mortality ratios have been calculated for direct and indirect deaths (Table 1 and Figure 1). The maternal mortality ratio for the last four-year period 2001-2004 was 11.5 deaths per 100,000 confinements. This is higher than the ratio for the preceding five-year period 1996-2000 which was 6.6 deaths per 100,000 confinements. However, this most recent period is incomplete for purposes of comparison with earlier five-year periods and the number of deaths is small. The Committee reviewed all the deaths and found no recurring pattern of causes of death.

*Of a total of 36 pregnancy-related maternal deaths in the period 1986-2004, 14 were direct deaths and 22 were indirect deaths. Three of the 14 direct deaths and four of the 22 indirect deaths were of Aboriginal women. As Aboriginal women accounted for only 2% of confinements 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 – 2004**

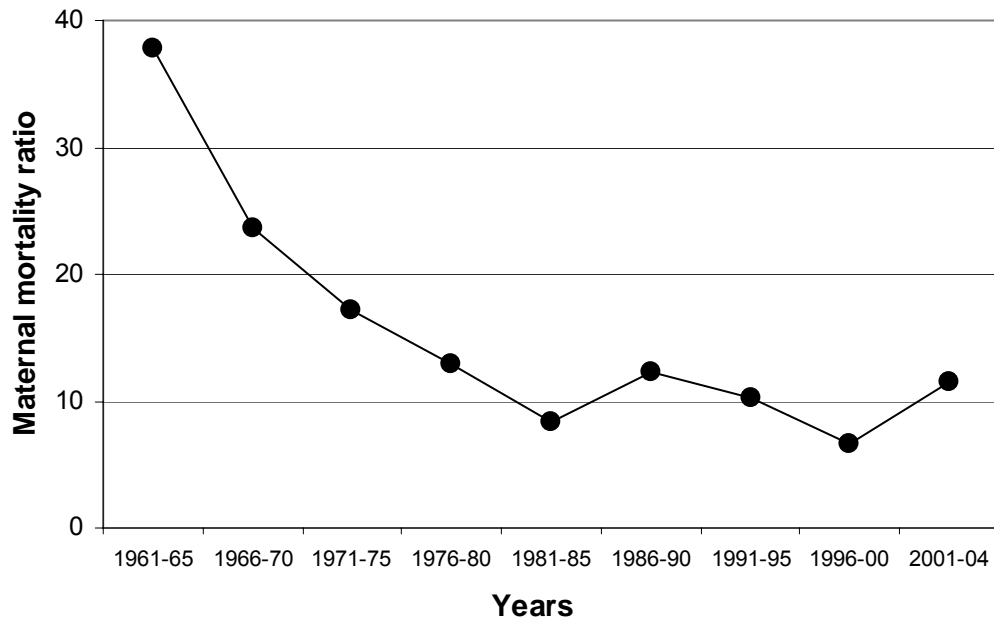
Years	Direct deaths	Indirect deaths	Incidental deaths	Total deaths	Direct and indirect maternal deaths	
	Number	Number	Number	Number	Number	Maternal mortality ratio*
1961 – 1965	34	6	13	53	40	37.8
1966 – 1970	21	4	8	33	25	23.7
1971 – 1975	17	1	6	24	18	17.2
1976 – 1980	6	6	2	14	12	12.9
1981 – 1985	3	5	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 – 2004**	4	4	0	8	8	11.5

\*Expressed as deaths per 100,000 confinements

\*\* Incomplete 5 year period.

**Figure 1: Maternal Mortality Ratio, South Australia 1961-2004**

Direct and Indirect Deaths per 100,000 Confinements



## 2. Perinatal mortality 2004

### (1) Perinatal mortality rates

In 2004 there were 17,522 births of at least 400g birthweight or 20 weeks gestation notified to the South Australian perinatal data collection. Of these, 113 were stillbirths. Of the 17,409 live births, 52 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 2004 was 9.4 deaths per 1,000 births. The stillbirth rate was 6.4 deaths per 1,000 births and the neonatal mortality rate 3.0 deaths per 1,000 live births. Forty-five of the 165 perinatal deaths (27.3%) were terminations of pregnancy. The exclusion of terminations would have resulted in a perinatal mortality rate of 6.8 deaths per 1,000 births. Forty-two perinatal deaths were less than 400g birthweight.

For international comparisons, only births of at least 1,000g birthweight and early neonatal deaths within the first seven days of life are included. This perinatal mortality rate for international comparisons was 3.5 deaths per 1,000 births and the early neonatal mortality rate was 0.8 deaths per 1,000 live births.

**Table 2: Perinatal mortality, South Australia, 2004**

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	17,522	17,409	113	6.4	52	3.0	165	9.4
≥500g/22 weeks*	17,460	17,388	72	4.1	34	2.0	106	6.1
					28**	1.6	100**	5.7
≥1,000g/28 weeks*	17,379	17,332	47	2.7	19	1.1	66	3.8
					14**	0.8	61**	3.5

\*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 comparisons, 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 comparisons. 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.

Table 3 shows that the perinatal mortality rate for South Australia over the years has generally tended to be lower than the national rate, although it has been marginally higher in the last three years. These rates for South Australia and Australia for 1990-2003 from the Australian Bureau of Statistics (ABS) are presented graphically in Figure 2. The South Australian rates provided by the ABS may differ slightly from those provided by the Committee as the ABS rates are based on deaths and births of at least 400g birthweight (or, if birthweight was unavailable, 20 weeks gestation) registered (not occurring) in the year and adjusted for state of usual residence of the mother. *Statistics provided by the Australian Bureau of Statistics on Aboriginal births and perinatal and infant deaths also include births where either parent is Aboriginal, whereas the Committee's reports are based on the perinatal data collection which categorises births only by mother's ethnicity.*

South Australian perinatal mortality rates, including stillbirth and neonatal mortality rates, for 1983-2004 from Committee data are presented in Figure 3 for all births. Rates for births of at least 1,000g birthweight (or when birthweight was unavailable, 28 weeks gestation,) are presented in Figure 4. Figure 4 includes only neonatal deaths 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 that in the stillbirth rate. The stillbirth rate for all births has not decreased over the last two decades, although a decrease is evident if only births of at least 1,000g birthweight are considered.

**Table 3: Perinatal mortality rate\*, Australian states, 1990 – 2003**

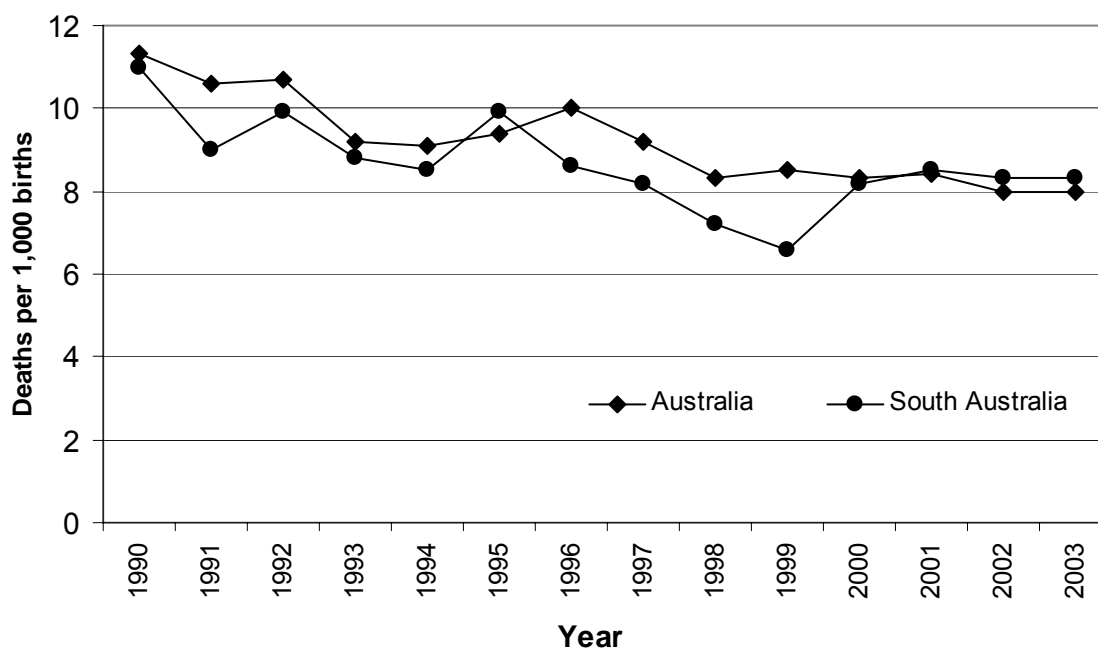
Year	NSW	VIC	Qld	SA	WA	Tas	NT	ACT	AUSTRALIA
1990	11.7	11.6	10.2	11.0	10.4	10.6	18.1	13.8	11.3
1991	11.0	9.8	11.1	9.0	10.3	11.9	18.2	12.5	10.6
1992	11.8	9.4	10.6	9.9	9.8	9.1	19.3	9.4	10.7
1993	9.5	8.5	9.4	8.8	8.3	10.0	21.1	7.7	9.2
1994	9.2	9.3	8.9	8.5	8.3	8.4	16.9	6.9	9.1
1995	8.9	9.2	9.8	9.9	9.3	9.7	16.3	9.2	9.4
1996	11.0	8.8	10.0	8.6	10.2	9.5	12.6	8.8	10.0
1997	9.8	8.5	9.1	8.2	8.1	11.6	15.5	6.6	9.2
1998	8.1	7.7	9.6	7.2	7.5	9.8	13.1	12.2	8.3
1999	8.1	9.2	8.2	6.6	8.3	10.7	16.1	11.7	8.5
2000	7.7	7.9	8.9	8.2	8.4	10.6	14.5	8.3	8.3
2001	7.8	8.7	9.7	8.5	7.9	5.6	12.2	8.3	8.4
2002	7.2	8.3	8.8	8.3	7.1	12.9	10.4	5.6	8.0
2003	6.8	8.8	7.8	8.3	8.2	11.9	15.2	9.4	8.0

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

Source: Australian Bureau of Statistics. 2003 Causes of Death Australia. Catalogue No 3303.0. Canberra: 2005.

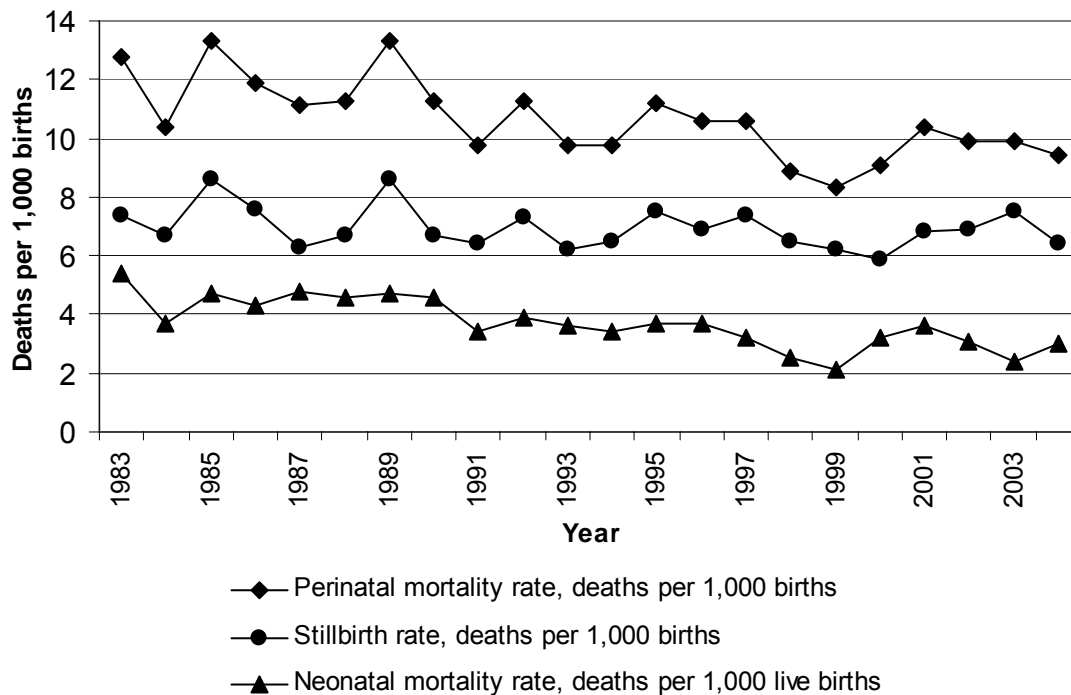
**Figure 2: Perinatal Mortality Rates South Australia and Australia 1990-2003**

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



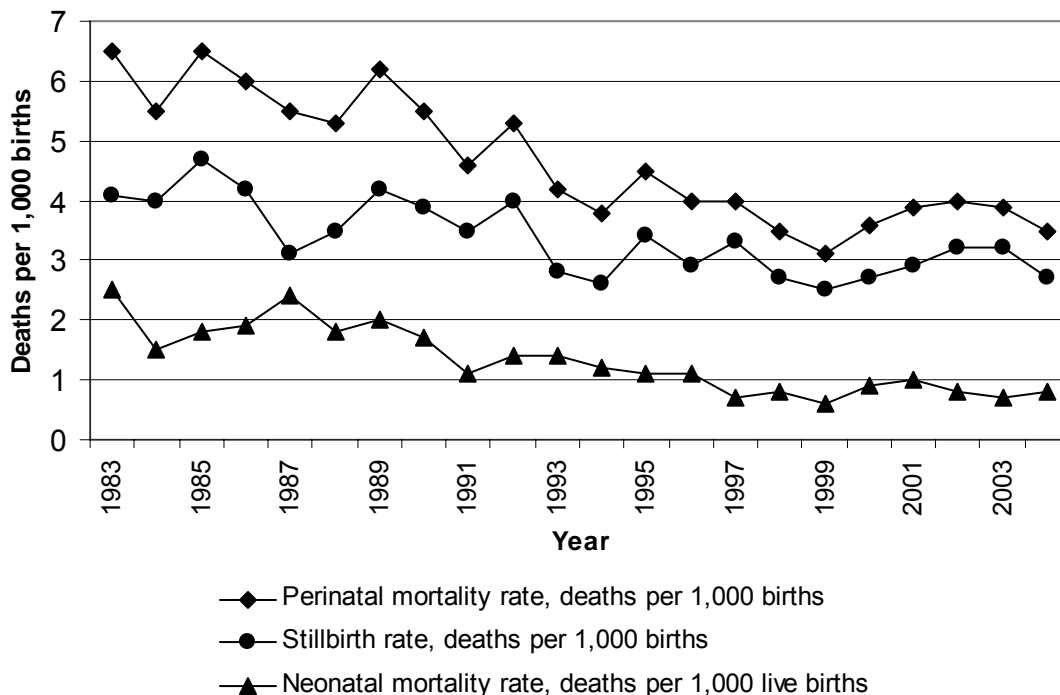
Source: Australian Bureau of Statistics, 2003 Causes of Death Australia. Cat. No. 3303.0, 2005

**Figure 3: Perinatal mortality rate ( $\geq 400\text{g}$  / 20 weeks gestation), South Australia 1983-2004**



Births of at least 400g birthweight or 20 weeks gestation

**Figure 4: Perinatal mortality rate ( $\geq 1,000\text{g}$  / 28 weeks gestation), South Australia 1983-2004**



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

## (2) Birthweight-specific perinatal mortality

The distribution of stillbirths and neonatal deaths by birthweight, and birthweight-specific perinatal mortality rates for 2004 are provided in Table 4. One hundred and twenty-five (75.8%) of the 165 perinatal deaths occurred in babies of low birthweight (<2,500g) and 123 (74.5%) of the deaths were preterm births (<37 weeks gestation).

One hundred and thirteen stillbirths accounted for 68.5% of the perinatal deaths in 2004. There were 49 intrapartum stillbirths, 38 of which were under 750g birthweight (Table 5). Thirty-two of these intrapartum stillbirths were terminations of pregnancy. Forty-one of the 52 neonatal deaths (78.8%) were low birthweight babies and 13 neonatal deaths resulted from terminations of pregnancy.

**Table 4: Perinatal mortality by birthweight, South Australia, 2004, (all births 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	42	10	32	761.9	8	800.0	40	952.4
400-499*	20	11	9	450.0	10	909.1	19	950.0
500-749	52	36	16	307.7	14	388.9	30	576.9
750-999	29	20	9	310.3	1	50.0	10	344.8
1,000-1,499	124	118	6	48.4	4	33.9	10	80.6
1,500-1,999	246	241	5	20.3	0	0	5	20.3
2,000-2,499	718	711	7	9.7	4	5.6	11	15.3
2,500-2,999	2,657	2,646	11	4.1	4	1.5	15	5.6
3,000-3,499	6,196	6,187	9	1.5	2	0.3	11	1.8
3,500-3,999	5,411	5,405	6	1.1	3	0.6	9	1.7
4,000-4,499	1,732	1,731	1	0.6	2	1.2	3	1.7
4500+	295	293	2	6.8	0	0	2	6.8
<b>Total</b>	<b>17,522</b>	<b>17,409</b>	<b>113</b>	<b>6.4</b>	<b>52</b>	<b>3.0</b>	<b>165</b>	<b>9.4</b>

\* includes one stillbirth of unknown birthweight at 20 weeks gestation.

**Table 5: Time of perinatal death by birthweight, South Australia, 2004 (births of at least 400g birthweight or 20 weeks gestation)**

Birthweight (grams)	Stillbirths		Neonatal deaths	Total
	Antepartum	Intrapartum		
<500*	14	27*	18	59
500-749	5	11	14	30
750-999	7	2	1	10
1,000-1,499	6	0	4	10
1,500-1,999	5	0	0	5
2,000-2,499	6	1	4	11
2,500-2,999	7	4	4	15
3,000-3,499	6	3	2	11
3,500-3,999	5	1	3	9
4,000-4,499	1	0	2	3
4,500+	2	0	0	2
<b>Total</b>	<b>64</b>	<b>49</b>	<b>52</b>	<b>165</b>

\*Includes one stillbirth of unknown birthweight at 20 weeks gestation.

### (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, 2004 (births 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	73	27	46	630.1	26	963.0	72	986.3
24-27	83	72	11	132.5	9	125.0	20	241.0
28-31	143	128	15	104.9	2	15.6	17	118.9
32-36	1,228	1,219	9	7.3	5	4.1	14	11.4
37-41	15,905	15,874	31	1.9	10	0.6	41	2.6
42+	90	89	1	11.1	0	0	1	11.1
<b>Total</b>	<b>17,522</b>	<b>17,409</b>	<b>113</b>	<b>6.4</b>	<b>52</b>	<b>3.0</b>	<b>165</b>	<b>9.4</b>

### 3. Post-neonatal and infant mortality 2004

There were 31 post-neonatal deaths among South Australian-born babies in 2004.

The post-neonatal death rate for South Australia for 2004 was 1.8 deaths per 1,000 live births, which was higher than the previous four years. The post-neonatal death rate due to Sudden Infant Death Syndrome (SIDS) fell to its lowest level of 0.1 death per 1,000 live births. The numbers of post-neonatal deaths and the post-neonatal death rates for South Australia for all years from 1986 to 2004 are presented in Table 7 and the rates for 1971-2004 in Figure 5, together with the relative contribution from SIDS.

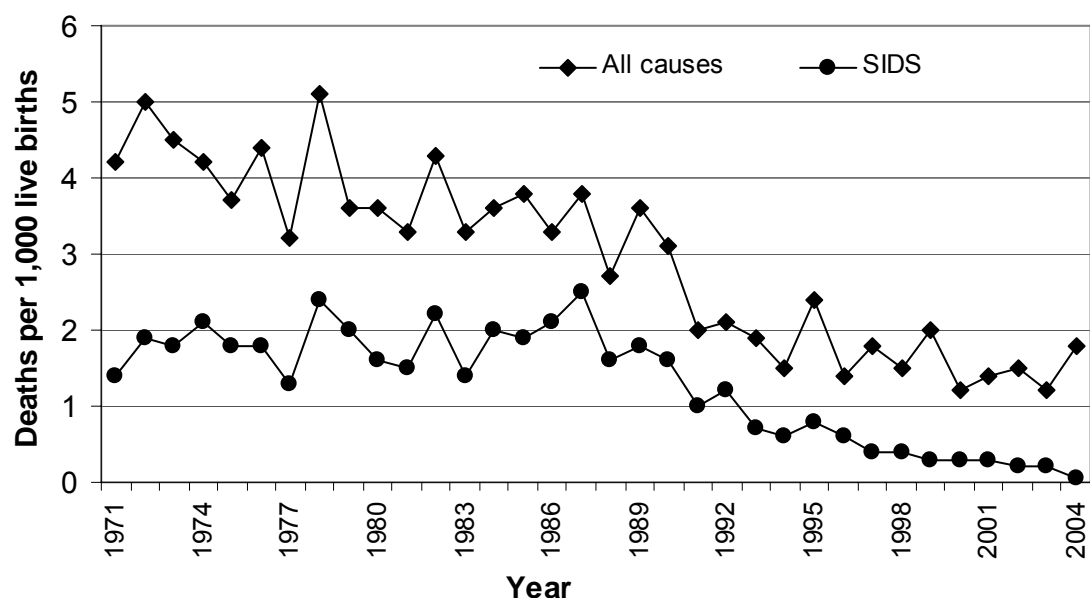
**Table 7: Post-neonatal deaths and death rate, South Australia, 1986 – 2004**

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

The infant mortality rate for South Australia for 2004 was 4.8 deaths per 1,000 live births, which was higher than the previous two years. This includes all deaths of infants under 1 year of age, that is, the 52 neonatal deaths and the 31 post-neonatal deaths (Appendix 3). *The infant mortality rate for babies of Aboriginal mothers (with six post-neonatal deaths and three neonatal deaths out of 483 live births) was 18.6 deaths per 1,000 live births, which is more than four times higher than the infant mortality rate of 4.4 deaths per 1,000 live births for babies of non-Aboriginal mothers.* Infant mortality rates for all Australian states for 1987-2003 from the Australian Bureau of Statistics are presented in Table 8: the rates for 2004 are not yet available. Rates for South Australia compared with Australia

for 1979-2003 (Figure 6) demonstrate that the South Australian infant mortality rate has generally been lower than the national rate. 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.

**Figure 5: Post-neonatal death rates, South Australia, 1971 – 2004**

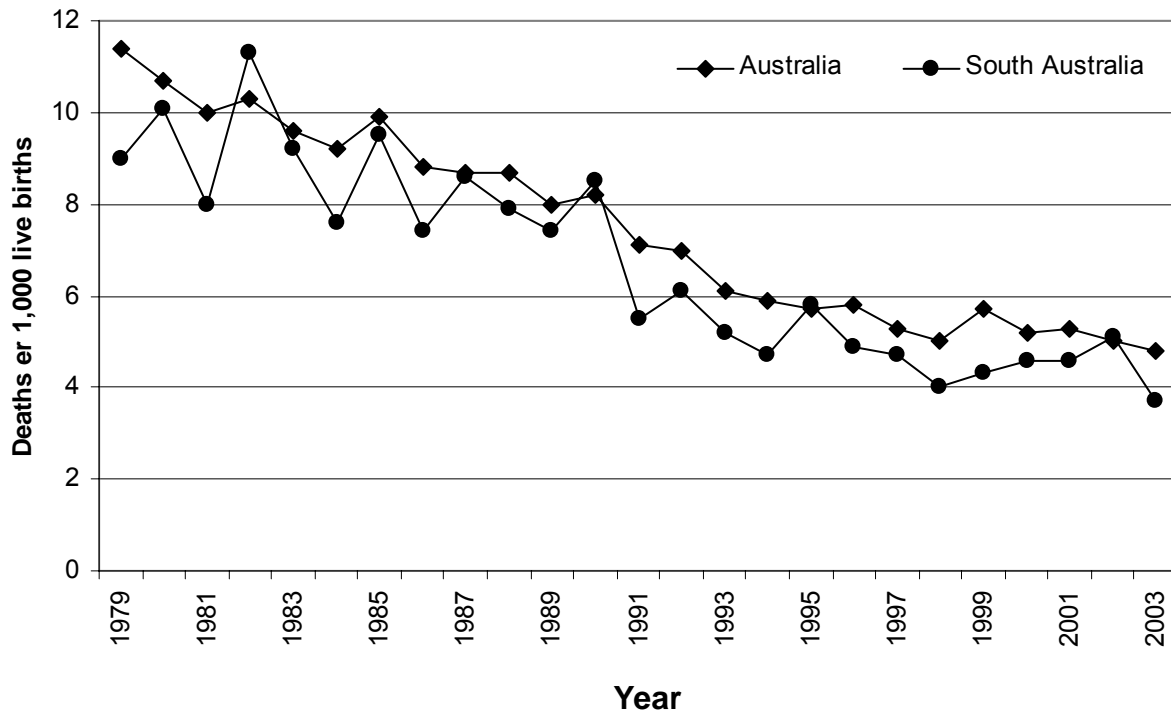


**Table 8: Infant mortality rates (per 1,000 live births), Australian states, 1987 – 2003**

Year	NSW	Vic	Qld	SA	WA	Tas	NT	ACT	Australia
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

Source: Australian Bureau of Statistics. Deaths Australia 2003. Catalogue No 3302.0. Canberra: ABS 2004

**Figure 6: Infant mortality rates, South Australia and Australia, 1979-2003**



Source: Australian Bureau of Statistics. Deaths Australia 2003. Catalogue No. 3302.0, 2004

## **III Causes of death 2004**

### **1. Causes of maternal deaths 2004**

The Committee reviewed the death of a woman which occurred 12 weeks after the end of pregnancy. This was an incidental death from homicide in the context of domestic violence. As this death was not related to pregnancy and occurred outside the 42 day limit for maternal deaths, it will not be included in the maternal mortality statistics.

The Committee was also advised about a death in 2003 of a woman about seven weeks after the end of pregnancy, which it had not previously reported. This woman had an apparently uncomplicated first trimester termination of pregnancy. However, she developed daily vomiting after the procedure and epigastric pain three days later. A laparotomy revealed transmural necrosis of the stomach and a total gastrectomy was performed. *Streptococcus pyogenes* was cultured from the blood and peritoneal swab, a diagnosis of phlegmonous gastritis and streptococcal septicaemia was made and she was treated with antibiotics. Investigation for continuing abdominal discomfort led to further laparotomies and treatment for a methicillin-resistant *Staphylococcus aureus* (MRSA) pelvic abscess. Death was attributed to the complications of MRSA peritonitis complicating total gastrectomy for *Streptococcus pyogenes* phlegmonous gastritis. Phlegmonous gastritis is an extremely rare condition for which diagnosis is difficult. This was considered to be a late direct maternal death.

### **2. Causes of perinatal deaths 2004**

#### **(1) Classification of perinatal deaths**

The Perinatal Subcommittee classified each of the 165 perinatal deaths which occurred in 2004 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](http://www.psanz.org.au)) and will be regularly updated by the PSANZ Perinatal Mortality Special Interest Group.

The classification of perinatal deaths in 2004 according to PSANZ-PDC is as follows (Table 9):

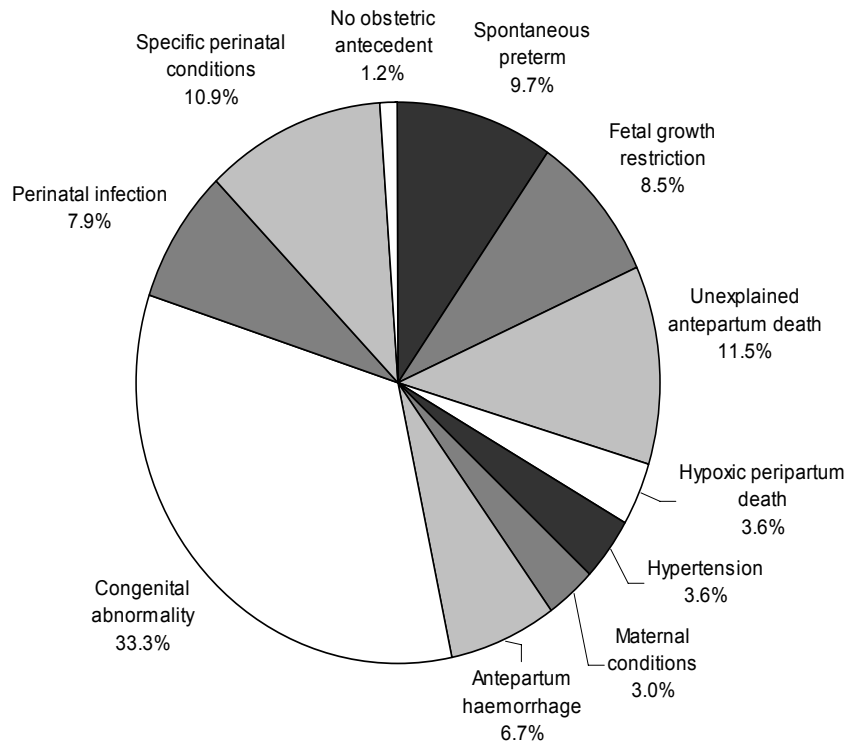
**Table 9: Classification of perinatal deaths, PSANZ-PDC, South Australia, 2004**

	<b>PSANZ-PDC</b>	<b>Number</b>	<b>Percent</b>	<b>Deaths per 1,000 births</b>
1.	Congenital abnormality	55	33.3	3.1
2.	Perinatal infection	13	7.9	0.7
3.	Hypertension	6	3.6	0.3
4.	Antepartum haemorrhage (APH)	11	6.7	0.6
5.	Maternal conditions	5	3.0	0.3
6.	Specific perinatal conditions	18	10.9	1.0
7.	Hypoxic peripartum death	6	3.6	0.3
8.	Fetal growth restriction	14	8.5	0.8
9.	Spontaneous preterm	16	9.7	0.9
10.	Unexplained antepartum death	19	11.5	1.1
11.	No obstetric antecedent	2	1.2	0.1
	<b>Total</b>	<b>165</b>	<b>100.0</b>	<b>9.4</b>

The PSANZ-PDC for perinatal deaths in 2004 is shown graphically in Figure 7 and its breakdown by subgroups and birthweight groups is provided in Appendix 4 and Appendix 5.

Congenital abnormalities were the leading cause of perinatal death in 2004, accounting for a third of all deaths. The contribution of this group has increased in comparison with previous years, as has its rate per 1,000 births. On the other hand, there was a fall in the percentage, as well as the rate per 1,000 births, of deaths classified in the 'Unexplained antepartum death' group. The rate of unexplained antepartum deaths fell from 2.0 per 1,000 births in 1995-1998 to 1.1 per 1,000 births in 2004.

**Figure 7: Perinatal deaths in South Australia 2004, by PSANZ-PDC (N=165)**



A brief description of each of the 11 groups follows.

**1. Congenital abnormality – 55 deaths**

This group of 55 deaths includes terminations of pregnancy at 20 weeks gestation or greater for fetuses with congenital abnormalities. The types of abnormalities were as follows, with the numbers of terminations of pregnancy also shown in parentheses:

Central nervous system	9	(9)
Cardiovascular	11	(6)
Urinary tract	7	(5)
Gastrointestinal tract	1	(1)
Chromosomal	16	(14)
Multiple	8	(7)
Other	3	(1)

Of the nine infants with central nervous system abnormalities, three had neural tube defects, two had abnormalities of the corpus callosum, two had cerebellar abnormalities and two had hydrocephalus.

The 11 infants with cardiovascular abnormalities had the following:

- Hypoplastic left heart syndrome – two babies;
- Hypoplastic left ventricle;

- Atrioventricular septal defects and other cardiac abnormalities in a pair of twins;
- Ebstein anomaly;
- Total anomalous pulmonary venous drainage and coarctation of the aorta;
- Hypoplastic right heart with tricuspid atresia – two babies;
- Congenital cardiomyopathy of undetermined aetiology and
- Endocardial fibroelastosis associated with hydrops fetalis.

Seven babies with urinary tract abnormalities had the following:

- Renal agenesis of one kidney and cystic dysplasia of the other;
- Cystic dysplastic kidneys;
- Autosomal recessive polycystic kidney disease;
- Renal tubular dysgenesis (there was a history of maternal buprenorphine dependence);
- Three babies with bladder outlet obstruction and obstructive uropathy. One case was due to posterior urethral valves, another to stenosis of the posterior urethra and the third to urethral atresia.

One infant had a gastro-intestinal tract abnormality.

The 16 babies with chromosomal abnormalities had the following:

- Trisomy 21 (seven babies, three of whom had congenital cardiac abnormalities);
- Trisomy 13 (two babies).
- Trisomy 18 (two babies);
- Triploidy, associated with multiple defects;
- Mosaic trisomy 20 and
- Chromosomal deletion or duplication (three babies).

There were eight babies with multiple congenital abnormalities, as follows:

- Renal agenesis and cardiac abnormalities.
- Microcephaly and a cardiac abnormality;
- Amniotic band syndrome: there were three babies, all of whom had multiple defects;
- Hydrops fetalis with renal and cerebral abnormalities, pulmonary hypoplasia and talipes equinovarus;

- Limb reduction and skeletal abnormalities with agenesis of one lung and preauricular skin tags and
- Ectopia vesicae and other urinary and gastrointestinal tract abnormalities, exomphalos and meningocele.

The three babies with 'other' fetal abnormalities had the following:

- exomphalos;
- thanatophoric dysplasia Type I and
- fetal akinesia syndrome with hydrops, arthrogryposis and severe pulmonary hypoplasia, attributed to intrauterine myositis.

## 2. *Perinatal infection – 13 deaths*

This group included four stillbirths infected with Group B Streptococcus. Three were term pregnancies. One pregnancy was complicated by maternal marijuana use, urinary tract infection, pregnancy hypertension and fetal growth restriction; another was complicated by prolonged pre-labour rupture of membranes and an associated Klebsiella pneumoniae infection and the third by genital tract colonization and urinary tract infection with Group B Streptococcus. In the fourth pregnancy, spontaneous labour and rupture of membranes with cord prolapse occurred at 21 weeks gestation.

There was one death from E coli sepsis. The mother of this preterm birth had a urinary tract infection and preterm pre-labour rupture of membranes. There was clinical and histological evidence of chorioamnionitis.

Four deaths were attributed to other bacterial infections. In one case of preterm labour, Haemophilus influenzae was cultured from the maternal vaginal swab as well as the fetal blood and lungs. This mother had Hepatitis C infection in pregnancy and smoked heavily. Another case was associated with fetal growth restriction and possible cord compression; in this case Pseudomonas fluorescens /putida group was isolated from the gastric swab. In the third case, preterm birth occurred at 21 weeks gestation after early intermittent bleeding. The placenta showed acute chorioamnionitis and a placental swab grew Mycoplasma/Ureaplasma. In the fourth case which also involved chorioamnionitis and preterm labour, coagulase negative Staphylococcus was cultured from the fetal blood. The mother had a renal abnormality and recurrent urinary tract infections.

In two other deaths associated with chorioamnionitis and preterm labour, the organism was not identified.

In one case of intrauterine death at 23 weeks gestation, widespread infection with Cytomegalovirus was demonstrated. In another case of intrauterine death at term, there was evidence of acute chorionitis and funisitis and an equivocal result for recent infection with Herpes simplex virus type 1.

### **3. Hypertension – six deaths**

All six deaths were associated with pre-eclampsia and five of these babies were born preterm. Three deaths were associated with fetal growth restriction: emergency caesarean section was performed in two cases for fetal growth restriction and worsening maternal or fetal condition. One of these babies was born at 24 weeks gestation and the other at 33 weeks; the latter developed necrotizing enterocolitis and died of septic shock following surgery. The third baby which was growth restricted died in utero at 26 weeks gestation. This pregnancy was also associated with maternal smoking and substance use and E coli urinary tract infection. Another mother had labour induced at 24 weeks gestation for pre-eclampsia and an abnormal CTG. There was severe chorioamnionitis in this case. A fifth mother was found to be hypertensive when she first presented at 27 weeks gestation. She left the hospital and presented again at 35 weeks with fulminant pre-eclampsia, placental abruption and intrauterine fetal death. The sixth mother had a history of epilepsy for which she was receiving treatment. Hypertension was detected during pregnancy and fetal death was diagnosed after a seizure at 38 weeks gestation, which was attributed to eclampsia.

### **4. Antepartum haemorrhage – 11 deaths**

There were eight deaths from placental abruption and three from APH of undetermined origin.

### **5. Maternal conditions - five deaths**

There were five deaths from maternal causes. One death of a macrosomic baby was attributed to gestational diabetes mellitus. Another mother who was pregnant with twins had a motor vehicle accident at 27 weeks gestation and sustained trauma to her lower abdomen. The twins were delivered by emergency caesarean section because of fetal distress. The affected twin was pale and shocked at birth. Ultrasound showed evidence of intracranial haemorrhage which resulted in disseminated intravascular coagulation and death. A pair of twins was stillborn at 35 weeks after their mother experienced a severe hepatic haemorrhage with intra-abdominal extravasation and shock. The fifth baby died following termination of pregnancy for a mother who had anti-phospholipid syndrome and multiple hepatic infarcts: this pregnancy was also complicated by oligohydramnios and fetal growth restriction.

### **6. Specific perinatal conditions – 18 deaths**

These deaths were due to the following:

- Twin-twin transfusion – seven deaths, including two sets of twins;
- Fetomaternal haemorrhage – three deaths.
- Antepartum cord complications – three deaths. There were two cases of intrauterine fetal death at term in which a true knot in the cord was

demonstrated. The third death was that of an undiagnosed twin. The mother's pregnancy was diagnosed at 35 weeks gestation and spontaneous labour occurred at term. The first twin was live born normally and the second twin stillborn 10 minutes later. This twin was found to have a partially severed cord with an area of ulceration and features of fetal thrombotic vasculopathy.

- Uterine abnormalities – three deaths. All these were attributed to cervical incompetence in women with previous histories of miscarriage. Two deaths were associated with preterm rupture of membranes and chorioamnionitis.
- Idiopathic hydrops fetalis – one death. This intrauterine death at 28 weeks gestation was attributed to maternal Warfarin therapy for mitral valve replacement. This fetus had large subdural haematomas and extensive cerebral necrosis.
- Other perinatal conditions – one death. This mother had an amniocentesis at 19 weeks gestation and developed signs of chorioamnionitis two days later, followed by spontaneous rupture of membranes.

#### 7. *Hypoxic peripartum death – six deaths.*

- One death was associated with cord prolapse during labour. This mother had pre-eclampsia and fetal distress was noted during labour at term. A forceps delivery was performed with difficulty and cord prolapse occurred during the procedure.

Three other deaths in this group were associated with the following;

- Delay in the birth of the second twin in a planned home birth. The first twin was born rapidly at home at term. There was delay in the birth of the second twin, and fetal distress was noted in sonicaid monitoring. The mother was transferred to hospital and emergency caesarean section performed within minutes of arrival, but the baby was in poor condition at birth and died two days later of multiorgan failure.
- Persistent occipito-posterior position and delay in the second stage of labour. This pregnancy was complicated by pre-eclampsia. Labour was induced at 39 weeks because of reduced fetal movements and brisk maternal reflexes, hypertension and oedema. During the second stage, Kielland's forceps rotation was unsuccessful and fetal bradycardia was noted. At emergency caesarean section, the fetal head was found to be deeply impacted in the pelvis in occipito-posterior position. The head was delivered with manual rotation, but the infant was in poor condition at birth and resuscitation attempts failed.
- Deep transverse arrest and cord compression with failure to progress in the second stage. This mother had labour induced at term+ 6 days and fetal distress was noted during the second stage of labour. Forceps delivery was unsuccessful and emergency caesarean section was undertaken for deep

transverse arrest. At caesarean section the cord was found entangled over the neck and shoulder and difficulty was encountered in releasing the infant. The infant was in poor condition at birth and died at nearly three days of age.

- There were no apparent complications in two other deaths. In one pregnancy, there was a bicornuate uterus and a hypercoiled umbilical cord and in the other, placental histology showed chorioamnionitis and thrombosis of the chorionic plate fetal vessels.

#### **8. *Fetal growth restriction – 14 deaths***

In 13 deaths in this group, there was evidence of uteroplacental insufficiency: in seven of these, maternal smoking during pregnancy was reported; in one other case, there was a history of maternal smoking as well as substance abuse and psychiatric disorder. In one other death which occurred during labour, placental histology showed non-specific chronic villitis and decidual necrosis without established chorioamnionitis.

#### **9. *Spontaneous preterm (<37 weeks gestation) – 16 deaths***

In seven deaths the membranes were ruptured for less than 24 hours before birth: in five of these there was histological evidence of chorioamnionitis; in one there was no chorioamnionitis and in the remaining death the placenta was not examined.

In seven deaths, the membranes had been ruptured for at least 24 hours. Four of the placentas showed evidence of chorioamnionitis.

In two deaths, in which the duration of membrane rupture was unknown, there was no examination of the placenta.

#### **10. *Unexplained antepartum death – 19 deaths***

In eight deaths there was evidence of uteroplacental insufficiency; in 10 deaths there was no evidence of such placental pathology or chronic villitis, and the placenta was not examined in one case.

#### **11. *No obstetric antecedent – two deaths***

One neonatal death of undetermined cause occurred at three weeks of age. The mother breastfed the infant in bed lying on one side and fell asleep. She found the infant stiff and blue when she awoke. There were no significant findings at autopsy.

Another neonatal death at two weeks of age occurred in an infant whose siblings were suffering from colds. The infant was found dead in its bassinet. Death was attributed to a florid myocarditis although culture was negative.

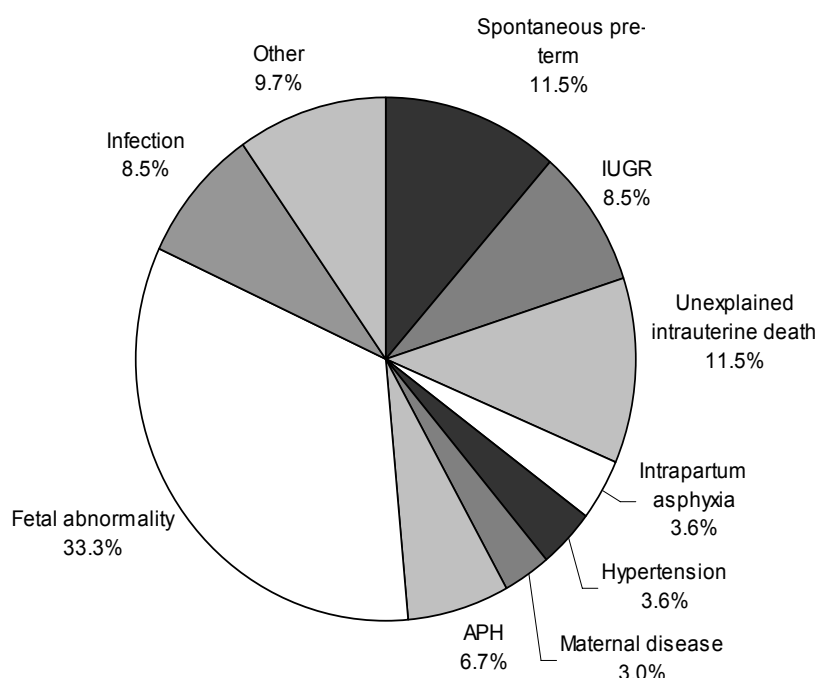
### *Whitfield Classification of perinatal deaths<sup>3</sup>*

The classification of the 165 perinatal deaths into the 12 groups of the amended Whitfield Classification is presented in Table 10 and Figure 8. Subgroups of the classification are also included in Appendix 6.

**Table 10: Amended Whitfield Classification of perinatal deaths, South Australia, 2004**

Amended Whitfield Classification	Number of deaths	%	Deaths per 1,000 births
1. Spontaneous preterm	19	11.5	1.1
2. Intrauterine growth restriction (IUGR)	14	8.5	0.8
3. Unexplained intrauterine death	19	11.5	1.1
4. Birth trauma	0	0	0
5. Intrapartum asphyxia	6	3.6	0.3
6. Hypertension	6	3.6	0.3
7. Maternal disease	5	3.0	0.3
8. Antepartum haemorrhage (APH)	11	6.7	0.6
9. Fetal abnormality	55	33.3	3.1
10. Haemolytic disease	0	0	0
11. Infection	14	8.5	0.8
12. Other	16	9.7	0.9
<b>Total</b>	<b>165</b>	<b>100.0</b>	<b>9.4</b>

**Figure 8: Causes of perinatal deaths, amended Whitfield Classification, South Australia 2004**



<sup>3</sup> 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.

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

The classification of the 52 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.

### ***Perinatal deaths of babies born interstate in 2004***

There was one neonatal death in South Australia in 2004 of a baby born at an interstate hospital. This mother was booked to give birth at an interstate hospital but went into spontaneous labour at 25 weeks gestation and gave birth at a hospital in another state which she was visiting. The birth was a difficult breech delivery. The baby was retrieved to a South Australian hospital, but died of the complications of prematurity at six days of age.

### **(2) Aboriginal perinatal deaths**

*There were 11 perinatal deaths (eight stillbirths and three neonatal deaths) among the 491 notified births to Aboriginal mothers. Ten of the babies who died were born in teaching hospitals and one was born in a country hospital. Eight were preterm and nine were low birthweight babies. The causes of the 11 deaths were as follows:*

- 1. Congenital abnormality – one neonatal death. This was a termination of pregnancy for renal agenesis of one kidney and cystic dysplasia of the other kidney.*
- 2. Perinatal infection – one stillbirth at term. This mother experienced ruptured membranes at term but delayed presentation at the hospital into which she had been booked. Meconium-stained liquor was noted and the fetal heart was absent. Autopsy showed acute chorioamnionitis and Group B Streptococcus and Klebsiella were cultured from the fetal lungs and stomach.*
- 3. Hypertension – two preterm stillbirths. One mother lived in the country and had no antenatal care. She was admitted to hospital with pre-eclampsia at 24 weeks gestation. Labour was induced for pre-eclampsia and CTGs showing recurrent decelerations with loss of variability, but the baby was stillborn. Autopsy showed severe chorioamnionitis. The other mother lived alone in the country and had a history of homelessness, depression and substance use. She presented at 25 weeks following an alleged assault. The fetal heart was heard, she had a urinary tract infection and her blood pressure was elevated. When she presented three days later for review, the fetal heart could not be heard and there was hypertension and gross proteinuria. E coli was cultured from the fetal blood and liver. The baby was growth restricted.*
- 4. Antepartum haemorrhage – one term stillbirth. This mother smoked and abused alcohol. She presented at 38 weeks gestation with antepartum haemorrhage. Placental abruption was diagnosed and an emergency caesarean section performed, but the fetus was stillborn. Placental histology showed acute chorioamnionitis.*

5. *Fetal growth restriction – one stillbirth. This mother smoked and did not attend regularly for antenatal care. She presented in labour at 37 weeks gestation, when intrauterine death was noted. The placenta was small, with increased coiling of the cord and findings were suggestive of fetal thrombotic vasculopathy.*
6. *Spontaneous preterm – one stillbirth and two neonatal deaths. In one pregnancy, which resulted in a stillbirth, preterm rupture of membranes and labour occurred at 21 weeks gestation, associated with pre-existing hypertension and urinary tract infection. In one case of neonatal death, the mother presented at 20 weeks gestation in labour with some antepartum haemorrhage, and the baby died shortly after delivery. Placental histology showed evidence of amniotic fluid infection. The mother of the other baby which died in the neonatal period was a smoker, abused alcohol, suffered from depression and was Hepatitis C antibody positive. She had little antenatal care. She was admitted to hospital with ruptured membranes at 30 weeks gestation and treated with steroids and antibiotics, but discharged herself. She presented four days later in labour, when the CTG showed deep decelerations followed by bradycardia. Emergency caesarean section was performed. The baby showed evidence of hypoxic ischaemic encephalopathy, had *E coli* septicaemia and died a few hours after birth. *E coli* was also cultured from the mother's blood. Placental histology showed acute chorioamnionitis.*
7. *Unexplained stillbirth – two stillbirths. One mother lived in the country and had no antenatal care. She presented in labour at 28 weeks gestation after her membranes had ruptured the previous day. She had not felt fetal movements for about a week. She was anaemic and the fetus was stillborn. Placental histology showed choriodecidualitis and extensive villous infarction. The second mother had a history of depression and stimulant use and had other adverse social factors. She presented at 23 weeks gestation in labour with absence of fetal movements. Placental histology showed multiple areas of haemorrhage and infarction.*

*In 2004, the perinatal mortality rate for births to Aboriginal mothers was 22.4 per 1,000 births compared with 9.0 per 1,000 births for non-Aboriginal mothers.*

*The Subcommittee notes, with concern, the high proportion of Aboriginal women who smoke during pregnancy. This proportion has not changed much since 1998, in contrast with the decreasing proportion among non-Aboriginal women. In 2004, this proportion was more than three times higher (57.8% v 18.9%).*

*The proportions of preterm births and small-for-gestational-age births remain considerably higher than for non-Aboriginal births in 2004 - 17.1% v 8.5% and 19.3% v 8.6%, respectively. As a result, the proportion of low birthweight births remains nearly three times higher than that among non-Aboriginal births – 18.5% v 6.7%.*

*The Committee acknowledges that community development projects are being undertaken in the state to improve the health, education and wellbeing of Aboriginal communities with a focus on improving nutrition and reducing tobacco use. Other initiatives are aimed at reducing alcohol intake and improving attendance for antenatal care, breastfeeding and health education in relation to maternal and child health. The*

*Committee supports evaluation, sustenance and possible extension of such programs as an urgent priority.*

### **(3) Autopsies in perinatal deaths**

Autopsies were performed in 90 perinatal deaths (54.5%). Six of the autopsies were limited, which is defined as autopsies which 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. If the same criteria are used for autopsy, that is, full or limited autopsy, in 2003, the proportion of perinatal deaths which had autopsies was 55.1% (97 out of 176). Previously, 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.

The distribution by place of death is presented in Table 11.

**Table 11: Autopsy status\* of perinatal deaths by place of death, South Australia, 2004**

Place of death	Deaths	Autopsies performed*	
	Number	Number	Percent of deaths
Metropolitan Level III** hospitals (teaching)	112	60	53.6
Other metropolitan teaching hospitals	19	9	47.4
Metropolitan private hospitals	14	10	71.4
Country hospitals	17	9	52.9
Home	2	2	100.0
Interstate	1	0	0
<b>Total</b>	<b>165</b>	<b>90</b>	<b>54.5</b>

\*Includes six limited autopsies

\*\*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 156 perinatal deaths (94.5%) in 2004.

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.<sup>4 5</sup> 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

<sup>4</sup> Gordijn SJ, Erwich JJ, Khong TY. Value of the perinatal autopsy: critique. *Pediatr Dev Pathol* 2002;5:480-488.

<sup>5</sup> Becher JC, Laing IA, Keeling JW, McIntosh N. Restoring high neonatal autopsy rates. *Lancet* 2004;364:2019-2020.

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**.

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. Causes of post-neonatal deaths 2004

In 2004 there were 31 post-neonatal deaths notified of infants born in South Australia. Autopsies were performed in 18 out of the 20 coronial cases. Autopsies were not performed in any of the 11 non-coronial cases. The autopsy rate was thus 58.1% (18 out of 31 cases) for post-neonatal deaths in 2004. Placental histology was available in only two of the non-coronial cases.

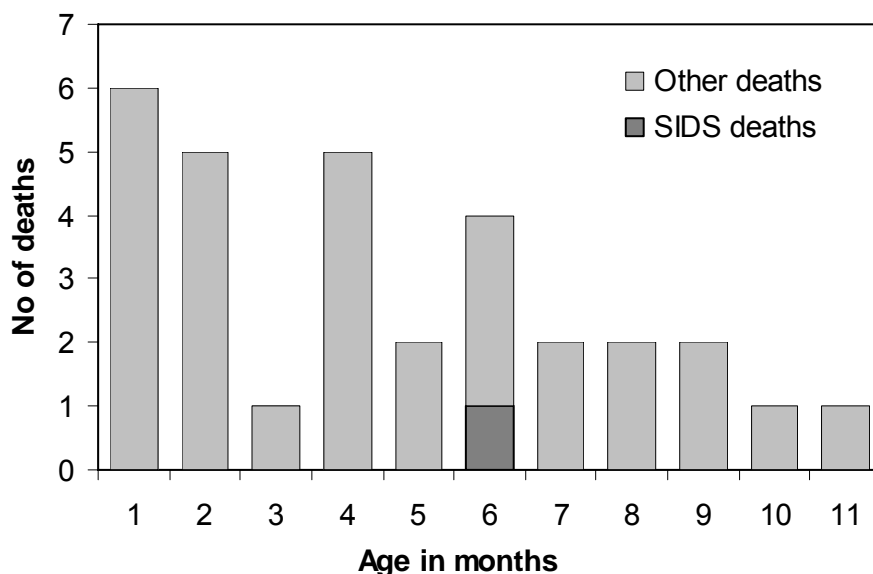
The causes of death are presented in Table 12, together with comparative statistics for 1986 - 2003.

**Table 12: Causes of post-neonatal deaths, South Australia, 1986 – 2004**

Causes of death	1986 – 2003		2004	
	Number	Percent	Number	Percent
SIDS	317	43.1	1	3.2
Congenital abnormalities	156	21.2	6	19.4
Conditions originating in the perinatal period	91	12.4	7	22.6
Accidents, poisoning and violence	60	8.2	7	22.6
Infections	58	7.9	4	12.9
Other	53	7.2	6	19.4
<b>Total</b>	<b>735</b>	<b>100.0</b>	<b>31</b>	<b>100.0</b>

Among the 31 post-neonatal deaths in 2004, there were 19 males and 12 females. Six were multiple births. Fifteen infants (48.4%) were born preterm. The distribution by age at death of the 31 infants (Figure 9) shows that most of the deaths occurred in the earlier months of the post-neonatal period. *Six of the 31 post-neonatal deaths (19.4%) were the children of Aboriginal mothers.*

**Figure 9: Age Distribution of Post-neonatal Deaths 2004**



### **(1) Sudden Infant Death Syndrome (SIDS)**

Only one death in the post-neonatal period in 2004 was attributed to SIDS. This infant was born preterm and discharged from hospital after nearly three months in intensive and special nursery care. This infant had only a slight cough within two weeks of its death at six months of age. It was put to sleep in a cot in the prone position and found lifeless a few hours later. (The neuter gender is used here and elsewhere in this report for reasons of confidentiality.)

In 2004, the single death from SIDS accounted for 3.2% of post-neonatal deaths in South Australia. The post-neonatal death rate due to SIDS was 0.1 per 1,000 live births, the lowest recorded in South Australia. Before the public educational campaign to reduce risk factors for SIDS was commenced in 1990, there were 158 post-neonatal deaths from SIDS in the four-year period 1986-1989, and the SIDS post-neonatal death rate was 2.0 per 1,000 livebirths. In comparison, in the four-year period 2001-2004, there were only 14 deaths from SIDS, and the SIDS post-neonatal death rate was 0.2 per 1,000 livebirths. SIDS accounted for 60.5% of post-neonatal deaths in the earlier period and only 13.3% in the later period.

In many of the deaths attributed to SIDS there are often other circumstances such as co-sleeping, which raise the possibility that some of these deaths may be due to accidental asphyxia. As the autopsy findings in cases of infantile asphyxia seem often 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 induced and accidental asphyxia have been initially incorrectly diagnosed as SIDS due to the non-specificity of autopsy pathology. Pertinent information often assists in formulating an initial correct diagnosis.**

## **(2) Congenital abnormalities**

Congenital abnormalities accounted for six post-neonatal deaths (19.4%) in 2004. *One of these infants had an Aboriginal mother.* The types of abnormalities were as follows:

- Velo-cardio-facial syndrome or Di George syndrome (a chromosome 22q11 deletion). This baby had pulmonary atresia with a large ventricular septal defect, hypoplastic pulmonary arteries and multiple aorto-pulmonary collateral arteries which were associated with high pulmonary blood flow, chronic lung disease and congestive cardiac failure. This baby also had polymicrogyria, developmental delay and feeding difficulties.
- Trisomy 18, with ventricular septal defects and an abnormal pulmonary valve. This infant was developmentally delayed and died of pneumonia.
- Gastroschisis. This defect was detected prenatally at 19 weeks gestation. There was polyhydramnios and the baby was born preterm. The infant's gut was ischaemic at birth and surgery was performed several times to remove strictured and perforated segments. There was continuous gut dysmotility requiring total parenteral nutrition and episodes of intra-abdominal sepsis ensued. Progressive liver damage led to death from liver failure.
- Complex cardiac abnormalities. These were detected prenatally at 20 weeks gestation. At birth, echocardiography showed multiple abnormalities including total anomalous pulmonary venous drainage, septal defects with common atrioventricular valve, atrial isomerism, discordant ventriculo-arterial connection, pulmonary atresia and hypoplastic pulmonary arteries. The cardiac lesions were regarded as inoperable.
- Agenesis of the corpus callosum, hypoplasia of the brainstem and cerebellum. This infant was born preterm, when many other congenital abnormalities were noted. This infant died of respiratory arrest.
- Hydranencephaly, with absent frontal, parietal and temporal lobes. The abnormalities were diagnosed by cranial ultrasound and magnetic resonance imaging at birth and palliative care was initiated.

## **(3) Conditions originating in the perinatal period**

*There were seven deaths in this group, two of which were the infants of Aboriginal mothers.* All were preterm births, six at 24-27 weeks and one at 30 weeks gestation, and all died of the complications of prematurity. One baby was born at 27 weeks by emergency caesarean section after severe fetal growth restriction and oligohydramnios were noted. Another infant was born by emergency caesarean section at 25 weeks gestation for severe pre-eclampsia. A third infant was born at 24 weeks following induction of labour for severe oligohydramnios and suspected chorioamnionitis. All three infants died of progressive bronchopulmonary dysplasia.

Two infants were born at 24 weeks gestation after their mothers went into preterm labour with signs of infection. There was chorioamnionitis, and in one case, a complicating urinary tract infection. One infant died of necrotizing enterocolitis and periventricular leukomalacia. The other infant, which was a twin, had its course complicated by hyaline membrane disease, pulmonary haemorrhage and Candida infection and died of necrotizing enterocolitis. The sixth infant in this group, born at 27 weeks after preterm rupture of membranes, also died of severe necrotizing enterocolitis.

A seventh infant was born at 30 weeks gestation after preterm rupture of membranes in a twin pregnancy. This twin experienced many complications of prematurity and succumbed after suffering a massive intracerebral haemorrhage.

#### **(4) Accidents, poisoning and violence**

There were seven deaths in this group, five of which were from accidental causes.

There was one death from drowning. A nine-month old infant was left unsupervised to play with its two-year old sibling in a shallow bath. The infant was found face down and lifeless in the bath by the mother five to 10 minutes later. Autopsy findings were consistent with drowning.

Four infants died of accidental asphyxiation. One infant was placed to sleep prone in the middle of a foam mattress between a bed and a built-in wardrobe. It was found with its head caught in the gap between the top of the mattress and the bedside drawer, with its face pointing towards the floor. A second infant placed to sleep on its side in a pram was found with its head between the base of the pram and the front rail of the pram, with its body suspended down towards the floor.

The third infant was sharing a bed with two adults and a two year old sibling. It was found at the bottom of the bed with its head covered with a heavy quilt. The room was noted to be very hot. The fourth infant was recovering from an upper respiratory tract infection at the time of its death. This infant was placed to sleep on its side in a cot and found in a prone position, entangled in a mound of blankets. The autopsy findings of patterned livid marks and blanching in the face in both cases suggested that the deaths were due to accidental asphyxia.

There were two deaths from head injuries.

#### **(5) Infections**

Four infants died of infections. *Two infants were the children of Aboriginal women.* Three infants died of septicaemia. One infant was prescribed ranitidine for gastro-oesophageal reflux on discharge from hospital some weeks after birth. This infant died suddenly about four weeks after discharge. Autopsy found a large retropharyngeal abscess associated with an apparent perforation of the side of the distal pharynx. *Streptococcus pneumoniae* was cultured from the

blood, spleen, cerebrospinal fluid, abscess cavity and a lung swab.

Retropharyngeal abscess is rare in the absence of primary tonsillar infection. It may be a complication of trauma in the region.

Another infant was in hospital for over a month after birth. This infant was placed to sleep on its side and found lifeless not long after. Its blood culture yielded E coli, which was also found in mixed growth in the lung swab. There were inflammatory changes indicative of urinary tract infection. Another infant was also in hospital for over a month after birth and had medications for gastro-oesophageal reflux at discharge. It developed a fever some weeks later and was taken to a hospital emergency department where it was diagnosed with a viral illness and discharged with paracetamol. The infant remained unsettled at home, developed a generalized rash a few hours after discharge and apparently went to sleep. It was found lifeless a few minutes later. *Neisseria meningitidis* was cultured from all sites sampled at autopsy.

The fourth infant in this group spent several weeks in hospital after birth with prematurity complications. About two weeks after discharge it developed an upper respiratory tract infection and did not feed well before it was put to bed. It was found lifeless next morning. Autopsy showed bilateral acute bronchopneumonia with a moderate growth of *Haemophilus influenzae*. *Streptococcus pneumoniae* and mixed coliforms were also cultured from the lungs.

The Committee would like to stress that infection is still an important cause of infant death. Any infant who is excessively drowsy should be considered seriously ill until proved otherwise. The seeking of advice and, if necessary, retrieval are of utmost importance.

#### **(6) Other causes**

Six deaths were considered to be of 'undetermined' cause. *One was the child of an Aboriginal mother.* One preterm infant had been in good health after initial problems and readmissions. It was tightly wrapped in a sheet, placed to sleep on a U-shaped pillow and found face down in the pillow which appeared wet. This death was attributed to undetermined cause although it was thought that the infant died from the combined effects of inhalation of gastric contents and asphyxia from suffocation.

The second infant had apparently recently recovered from an upper respiratory tract infection. It was placed to sleep on its side on one side of an adult bed. It was found face down and very pale. The finding of multifocal axonal abnormalities within the brain was thought to reflect previous hypoxic episodes or trauma.

The third infant had been unwell for a few weeks with an upper respiratory tract infection and vomiting once or twice a day. It was placed to sleep in warm clothes, covered by a sheet and blankets, and an electric heater was turned on in the room. It was found unresponsive and cyanosed in the early hours of the

morning. There were features in the history and death scene examination which raised the possibility of overheating as the cause of death.

The fourth infant had been admitted to hospital with bronchiolitis about two weeks before its death. It was placed to sleep on an adult bed between its mother and its sibling. The mother had consumed alcohol before going to sleep. It was found lifeless on its back next morning, covered by bedsheets and blankets, having moved so that its head was closer to the foot of the bed. There were generalized axonal abnormalities found in the brain at autopsy.

The fifth infant was in hospital for a few weeks after birth and was found about a week after discharge face down with its head in a pillow on a lounge chair where it had been placed to sleep. There were minor superficial abrasions on its face. The Committee considered the cause of death to be undetermined, with the possibility of suffocation as the cause.

The sixth infant had a mild upper respiratory infection a few weeks before its death. It was placed to sleep on its side in a cot and found lifeless some hours later. Streptococci were found in mixed growths from the blood culture and left middle ear cavity swab. The Committee considered these findings of localized infection inadequate in severity to have been the cause of death.

Three of the infants who died of infections or undetermined causes had earlier suffered from neonatal abstinence syndrome. Another infant had evidence of healing skeletal fractures.

## IV Recommendations

### 1. Maternal Subcommittee recommendations

There were no new recommendations. The recommendations from the previous years were:

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.
2. Strong consideration should be given for review by a physician early in pregnancy of women with current or previous serious medical conditions.

### 2. Perinatal Subcommittee recommendations

1. The Subcommittee would like to advise practitioners of the importance of caring for pregnant women in a setting 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. There is good evidence that planned home birth for twins, breech presentations and post-term infants is associated with unacceptably high risks.<sup>6 7</sup>
2. The need for development of evidenced-based statewide protocols for level I, II and III maternity services with an emphasis on timely recognition and appropriate management of common obstetric problems such as fetal growth restriction, preterm rupture of membranes, meconium-stained liquor, antepartum haemorrhage and pre-eclampsia. Practitioners must ensure that pregnant women with a higher level of risk than defined for their level of care setting are referred promptly and appropriately.
3. Vigilance in the recognition of fetal growth restriction. Fetal growth restriction was the cause of death for 8.5% of perinatal deaths in 2004. Practitioners are asked to be vigilant so that fetal growth restriction is not missed.
4. Implementation of effective strategies to reduce smoking in pregnancy, including culturally appropriate smoking cessation interventions for Aboriginal women. Smoking in pregnancy has been associated with fetal growth restriction. Smoking cessation programs implemented during

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<sup>6</sup> Bastian H, Keirse MJNC, Lancaster PAL. Perinatal death associated with planned home birth in Australia: population based study. *BMJ* 1998; 384-388.

<sup>7</sup> 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.

pregnancy have been demonstrated to reduce smoking significantly, with reductions in the frequency of low birthweight and preterm birth and an increase in mean birthweight.<sup>8</sup> *The proportion of women smoking in pregnancy has decreased in South Australia, but not among Aboriginal women, whose proportion in 2004 was 58% compared with 19% among non-Aboriginal women. Births to Aboriginal women continue to be associated with rates of preterm and small-for-gestational-age birth more than twice those of births to non-Aboriginal women. The proportion of low birthweight births is nearly three times higher.*

5. Appropriate training and maintenance of competence in cardiotocograph (CTG) interpretation for all levels of medical and midwifery staff.
6. 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.
7. Antibiotic prophylaxis during labour for women carrying Group B Streptococcus has been shown to be effective in preventing Group B streptococcal transmission to the neonate and to reduce early onset Group B streptococcal sepsis. A policy of screening for Group B Streptococcus in late pregnancy and giving intrapartum antibiotic prophylaxis to carrier mothers is recommended in the South Australian Perinatal Practice Guidelines ([www.health.sa.gov.au/ppg](http://www.health.sa.gov.au/ppg)).
8. The Committee recommends use of the recently revised guidelines for investigating stillbirths including a more systematic approach to investigate the potential involvement of thrombophilias (Appendix 8). This statewide protocol for the investigation of all stillbirths has been sent to all maternity units in South Australia.
9. Autopsy often provides considerable information that is not available otherwise and should be strongly recommended. The decrease in the autopsy rate in perinatal death over the past few years is of serious concern. When parents decline autopsy, we recommend that photographic and X-ray documentation be obtained. It is also important to document the clinical appearance of the infant in the case record in all cases of perinatal death. **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.**
10. Placentas should be sent for examination in all cases of perinatal death (See Appendix 9). Histopathological examination of the placenta provides considerable additional information and should be attainable for 100% of perinatal deaths. It was performed on 95% of cases in 2004.

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<sup>8</sup> Lumley J, Oliver SS, Chamberlain C, Oakley L. Interventions for promoting smoking cessation during pregnancy. The Cochrane Database of Systematic Reviews 2004, issue 4.

**As a guide, all placentas should be sent for pathological examination, at least for:**

- 1) All stillborn infants, early neonatal deaths and mid-trimester miscarriages.
- 2) All multiple pregnancies with same sex infants.
- 3) All triplet and higher order multiple pregnancies.
- 4) All cases of discordant twin growth with greater than 20% weight difference.
- 5) All cases of prolonged rupture of membranes or suspected chorioamnionitis or maternal fever (any cause).
- 6) All preterm deliveries.
- 7) All cases where birthweight is less than the 10<sup>th</sup> percentile or greater than the 95<sup>th</sup> percentile for gestational age.
- 8) All cases of fetal malformation.
- 9) All cases of pregnancy complicated by oligohydramnios, polyhydramnios or placental abnormalities detected prenatally (vascular channels, chorioangioma, etc).
- 10) All cases with a physical abnormality in the placenta (eg. a mass, abnormal colour, malodour).
- 11) All cases subjected to chorion villus sampling or amniocentesis, if complications occur.
- 12) All cases of pre-existing diabetes, pre-eclampsia, systemic lupus erythematosus and documented thrombophilias known to be associated with fetal hazard.
- 13) All cases of placental abruption.
- 14) All retrievals.
- 15) 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).
- 16) All cases of maternal death.

11. The Subcommittee also recommends the use of the birthweight for gestational age percentile charts for singletons<sup>9</sup> and twins<sup>10</sup> prepared using

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<sup>9</sup> Roberts CL, Lancaster PAL. Australian national birthweight percentiles by gestational age. *Med J Aust* 1999;170:114-118.

<sup>10</sup> Roberts C, Lancaster P. National birthweight percentiles by gestational age for twins born in Australia. *J Paediatr Child Health* 1999;35:278-282.

national perinatal data, which are available on the PSANZ website with the PSANZ perinatal death classifications ([www.psanz.org.au](http://www.psanz.org.au)). The singleton charts have been reproduced in Appendix 10 with the permission of the Medical Journal of Australia.

### 3. Post-neonatal Subcommittee recommendations

The following recommendations are pertinent to the deaths in 2004:

1. Health professionals providing care both in the antenatal and postnatal period should ensure that women are provided with information about safe infant sleeping practices and prevention of SIDS.
  - Babies should be placed on their backs to sleep, unless there is a contra-indication. Sleeping supine is not contraindicated in babies with gastro-oesophageal reflux.
  - Falling asleep with the infant at the breast may be hazardous. Other forms of co-sleeping or bed sharing may be hazardous, particularly if the adults are intoxicated or sedated (see Appendix 11).
  - Potential hazards must be removed from the infant's sleeping environment.
  - Babies must not be placed in cots with any pillows, U-pillows, cot bumpers, large soft toys, thick blankets or quilts or other items which may overheat or suffocate the infant. Infants should not be left to sleep unattended in stroller-prams or bouncinettes.
  - Ensure that all new cots meet Australian Standards and only use old ones that do. Mattresses which do not fit cots properly should not be used, especially in cots that have unsupported webbing.
2. 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. Infants should never be left unattended in a bath or near water, even for a minute. Parents should not be reassured by the presence of an older sibling in the bath with the infant. This warning also applies to infants placed in devices such as ring bath seats. These devices have been banned in some Australian states due to deaths from drowning associated with their use.
3. 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, extreme youth of the mother and poor social circumstances. This should be continued at least until the end of infancy, if not for a longer period of time.

In reviewing the causes of death in 2004 and other recent years, the Committee has been concerned about the number of deaths in which adverse factors such as smoking, alcohol and substance abuse, bed sharing when intoxicated, physical abuse and poor social circumstances are present.

4. 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. Infants with cyanotic heart disease are more prone to the complications of dehydration and specialist advice should be sought. Urgent retrieval may be necessary for any infant who is thought to be suffering from a significant bacterial infection. The Subcommittee notes that infection remains an important cause of infant death.
5. Peripheral hospitals with high levels of paediatric throughput need provision of 24-hour paediatric expertise. Appropriate protocols regarding detection and management of potentially life-threatening paediatric conditions need to be developed, reviewed, distributed to and supported by all hospitals treating children.

**The following recommendations made in previous reports are still relevant:**

1. 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. The Committee was pleased to note that there were no deaths in 2004 from feeding accidents.
2. Recording and charting of child's weight  
The Subcommittee would also like to stress to both parents and health professionals the importance 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. Any child who is not thriving should be referred to a medical practitioner.
3. The Subcommittee would also like to stress the importance of immunisation in the prevention of infectious disease in children. There is some evidence that there is a reduced rate of SIDS in immunised compared with non-immunised children.<sup>11</sup>

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<sup>11</sup> 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.

#### 4. 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/](http://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 and
- A resident death in a licensed supported residential facility.

5. The Subcommittee would like to draw attention once again to the importance of autopsy in eliciting the cause of death, which should always be carefully recorded in the clinical history. The autopsy rate among all post-neonatal deaths in 2004 was 58.1% (18 out of 31), but no autopsies were performed on the 11 non-coronial cases.

- 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](http://www.health.sa.gov.au/pregnancy)
- The South Australian Perinatal Practice Guidelines website: [www.health.sa.gov.au/ppg](http://www.health.sa.gov.au/ppg)
- The SIDS website is [www.sidsandkids.org](http://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](http://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.dh.sa.gov.au/pehs/pregnancyoutcome.htm](http://www.dh.sa.gov.au/pehs/pregnancyoutcome.htm).

## V Education Subcommittee Report

The ninth annual educational meeting was organized on the evening of 20 September 2005 by the Education Subcommittee of the Maternal, Perinatal and Infant Mortality Committee.

These meetings 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 midwifery and medical staff providing care within those units. Initially these meetings were annual events organized by an ad hoc group chaired by the late Dr. Brian Pridmore, then Chair of the Perinatal Subcommittee. 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 ensure that these meetings become formalized as part of the South Australian perinatal 'scene' 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 those at the 'coal face'.

The ninth meeting, held at the Women's and Children's Hospital, was titled 'The Seduction of Induction.' An electronic voting system was used initially to obtain audience responses to questions on induction of labour. Dr Jodie Dodd and Dr Peter Muller made presentations on 'The role of prostaglandins in induction of labour' and 'Oxytocin and induction' respectively. Mrs Jane Warland presented the findings of a survey conducted on understanding of induction of labour by women who had been admitted to hospital for induction. An animated discussion then took place between panel members Drs Dodd and Muller, Mrs Julia Ats and Mr John Coombas and the audience of 150 persons. The audience included hospital and community midwives, student midwives, general practitioners, resident medical officers, obstetric registrars and obstetricians, and was video-conferenced/ telecast to five country sites. A videotape of the meeting was made, which was provided to all obstetric units. Copies of the presentations are also available.

Dr Brian Wheatley, Chair of the Education Subcommittee also communicated the main recommendations of the Committee made in the 2003 report.

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

# 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 the 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



Births, Deaths and Marriages Registration Act, 1966-1980

Form 14  
To be completed  
by a Medical  
Practitioner



Births, Deaths and Marriages Registration  
Act, 1966-1980

Form 12

### 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.....  
.....  
.....

If live born:  
Date of death.....  
Place of death.....  
Age at death.....  
If not born alive:  
Born..... a.m. or..... p.m.  
on.....

Attended child before death   
Viewed body after death

P.M. Carried out   
To be carried out   
Not to be carried out

### CAUSE OF DEATH

Signed.....  
Date.....

Date of delivery of Notice of Signing to  
1. Parent or  
2. Occupier of premises

### 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

#### A. Particulars Relating to the Mother

- Mother's full name (Surname in BLOCK letters).....
- Mother's address of usual residence.....  
Postcode
- Mother's age in years..... AND date of birth...../...../19.....
- Mother's Race: Caucasian  Aboriginal/Torres Strait Islander   
Asian  Other  —(Specify).....

#### B. Details of Previous Pregnancies

- If no previous pregnancy, tick this box  and go to Section C.
- Where a previous pregnancy, please indicate:
 

(a) Number of previous pregnancies..... If not known, tick box <input type="checkbox"/>	(c) Outcome of LAST pregnancy (select category)
(b) Number of previous pregnancies known to have resulted in	
(number)	
single births <input type="checkbox"/>	single birth <input type="checkbox"/>
surviving livebirths <input type="checkbox"/>	surviving livebirths <input type="checkbox"/>
stillbirths (at least 20 weeks) <input type="checkbox"/>	stillbirths <input type="checkbox"/>
neonatal deaths (within 20 days) <input type="checkbox"/>	neonatal death <input type="checkbox"/>
multiple birth <input type="checkbox"/>	multiple birth <input type="checkbox"/>
surviving livebirths only <input type="checkbox"/>	surviving livebirths only <input type="checkbox"/>
stillbirth only <input type="checkbox"/>	stillbirths only <input type="checkbox"/>
neonatal deaths only <input type="checkbox"/>	neonatal deaths only <input type="checkbox"/>
a combination <input type="checkbox"/>	a combination <input type="checkbox"/>
abortion (spontan/induced) <input type="checkbox"/>	abortion (spontan/induced) <input type="checkbox"/>
	not known <input type="checkbox"/>
- Date of outcome of LAST pregnancy...../...../19.....

#### C. Details of Present Pregnancy

- Estimated period of gestation at outcome was..... completed weeks from first day of L.M.P.
- First day of last menstrual period...../...../19.....
- Approximate number of antenatal visits..... AND estimated month of gestation at first visit.....
- Delivery: Normal spontaneous vertex  Other  Specify.....
- Most senior attendant present at birth: Specialist Obstetrician  GP   
Registered Midwife  Not Known  RMO  Registrar   
None  Other  —(Specify).....

#### D. Particulars Relating to the Child

- Name (if given).....
- Place of birth..... AND place of death.....
- Sex: Male  Female  Indeterminate
- Plurality: Single  First Twin  Second Twin  Other multiple   
(Specify).....
- Birthweight..... grams
- Date of birth...../...../19..... AND time of birth..... am/pm
- Did heartbeat cease:
  - Before labour commenced  —Estimate how long before..... hours/days
  - During labour and before delivery
  - Before delivery but not known if before or during labour
  - After delivery  —Indicate date...../...../19..... AND time..... am/pm
  - Not known whether before or after delivery
- Did the child breathe spontaneously? Yes  No  Not known

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

- Main disease/condition in foetus or infant leading to death.....
- Other disease(s)/condition(s) in foetus or infant.....
- Main maternal disease/condition relating to the death.....
- Other maternal disease(s)/condition(s) relating to the death.....
- Other relevant information.....

- 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.....

### 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

82174

# APPENDIX 2B

## Doctor's Certificate of Cause of Death

07326



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

### 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

07326



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

### 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)

Duration

Disease

A .....

B .....

C .....

D .....

E .....

#### Part II

Other significant conditions and duration:

CONTINUE ON REVERSE

### 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.....

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

**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.<sup>12</sup>

Maternal deaths in South Australia 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.

**Maternal mortality ratio:**

$$= \frac{\text{Number of direct and indirect deaths in a year}}{\text{Number of confinements in the same year}} \times 100,000$$

**Perinatal death:** includes stillbirth (late fetal death) and neonatal death.

**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.

**Confinement:** a pregnancy ending with the birth of one or more fetuses (dead or alive) at or after 20 weeks of gestation and/or with a birthweight of 400g or more.

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<sup>12</sup> World Health Organization. International Statistical Classification of Diseases and Related Health Problems. Tenth Revision. Volume 2. Geneva: WHO, 1993.

**Stillbirth rate:**

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

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

**Neonatal death rate:**

$$= \frac{\text{Number of neonatal deaths in a year}}{\text{Number of livebirths in that year}} \times 1,000$$

**Perinatal mortality rate:**

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

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

**Infant mortality rate:**

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

Infant deaths include neonatal and post-neonatal deaths.

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

**Post-neonatal death rate:**

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

## APPENDIX 4

### Perinatal Society of Australia and New Zealand-Perinatal Death Classification (PSANZ-PDC), SA perinatal deaths, 2004

	No.	%
<b>1. CONGENITAL ABNORMALITY (including terminations for congenital abnormalities)</b>	<b>55</b>	<b>33.3</b>
1.1 Central nervous system	9	5.5
1.2 Cardiovascular system	11	6.7
1.3 Urinary tract	7	4.2
1.4 Gastrointestinal tract	1	0.6
1.5 Chromosomal	16	9.7
1.6 Metabolic	0	0
1.7 Multiple	8	4.8
1.8 Other	3	1.8
1.81 Musculoskeletal	3	
1.82 Respiratory	0	
1.83 Diaphragmatic hernia	0	
1.9 Unspecified	0	0
<b>2. PERINATAL INFECTION</b>	<b>13</b>	<b>7.9</b>
2.1 Bacterial	11	6.7
2.11 Group B Streptococcus	4	
2.12 E coli	1	
2.13 Listeria monocytogenes	0	
2.18 Other bacterial	4	
2.19 Unspecified bacterial	2	
2.2 Viral	1	0.6
2.21 Cytomegalovirus	1	
2.22 Parvo virus	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 eg toxoplasmosis	0	0
2.4 Spirochaetal eg syphilis	0	0
2.5 Fungal	0	0
2.8 Other	0	0
2.9 Unspecified organism	1	0.6

	No.	%
<b>3. HYPERTENSION</b>	<b>6</b>	<b>3.6</b>
3.1 Chronic hypertension: essential	0	0
3.2 Chronic hypertension: secondary, eg renal disease	0	0
3.3 Chronic hypertension: unspecified	0	0
3.4 Gestational hypertension	0	0
3.5 Pre-eclampsia	6	3.6
3.6 Pre-eclampsia superimposed on chronic hypertension	0	0
3.9 Unspecified hypertension	0	0
<b>4. ANTEPARTUM HAEMORRHAGE (APH)</b>	<b>11</b>	<b>6.7</b>
4.1 Placental abruption	8	4.8
4.2 Placenta praevia	0	0
4.3 Vasa praevia	0	0
4.8 Other APH	0	0
4.9 APH of undetermined origin	3	1.8
<b>5. MATERNAL CONDITIONS</b>	<b>5</b>	<b>3.0</b>
5.1 Termination of pregnancy (other than for congenital (fetal) abnormality)	0	0
5.2 Diabetes / Gestational diabetes	1	0.6
5.3 Maternal injury	1	0.6
5.31 <i>Accidental</i>	1	
5.32 <i>Non-Accidental</i>	0	
5.4 Maternal sepsis	0	0
5.8 Other maternal conditions, eg Lupus obstetric syndrome	3	1.8
<b>6. SPECIFIC PERINATAL CONDITIONS</b>	<b>18</b>	<b>10.9</b>
6.1 Twin-twin transfusion	7	4.2
6.2 Fetomaternal haemorrhage	3	1.8
6.3 Antepartum cord complications (eg cord haemorrhage; true knot with evidence of occlusion)	3	1.8
6.4 Uterine abnormalities, eg bicornuate uterus, cervical incompetence	3	1.8
6.5 Birth trauma (typically infants of >24 weeks gestation or >600g birthweight)	0	0
6.6 Alloimmune disease	0	0
6.7 Idiopathic hydrops	1	0.6
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)	1	0.6

		No	%
<b>7.</b>	<b>HYPOXIC PERIPARTUM DEATH (typically infants of &gt;24 weeks gestation or &gt; 600g birthweight)</b>	<b>6</b>	<b>3.6</b>
7.1	With intrapartum complications	4	2.4
	7.11 Uterine rupture	0	
	7.12 Cord prolapse	1	
	7.13 Shoulder dystocia	0	
	7.18 Other	3	
7.2	No apparent complications	2	1.2
7.9	Unspecified hypoxic peripartum death	0	0
<b>8.</b>	<b>FETAL GROWTH RESTRICTION (FGR)</b>	<b>14</b>	<b>8.5</b>
8.1	With evidence of uteroplacental insufficiency eg significant infarction, acute atherosclerosis, maternal vascular thrombosis or maternal floor infarction	13	7.9
8.2	With chronic villitis	1	0.6
8.3	Without the above placental pathology	0	0
8.4	No examination of placenta	0	0
8.9	Unspecified FGR or not known whether placenta examined	0	0
<b>9.</b>	<b>SPONTANEOUS PRETERM (&lt;37 weeks gestation)</b>	<b>16</b>	<b>9.7</b>
9.1	Spontaneous preterm with intact membranes, or membrane rupture <24 hours before delivery	7	4.2
	9.11 with chorioamnionitis	5	
	9.12 without chorioamnionitis	1	
	9.13 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	7	4.2
	9.21 with chorioamnionitis	4	
	9.22 without chorioamnionitis	3	
	9.23 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	2	1.2
	9.31 with chorioamnionitis	0	
	9.32 without chorioamnionitis	0	
	9.33 no examination of placenta	2	
	9.39 unspecified or not known whether placenta examined	0	

		No.	%
<b>10.</b>	<b>UNEXPLAINED ANTEPARTUM DEATH</b>	<b>19</b>	<b>11.5</b>
10.1	With evidence of uteroplacental insufficiency, eg significant infarction, acute atherosclerosis, maternal vascular thrombosis or maternal floor infarction	8	4.8
10.2	With chronic villitis	0	0
10.3	Without the above placental pathology	10	6.1
10.4	No examination of placenta	1	0.6
10.9	Unspecified unexplained antepartum death or not known whether placenta examined	0	0
<b>11.</b>	<b>NO OBSTETRIC ANTECEDENT</b>	<b>2</b>	<b>1.2</b>
11.1	SIDS	0	0
	11.11 Consistent with SIDS	0	
	11.12 Possible SIDS	0	
11.2	Postnatally acquired infection	1	0.6
11.3	Accidental asphyxiation	0	0
11.4	Other accident, poisoning or violence (postnatal)	0	0
11.8	Other	0	0
11.9	Unknown / Unexplained	1	0.6
	<b>TOTAL</b>	<b>165</b>	<b>100.0</b>

## APPENDIX 5

### Perinatal Society of Australia and New Zealand Perinatal Death Classification (PSANZ-PDC), SA perinatal deaths by birthweight, 2004

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	32*	11	2	1	0	4	5	55	33.3
2	Perinatal infection	3	5	0	0	0	0	5	13	7.9
3	Hypertension	1	2	0	1	0	1	1	6	3.6
4	Antepartum haemorrhage	3	1	1	1	1	0	4	11	6.7
5	Maternal conditions	1	0	0	1	0	1	2	5	3.0
6	Specific perinatal conditions	7	3	1	1	2	0	4	18	10.9
7	Hypoxic peripartum death	0	0	0	0	0	0	6	6	3.6
8	Fetal growth restriction	1	0	5	1	1	3	3	14	8.5
9	Spontaneous preterm	7	7	0	2	0	0	0	16	9.7
10	Unexplained antepartum death	4	1	1	2	1	2	8	19	11.5
11	No obstetric antecedent	0	0	0	0	0	0	2	2	1.2
	Total	59*	30	10	10	5	11	40	165	100
	%	35.8	18.2	6.1	6.1	3.0	6.7	24.2	100	%

\* includes one stillbirth of unknown birthweight born at 20 weeks gestation

## APPENDIX 6

### Obstetric cause-specific classification of perinatal deaths, SA perinatal deaths, 2004 (Amended Whitfield)

	No	%
<b>1. SPONTANEOUS PRETERM &lt;37 weeks, normally formed, appropriately grown.</b>	<b>19</b>	<b>11.5</b>
1.1 Multiple pregnancy	0	
1.2 Previous bleeding	1	
1.3 Previous spontaneous rupture of membranes >12 hours before labour	7	
1.4 Cervical incompetence	3	
1.5 Other, eg uterine malformation	1	
1.6 Idiopathic	7	
<b>2. INTRAUTERINE GROWTH RESTRICTION (IUGR) &lt;10th percentile for gestational age</b>	<b>14</b>	<b>8.5</b>
<b>3. UNEXPLAINED INTRAUTERINE DEATH</b> Normally formed fetuses without IUGR where fetal death is known to have preceded labour in the absence of any other primary complication	<b>19</b>	<b>11.5</b>
<b>4. BIRTH TRAUMA <math>\geq 1,500</math>g, with evidence of lethal trauma at autopsy even when labour and delivery were not complicated by mechanical difficulty</b>	<b>0</b>	<b>0</b>
4.1 Cord complication	0	
4.2 Breech delivery	0	
4.3 Caesarean section	0	
4.4 Forceps delivery	0	
4.5 Ventouse delivery	0	
4.6 Other delivery	0	
<b>5. INTRAPARTUM ASPHYXIA <math>\geq 1,500</math>g with evidence of intrapartum hypoxia and confirmed by hypoxic changes at autopsy</b>	<b>6</b>	<b>3.6</b>
5.0 Vaginal	1	
5.1 Cord complication	1	
5.2 Breech delivery	0	
5.3 Caesarean section	3	
5.4 Forceps delivery	0	
5.5 Ventouse delivery	1	
5.6 Other delivery & unspecified	0	

	No.	%
<b>6. HYPERTENSION</b>	<b>6</b>	<b>3.6</b>
6.0 Unspecified	0	
6.1 Pre-existing hypertension	0	
6.2 Pre-eclampsia	6	
6.3 Pre-existing hypertension and pre-eclampsia	0	
<b>7. MATERNAL DISEASE</b>	<b>5</b>	<b>3.0</b>
7.0 Unspecified	0	
7.1 Maternal injury	1	
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	3	
<b>8. ANTEPARTUM HAEMORRHAGE (APH)</b>	<b>11</b>	<b>6.7</b>
8.1 Placental abruption	8	
8.2 Placenta praevia	0	
8.3 APH undetermined origin	3	
8.4 Vasa praevia	0	
<b>9. FETAL ABNORMALITY</b>	<b>55</b>	<b>33.3</b>
9.1 Central nervous system	9	
9.2 Cardiovascular system	11	
9.3 Urinary tract	7	
9.4 Gastrointestinal tract	1	
9.5 Chromosomal	16	
9.6 Metabolic	0	
9.7 Multiple	8	
9.9 Other	3	
<b>10. HAEMOLYTIC DISEASE</b>	<b>0</b>	<b>0</b>
10.1 Rhesus incompatibility	0	
10.2 Other feto-maternal blood group incompatibility (eg Kell)	0	
10.3 Haemoglobinopathy	0	

	<b>No.</b>	<b>%</b>
<b>11. INFECTION</b> Pathological evidence of infection required. Infections occurring as primary factors including deaths with chorioamnionitis or congenital pneumonia preceding membrane rupture.	<b>14</b>	<b>8.5</b>
11.0 Unspecified	1	
11.1 Streptococcus, Group B	4	
11.2 Escherichia coli	1	
11.3 Other bacterial	5	
11.4 Toxoplasma	0	
11.5 Syphilis	0	
11.6 Cytomegalovirus	1	
11.7 Other viral	1	
11.8 Fungal	0	
11.9 Other	1	
<b>12. OTHER</b>	<b>16</b>	<b>9.7</b>
12.1 Non-immune hydrops	1	
12.2 Feto-maternal haemorrhage	3	
12.3 Twin-twin transfusion	7	
12.4 Accident, poisoning or violence (Postnatal)	0	
12.5 SIDS	0	
12.8 Unknown / unexplained	1	
12.9 Other	4	
<b>TOTAL</b>	<b>165</b>	<b>100.0</b>

## APPENDIX 7

### Perinatal Society of Australia and New Zealand-Neonatal Death Classification (PSANZ-NDC), SA neonatal deaths, 2004

	No	%
<b>1. CONGENITAL ABNORMALITY</b>	<b>22</b>	<b>42.3</b>
1.1 Central nervous system	3	5.8
1.2 Cardiovascular system	5	9.6
1.3 Urinary tract	4	7.7
1.4 Gastrointestinal tract	0	0
1.5 Chromosomal	6	11.5
1.6 Metabolic	0	0
1.7 Multiple	3	5.8
1.8 Other congenital abnormality	1	1.9
1.9 Unspecified congenital abnormality	0	0
<b>2 EXTREME PREMATURITY</b>	<b>13</b>	<b>25.0</b>
<b>(typically infants of &lt;=24 weeks gestation or &lt;=600g birthweight)</b>		
Includes infants deemed too immature for resuscitation or continued life support beyond the delivery room		
<b>3 CARDIO-RESPIRATORY DISORDERS</b>	<b>1</b>	<b>1.9</b>
3.1 Hyaline membrane disease / Respiratory distress syndrome (RDS)	0	0
3.2 Meconium aspiration syndrome	0	0
3.3 Primary persistent pulmonary hypertension	1	1.9
3.4 Pulmonary hypoplasia	0	0
3.5 Chronic neonatal lung disease (typically, bronchopulmonary dysplasia)	0	0
3.8 Other	0	0
<b>4. INFECTION</b>	<b>7</b>	<b>13.5</b>
4.1 Bacterial	6	11.5
4.11 Congenital bacterial	6	
4.12 Acquired bacterial	0	
4.2 Viral	1	1.9
4.21 Congenital viral	0	
4.22 Acquired viral	1	
4.3 Protozoal eg Toxoplasma	0	0
4.4 Spirochaetal eg Syphilis	0	0
4.5 Fungal	0	0
4.8 Other	0	0
4.9 Unspecified organism	0	0

	No.	%
<b>5. NEUROLOGICAL</b>	<b>6</b>	<b>11.5</b>
5.1 Hypoxic ischaemic encephalopathy / Perinatal asphyxia (typically infants of >24 weeks gestation or >600g birthweight)	4	7.7
5.2 Intracranial haemorrhage	2	3.8
5.8 Other	0	0
<b>6. GASTROINTESTINAL</b>	<b>2</b>	<b>3.8</b>
6.1 Necrotising enterocolitis	2	3.8
6.8 Other	0	0
<b>7. OTHER</b>	<b>1</b>	<b>1.9</b>
7.1 SIDS	0	0
7.11 Consistent with SIDS	0	
7.12 Possible SIDS	0	
7.2 Multi-system failure - only if unknown primary cause or trigger event	0	0
7.3 Trauma	0	0
7.8 Other	0	0
7.9 Undetermined / Unknown	1	1.9
<b>TOTAL</b>	<b>52</b>	<b>100.0</b>

## APPENDIX 8

### South Australian Protocol for investigation of stillbirths

#### *Working party members:*

Dr R Watson (Chair)

Professor MJNC Keirse

Professor G Dekker

Dr TY Khong

Dr W Hague

#### **Introduction**

The perinatal mortality rate for South Australia in 2004 of 3.5 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 9.4 deaths per 1,000 births that year. Sixty-nine 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 2004, 17% 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.
- **Guthrie 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.<sup>13</sup>

**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.

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<sup>13</sup> 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.

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 should be sent to Pathology at least from:

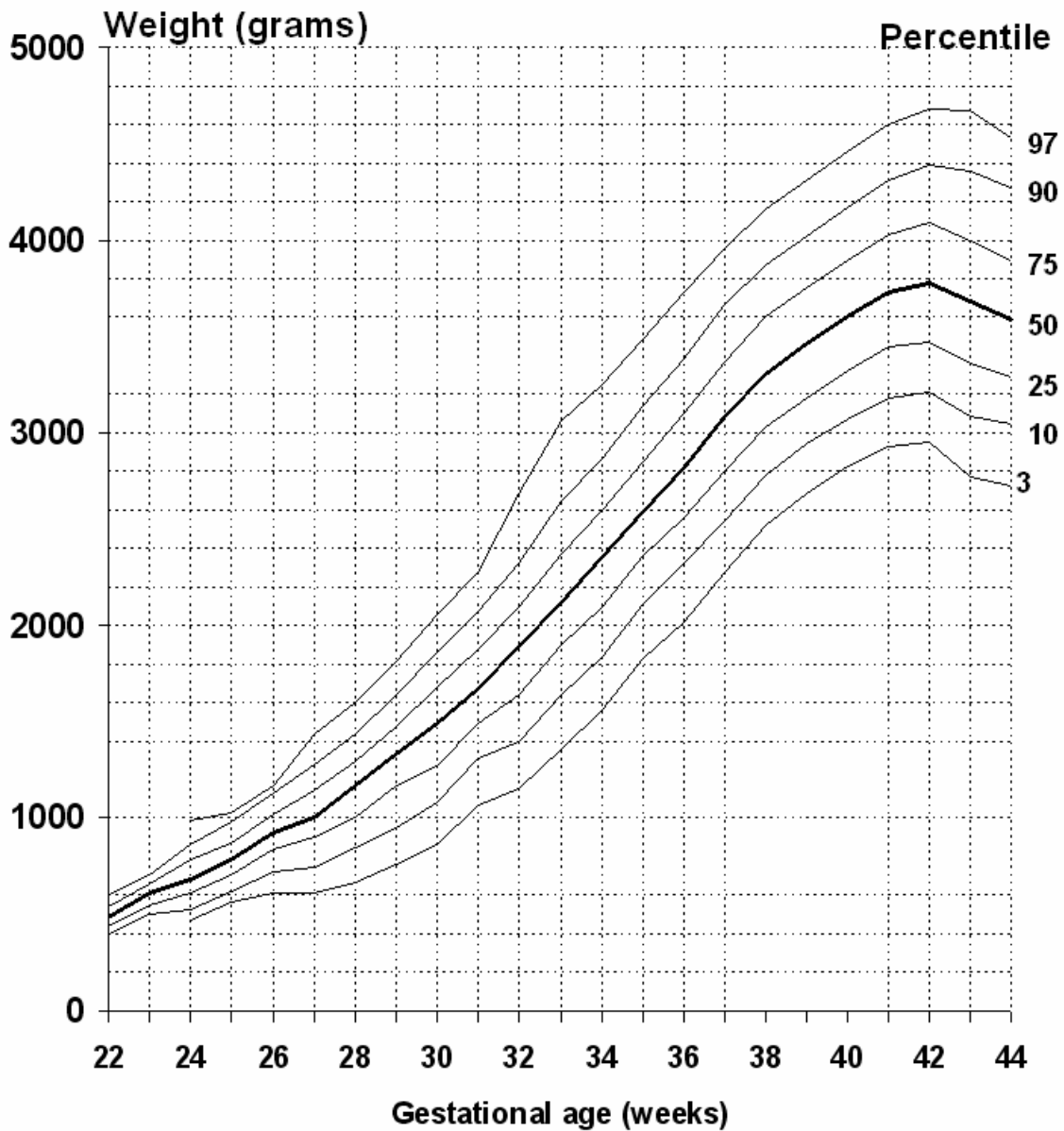
1. All stillborn infants, early neonatal deaths and mid-trimester miscarriages.
2. All multiple pregnancies with same sex infants.
3. All triplet and higher order multiple pregnancies.
4. All cases of discordant twin growth with greater than 20% weight difference.
5. All cases of prolonged rupture of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

# APPENDIX 10

## Australian birthweight percentiles

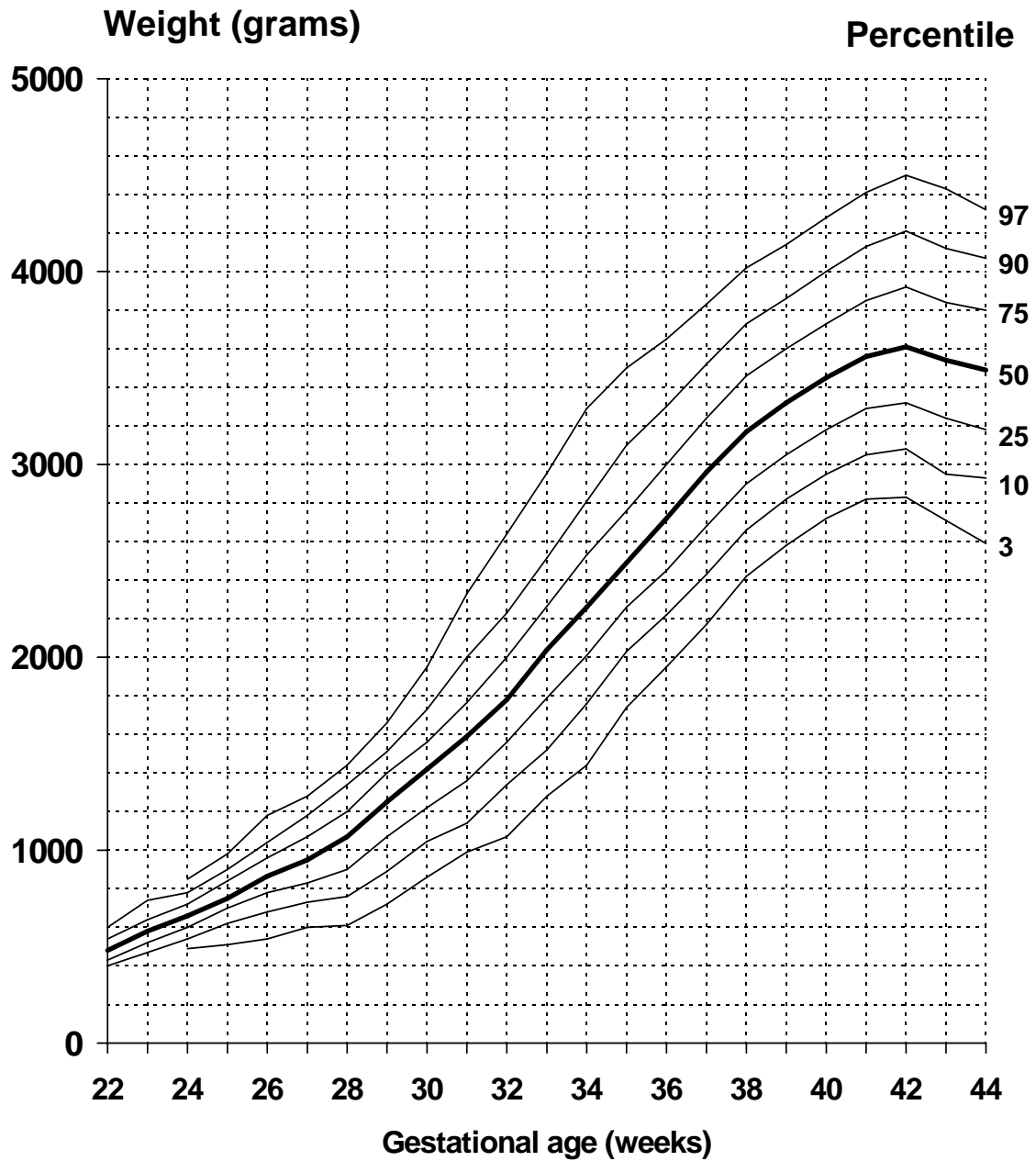
APPENDIX 10

### 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.

## Australian birthweight percentiles for singleton girls



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**Table 13: 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
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.

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**Table 14: 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
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.

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## 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.