Government of South Australia

Department of Health

Maternal, Perinatal and Infant Mortality in South Australia 2006

Including
the South Australian Protocol
for investigation of Stillbirths

NOVEMBER 2007

TWENTY-FIRST REPORT OF THE MATERNAL, PERINATAL AND INFANT MORTALITY COMMITTEE

on maternal, perinatal and post-neonatal deaths in 2006
including the South Australian Protocol for investigation of Stillbirths

DEPARTMENT OF HEALTH

Adelaide

November 2007

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Twenty-first Report of the Maternal, Perinatal and Infant Mortality Committee on maternal, perinatal and post-neonatal deaths in 2006 including the South Australian Protocol for investigation of Stillbirths

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Dr James Harvey	*Obstetrician*
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Dr Jonathan Hopkinson	*Obstetric anaesthetist*
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Mrs Jane Warland	*Midwife*
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Ms Robyn Kennare	*Senior midwife / Minute secretary*

We would like to express our most sincere thanks to the following members who retired from the Committee in 2007:

- Dr Elinor Atkinson
- Dr Chris Barnett
- Dr James Harvey
- Associate Professor Ross Haslam

We welcome back Dr George Kokar and new members Dr Rachel Chen, Dr Nicholas Manton, Dr Linda McKendrick and Mrs Julie Pratt to the Committee.

Acknowledgements

We gratefully acknowledge the valuable assistance of the following:

- Medical practitioners who completed confidential reports on maternal, perinatal or post-neonatal deaths and submitted autopsy reports;
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- Ms Sandra Sowerby and Ms Robyn Kennare for formatting the report and preparing the graphs.

Summary

This is the Twenty-first Annual Report of the Maternal, Perinatal and Infant Mortality Committee, for the year 2006:

1. There was one direct maternal death in South Australia in 2006. The maternal mortality ratio for direct and indirect deaths in the six years 2001-2006 was 8.5 per 100,000 confinements, which is very low by international standards. It is slightly higher than in the preceding five-year period. The number of deaths was small (nine) and the Committee has examined all the deaths and found no recurring causes for concern.

2. The Committee reviewed the 178 perinatal deaths (140 stillbirths and 38 neonatal deaths) occurring among babies born in South Australia in 2006. The perinatal mortality rate for all births (stillbirths of at least 400g or 20 weeks gestation and all live births) was 9.5 per 1,000 births, and the stillbirth rate 7.4 per 1,000 births. The neonatal mortality rate of 2.0 per 1,000 live births was the lowest ever recorded in the state.

3. Eighty-two percent of the perinatal deaths occurred in preterm babies (less than 37 weeks gestation). The leading cause of perinatal death in 2006 was again congenital abnormality, which accounted for 37% of the deaths. Other important causes were spontaneous preterm birth (13%), stillbirth of unknown cause (12%), fetal growth restriction (11%) and specific perinatal conditions (9%). There were 21 stillbirths of unknown cause, a rate of 1.1 per 1,000 births in 2006. This rate has fallen in recent years, compared with 2.0 per 1,000 births in 1995-1998. The Committee has distributed its protocol for the investigation of stillbirths to all obstetric units (Appendix 8). Nineteen deaths were attributed to fetal growth restriction. Poor fetal growth and preterm birth have been associated with smoking during pregnancy. Eighteen percent of women who gave birth in South Australia in 2006 smoked during pregnancy.

4. *Eight babies of Aboriginal mothers died during the perinatal period. The perinatal mortality rate of 14.3 per 1,000 births for Aboriginal mothers in 2006 was still higher than that of 9.3 per 1,000 for non-Aboriginal mothers. Although the rates of preterm, small-for-gestational-age and low birthweight births for Aboriginal mothers have fallen in 2006, these rates remain about twice those of births to non-Aboriginal mothers. The proportion of Aboriginal women who smoked during pregnancy also fell in 2006, but remained much higher than the proportion for non-Aboriginal women (54% v 17%).*

5. The Committee also reviewed the 27 post-neonatal deaths in 2006 among babies born in South Australia*, three of which were babies of Aboriginal mothers.* The post-neonatal mortality rate remained very low at 1.4 per 1,000 live births. Although the post-neonatal death rate attributed to SIDS (Sudden Infant Death Syndrome) remains low with three deaths attributed to SIDS,

the numbers of deaths from 'sudden unexpected deaths in infancy' have not fallen in recent years. These include deaths from SIDS, accidental asphyxiation and undetermined cause. These deaths often have similar associated factors including inappropriate sleeping practices.

6. The infant mortality rate in 2006 was 3.5 per 1,000 live births, the lowest ever recorded in the state. *The 2006 infant mortality rate for babies of Aboriginal mothers of 9.0 per 1,000 live births was still substantially higher than that of 3.3 for babies of non-Aboriginal mothers.*

7. From reviewing maternal and perinatal deaths in recent years, 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.
   - Review by a physician early in pregnancy of women with current or previous serious medical conditions.
   - Pregnant women travelling in motor vehicles need to wear seat belts at all times for safety.
   - Pregnant women with a Body Mass Index (BMI) greater than 35 are at higher risk from anaesthesia. A timely referral for an anaesthetic consultation should be considered for women with a high BMI.
   - That health professionals implement effective strategies to reduce smoking in pregnancy, *including culturally appropriate smoking cessation interventions for Aboriginal women.*
   - Testing the antibody status of Rhesus D negative women before the first administration of Anti-D is important. A measurable titre of Anti-D antibodies is an indicator of potential alloimmunisation and always requires investigation and a specialist opinion.
   - Early ultrasound determination of chorionicity is advised for twin pregnancies, followed by further surveillance for twin-twin transfusion in monochorionic pregnancies.
   - Vigilance to ensure that fetal growth restriction is not missed.
   - 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 there is a lack of on-site CTG expertise; this includes easier access of rural practitioners to the consultant on call.
   - Appropriate antibiotic treatment for carriers of Group B Streptococcus and for women with risk factors such as prolonged rupture of membranes and preterm labour.

- When induction of labour is deemed necessary in the presence of a uterine scar and an unripe cervix, careful consideration should be given to alternative options such as postponing the induction or caesarean section.
- Further development and implementation of statewide perinatal protocols is recommended (www.health.sa.gov.au/ppg).
- Use of the recently-revised protocol for investigating stillbirths, which has been sent to all maternity units in South Australia (Appendix 8).
- Seeking parental permission for autopsy, which may provide information most valuable in the counselling of parents and in the management of future pregnancies. The State Perinatal Autopsy Service (telephone 08-8161-7333) is available at no cost to the parents, including those in country areas. Certain categories of death have to be reported to the State Coroner (see page 37).
- Sending placentas for histological examination with all relevant clinical information in all cases of perinatal death (see Appendix 9).

8. From the review of the post-neonatal deaths in recent years, the Committee recommends the following:
   - A major public health campaign to promote safe sleeping and prevent sudden unexpected death in infancy needs to be implemented. 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 sudden unexpected death in infancy. 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.
   - An effective system of appropriate and ongoing support, supervision and referral should be offered to families with known risk factors for adverse child outcome, such as substance abuse, psychiatric illness, extreme youth of the mother or violence in the household. This should be continued at least throughout the first year of life, if not for a longer period of time.
   - Monitoring growth in children, which can be undertaken using the weight percentiles in the child's Personal Health Record (Blue Book), and investigating why a child is not thriving.
   - Immunisation of children to prevent infectious disease.

- Vigilance to ensure that potential hazards in the home are removed from the infant's environment.
- Vigilance to ensure safe feeding in children under four years of age. Foods that can break off into pieces should not be given, as accidental asphyxiation may occur.
- Consideration should be given to better ways of identifying serious underlying illness in children presenting to clinicians, for example, Medic Alert bracelets.
- Systems to facilitate referral by community nurses of high-risk children to paediatricians or tertiary hospitals for urgent appointments need to be considered.
- Hospitals with high paediatric throughput need provision of 24 hour paediatric expertise.
- Appropriate paediatric protocols need to be available in all hospitals.
- Professional advice should be sought for infants who are excessively drowsy or irritable. These infants should be considered seriously ill unless proven otherwise.
- Professional advice should be sought for infants who are feeding poorly, as these infants can become dehydrated very quickly.
- Further research needs to be undertaken in relation to the incidence of community acquired Methicillin Resistant Staphylococcus Aureus (MRSA) infections, to help guide clinical practice in terms of antibiotic choice in sick children. This may include setting up systems to make hospital and community acquired MRSA infection a notifiable communicable disease.

I Introduction

This is the Twenty-first 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 practitioners identified as having been in charge of clinical care through the completion of confidential medical reports, and these are supplemented by autopsy information from the Coroner's Office and hospital pathology services. Case summaries are prepared by the

Committee's senior midwife and the medical secretary for discussion by the Subcommittees. These do not contain any identifying information but the members are made aware of the type of health services available in each case, for example, location (metropolitan or country) and hospital category. Where certain aspects of a case require clarification, a member of the Subcommittee may seek clarification from the practitioner concerned. In the Post-neonatal Subcommittee a paediatrician acts as the consultant for each case and obtains detailed clinical information where necessary. The discussions aim to identify the factors associated with the death, and to assign a cause or causes of death in each case. Comments or recommendations made by the Subcommittees are included in the Committee Report.

Definitions used by the Committee are provided in Appendix 3 of this Report. The Committee receives notifications of maternal, perinatal and post-neonatal deaths occurring in South Australia. However, statistics presented for perinatal and post-neonatal deaths relate only to those occurring in babies born in South Australia. Deaths of South Australian born babies occurring in other states are also included in the statistics where information is available for them. This Twenty-first Report of the Committee incorporates information on maternal, perinatal and post-neonatal deaths in South Australia in the year 2006.

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 2006

1. Maternal mortality 2006

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

The Australian Institute of Health and Welfare National Advisory Committee on Maternal Mortality complies with international reporting protocols[2] and reports a maternal mortality ratio (see Appendix 3) which only includes pregnancy-related deaths, that is, direct and indirect maternal deaths, per 100,000 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 was one direct maternal death in 2006. Maternal deaths in South Australia for the three categories of deaths from 1961 to 2006 are presented in Table 1 by five-year periods except for the most recent period of six years (2001-2006). Maternal mortality ratios have been calculated for direct and indirect deaths (Table 1 and Figure 1). The maternal mortality ratio for the last six-year period 2001-2006 was 8.5 deaths per 100,000 confinements. This is higher than the ratio for South Australia for the preceding five-year period 1996-2000 which was 6.6 deaths per 100,000 confinements. However, the number of deaths is small (nine in 2001-2006, compared with six in 1996-2000). The Committee reviewed all the deaths and found no recurring pattern of causes of death.

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

[2] Sullivan EA, King JF (eds) 2006. Maternal Deaths in Australia 2000-2002. Sydney: AIHW National Perinatal Statistics Unit. Maternal Deaths Series no. 2. Cat . no. PER 32.

Of a total of 37 pregnancy-related maternal deaths in the period 1986-2006, 15 were direct deaths and 22 were indirect deaths. Three of the 15 direct deaths and two of the 22 indirect deaths were of Aboriginal women. As Aboriginal women accounted for only 2%- 3% 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.

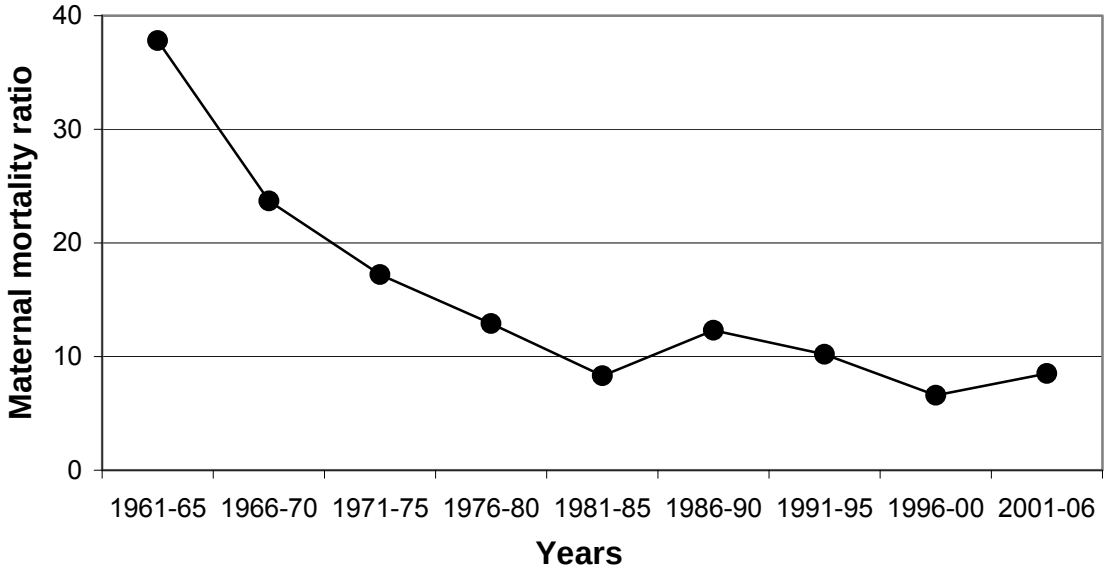
Table 1: Maternal mortality by category of death, in 5-year periods, South Australia, 1961 – 2006

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 – 2006**	5	4	2	11	9	8.5

*Expressed as deaths per 100,000 confinements

** Six year period

Figure 1: Maternal Mortality Ratio, South Australia 1961-2006



2. Perinatal mortality 2006

(1) Perinatal mortality rates

In 2006 there were 18,803 births in South Australia. These included live births of any gestation and stillbirths of at least 400g birthweight or 20 weeks gestation. There were 140 stillbirths and 18,663 live births. Thirty-eight live births died within 28 days of birth (neonatal deaths). Table 2 shows the numbers of stillbirths and neonatal deaths for specified birthweights or gestations.

The perinatal mortality rate for all births in 2006 was 9.5 deaths per 1,000 births. The stillbirth rate was 7.4 deaths per 1,000 births and the neonatal mortality rate 2.0 deaths per 1,000 live births (the lowest recorded in the state, equal to the rate in 1999). Forty-six of the 178 perinatal deaths (25.8%) were terminations of pregnancy. The exclusion of terminations would have resulted in a perinatal mortality rate of 7.0 deaths per 1,000 births. Fifty perinatal deaths (28.1%) were less than 400g birthweight.

Perinatal mortality for international comparison includes only births of at least 1,000g birthweight (or 28 weeks gestation if birthweight unavailable) and early neonatal deaths within the first seven days of life. This perinatal mortality rate was 3.1 deaths per 1,000 births, with a stillbirth rate of 2.4 per 1,000 births and an early neonatal mortality rate of 0.7 deaths per 1,000 live births.

Table 2: Perinatal mortality, South Australia, 2006

Specified birthweight/ gestation	Total births	Live births	Stillbirths		Neonatal deaths		Perinatal deaths	
			Number	Deaths per 1,000 births	Number	Deaths per 1,000 live births	Number	Deaths per 1,000 births
≥400g/20 weeks (all livebirths included)	18,803	18,663	140	7.4	38	2.0	178	9.5
≥500g/22 weeks*	18,721	18,649	72	3.8	26	1.4	98	5.2
					20**	1.1	92**	4.9
≥1,000g/28 weeks*	18,613	18,568	45	2.4	16	0.9	61	3.3
					13**	0.7	58**	3.1

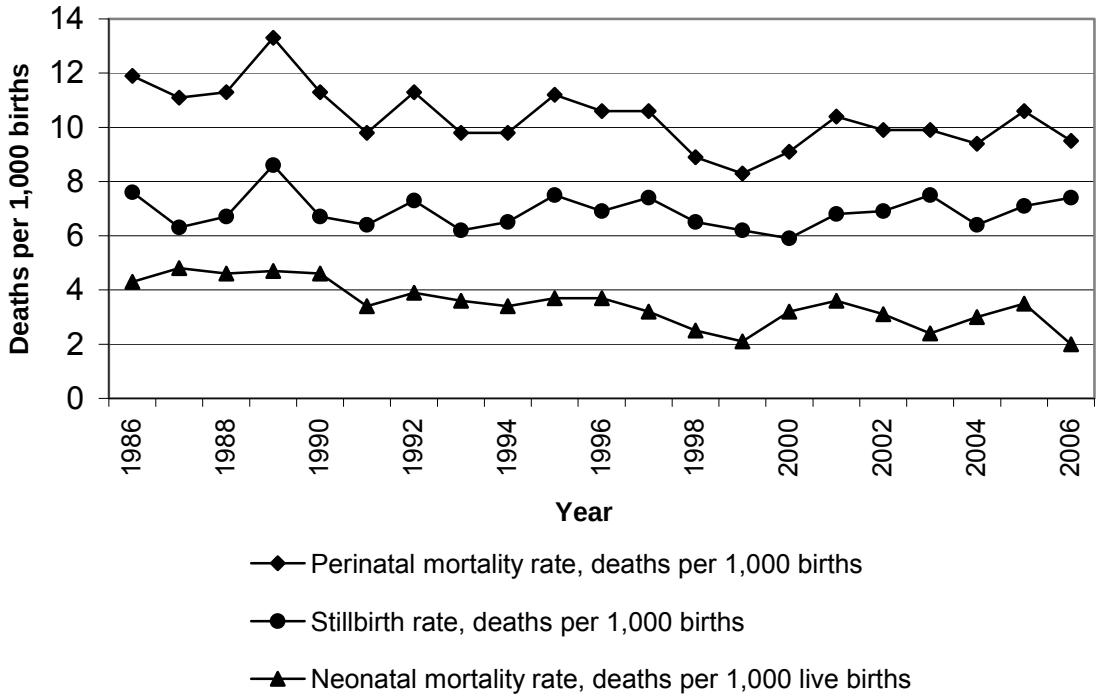
* For national statistics as recommended by WHO, only fetuses and infants of at least 500g birthweight, or, when birthweight is unavailable, the corresponding gestational age (22 weeks) or body length (25cm crown-heel), are included.

* 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.

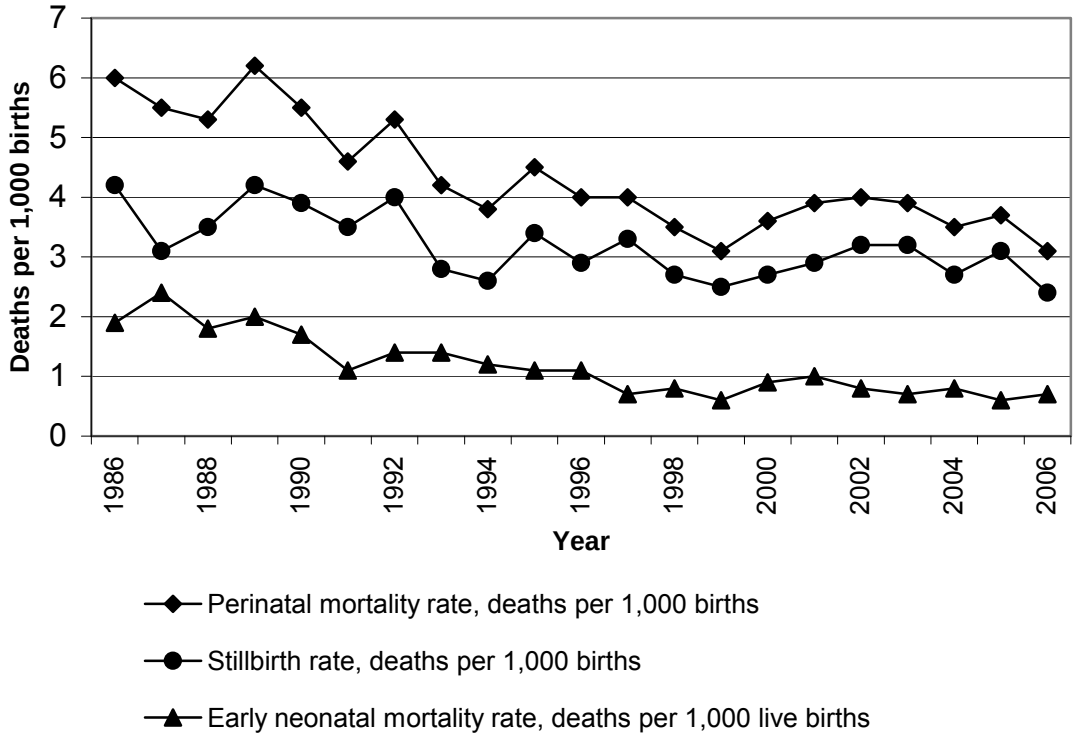
South Australian perinatal mortality rates, including stillbirth and neonatal mortality rates, for 1986-2006 from Committee data are presented in Figure 2 for all births. Rates for births of at least 1,000g birthweight (or when birthweight was unavailable, 28 weeks gestation) are presented in Figure 3. Figure 3 includes only early neonatal deaths, ie, occurring within the first seven days of life (WHO recommendation for international statistics). The graphs demonstrate that the fall in the perinatal mortality rate has received a greater contribution from the fall in the neonatal mortality rate than from that in the stillbirth rate. The stillbirth rate for all births has not decreased over the last two decades. However, if only births of at least 1,000g birthweight are considered, a decrease is evident from 4.2 deaths per 1,000 births in 1986 to 2.4 deaths per 1,000 births in 2006.

Figure 2: Perinatal mortality rate (live births of any gestation and stillbirths >=400g / 20 weeks gestation), South Australia 1986-2006



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

Figure 3: Perinatal mortality rate (births >=1,000g / 28 weeks gestation), South Australia 1986-2006



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

Comparisons of perinatal mortality rates among Australian states by the Australian Bureau of Statistics

Table 3 shows that the perinatal mortality rate for South Australia over the years has generally tended to be lower than the national rate. In 2004 and 2005, South Australia recorded the lowest rates in Australia. Data for 2006 are not yet available. These rates for South Australia and Australia for 1990-2005 from the Australian Bureau of Statistics (ABS) are presented graphically in Figure 4. The South Australian rates provided by the ABS differ from those provided by the Committee. The Committee's rates are based on births and deaths that occurred in the state in the year. Those of the ABS are based on births and deaths registered in Australia in the year for mothers usually resident in South Australia, irrespective of where and when they occurred. The ABS also excludes those births and deaths which are less than 400g birthweight; if birthweight is unavailable, gestation has to be at least 20 weeks for inclusion. *Statistics provided by the Australian Bureau of Statistics on Aboriginal births 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.*

Table 3: Perinatal mortality rate*, Australian states, 1990 – 2005

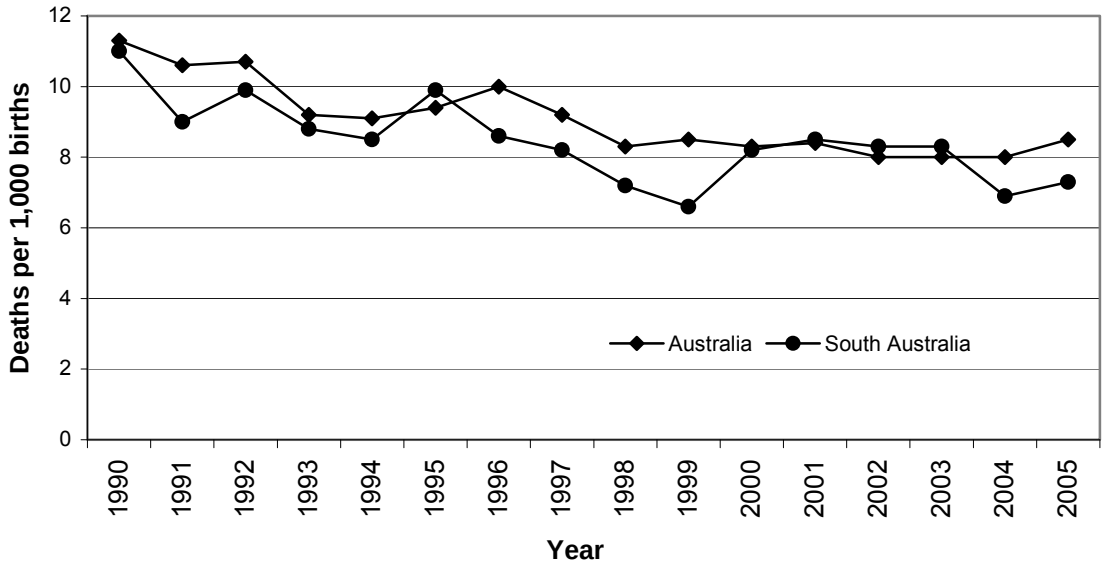
Year	NSW	VIC	Qld	SA	WA	Tas	NT	ACT	AUSTRALIA
1990	11.7	11.6	10.2	11.0	10.4	10.6	18.1	13.8	11.3
1991	11.0	9.8	11.1	9.0	10.3	11.9	18.2	12.5	10.6
1992	11.8	9.4	10.6	9.9	9.8	9.1	19.3	9.4	10.7
1993	9.5	8.5	9.4	8.8	8.3	10.0	21.1	7.7	9.2
1994	9.2	9.3	8.9	8.5	8.3	8.4	16.9	6.9	9.1
1995	8.9	9.2	9.8	9.9	9.3	9.7	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
2004	7.2	9.2	8.4	6.9	7.4	6.9	11.2	11.0	8.0
2005	7.4	9.9	8.8	7.3	7.7	8.5	14.6	10.4	8.5

* 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. Catalogue No 3303.0 - Causes of Death, Australia, 2005, March 2007.

Figure 4: Perinatal Mortality Rates, South Australia and Australia 1990-2005

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



Source: Australian Bureau of Statistics, Cat. No. 3303.0 - Causes of Death, Australia, 2005, March 2007

(2) Birthweight-specific perinatal mortality

The distribution of stillbirths and neonatal deaths by birthweight, and birthweight-specific perinatal mortality rates for 2006 are provided in Table 4. Of the 178 perinatal deaths, 148 (83.1%) were of low birthweight (<2,500g) and 146 (82.0%) were preterm births (<37 weeks gestation, Table 6).

There were 140 stillbirths, accounting for 78.7% of the perinatal deaths in 2006. Of the 58 intrapartum stillbirths, 53 were under 750g birthweight (Table 5) and 42 were terminations of pregnancy. Of the 38 neonatal deaths, 27 (71.1%) were low birthweight babies and three resulted from terminations of pregnancy.

Table 4: Perinatal mortality by birthweight, South Australia, 2006, (live births of any gestation and stillbirths of at least 400g or 20 weeks gestation)

			Stillbirths		Neonatal deaths		Perinatal deaths	
Birthweight (grams)	Total births	Live births	Number	Deaths per 1,000 births	Number	Deaths per 1,000 live births	Number	Deaths per 1,000 births
<400	50	4	46	920.0	4	1,000.0	50	1,000.0
400-499	31	9	22	709.7	7	777.8	29	935.5
500-749	49	29	20	408.2	4	137.9	24	489.8
750-999	59	52	7	118.6	6	115.4	13	220.3
1,000-1,499	115	109	6	52.2	1	9.2	7	60.9
1,500-1,999	235	227	8	34.0	1	4.4	9	38.3
2,000-2,499	773	762	11	14.2	3	3.9	14	18.1
2,500-2,999	2,881	2,874	7	2.4	7	2.4	14	4.9
3,000-3,499	6,756	6,750	6	0.9	3	0.4	9	1.3
3,500-3,999	5,675	5,673	2	0.4	1	0.2	3	0.5
4,000-4,499	1,873	1,869	4	2.1	0	0	4	2.1
4500+	303	303	0	0	0	0	0	0
Unknown	3	2	1*	na	1**	na	2	na
Total	**18,803**	**18,663**	**140**	**7.4**	**38**	**2.0**	**178**	**9.5**

* This stillbirth was a twin which died in utero at 19 weeks and was born at 28 weeks gestation with its twin

** This live birth/neonatal death was born at 19 weeks gestation

na: not applicable

Table 5: Time of perinatal death by birthweight, South Australia, 2006 (live births of any gestation and stillbirths of at least 400g birthweight or 20 weeks gestation)

Birthweight (grams)	Stillbirths			Neonatal deaths	Total
	Antepartum	Intrapartum	Uncertain if antepartum or intrapartum		
<500	23	43	2	11	79
500-749	10	10	0	4	24
750-999	4	3	0	6	13
1,000-1,499	5	1	0	1	7
1,500-1,999	8	0	0	1	9
2,000-2,499	9	1	1	3	14
2,500-2,999	6	0	1	7	14
3,000-3,499	5	0	1	3	9
3,500-3,999	2	0	0	1	3
4,000-4,499	4	0	0	0	4
4,500+	0	0	0	0	0
Unknown	1*	0	0	1†	2
Total	**77**	**58**	**5**	**38**	**178**

* This stillbirth was a twin which died antepartum at 19 weeks and was born at 28 weeks gestation

† This neonatal death was liveborn at 19 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, 2006 (live births of any gestation and stillbirths of at least 400g or 20 weeks gestation)

Gestational age at birth (weeks)	Total births	Live births	Stillbirths		Neonatal deaths		Perinatal deaths	
			Number	Deaths per 1,000 births	Number	Deaths per 1,000 live births	Number	Deaths per 1,000 births
<24	94	16	78	829.8	13	812.5	91	968.1
24-27	84	70	14	166.7	8	114.3	22	261.9
28-31	158	149	9	57.0	2	13.4	11	69.6
32-36	1,210	1,192	18	14.9	4	3.4	22	18.2
37-41	17,174	17,153	21	1.2	11	0.6	32	1.9
42+	83	83	0	0	0	0	0	0
Total	**18,803**	**18,663**	**140**	**7.4**	**38**	**2.0**	**178**	**9.5**

3. Post-neonatal and infant mortality 2006

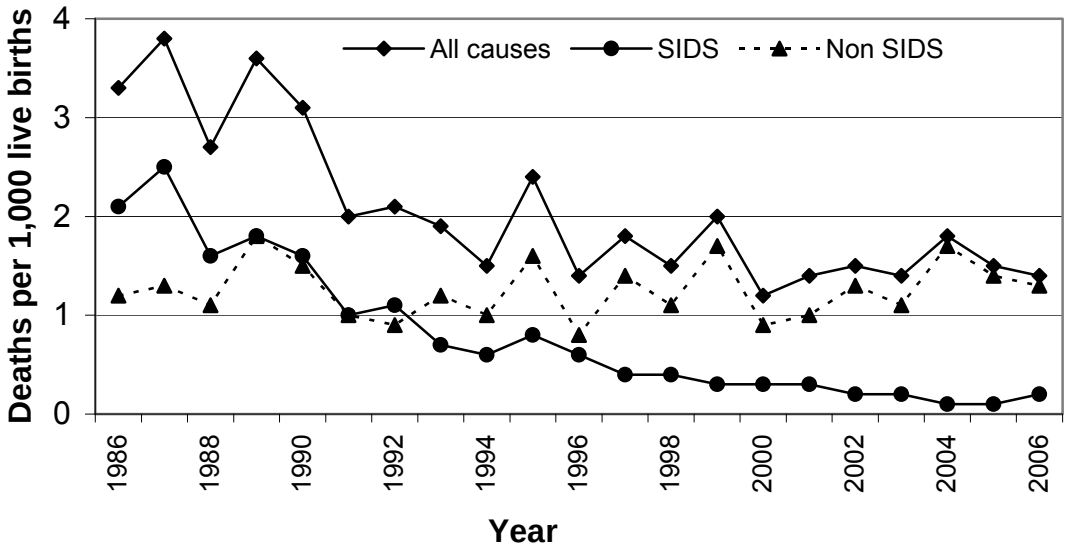
There were 27 post-neonatal deaths in 2006 among babies born in South Australia. The post-neonatal death rate for South Australia for 2006 was 1.4 deaths per 1,000 live births. The post-neonatal death rate due to Sudden Infant Death Syndrome (SIDS), with three deaths, remained at a low level of 0.2 per 1,000 live births. However, despite the low incidence of SIDS deaths in 2006 and recent years, the number of post-neonatal deaths from other causes has not decreased. In addition, the number of deaths categorised as Sudden Unexpected Deaths in Infancy (SUDIs, which include SIDS, accidental asphyxiation and 'undetermined') has not changed: many of these deaths are associated with unsafe infant sleeping and bedding practices.

The numbers and rates of post-neonatal deaths for South Australia for all years from 1986 to 2006 are presented in Table 7 and the rates in Figure 5, together with the relative contributions from SIDS and non-SIDS deaths**.**

Table 7: Post-neonatal deaths and death rates, South Australia, 1986 – 2006

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

Figure 5: Post-neonatal death rates, South Australia, 1986 – 2006

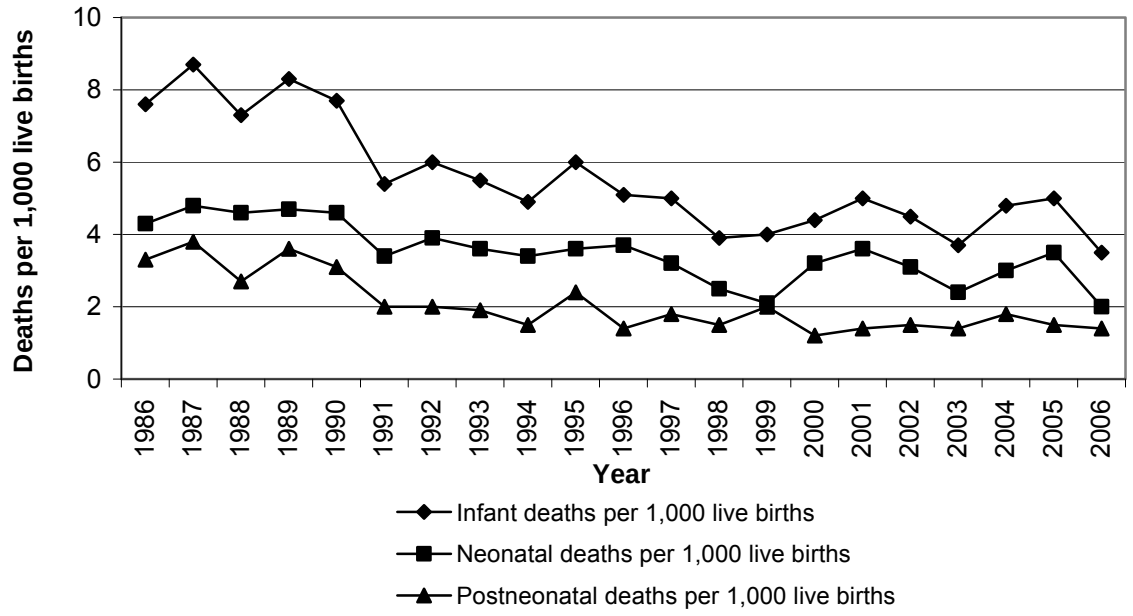


The infant mortality rate for South Australia for 2006 was 3.5 deaths per 1,000 live births, which is the lowest rate ever recorded in the state. This includes all 65 deaths of infants under 1 year of age, ie, the 38 neonatal deaths and the 27 post-neonatal deaths (Appendix 3). *The infant mortality rate for babies of Aboriginal mothers (with three post-neonatal deaths and two neonatal deaths out of 553 live births) was 9.0 deaths per 1,000 live births, compared with the infant mortality rate of 3.3 deaths per 1,000 live births for babies of non-Aboriginal mothers.* Infant mortality rates with the component post-neonatal and neonatal death rates for South Australia for 1986-2006 are presented in Table 8 and Figure 6.

Table 8: Infant deaths (neonatal and post-neonatal) and death rates, South Australia, 1986 - 2006

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

Figure 6: Infant mortality rates, South Australia, 1986 - 2006



* Infant deaths include post-neonatal and neonatal deaths

Comparisons of infant mortality rates for all Australian states for 1986-2005 from the Australian Bureau of Statistics

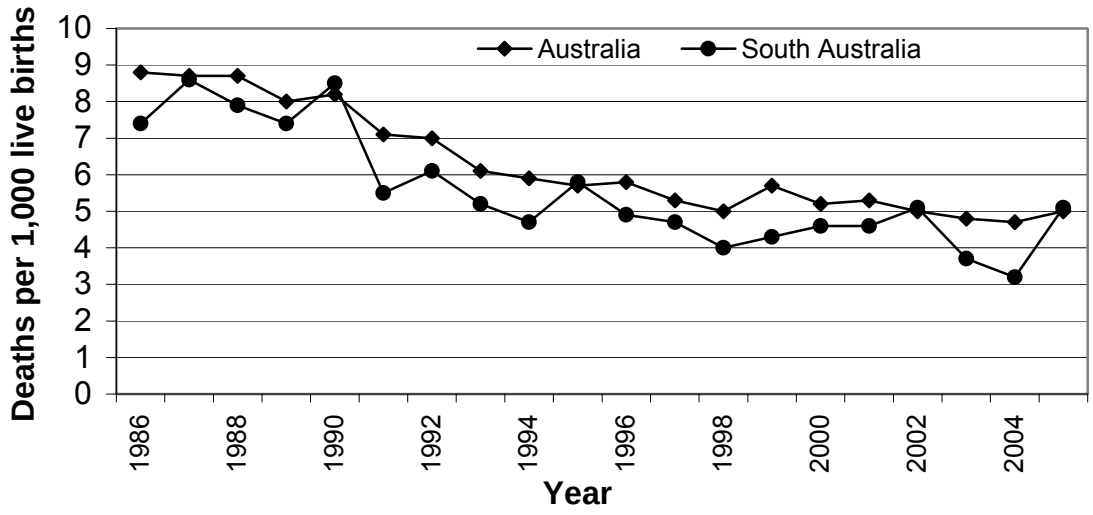
These are presented in Table 9: the rates for 2006 are not yet available. Rates for South Australia compared with Australia for 1986-2005 are shown in Figure 7. The South Australian infant mortality rate has been comparable with most of the other states. **Please note that the ABS includes only registered births and deaths in any year of at least 400g birthweight (or 20 weeks gestation if birthweight unavailable) and adjusts for state of usual residence: hence rates reported may differ from those reported by this Committee, eg in Table 8.**

Table 9: Comparison of infant mortality rates (deaths per 1,000 live births), across Australian states using ABS data, 1986 – 2005

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

Source: Australian Bureau of Statistics. Catalogue No 3302.0 – 2005 Deaths Australia, November 2006

Figure 7: Infant mortality rates, South Australia and Australia, 1986-2005



Source: Australian Bureau of Statistics. Catalogue No. 3302.0 - 2005 Deaths Australia, November 2006

III Causes of death 2006

1. Causes of maternal deaths 2006

There was one direct maternal death in 2006. This mother in her twenties had a postpartum haemorrhage at birth. A few hours later she felt faint, began to breathe rapidly, had a rapid pulse and was hypotensive and pale. The uterus was well contracted and there was no unusual vaginal loss. She was transfused but deteriorated and died about eight hours after giving birth. A large pulmonary embolus was found at autopsy, the origin of which could not be determined. This was a direct maternal death from pulmonary embolism (ICD 10AM code O88.2). The Committee also reviewed the circumstances of two late maternal deaths in 2006 and resolved that the deaths were both incidental ones. Thus they will not be included in the statistics for late maternal deaths. One was a death from drug use and the other from undetermined cause.

2. Causes of perinatal deaths 2006

(1) Classification of perinatal deaths

The Perinatal Subcommittee classified each of the 178 perinatal deaths which occurred in 2006 according to the Perinatal Society of Australia and New Zealand – Perinatal Death Classification (PSANZ-PDC). This classification, together with the Australian birthweight / gestation percentile charts (for singletons as well as twins), is available on the PSANZ website (www.psanz.org.au) and will be regularly updated by the PSANZ Perinatal Mortality Special Interest Group.

The classification of perinatal deaths in 2006 according to PSANZ-PDC is as follows (Table 10):

Table 10: Classification of perinatal deaths, PSANZ-PDC, South Australia, 2006

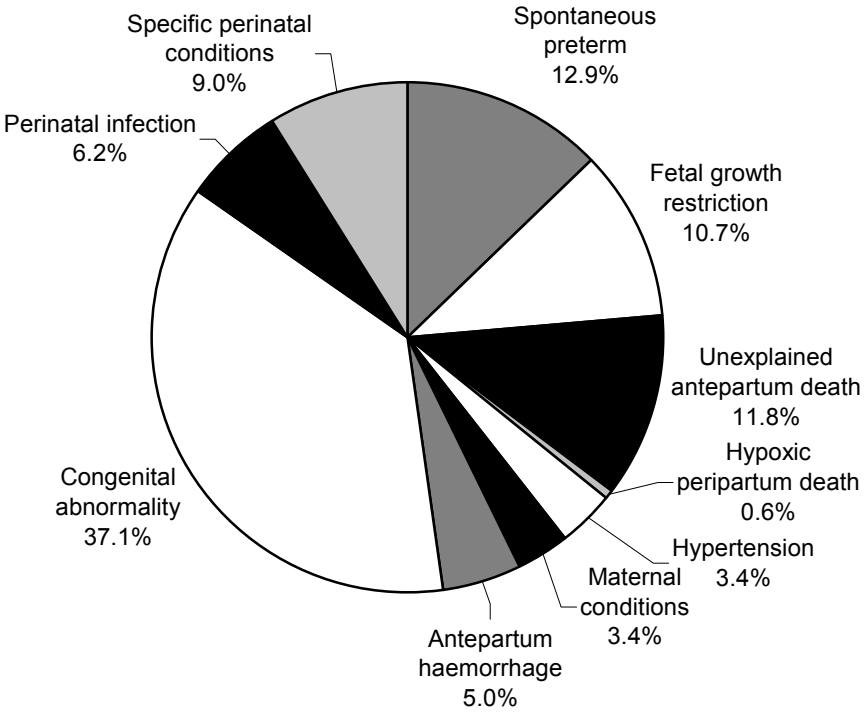
	PSANZ-PDC	Number	Percent	Deaths per 1,000 births
1.	Congenital abnormality	66	37.1	3.5
2.	Perinatal infection	11	6.2	0.6
3.	Hypertension	6	3.4	0.3
4.	Antepartum haemorrhage (APH)	9	5.0	0.5
5.	Maternal conditions	6	3.4	0.3
6.	Specific perinatal conditions	16	9.0	0.9
7.	Hypoxic peripartum death	1	0.6	0.1
8.	Fetal growth restriction	19	10.7	1.0
9.	Spontaneous preterm	23	12.9	1.2
10.	Unexplained antepartum death	21	11.8	1.1
11.	No obstetric antecedent	0	0	0
	Total	**178**	**100.0**	**9.5**

The PSANZ-PDC for perinatal deaths in 2006 is shown graphically in Figure 8 and its breakdown by subgroups and birthweight groups is provided in Appendix 4 and Appendix 5.

Congenital abnormalities were again the leading cause of perinatal death in 2006, accounting for 37% of all deaths. The next leading causes were preterm birth due to spontaneous labour or pre-labour rupture of membranes (13%) and unexplained antepartum death (12%), followed by fetal growth restriction (11%) and specific perinatal conditions (9%).

The death rate due to unexplained stillbirth remained relatively low at 1.1 per 1,000 births compared with 2.0 per 1,000 births in 1995-1998.

Figure 8: Perinatal deaths in South Australia 2006, by PSANZ-PDC (N=178)



A brief description of each of the 11 groups follows.

1. Congenital abnormality – 66 deaths

This group of 66 deaths includes 41 terminations of pregnancy at 20 weeks gestation or more for fetuses with congenital abnormalities. The types of abnormalities were as follows:

Central nervous system	12
Cardiovascular	10
Urinary tract	2
Gastrointestinal tract	1
Chromosomal	13
Metabolic	2
Multiple	17
Other	9
Total	**66**

Of the 12 babies with central nervous system abnormalities, seven had neural tube defects and three had hydrocephalus. One baby had holoprosencephaly and another had agenesis of the corpus callosum.

The 10 infants with cardiovascular abnormalities had the following:

- Hypoplastic left heart syndrome – six babies: one had an associated abnormality of a peripheral artery.
- Truncus arteriosus
- Tricuspid atresia, ventricular septal defect and hypoplastic right ventricle
- Complex abnormalities – two babies: one had an aorta serving as outlet for both ventricles, a large ventricular septal defect and pulmonary atresia. The other had severe aortic stenosis, coarctation, a dilated left ventricle with severe dysfunction and a small patent ductus arteriosus.

The two babies with urinary tract abnormalities were a set of twins with renal tubular dysgenesis. Oligohydramnios was noted in this pregnancy and the twins were electively delivered preterm. However their renal function was incompatible with life.

One baby had a gastrointestinal tract abnormality.

Thirteen babies had chromosomal abnormalities, which were as follows:

- Trisomy 21 - two babies, one of whom had a congenital cardiac abnormality
- Trisomy 13
- Trisomy 18 - five babies, one of whom had a spina bifida with hydrocephalus
- Turner's syndrome – two babies. Both were hydropic; one had cardiac abnormalities and the other had an aortic abnormality, renal tubular dysgenesis and pulmonary hypoplasia.

- Trisomy 9, associated with cleft palate, micrognathia and severe growth restriction
- Wolf-Hirschhorn syndrome (a deletion defect of the short arm of chromosome 4) with congenital diaphragmatic hernia
- An abnormality of chromosome 18.

Two babies had metabolic defects. One baby had an abnormal fatty acid profile, associated with macrosomia and hepatic steatosis. The baby's mother had fatty liver of pregnancy. The mother of the other baby had been treated for longstanding derangement of liver function following removal of a hepatic tumour in childhood and a porto-gastric anastomosis. She had hepatic portal hypertension with pre-existing mild cholestasis which worsened later in pregnancy. Antepartum fetal death occurred at 36 weeks. The fetus had hepatomegaly and cord blood bile acid concentration was very much higher than normal. Subsequent histopathology of the fetal liver showed marked deficiency of expression of a bile acid transporter protein.

There were 17 babies with multiple congenital abnormalities. No specific syndromes were identified except for a caudal regression sequence and a possible fetal alcohol syndrome which was associated with multiple defects including a cardiovascular defect. Three babies had congenital diaphragmatic hernia among their abnormalities and one of these also had a neural tube defect.

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

- Congenital diaphragmatic hernia – four babies
- Exomphalos
- Thanatophoric dysplasia
- Other musculoskeletal abnormalities – two babies
- Tuberous sclerosis with multiple cardiac rhabdomyomata and cerebral white matter abnormalities.

2. Perinatal infection – 11 deaths

- Group B Streptococcus - infections were noted in two stillbirths and two neonatal deaths. One neonatal death was associated with prolonged labour in a woman who had been screened for Group B Streptococcus and yielded a negative result. The other was a preterm birth to a mother with a urinary tract infection.
- Escherischia coli sepsis - two deaths. One infant was born at 41 weeks: autopsy showed severe meconium aspiration and blood cultures yielded E coli.

- Haemophilus influenzae infection - one death. The infant's mother developed symptoms and signs of sepsis. H influenzae was cultured from her blood, high vaginal swab and the placenta.
- Unspecified bacterial infections - two deaths. One baby died in utero at 27 weeks while the other, which was growth restricted, was 41 weeks gestation.
- Cytomegalovirus infection - one death. This mother presented with an intrauterine fetal death at 23 weeks gestation.
- Toxoplasma infection - one death. This mother had preterm rupture of membranes, a febrile illness and IgM was still detectable seven weeks after stillbirth at 23 weeks. The fetus had hydrocephalus.

3. Hypertension – 6 deaths

- Pre-eclampsia - five deaths, all stillbirths occurring before term. Two were complicated by placental abruption and one other by fetal growth restriction.
- One other stillbirth was attributed to pre-eclampsia superimposed on essential hypertension.

4. Antepartum haemorrhage – 9 deaths

- Placental abruption - six deaths
- Placenta praevia - one death; this was a Grade IV placenta praevia increta with massive haemorrhage.
- Antepartum haemorrhage of undetermined origin - two deaths.

5. Maternal conditions - 6 deaths

- One stillbirth was a twin. Termination of this twin pregnancy for anencephaly in the other twin was performed when the mother presented with bulging membranes at 23 weeks.
- One stillbirth was the result of a termination for maternal mental health reasons.
- One stillbirth occurred at 23 weeks in a mother who was diagnosed with diabetic ketoacidosis: this was the first presentation of her Type 1 diabetes. The large fetal organs and presence of increased perinephric and subcutaneous fat suggested a fetal response to maternal diabetes.
- Two neonatal deaths were attributed to mothers being involved in motor vehicle accidents. One mother presented five days after the accident with vaginal bleeding and preterm labour at 21 weeks. The placenta showed a retroplacental clot. The other mother was scheduled for an induction of labour at 38 weeks because of fetal growth restriction. In the motor vehicle accident she suffered a placental abruption and ruptured membranes. The baby showed evidence of hypoxic ischaemic encephalopathy and died of multiorgan failure. The Kleihauer test found 1.3% of fetal cells, which was in

keeping with feto-maternal haemorrhage comprising 54ml or 19% of the fetal blood volume.

- One antepartum stillbirth at 27 weeks was associated with maternal antiphospholipid syndrome and hepatic infarction. The fetus was growth restricted and the placenta showed multiple thrombi.

6. Specific perinatal conditions – 16 deaths

These deaths were due to the following:

- Twin-twin transfusion – six deaths, involving four twin pregnancies.
  - In one twin pregnancy, the mother presented at 23 weeks in labour, one week after the cessation of fetal movements. Intrauterine deaths of twins were diagnosed. One twin was hydropic and the other acardiac and amorphous.
  - In another twin pregnancy, twin-twin transfusion was diagnosed at 22 weeks and amnioreduction was planned, but the mother went into spontaneous labour at 23 weeks. One twin was stillborn and the other, which was liveborn, died from an intraventricular haemorrhage.
  - In a third twin pregnancy, twin-twin transfusion was diagnosed at 25 weeks. Amnioreductions were performed and close monitoring continued. The donor twin showed signs of cerebral damage by 26 weeks and these progressed. The recipient twin developed congestive cardiac failure. An emergency caesarean was performed. The donor twin was found to have extensive cystic encephalomalacia and died, but the other twin survived.
  - In the fourth twin pregnancy, twin-twin transfusion was diagnosed earlier and amnioreduction performed from 17 weeks. Laser ablation of the placental vascular anastomosis was undertaken but the donor twin became severely hydropic a few days later and died in utero. The recipient surviving twin was delivered by emergency caesarean section at 28 weeks because of preterm rupture of membranes and survived.
- Feto-maternal haemorrhage – two stillbirths. One antepartum stillbirth at 37 weeks was found at autopsy to be growth restricted. The Kleihauer test showed 21.4% fetal cells, indicative of severe chronic feto-maternal haemorrhage. The second stillbirth occurred at 36 weeks gestation. At autopsy the fetus was noted to be pale with mild dysmorphic features. The Kleihauer test was consistent with feto-maternal haemorrhage of 100-120ml.
- Antepartum cord complications – one death. This stillbirth at term was found to have upper thoracic skin pallor corresponding to the excessively long cord being tightly wrapped around the chest.
- Uterine abnormalities – two deaths. These were extremely preterm births from cervical incompetence.

- Birth trauma – one death, associated with vacuum extraction.
- Rhesus alloimmune disease - one death. This Rhesus negative mother had Rhesus antibodies detected and rising from 28 weeks gestation. Routine Anti-D was given at 28 weeks and 34 weeks. She presented with an intrauterine fetal death at 37 weeks. Death was attributed to erythroblastosis fetalis.
- Idiopathic hydrops fetalis – three deaths. Two were terminations of pregnancy. One of these was associated with a cardiac defect and maternal urinary tract infection. The third was a spontaneous fetal death at 21 weeks gestation.

7. Hypoxic peripartum death – 1 death

- This stillbirth which occurred at term in an apparently normal pregnancy and labour was attributed to placental pathology. It is not clear whether fetal death occurred before or during labour. The placenta was meconium–stained with myocytolysis.

8. Fetal growth restriction – 19 deaths

In six deaths in this group, there was evidence of uteroplacental insufficiency, in one there was chronic villitis and in eight there was other placental pathology. There was no placental pathology in three cases and the placenta was not examined in one case.

9. Spontaneous preterm (<37 weeks gestation) – 23 deaths

All these were perinatal deaths at 19 to 28 weeks gestation and five were multiple births. In four deaths the membranes were ruptured for less than 24 hours before birth. In 17 deaths, the membranes had been ruptured for at least 24 hours. In the remaining two deaths, the duration of membrane rupture was unknown. There was histological evidence of chorioamnionitis in 17 cases.

10. Unexplained antepartum death – 21 deaths

Only five of these were term stillbirths. There was evidence of reduced vascular perfusion on placental histology in six cases, chronic villitis in one and other placental pathology in seven other cases. There was no placental pathology in the remaining seven cases.

11. No obstetric antecedent

There were no deaths in this group.

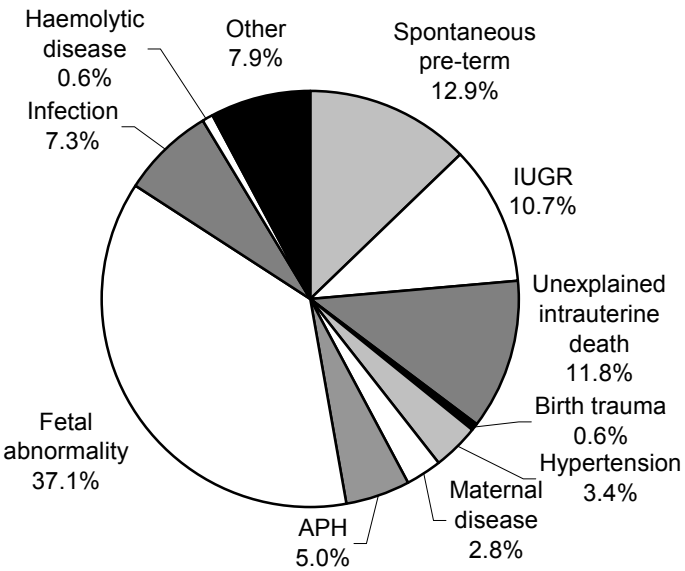
Whitfield Classification of perinatal deaths[3]

The classification of the 178 perinatal deaths into the 12 groups of the amended Whitfield Classification is presented in Table 11 and Figure 9. Subgroups of the classification are also included in Appendix 6.

Table 11: Amended Whitfield Classification of perinatal deaths, South Australia, 2006

	Amended Whitfield Classification	Number of deaths	%	Deaths per 1,000 births
1.	Spontaneous preterm	23	12.9	1.2
2.	Intrauterine growth restriction (IUGR)	19	10.7	1.0
3.	Unexplained intrauterine death	21	11.8	1.1
4.	Birth trauma	1	0.6	0.1
5.	Intrapartum asphyxia	0	0	0
6	Hypertension	6	3.4	0.3
7.	Maternal disease	5	2.8	0.3
8.	Antepartum haemorrhage (APH)	9	5.0	0.5
9.	Fetal abnormality	66	37.1	3.5
10.	Haemolytic disease	1	0.6	0.1
11.	Infection	13	7.3	0.7
12.	Other	14	7.9	0.7
	Total	**178**	**100.0**	**9.5**

Figure 9: Causes of perinatal deaths, amended Whitfield Classification, South Australia 2006



[3] 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 38 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 2006

There were two neonatal deaths in South Australia of babies born at interstate hospitals. These deaths are not included in the South Australian perinatal mortality statistics. *One of these was the baby of an Aboriginal mother.*

One baby was the second of twins born at 25 weeks gestation at an interstate hospital following maternal antepartum haemorrhage. This infant was retrieved to a level III hospital in Adelaide but died of intraventricular and pulmonary haemorrhage. The mother of the other baby had no antenatal care and gave birth at 36 weeks. Thick meconium-stained liquor was noted at birth. The infant was transferred to an Adelaide level III hospital with worsening hydrocephalus and recent respiratory arrest. A diagnosis of congenital toxoplasmosis was made. There was evidence of severe cortical damage and the infant died in the neonatal period.

(2) Aboriginal perinatal deaths

There were eight perinatal deaths (six stillbirths and two neonatal deaths) among the 559 births to Aboriginal mothers. Four were born in teaching hospitals and four in country hospitals. Seven were preterm births. Some factors associated with these deaths were maternal smoking and substance use, anaemia and infections, social problems and lack of antenatal care. The causes of the eight deaths were as follows:

- *Antepartum haemorrhage – one preterm stillbirth*

  This mother had intermittent contractions for a few days at 34 weeks gestation, followed by heavy bleeding with fetal distress. A large retroplacental clot was found at emergency caesarean section.

- *Maternal conditions – one preterm neonatal death*

  This death was attributed to placental abruption associated with a motor vehicle accident at 21 weeks.

- *Specific perinatal conditions – three preterm stillbirths*

  Two of the deaths occurred in a twin pregnancy complicated by twin-twin transfusion. The third baby in this group had generalised hydrops at 19 weeks. A cardiac defect was noted at autopsy.

- *Fetal growth restriction – two stillbirths, one of which was preterm*

  One intrauterine fetal death was noted on ultrasound when the mother first presented for antenatal care at 24 weeks. The mother of the other baby experienced

abdominal pain and reduction in fetal movements at 39 weeks and intrauterine death was diagnosed.

- *Spontaneous preterm – one preterm neonatal death*

  This mother presented with preterm prelabour rupture of membranes at 25 weeks and went into labour spontaneously six days later. The extremely preterm infant suffered many complications of prematurity and died of fulminant necrotising enterocolitis.

In 2006, the perinatal mortality rate for births to Aboriginal mothers was 14.3 per 1,000 births compared with 9.3 per 1,000 births for non-Aboriginal mothers.

The proportion of Aboriginal women who smoked during pregnancy decreased from 61.2% in 2005 to 54.2% in 2006, but remains about three times higher than among non-Aboriginal women (16.9% in 2006).

There have also been decreases in the proportions of preterm births and small-for-gestational-age births for Aboriginal mothers although these proportions remain considerably higher than for non-Aboriginal births in 2006 (15.9% v 8.0% and 13.6% v 8.8% respectively). Overall the proportion of low birthweight births for Aboriginal mothers also decreased but remains much higher than that for non-Aboriginal births (14.3% v 6.8%).

(3) Autopsies in perinatal deaths

Autopsies were performed in 89 of the 178 perinatal deaths (50.0%). Eight 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. Before 2004 a small number of cases which had external examination of the body and growth parameters, radiological survey and placental histology only were included as having autopsies. In 2006, such examinations were performed in 10 perinatal deaths which did not have autopsy. Nine of these were undertaken in metropolitan level III hospitals and one in a metropolitan private hospital.

The distribution of autopsies by place of death is presented in Table 12.

Table 12: Autopsy status* of perinatal deaths by place of death, South Australia, 2006

Place of death	Deaths	Autopsies performed*	
	Number	Number	Percent of deaths
Metropolitan Level III** hospitals (teaching)	130	66	50.8
Other metropolitan teaching hospitals	19	9	47.4
Metropolitan private hospitals	13	5	38.5
Country hospitals	15	9	60.0
Interstate hospitals	1	0	0
Total	**178**	**89**	**50.0**

* Includes 8 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 157 perinatal deaths (88.2%) in 2006.

The falling proportion of autopsies in perinatal deaths is of concern. A good quality autopsy is invaluable in confirming antenatal diagnoses, eliciting other findings of clinical significance, particularly significant negative ones, and determining the time course of events leading to death.[4] [5] It may thus be invaluable in alleviating parental guilt, helping with the grieving process and parental counselling, and gaining understanding of the patterns and evaluation of fetal and neonatal disease. Parental permission should therefore be sought as often as possible.

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

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).

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

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

3. Causes of post-neonatal deaths 2006

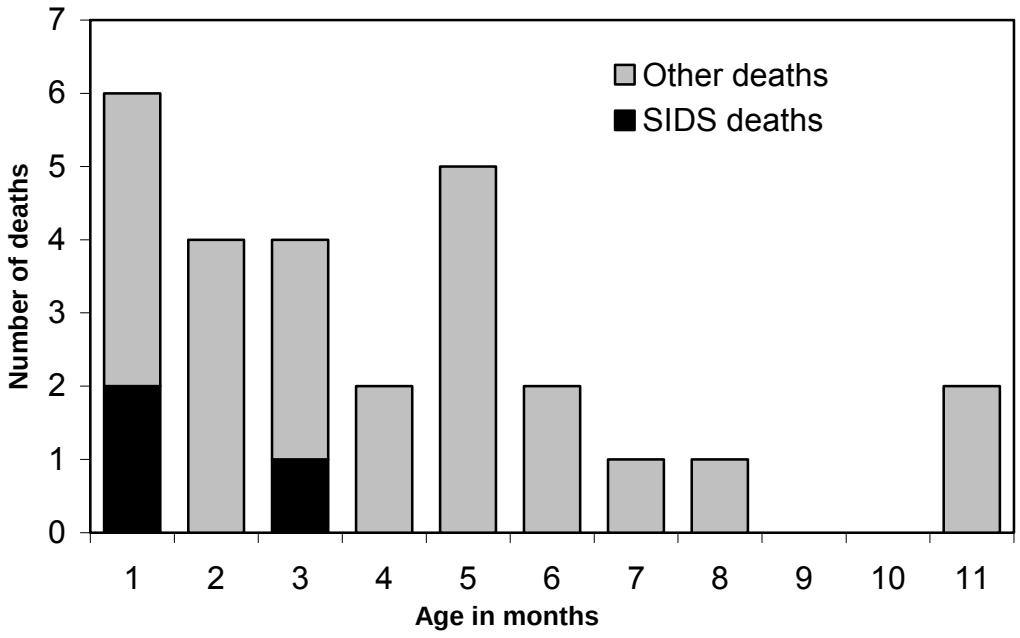
In 2006 there were 27 post-neonatal deaths notified of infants born in South Australia. Autopsies were performed in 18 out of the 19 coronial cases (94.7%). Only one autopsy was performed in the remaining eight non-coronial cases. The autopsy rate was thus 70.4% (19 out of 27 cases) for post-neonatal deaths in 2006. The causes of death are presented in Table 13, together with comparative statistics for 1986 - 2005.

Table 13: Causes of post-neonatal deaths, South Australia, 1986 – 2006

Causes of death	1986 – 2005		2006	
	Number	Percent	Number	Percent
SIDS	320	40.4	3	11.1
Congenital abnormalities	170	21.4	6	22.2
Conditions originating in the perinatal period	101	12.7	4	14.8
Accidents, poisonings and violence	74	9.3	5	18.5
Infections	65	8.2	0	0
Other	63	8.0	9	33.3
Total	**793**	**100.0**	**27**	**100.0**

Among the 27 post-neonatal deaths in 2006, there were 14 males and 13 females. Three were multiple births. Eight infants (29.6%) were born preterm. The distribution by age at death of the 27 infants (Figure 10) shows that most of the deaths occurred in the earlier months of the post-neonatal period. *Three of the 27 post-neonatal deaths (11.1%) were children of Aboriginal mothers.*

Figure 10: Age Distribution of Post-neonatal Deaths, South Australia, 2006



(1) Congenital abnormalities

Congenital abnormalities accounted for six post-neonatal deaths (22.2%) in 2006. All these infants were born at term. The types of abnormalities were as follows:

- Spinal muscular atrophy Type 1
- Congenital cerebral degeneration
- Leigh's disease
- Congenital abnormalities, predominantly cardiac, associated with pulmonary hypertension and congestive cardiac failure. This infant died of superimposed bronchopneumonia.
- Trisomy 18 with cardiac defects
- A chromosomal deletion defect associated with complex cardiac and other abnormalities.

(2) Conditions originating in the perinatal period

There were four deaths in this group, all occurring in preterm births. *One was the infant of an Aboriginal mother.*

- A set of twins was born extremely preterm at 23 weeks. Both twins suffered many complications of prematurity. One died from necrotising enterocolitis and the other from chronic lung disease.
- Another infant death was a twin from a pregnancy complicated by twin-twin transfusion, resulting in preterm delivery and complications of prematurity. This infant died of chronic lung disease and cardiac failure complicating a cardiac defect and pulmonary haemangioma.
- A fourth infant was born preterm at 25 weeks following a pregnancy complicated by early onset pre-eclampsia and oligohydramnios. This infant was growth restricted at birth and died of complications of prematurity (chronic lung disease and bowel perforation).

(3) Sudden Infant Death Syndrome (SIDS)

Three deaths in the post-neonatal period in 2006 were attributed to SIDS.

- One infant was born preterm and died at one month of age after being placed supine to sleep.
- Another one month old infant was placed to sleep in the prone position and found not breathing shortly after. It was resuscitated but died two days later from hypoxic ischaemic encephalopathy.
- A three-month old infant, reported to have been placed supine to sleep, was found in the prone face down position.

In 2006, with three deaths attributed to SIDS, the post-neonatal death rate due to SIDS was 0.2 per 1,000 live births. Before the public education 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 live births. In comparison, in the six-year period 2001-2006, there were only 19 deaths from SIDS, and the SIDS post-neonatal death rate was 0.2 per 1,000 live births. SIDS accounted for 60.1% of post-neonatal deaths in the earlier period and only 11.9% 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 asphyxia in infants may be identical to those found in SIDS, differentiation of these entities may be extremely difficult. **For this reason comprehensive death scene examination and parental interview by trained personnel have become essential features in the assessment of unexpected infant death. Cases have occurred in South Australia where both accidental and non-accidental 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**.

(4) Accidents, poisonings and violence

There were five deaths in this group, which accounted for 18.5% of post-neonatal deaths.

- Three infants were considered to have died of **accidental asphyxiation**. All three infants were found in unsafe sleeping arrangements. Two had been placed to sleep on sofas, one with an adult. The third infant was found entangled in bedding and wedged on an adult bed.
- A five month old infant accidentally drowned.
- The fifth infant in this group died of head injuries of unknown aetiology at six months of age.

(5) Other causes

There were nine deaths from other causes.

One infant was placed to sleep on its side in its cot and found prone face down in the mattress. Autopsy showed vomitus in the upper and lower respiratory tract, raising the possibility of aspiration.

Eight infants died of **undetermined causes**. *Two were the infants of Aboriginal mothers.*

- One two-month old infant had apparently been well, without evidence of infection. This infant was found prone. E coli was cultured from its blood, lungs and spleen, but there was no inflammatory focus.

- A three-month old infant was found face down in soft bedding which had a groove between the base of the mattress and the rolled outer rim. Clostridium sordelli was cultured from blood, lungs, spleen and cerebrospinal fluid. Although this organism has been associated with infections including fatal infections following childbirth, miscarriage or induced abortion and surgical procedures, soft tissue injuries and in intravenous drug users, it has not been associated with sudden infant death. The strain did not appear to be toxigenic and there was no primary focus of infection, so that infection by the organism was not considered the cause of death.
- One infant which had been placed to sleep swaddled in the prone position was found prone face down.
- One infant which had been placed to sleep in the supine position on a mattress on the floor was found with its head and upper part of its body over the side of the mattress and face on a pillow below the level of the mattress.
- One infant was found where it had been placed to sleep on a foam mattress on the floor with pillows and blankets.
- Three other infants had been co-sleeping. One infant was sleeping with an adult on a single bed with pillows and an adult blanket. A coincidental finding was Streptococcus pneumoniae cultured from both middle ear cavities. Another infant was sleeping with several persons on a mattress, fell off the mattress and was found between it and the lounge. Another infant was sleeping with adults and another child in a water bed with several pillows.

Sudden Unexpected Deaths in Infancy (SUDIs)

Sudden deaths from the three categories of SIDS, accidental asphyxiation and undetermined cause have been included as 'Sudden Unexpected Deaths in Infancy'. In 2006, numbers of deaths in these categories were as follows:

SIDS - three deaths;

Accidental asphyxiation - three deaths;

Undetermined cause - eight deaths.

The distinction between these deaths can be quite difficult and may be arbitrary. Over the last few years there have been about 10 such sudden unexpected post-neonatal deaths a year. In 2006, there were 14 such deaths, together accounting for 51.9% of the post-neonatal deaths. There has been no reduction in sudden unexpected infant deaths between 1998 and 2006. Many of these deaths have had some, but not necessarily all, of the following features:

- found prone;
- excessive or inappropriate bedding;
- co-sleeping, especially with adults who were excessively tired or intoxicated on alcohol or drugs.

The Committee is concerned about these deaths. We recommend that consideration is given to the renewal of a major public health campaign about safe sleeping practices and prevention of sudden unexpected deaths of infants.

Deaths of babies born interstate

There was one post-neonatal death of an 11 month old infant born interstate. This infant died of X-linked myotubular myopathy with terminal respiratory failure. The diagnosis was made following muscle biopsy and genetic testing.

IV Recommendations

1. Maternal Subcommittee recommendations

Recommendations from recent years are:

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.
3. Pregnant women travelling in motor vehicles need to wear seat belts at all times for safety. The South Australian Department of Transport, Energy and Infrastructure recommends that the lap part of the seat belt should be worn as low as possible, below the unborn child. It should be over the upper thighs and across the pelvis. The sash part of the seat belt passes above the stomach and between the breasts.[6] The seat belt should be worn at all times when the vehicle is in motion.

2. Perinatal Subcommittee recommendations

1. It is important to care for pregnant women in a setting that is appropriate for the level of risk the pregnancy presents for the mother and / or the baby. For example, women with severe hypertension or insulin-dependent diabetes should be managed in at least a level II hospital with 24 hour on-site medical cover. Planned home birth for twins, breech presentations and post-term infants is associated with unacceptably high risks.[7,8] Similarly, women with serious maternal conditions should be cared for in hospitals with adequate comprehensive adult services.
2. Pregnant women with a Body Mass Index (BMI) greater than 35 are at higher risk from anaesthesia.[9] A timely referral for an anaesthetic consultation should be considered for women with a high BMI.

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

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

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

[9] Confidential Enquiries into Maternal and Child Health. Why mothers die 2000-2002. The Sixth Report of the Confidential Enquiries into Maternal Deaths in the United Kingdom. London: RCOG Press, CEMACH 2004: http://www.cemach.org.uk (accessed October 18 2007).

3. Implementation of effective strategies to reduce smoking in pregnancy remains important, *including culturally appropriate smoking cessation interventions for Aboriginal women.*[10]
4. Testing the antibody status of Rhesus D negative women before the first administration of Anti-D is important. A measurable titre of Anti-D antibodies is an indicator of potential alloimmunisation and always requires investigation and a specialist opinion.
5. Early ultrasound determination of chorionicity is advised for twin pregnancies, followed by further surveillance for twin-twin transfusion in monochorionic pregnancies.
6. Vigilance is required in the recognition of fetal growth restriction. Fetal growth restriction was considered the cause of death for 10.7% of perinatal deaths in 2006. Practitioners are asked to be vigilant so that fetal growth restriction is not missed.
7. Appropriate training and maintenance of competence in cardiotocograph (CTG) interpretation for all levels of medical and midwifery staff.
8. The institution of streamlined arrangements between rural/level I hospitals and their regional level II/III maternity service in situations where there is a lack of on-site CTG expertise. This includes easier access of rural practitioners to the consultant on call.
9. Appropriate antibiotic treatment for carriers of Group B Steptococcus and for women with risk factors, such as prolonged rupture of membranes and preterm labour, remains important.
10. When induction of labour is deemed necessary in the presence of a uterine scar and an unripe cervix, careful consideration should be given to alternative options, such as postponing the induction or caesarean section.
11. Further development and implementation of the statewide perinatal protocols is recommended (www.health.sa.gov.au/ppg).
12. The Committee recommends use of the recently revised protocol 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.
13. Autopsy often provides considerable information that is not available otherwise and should be strongly recommended. The continuing decrease in the autopsy rate in perinatal deaths over the past few years remains a serious concern. When parents decline autopsy, we recommend that

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[10] Lumley J, Oliver SS, Chamberlain C, Oakely L. Interventions for promoting smoking cessation during pregnancy. The Cochrane Database of Systematic Reviews 2004, Issue 4.

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.**

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

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

3. Post-neonatal Subcommittee recommendations

In reviewing the causes of death in 2006 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.

The following recommendations are pertinent to the deaths in 2006:

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 sudden unexpected deaths in infancy.

   - 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.

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

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

- 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. Do not use very soft mattresses or inflatable mattresses which may vary in their firmness and present spaces in which the infant's head or face may be trapped.
- Care should be taken when placing infants to sleep on mattresses on the floor as infants may roll off and become wedged.

The Committee is concerned about the number of sudden unexpected infant deaths in the last few years, many of which are associated with excessive or inappropriate bedding or other unsafe sleeping practices. We recommend a repeat major public health campaign on safe infant sleeping and prevention of sudden unexpected deaths of infants.

2. An effective system of appropriate and ongoing support, supervision and referral should be offered to families with known risk factors for adverse child outcome, such as parental substance abuse, parental psychiatric illness, household violence, extreme youth of the mother and poor social circumstances. This should be continued at least throughout the first year of life, if not for a longer period of time.
3. Systems to facilitate referral by community nurses of high risk children to paediatricians or tertiary hospitals for urgent appointments need to be considered.

The following recommendations made in previous reports are still relevant:

1. Recording and charting of child's weight.
   The Subcommittee stresses the importance to both parents and health professionals of recording the child's weight in the Personal Health Record (Blue Book) and charting the weight on the percentile growth charts to identify children who are not thriving. It is important to investigate why a child is not thriving. Any child who is not thriving should be referred to a medical practitioner.
2. The Subcommittee stresses 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.[13]

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

3. 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. This applies also to water features in gardens. 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.

4. 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 2006 from feeding accidents.

5. Consideration should be given to better ways of identifying serious underlying illness in children presenting to clinicians, for example, by Medic Alert bracelets.

6. 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.

7. 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. Health professionals are reminded that intravenous fluids are lifesaving for any sick infant. Infants with cyanotic heart disease are more prone to the complications of dehydration and specialist advice should be sought. 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.

8. The Committee recommends that further research be undertaken on the incidence of community acquired Methicillin Resistant Staphylococcus Aureus (MRSA) infections to help guide clinical practice in terms of antibiotic choice in sick children. This may include setting up systems to make hospital and community acquired MRSA infection a notifiable communicable disease.

Reporting of deaths to the State Coroner

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

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

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

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

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

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

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

V Education Subcommittee Report

The eleventh annual educational meeting was organized on the evening of 11th September 2007 by the Education Subcommittee of the Maternal, Perinatal and Infant Mortality Committee.

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

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

The topic of the eleventh meeting was ultrasound imaging in pregnancy and was titled 'Through a Glass Darkly.' It was held at the Women's and Children's Hospital. An electronic voting system was used to display audience responses to questions on the current use of ultrasound in dating of pregnancy, first trimester screening for chromosome abnormalities and assessment of fetal growth. The responses generated an interactive discussion between the panel members and the audience of 74 people. The panel members were Dr Peter Muller (maternal-fetal medicine specialist), Mr Robert Cocciolone (Head of the South Australian Maternal Serum Antenatal Screening programme), Dr Megan Gunn (ultrasound specialist in organ imaging) and Dr Peter Downey (ultrasound specialist in organ imaging). The audience included obstetric registrars, resident medical officers and obstetricians, sonographers, hospital and community midwives, general practitioners and students.

Dr Brian Wheatley, Chair of the Education Subcommittee presented the main recommendations of the Committee made in the 2005 report.

The forum was filmed this year. The Committee is planning for the DVD to be used to present similar education sessions in regional country areas with the assistance of the Country Health Division of the Department of Health of South Australia.

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

SOUTH AUSTRALIA

Form 14
To be completed by a Medical Practitioner

Births, Deaths and Marriages Registration Act, 1966-1980

MEDICAL CERTIFICATE OF CAUSE OF PERINATAL DEATH

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

A. Particulars Relating to the Mother

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

B. Details of Previous Pregnancies

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

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

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

C. Details of Present Pregnancy

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

D. Particulars Relating to the Child

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

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

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

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.....

B2174

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

SOUTH AUSTRALIA

Births, Deaths and Marriages Registration Act, 1966-1980

Form 12

NOTICE OF SIGNING OF MEDICAL CERTIFICATE OF CAUSE OF PERINATAL DEATH

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

concerning the death of.....

.....

who died at.....

.....

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

.....
Signature of Medical Practitioner

Surname of Medical Practitioner.....

Address.....

.....

Date.....

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

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

OR

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

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

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....

.....

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)

	Disease	Duration
A	.....	.....
B	.....	.....
C	.....	.....
D	.....	.....
E	.....	.....

Part II
Other significant conditions and duration:

.....

.....

CONTINUE ON REVERSE

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

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.[14]

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.

---

[14] 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, 2006

		No.	%
1.	**CONGENITAL ABNORMALITY (including terminations for congenital abnormalities)**	**66**	**37.1**
	1.1 Central nervous system	12	6.7
	1.2 Cardiovascular system	10	5.6
	1.3 Urinary tract	2	1.1
	1.4 Gastrointestinal tract	1	0.6
	1.5 Chromosomal	13	7.3
	1.6 Metabolic	2	1.1
	1.7 Multiple/ non chromosomal syndromes	17	9.6
	1.8 Other	9	5.1
	1.81 Musculoskeletal	*4*	
	1.82 Respiratory	*0*	
	1.83 Diaphragmatic hernia	*4*	
	1.84 Haematological	*0*	
	1.85 Tumours	*1*	
	1.88 Other specified congenital abnormality	*0*	
	1.9 Unspecified	0	0
2.	**PERINATAL INFECTION**	**11**	**6.2**
	2.1 Bacterial	9	5.1
	2.11 Group B Streptococcus	*4*	
	2.12 E coli	*2*	
	2.13 Listeria monocytogenes	*0*	
	2.14 Spirochaetal, e.g. Syphilis	*0*	
	2.18 Other bacterial	*1*	
	2.19 Unspecified bacterial	*2*	
	2.2 Viral	1	0.6
	2.21 Cytomegalovirus	*1*	
	2.22 Parvovirus	*0*	
	2.23 Herpes simplex virus	*0*	
	2.24 Rubella virus	*0*	
	2.28 Other viral	*0*	
	2.29 Unspecified viral	*0*	
	2.3 Protozoal e.g. Toxoplasma	1	0.6
	2.5 Fungal	0	0
	2.8 Other specified organism	0	0
	2.9 Other unspecified organism	0	0

		No.	%
3.	**HYPERTENSION**	**6**	**3.4**
	3.1 Chronic hypertension: essential	0	0
	3.2 Chronic hypertension: secondary, e.g. renal disease	0	0
	3.3 Chronic hypertension: unspecified	0	0
	3.4 Gestational hypertension	0	0
	3.5 Pre-eclampsia	5	2.8
	3.51 With laboratory evidence of thrombophilia	*1*	
	3.6 Pre-eclampsia superimposed on chronic hypertension	1	0.6
	3.61 With laboratory evidence of thrombophilia		
	3.9 Unspecified hypertension	0	0
4.	**ANTEPARTUM HAEMORRHAGE (APH)**	**9**	**5.0**
	4.1 Placental abruption	6	3.4
	4.11 With laboratory evidence of thrombophilia	*0*	
	4.2 Placenta praevia	1	0.6
	4.3 Vasa praevia	0	0
	4.8 Other APH	0	0
	4.9 APH of undetermined origin	2	1.1
5.	**MATERNAL CONDITIONS**	**6**	**3.4**
	5.1 Termination of pregnancy (other than for congenital (fetal) abnormality)	2	1.1
	5.2 Diabetes / Gestational diabetes	1	0.6
	5.3 Maternal injury	2	1.1
	5.31 Accidental	*2*	
	5.32 Non-Accidental	*0*	
	5.4 Maternal sepsis	0	0
	5.5 Lupus obstetric syndrome	1	0.6
	5.6 Obstetric cholestasis	0	0
	5.8 Other specified maternal conditions	0	0
6.	**SPECIFIC PERINATAL CONDITIONS**	**16**	**9.0**
	6.1 Twin-twin transfusion	6	3.4
	6.2 Feto-maternal haemorrhage	2	1.1
	6.3 Antepartum cord complications (e.g. cord haemorrhage, true knot with evidence of occlusion)	1	0.6
	6.4 Uterine abnormalities, eg bicornuate uterus, cervical incompetence	2	1.1
	6.5 Birth trauma (typically infants of >24 weeks gestation or >600g birthweight)	1	0.6
	6.6 Alloimmune disease	1	0.6
	6.61 Rhesus	*1*	
	6.62 ABO	*0*	
	6.63 Kell	*0*	
	6.64 Alloimmune thrombocytopenia	*0*	
	6.68 Other	*0*	
	6.69 Unspecified	*0*	

		No	%
6.7	Idiopathic hydrops	3	1.7
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)	0	0
7.	**HYPOXIC PERIPARTUM DEATH (typically infants of >24 weeks gestation or > 600g birthweight)**	**1**	**0.6**
7.1	With intrapartum complications	0	0
	7.11 Uterine rupture	*0*	
	7.12 Cord prolapse	*0*	
	7.13 Shoulder dystocia	*0*	
	7.18 Other	*0*	
7.2	Evidence of non-reassuring fetal status in a normally grown infant (e.g. abnormal fetal heart rate, fetal scalp pH/lactate, fetal pulse oximetry without intrapartum complications)	0	0
7.3	No intrapartum complications and no evidence of non-reassuring fetal status	1	0.6
7.9	Unspecified hypoxic peripartum death	0	0
8.	**FETAL GROWTH RESTRICTION (FGR)**	**19**	**10.7**
8.1	With evidence of reduced vascular perfusion on Doppler studies and/or placental histopathology (e.g. significant infarction, acute atherosis, maternal and or fetal vascular thrombosis or maternal floor infarction	6	3.4
8.2	With chronic villitis	1	0.6
8.3	No placental pathology	3	1.7
8.4	No examination of placenta	1	0.6
8.8	Other specified placental pathology	8	4.5
8.9	Unspecified or not known whether placenta examined	0	0
9.	**SPONTANEOUS PRETERM (<37 weeks gestation)**	**23**	**12.9**
9.1	Spontaneous preterm with intact membranes, or membrane rupture <24 hours before delivery	4	2.2
	9.11 With chorioamnionitis on placental histopathology	*1*	
	9.12 Without chorioamnionitis on placental histopathology	*3*	
	9.13 With clinical evidence of chorioamnionitis, no examination of placenta	*0*	
	9.17 No clinical signs of chorioamnionitis, no examination of placenta	*0*	
	9.19 Unspecified or not known whether placenta examined	*0*	
9.2	Spontaneous preterm with membrane rupture ≥24 hours before delivery	17	9.6
	9.21 With chorioamnionitis on placental histology	*14*	
	9.22 Without chorioamnionitis on placental histology	*1*	
	9.23 With clinical evidence of chorioamnionitis, no examination of placenta	*0*	
	9.27 No clinical signs of chorioamnionitis, no examination of placenta	*1*	
	9.29 Unspecified or not known whether placenta examined	*1*	

		No	%
	9.3 Spontaneous preterm with membrane rupture of unknown duration before delivery	2	1.1
	9.31 With chorioamnionitis on placental histology	*2*	
	9.32 Without chorioamnionitis on placental histology	*0*	
	9.33 With clinical evidence of chorioamnionitis, no examination of placenta	*0*	
	9.37 No clinical signs of chorioamnionitis, no examination of placenta	*0*	
	9.39 Unspecified or not known whether placenta examined	*0*	
10.	**UNEXPLAINED ANTEPARTUM DEATH**	**21**	**11.8**
	10.1 With evidence of reduced vascular perfusion on Doppler studies and/or placental histopathology (e.g. significant infarction, acute atherosis, maternal and/or fetal vascular thrombosis or maternal floor infarction)	6	3.4
	10.2 With chronic villitis	1	0.6
	10.3 No placental pathology	7	3.9
	10.7 No examination of placenta	0	0
	10.8 Other specified placental histology	7	3.9
	10.9 Unspecified unexplained antepartum death or not known whether placenta examined	0	0
11.	**NO OBSTETRIC ANTECEDENT**	**0**	**0**
	11.1 SIDS	0	0
	11.11 SIDS Category IA: Classic features of SIDS present and completely documented.		
	11.12 SIDS Category IB: Classic features of SIDS present but incompletely documented.		
	11.13 SIDS Category II: Infant deaths that meet Category I except for one or more features.		
	11.2 Postnatally acquired infection	0	0
	11.3 Accidental asphyxiation	0	0
	11.4 Other accident, poisoning or violence (postnatal)	0	0
	11.8 Other specified	0	0
	11.9 Unknown / Unexplained	0	0
	11.91 Unclassified Sudden Infant Death		
	11.92 Other Unknown / Undetermined		
	TOTAL	**178**	**100.0**

APPENDIX 5

Perinatal Society of Australia and New Zealand Perinatal Death Classification (PSANZ-PDC), SA perinatal deaths by birthweight, 2006

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	38	7	4	1	2	3	11	66	37.1
2	Perinatal infection	3	2	1	1	0	0	4	11	6.2
3	Hypertension	0	2	2	1	1	0	0	6	3.4
4	Antepartum haemorrhage	5	1	0	1	0	2	0	9	5.0
5	Maternal conditions	2	3	0	0	0	0	1	6	3.4
6	Specific perinatal conditions	7*	1	3	0	0	1	4	16	9.0
7	Hypoxic peripartum death	0	0	0	0	0	0	1	1	0.6
8	Fetal growth restriction	6	1	0	1	3	5	3	19	10.7
9	Spontaneous preterm	13**	6	2	2	0	0	0	23	12.9
10	Unexplained antepartum death	7	1	1	0	3	3	6	21	11.8
11	No obstetric antecedent	0	0	0	0	0	0	0	0	0
	Total	81	24	13	7	9	14	30	178	100
	%	45.5	13.5	7.3	3.9	5.1	7.9	16.9	100	%

***** includes one stillbirth twin of unknown birthweight which died at 19 weeks and was born at 28 weeks gestation

** includes one neonatal death of unknown birthweight which was liveborn at 19 weeks gestation

APPENDIX 6

Obstetric cause-specific classification of perinatal deaths, SA perinatal deaths, 2006 (Amended Whitfield)

		No	%
1.	**SPONTANEOUS PRETERM <37 weeks, normally formed, appropriately grown.**	**23**	**12.9**
	1.1 Multiple pregnancy	5	
	1.2 Previous bleeding	2	
	1.3 Previous spontaneous rupture of membranes >12 hours before labour	13	
	1.4 Cervical incompetence	2	
	1.5 Other, eg uterine malformation	0	
	1.6 Idiopathic	1	
2.	**INTRAUTERINE GROWTH RESTRICTION (IUGR)** <10th percentile for gestational age	**19**	**10.7**
3.	**UNEXPLAINED INTRAUTERINE DEATH** Normally formed fetuses without IUGR where fetal death is known to have preceded labour in the absence of any other primary complication	**21**	**11.8**
4.	**BIRTH TRAUMA** ≥1,500g, with evidence of lethal trauma at autopsy even when labour and delivery were not complicated by mechanical difficulty	**1**	**0.6**
	4.1 Cord complication	0	
	4.2 Breech delivery	0	
	4.3 Caesarean section	0	
	4.4 Forceps delivery	0	
	4.5 Ventouse delivery	1	
	4.6 Other delivery	0	
5.	**INTRAPARTUM ASPHYXIA** ≥1,500g with evidence of intrapartum hypoxia and confirmed by hypoxic changes at autopsy	**0**	**0**
	5.0 Vaginal	0	
	5.1 Cord complication	0	
	5.2 Breech delivery	0	
	5.3 Caesarean section	0	
	5.4 Forceps delivery	0	
	5.5 Ventouse delivery	0	
	5.6 Other delivery & unspecified	0	

		No.	%
6.	**HYPERTENSION**	**6**	**3.4**
	6.0 Unspecified	0	
	6.1 Pre-existing hypertension	0	
	6.2 Pre-eclampsia	5	
	6.3 Pre-existing hypertension and pre-eclampsia	1	
7.	**MATERNAL DISEASE**	**5**	**2.8**
	7.0 Unspecified	0	
	7.1 Maternal injury	2	
	7.2 Abdominal operation	0	
	7.3 Diabetes/Gestational diabetes	1	
	7.4 Malignancy	0	
	7.5 Infection	0	
	7.8 Maternal death	0	
	7.9 Other	2	
8.	**ANTEPARTUM HAEMORRHAGE (APH)**	**9**	**5.0**
	8.1 Placental abruption	6	
	8.2 Placenta praevia	1	
	8.3 APH undetermined origin	2	
	8.4 Vasa praevia	0	
9.	**FETAL ABNORMALITY**	**66**	**37.1**
	9.1 Central nervous system	12	
	9.2 Cardiovascular system	10	
	9.3 Urinary tract	2	
	9.4 Gastrointestinal tract	1	
	9.5 Chromosomal	13	
	9.6 Metabolic	2	
	9.7 Multiple	17	
	9.9 Other	9	
10.	**HAEMOLYTIC DISEASE**	**1**	**0.6**
	10.1 Rhesus incompatibility	1	
	10.2 Other feto-maternal blood group incompatibility (eg Kell)	0	
	10.3 Haemoglobinopathy	0	

		No.	%
11.	**INFECTION** Pathological evidence of infection required. Infections occurring as primary factors including deaths with chorioamnionitis or congenital pneumonia preceding membrane rupture.	**13**	**7.3**
	11.0 Unspecified	0	
	11.1 Streptococcus, Group B	4	
	11.2 Escherichia coli	3	
	11.3 Other bacterial	3	
	11.4 Toxoplasma	1	
	11.5 Syphilis	0	
	11.6 Cytomegalovirus	1	
	11.7 Other viral	0	
	11.8 Fungal	0	
	11.9 Other	1	
12.	**OTHER**	**14**	**7.9**
	12.1 Non-immune hydrops	3	
	12.2 Feto-maternal haemorrhage	2	
	12.3 Twin-twin transfusion	6	
	12.4 Accident, poisoning or violence (Postnatal)	0	
	12.5 SIDS	0	
	12.8 Unknown / unexplained	0	
	12.9 Other	3	
	TOTAL	**178**	**100.0**

APPENDIX 7

Perinatal Society of Australia and New Zealand-Neonatal Death Classification (PSANZ-NDC), SA neonatal deaths, 2006

	No	%
1. CONGENITAL ABNORMALITY	**17**	**44.7**
1.1 Central nervous system	0	0
1.2 Cardiovascular system	5	13.2
1.3 Urinary tract	2	5.3
1.4 Gastrointestinal tract	0	0
1.5 Chromosomal	2	5.3
1.6 Metabolic	0	0
1.7 Multiple/ non chromosomal syndromes	6	15.8
1.8 Other congenital abnormality	2	5.3
1.81 Musculoskeletal	*1*	
1.82 Respiratory	*0*	
1.83 Diaphragmatic hernia	*1*	
1.84 Haematological	*0*	
1.85 Tumours	*0*	
1.88 Other specified congenital abnormality	*0*	
1.9 Unspecified congenital abnormality	0	0
2. EXTREME PREMATURITY	**9**	**23.7**
(typically infants of <=24 weeks gestation or <=600g birthweight)		
2.1 Not resuscitated	5	13.2
2.2 Unsuccessful resuscitation	4	10.5
2.9 Unspecified or not known whether resuscitation attempted	0	0
3. CARDIO-RESPIRATORY DISORDERS	**0**	**0**
3.1 Hyaline membrane disease / Respiratory distress syndrome (RDS)	0	0
3.2 Meconium aspiration syndrome	0	0
3.3 Primary persistent pulmonary hypertension	0	0
3.4 Pulmonary hypoplasia	0	0
3.5 Chronic neonatal lung disease (typically, bronchopulmonary dysplasia)	0	0
3.8 Other	0	0

	No.	%
4. INFECTION	**3**	**7.9**
4.1 Bacterial	3	7.9
4.11 Congenital bacterial	*3*	
4.12 Acquired bacterial	*0*	
4.2 Viral	0	0
4.21 Congenital viral	*0*	
4.22 Acquired viral	*0*	
4.3 Protozoal e.g. Toxoplasma	0	0
4.4 Spirochaetal e.g. Syphilis	0	0
4.5 Fungal	0	0
4.8 Other	0	0
4.9 Unspecified organism	0	0
5. NEUROLOGICAL	**5**	**13.2**
5.1 Hypoxic ischaemic encephalopathy / Perinatal asphyxia (typically infants of >24 weeks gestation or >600g birthweight)	2	5.3
5.2 Intracranial haemorrhage	3	7.9
5.8 Other	0	0
6. GASTROINTESTINAL	**2**	**5.3**
6.1 Necrotising enterocolitis	2	5.3
6.8 Other	0	0
7. OTHER	**2**	**5.3**
7.1 Sudden Infant Death Syndrome (SIDS)	0	0
7.11 SIDS Category IA: Classic features of SIDS present and completely documented.		
7.12 SIDS Category IB: Classic features of SIDS present but incompletely documented.		
7.13 SIDS Category II: Infant deaths that meet category I except for one or more features.		
7.2 Multi-system failure - only if unknown primary cause or trigger event	0	0
7.3 Trauma	1	2.6
7.8 Other specified	1	2.6
7.9 Undetermined / Unknown	0	0
7.91 Unclassified Sudden Infant Death		
7.92 Other Unknown / Undetermined		
TOTAL	**38**	**100.0**

APPENDIX 8

South Australian Protocol for investigation of stillbirths

Working party members:

Dr R Watson (Chair)

Professor MJNC Keirse

Professor G Dekker

Professor TY Khong

Dr W Hague

Introduction

The perinatal mortality rate for South Australia in 2006 of 3.1 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 9.5 deaths per 1,000 births that year. Seventy-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 2006, 15% of stillbirths had no cause identified, possibly, in part due to the lack of a systematic and up-to-date approach to the investigation of stillbirths for which there is no immediate obvious cause. Currently protocols for investigating such cases vary markedly between hospitals and generally have not kept pace with advances in obstetric knowledge, particularly in the area of vasculopathies.

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

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

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

- **A detailed history and examination of the mother** along with a careful review of the antenatal record can often provide clues to intercurrent infection, previously undiagnosed pre-eclampsia, drug use or intra-hepatic cholestasis of pregnancy.
- **Autopsy of the stillbirth.** With parental consent, autopsy should be conducted by the State Perinatal Autopsy Service.
- **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.[15]

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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[15] 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

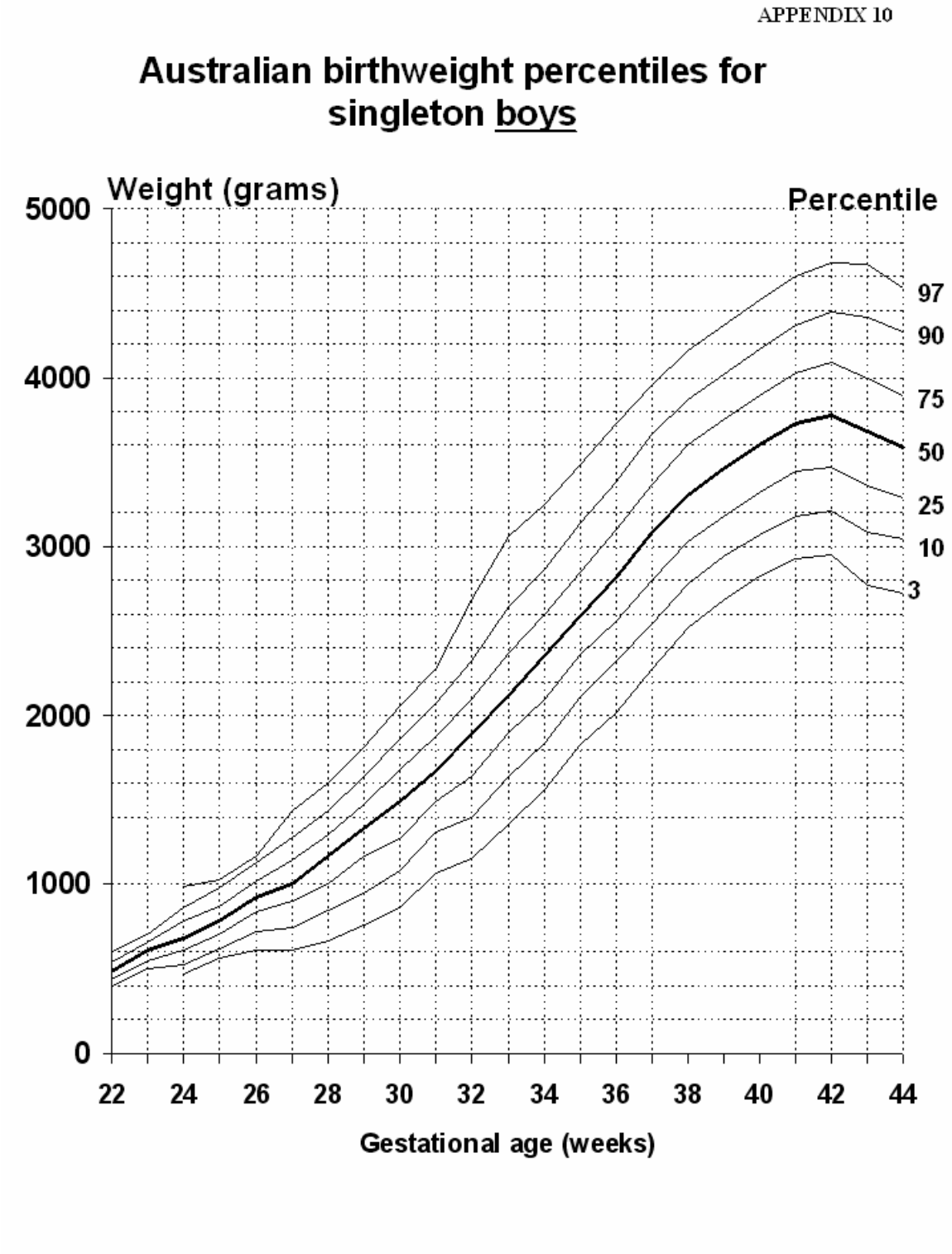
Histological examination of the placenta provides additional information about perinatal deaths and placentas should be sent for examination where possible.

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

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

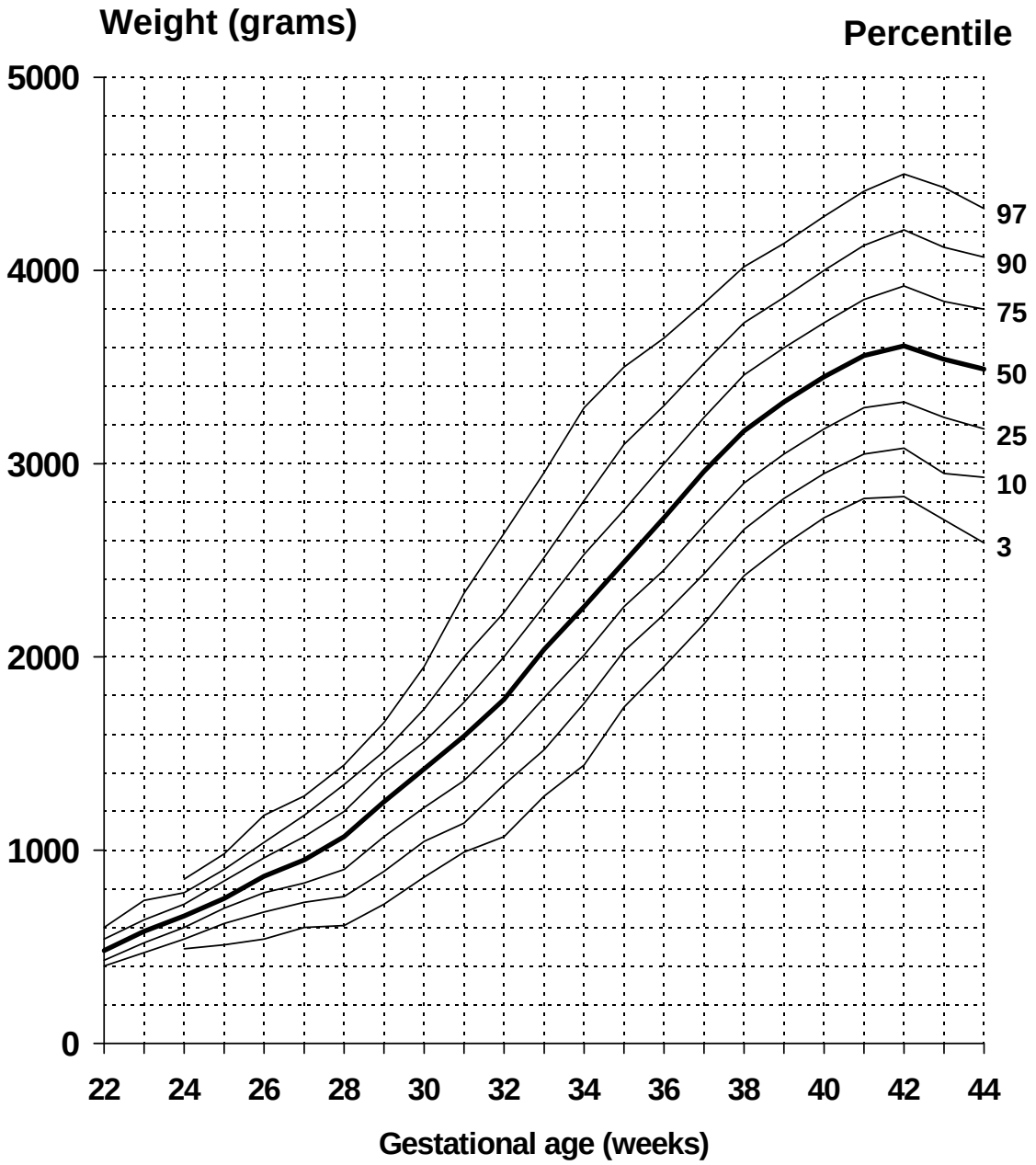
APPENDIX 10

Australian birthweight percentiles



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



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

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

Gestation	No. births	Mean	Standard	Percentile (gm)										
(weeks)		(gm)	Deviation	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.

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

Gestation (weeks)	No. births	Mean (gm)	Standard Deviation	Percentile (gm)									
				1st	3rd	5th	10th	25th	50th	75th	90th	95th	97th	99th
20	12	418	184						345					
21	25	414	55					400	420	440				
22	71	485	85				400	430	480	540	600			
23	79	591	103				470	520	580	640	740			
24	115	661	95		490	500	540	600	660	720	780	830	850	
25	136	760	116		510	560	620	700	750	840	900	960	980	
26	188	865	158		540	550	680	780	865	960	1040	1130	1180	
27	231	944	183		600	620	730	830	950	1070	1180	1250	1280	
28	287	1060	228		610	700	760	900	1070	1200	1340	1400	1440	
29	325	1233	247	630	720	810	890	1070	1250	1400	1510	1580	1660	1820
30	440	1403	275	740	860	945	1045	1220	1420	1560	1730	1885	1950	2100
31	548	1581	336	800	990	1050	1140	1360	1590	1765	2000	2130	2330	2560
32	877	1797	383	920	1070	1170	1340	1560	1780	2000	2230	2470	2640	2970
33	1200	2038	403	1135	1280	1385	1520	1790	2040	2265	2515	2755	2955	3150
34	2086	2282	439	1260	1440	1570	1760	2010	2260	2530	2810	3090	3290	3510
35	3418	2523	433	1520	1740	1840	2030	2260	2490	2760	3100	3340	3500	3710
36	7320	2738	433	1740	1950	2060	2220	2450	2720	3000	3300	3505	3650	3860
37	16105	2967	432	1940	2170	2280	2430	2680	2960	3240	3520	3700	3830	4050
38	47809	3187	419	2220	2420	2520	2660	2900	3170	3460	3730	3900	4020	4220
39	68846	3329	412	2390	2580	2670	2820	3050	3320	3600	3860	4030	4140	4340
40	137570	3463	414	2530	2720	2810	2950	3180	3450	3730	4000	4170	4280	4490
41	53260	3577	421	2630	2820	2910	3050	3290	3560	3850	4130	4300	4410	4620
42	13318	3627	442	2630	2830	2930	3080	3320	3610	3920	4210	4370	4500	4700
43	1285	3539	463	2460	2710	2770	2950	3240	3540	3840	4120	4320	4430	4620
44	433	3490	448	2420	2590	2720	2930	3180	3490	3800	4070	4230	4320	4470

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

APPENDIX 11

Co-sleeping while breastfeeding: advice to health professionals

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

Recommendations

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

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

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

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

Recommendations

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

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