



Government of South Australia

Department of Health

Maternal, Perinatal and Infant Mortality in South Australia 2005

Including
the South Australian Protocol
for the Investigation of Stillbirths

DECEMBER 2006

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

on maternal, perinatal and post-neonatal deaths in 2005
including the South Australian Protocol for investigation of Stillbirths

DEPARTMENT OF HEALTH

Adelaide

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Twentieth Report of the Maternal, Perinatal
and Infant Mortality Committee on maternal,
perinatal and post-neonatal deaths in 2005
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investigation of Stillbirths

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Committees

Maternal, Perinatal and Infant Mortality Committee

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

Maternal Subcommittee

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

Perinatal Subcommittee

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

Post-neonatal Subcommittee

Dr Aileen F. Connon	<i>Obstetrician, Chairperson (till May 2006)</i>
Dr Nicola Spurrier	<i>Paediatrician, Chairperson (from May 2006)</i>
Dr Susan M. Beal	<i>Paediatrician</i>
Dr Vineesh Bhatia	<i>Neonatal paediatrician</i>
Dr Harry Burnell	<i>Paediatrician</i>
Professor Roger Byard	<i>Pathologist</i>
Dr Lynette Moore	<i>Pathologist</i>
Associate Professor Victor Nossar	<i>Community paediatrician</i>
Dr Annabelle Chan	<i>Public health physician, Medical Secretary</i>

Education Subcommittee

Dr Brian Wheatley	<i>Obstetrician, Chairperson</i>
Mrs Julia Ats	<i>Midwife</i>
Dr Chris Barnett	<i>Neonatal paediatrician</i>
Dr David Morris	<i>Obstetrician</i>
Dr Annabelle Chan	<i>Public health physician, Medical Secretary</i>

Committee staff

Ms Robyn Kennare	<i>Senior midwife / Minute secretary</i>
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We would like to express our most sincere thanks to the following members who retired from the Committee in 2006:

- Dr Aileen Connon
- Ms Jackie Kitschke
- Dr George Kokar
- Associate Professor Victor Nossar

Our special thanks go to Dr Connon, who played a major role in setting up the Committee in 1985 and in participating as a member since its inception.

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- Medical practitioners who completed confidential reports on maternal, perinatal or post-neonatal deaths and submitted autopsy reports;
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Summary

This is the Twentieth Annual Report of the Maternal, Perinatal and Infant Mortality Committee, for the year 2005:

1. There were no maternal deaths related to pregnancy in South Australia in 2005, but there was an incidental death of a pregnant woman from injuries sustained in a motor vehicle accident. The maternal mortality ratio for direct and indirect deaths in the five years 2001-2005 was 9.1 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 (eight) and the Committee has examined all the deaths and found no recurring causes for concern.
2. The Committee reviewed the 192 perinatal deaths (129 stillbirths and 63 neonatal deaths) occurring among babies born in South Australia in 2005. The perinatal mortality rate for all births (of at least 400g or 20 weeks gestation) was 10.6 per 1,000 births, and the neonatal mortality rate 3.5 per 1,000 live births. The early neonatal mortality rate used for international comparison was 0.6 per 1,000 live births, the lowest ever reported in the state.
3. Seventy-eight percent of the perinatal deaths occurred in preterm babies (less than 37 weeks gestation). The leading cause of perinatal death in 2005 was congenital abnormality, which accounted for 29% of the deaths. Other important causes were spontaneous preterm birth (16%), specific perinatal conditions (10%), antepartum haemorrhage (9%), stillbirth of unknown cause (8%), fetal growth restriction (8%) and perinatal infection (8%). There were 15 stillbirths of unknown cause, a rate of 0.8 per 1,000 births in 2005, compared with 2.0 in 1995-1998. This is the first year since the Committee started reviewing perinatal deaths in 1986 that stillbirths of unknown cause have not been among the three leading causes of perinatal death. The Committee has distributed its protocol for the investigation of stillbirths to all obstetric units (Appendix 8). Sixteen deaths were attributed to fetal growth restriction. Poor fetal growth and preterm birth have been associated with smoking during pregnancy. Twenty percent of women who gave birth in South Australia in 2005 smoked during pregnancy.
4. *Fourteen babies of Aboriginal mothers died during the perinatal period. Eleven were stillbirths and three were neonatal deaths. The perinatal mortality rate of 28.5 per 1,000 births for Aboriginal mothers in 2005 was much higher than that of 10.1 per 1,000 for non-Aboriginal mothers. Preterm and small-for-gestational-age births were twice as high among births to Aboriginal mothers compared with non-Aboriginal mothers. The proportion of low birthweight births was nearly three times as high. These births are associated with a higher rate of smoking during pregnancy of 64% among Aboriginal women compared with 18% among non-Aboriginal women.*

5. The Committee also reviewed the 27 post-neonatal deaths in 2005 among babies born in South Australia, *four of which were babies of Aboriginal mothers*. The post-neonatal mortality rate remained very low at 1.5 per 1,000 live births. Two post-neonatal deaths were attributed to SIDS (Sudden Infant Death Syndrome). The SIDS rate remained at its lowest level ever recorded in the state: 0.1 per 1,000 live births. This rate declined dramatically following the introduction in 1990 of the educational campaign aimed at reducing the prevalence of risk factors for SIDS, including prone sleeping. In 2001-2005 there was an annual average of 3 or 4 post-neonatal deaths from SIDS compared with 40 in 1986-1989. However, it is difficult to distinguish some of these deaths from other sudden infant deaths which have been assigned to 'undetermined cause' or accidental asphyxiation. These deaths often have similar associated factors including inappropriate bedding.
6. The infant mortality rate in 2005 was 5.0 per 1,000 live births. *The 2005 infant mortality rate for babies of Aboriginal mothers of 14.6 per 1,000 live births was still substantially higher than that of 4.7 for babies of non-Aboriginal mothers.*
7. From reviewing perinatal deaths in 2005, the Committee recommends
 - 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;
 - pregnant women with a Body Mass Index (BMI) greater than 35 are at higher risk from anaesthesia and should have a timely referral for an anaesthetic consultation, in particular before any obstetric intervention in pregnancy or labour;
 - ultrasound determination of chorionicity is advised for twin pregnancies, followed by further surveillance for twin-twin transfusion in monochorionic pregnancies.
8. In relation to perinatal deaths, recommendations made by the Committee in recent years remain relevant:
 - caring for pregnant women in a setting which is appropriate for the level of risk the pregnancy presents for the mother and/or the baby: home birth is not appropriate for twins, breech presentations and post-term pregnancies;
 - vigilance to ensure that fetal growth restriction is not missed;
 - that health professionals implement effective strategies to reduce smoking in pregnancy, *including culturally appropriate smoking cessation interventions for Aboriginal women*;
 - screening for Group B Streptococcus in late pregnancy and giving intrapartum antibiotic prophylaxis to carrier mothers.

9. From reviewing maternal and perinatal deaths in recent years, the Committee also recommends:
- pregnant women travelling in motor vehicles need to wear seat belts at all times for safety;
 - review by a physician early in pregnancy of women with current or previous serious medical conditions;
 - appropriate training and maintenance of competence in cardiotocograph (CTG) interpretation for all levels of medical and midwifery staff;
 - the institution of streamlined arrangements between rural/level I hospitals and their regional level II/III maternity service in situations where on-site CTG expertise in the rural/level I hospital is insufficient; this includes easier access of rural practitioners to the consultant on call;
 - the development of statewide protocols for level I, II and III maternity services with an emphasis on timely recognition and proactive management of fetal growth restriction, preterm rupture of membranes, meconium-stained liquor, antepartum haemorrhage and pre-eclampsia;
 - use of the recently-revised protocol for investigating stillbirths, which has been sent to all maternity units in South Australia (Appendix 8);
 - seeking parental permission for autopsy, which may provide information most valuable in the counselling of parents and in the management of future pregnancies; and of sending placentas for histological examination (see Appendix 9). The **State Perinatal Autopsy Service** (telephone on **08-8161-7333**) is available at no cost to the parents, including those in country areas. Certain categories of death have to be reported to the State Coroner (see page 37).
10. From the review of the post-neonatal deaths in 2005, the Committee recommends the following:
- a major public health campaign to promote safe sleeping and prevent SIDS 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 SIDS. Parents should ensure that cots meet safety standards. Co-sleeping or bed-sharing may be hazardous for the infant, especially when a parent is under the influence of drugs or alcohol (see Appendix 11). Care should be taken with the use of blankets, pillows and other items in cots which may cause suffocation. Infants should not be allowed to sleep unattended in stroller-prams and bouncinettes;
 - 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;

- 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;
- peripheral hospitals with high paediatric throughput need adequate provision of paediatric expertise;
- appropriate paediatric protocols need to be distributed to all hospitals;
- consideration should be given to better ways of identifying serious underlying illness in children presenting to clinicians, for example, Medic Alert bracelets.

11. In reviewing infant deaths in recent years, the Committee recommends:

- vigilance to ensure safe feeding in children under four years of age. Foods that can break off into pieces should not be given, as accidental asphyxiation may occur;
- babies should never be left alone or with a sibling in a bath with water, with or without a device such as a ring bath seat.;
- monitoring growth in children, which can be undertaken using the weight percentiles in the child's Personal Health Record (Blue Book), and investigating why a child is not thriving;
- immunisation of children to prevent infectious disease.

I Introduction

This is the Twentieth 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 Twentieth Report of the Committee incorporates information on maternal, perinatal and post-neonatal deaths in South Australia in the year 2005.

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 2005

1. Maternal mortality 2005

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 protocols² and reports a maternal mortality ratio (see Appendix 3) which only includes pregnancy-related deaths, that is, direct and indirect maternal deaths, per 100,000 confinements. The South Australian Maternal, Perinatal and Infant Mortality Committee will continue to review incidental deaths to ensure that indirect deaths are not missed. It will, however, report only maternal mortality ratios for pregnancy-related deaths to be consistent with national and international protocols. At the request of this national committee, pregnancy-related deaths of women occurring from 42 days to within a year of the end of pregnancy ('late maternal deaths') are also reviewed, but these are not included in the South Australian statistics on maternal deaths or maternal mortality ratios.

There were no direct or indirect maternal deaths in 2005. The Committee was advised of the death in 2005 of a pregnant woman from multiple injuries sustained in a motor vehicle accident. This was an incidental maternal death. The Committee was also advised of the sudden death of a woman in 2003 five months after she had given birth. The Committee reviewed the circumstances of this death and resolved that the cause was undetermined but not pregnancy-related. This was also an incidental death, and will not be included in the statistics for late maternal deaths.

Maternal deaths in South Australia for the three categories of deaths from 1961 to 2005 are presented in Table 1 by 5-year periods. Maternal mortality ratios have been calculated for direct and indirect deaths (Table 1 and Figure 1). The

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.

maternal mortality ratio for the last 5-year period 2001-2005 was 9.1 deaths per 100,000 confinements. This is lower than the national ratio of 11.1 for 2000-2002, but 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 (eight in 2001-2005, compared with six in 1996-2000). The Committee reviewed all the deaths and found no recurring pattern of causes of death.

Of a total of 36 pregnancy-related maternal deaths in the period 1986-2005, 14 were direct deaths and 22 were indirect deaths. Three of the 14 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.

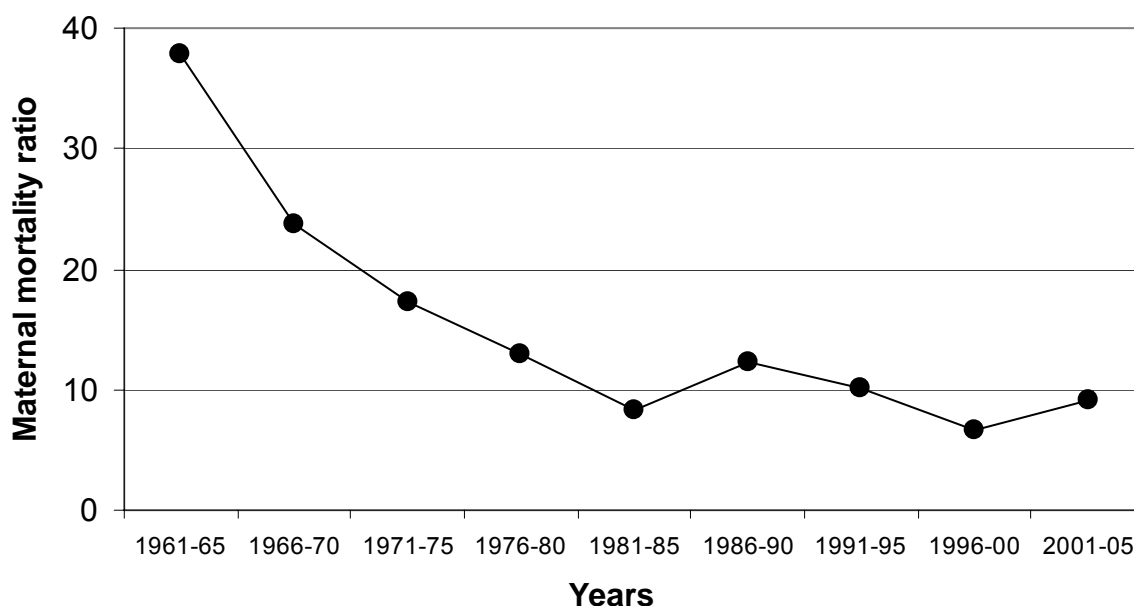
Table 1: Maternal mortality by category of death, in 5-year periods, South Australia, 1961 - 2005

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 – 2005	4	4	2	10	8	9.1

*Expressed as deaths per 100,000 confinements

Figure 1: Maternal Mortality Ratio, South Australia 1961-2005

Direct and Indirect Deaths per 100,000 Confinements



2. Perinatal mortality 2005

(1) Perinatal mortality rates

In 2005 there were 18,196 live births and stillbirths of at least 400g birthweight or 20 weeks gestation notified to the South Australian perinatal data collection. Of these, 129 were stillbirths. Of the 18,067 live births, 63 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 2005 was 10.6 deaths per 1,000 births. The stillbirth rate was 7.1 deaths per 1,000 births and the neonatal mortality rate 3.5 deaths per 1,000 live births. Thirty-eight of the 192 perinatal deaths (19.8%) were terminations of pregnancy. The exclusion of terminations would have resulted in a perinatal mortality rate of 8.5 deaths per 1,000 births. Forty-five perinatal deaths (23.4%) were less than 400g birthweight.

For international comparison, only births of at least 1,000g birthweight and early neonatal deaths within the first seven days of life are included. This perinatal mortality rate for international comparison was 3.7 deaths per 1,000 births and the early neonatal mortality rate was 0.6 deaths per 1,000 live births, the lowest ever recorded in the state.

Table 2: Perinatal mortality, South Australia, 2005

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	18,196	18,067	129	7.1	63	3.5	192	10.6
≥500g/22 weeks*	18,123	18,041	82	4.5	41	2.3	123	6.8
					30**	1.7	112**	6.2
≥1,000g/28 weeks*	18,011	17,956	55	3.1	22	1.2	77	4.3
					11**	0.6	66**	3.7

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

*For international comparisons, only fetuses and infants of at least 1,000g birthweight, or when birthweight is unavailable, the corresponding gestational age (28 weeks) or body length (35cm crown-heel) are included.

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

Table 3 shows that the perinatal mortality rate for South Australia over the years has generally tended to be lower than the national rate. In 2004, South Australia and Tasmania recorded the lowest rates in Australia. These rates for South Australia and Australia for 1990-2004 from the Australian Bureau of Statistics (ABS) are presented graphically in Figure 2. The South Australian rates provided by the ABS differ slightly 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.*

South Australian perinatal mortality rates, including stillbirth and neonatal mortality rates, for 1983-2005 from Committee data are presented in Figure 3 for all births. Rates for births of at least 1,000g birthweight (or when birthweight was unavailable, 28 weeks gestation,) are presented in Figure 4. Figure 4 includes only 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,

although a decrease is evident if only births of at least 1,000g birthweight are considered.

Table 3: Perinatal mortality rate*, Australian states, 1990 – 2004

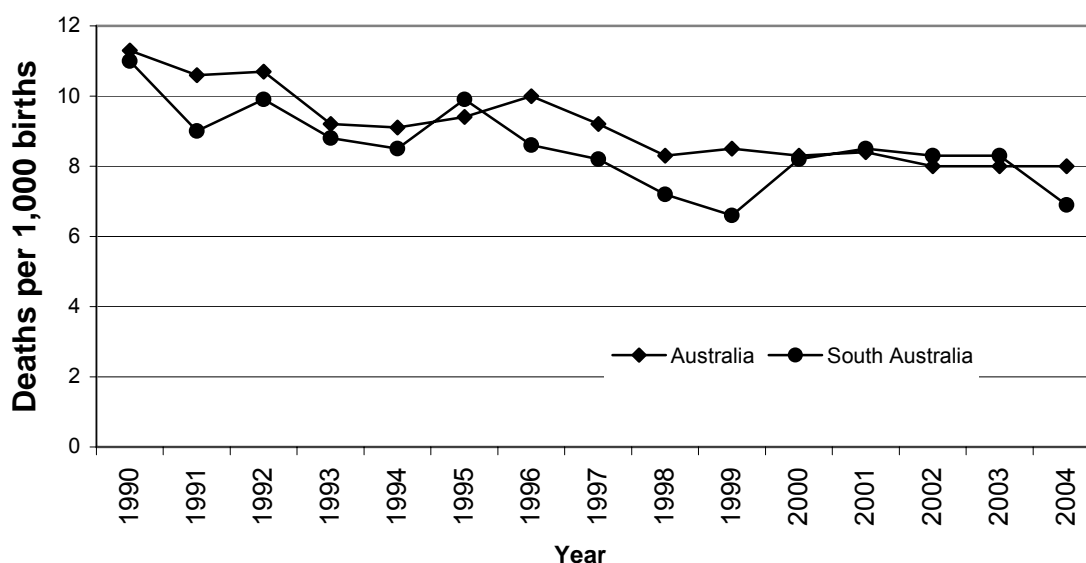
Year	NSW	VIC	Qld	SA	WA	Tas	NT	ACT	AUSTRALIA
1990	11.7	11.6	10.2	11.0	10.4	10.6	18.1	13.8	11.3
1991	11.0	9.8	11.1	9.0	10.3	11.9	18.2	12.5	10.6
1992	11.8	9.4	10.6	9.9	9.8	9.1	19.3	9.4	10.7
1993	9.5	8.5	9.4	8.8	8.3	10.0	21.1	7.7	9.2
1994	9.2	9.3	8.9	8.5	8.3	8.4	16.9	6.9	9.1
1995	8.9	9.2	9.8	9.9	9.3	9.7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

*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, 2004 Causes of Death Australia. Catalogue No 3303.0. Canberra: 2006.

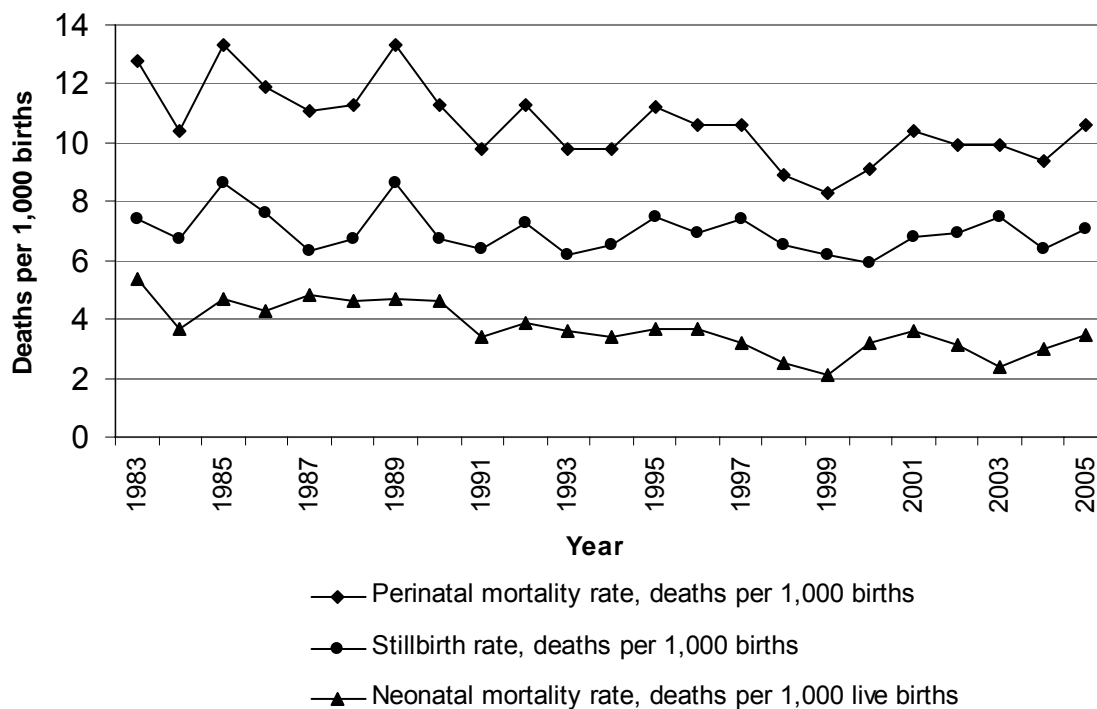
Figure 2: Perinatal Mortality Rates, South Australia and Australia 1990-2004

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



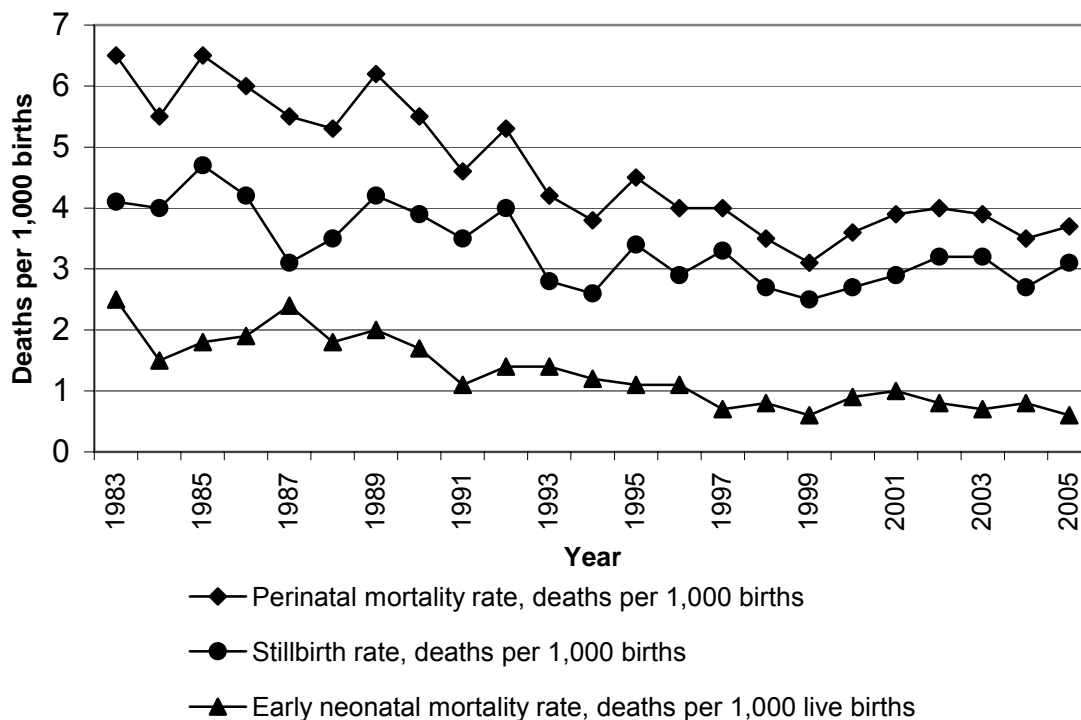
Source: Australian Bureau of Statistics, 2004 Causes of Death Australia. Cat. No. 3303.0, 2006

Figure 3: Perinatal mortality rate ($\geq 400\text{g}/20$ weeks gestation), South Australia 1983-2005



Births of at least 400g birthweight or 20 weeks gestation

Figure 4: Perinatal mortality rate ($\geq 1,000\text{g}/28$ weeks gestation), South Australia 1983-2005



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

(2) Birthweight-specific perinatal mortality

The distribution of stillbirths and neonatal deaths by birthweight, and birthweight-specific perinatal mortality rates for 2005 are provided in Table 4. Of the 192 perinatal deaths, 148 (77.1%) were of low birthweight (<2,500g) and 150 (78.1%) were preterm births (<37 weeks gestation).

There were 129 stillbirths, accounting for 67.2% of the perinatal deaths in 2005. Of the 62 intrapartum stillbirths, 53 were under 750g birthweight (Table 5) and 32 were terminations of pregnancy. Of the 63 neonatal deaths, 45 (71.4%) were low birthweight babies and five resulted from terminations of pregnancy.

Table 4: Perinatal mortality by birthweight, South Australia, 2005, (all births of at least 400g or 20 weeks gestation)

Birthweight (grams)	Total births	Live births	Stillbirths		Neonatal deaths		Perinatal deaths	
			Number	Deaths per 1,000 births	Number	Deaths per 1,000 live births	Number	Deaths per 1,000 births
<400	45	14	31	688.9	14	1,000.0	45	1,000.0
400-499	28	12	16	571.4	8	666.7	24	857.1
500-749	65	43	22	338.5	16	372.1	38	584.6
750-999	46	42	4	87.0	3	71.4	7	152.2
1,000-1,499	153	138	15	98.0	0	0	15	98.0
1,500-1,999	252	245	7	27.8	0	0	7	27.8
2,000-2,499	786	778	8	10.2	4	5.1	12	15.3
2,500-2,999	2,705	2,694	11	4.1	3	1.1	14	5.2
3,000-3,499	6,532	6,523	9	1.4	7	1.1	16	2.4
3,500-3,999	5,505	5,501	4	0.7	5	0.9	9	1.6
4,000-4,499	1,780	1,779	1	0.6	2	1.1	3	1.7
4500+	297	297	0	0	1	3.4	1	3.4
Unknown	2	1**	1*	-	0	0	1*	-
Total	18,196	18,067	129	7.1	63	3.5	192	10.6

*this stillbirth occurred at 23 weeks gestation

**this was a live birth at 42 weeks gestation

Table 5: Time of perinatal death by birthweight, South Australia, 2005 (births of at least 400g birthweight or 20 weeks gestation)

Birthweight (grams)	Stillbirths			Neonatal deaths	Total
	Antepartum	Intrapartum	Uncertain if antepartum or intrapartum		
<500	10	36	1	22	69
500-749	5	17	0	16	38
750-999	4	0	0	3	7
1,000-1,499	13	0	2	0	15
1,500-1,999	6	1	0	0	7
2,000-2,499	7	0	1	4	12
2,500-2,999	8	3	0	3	14
3,000-3,499	6	3	0	7	16
3,500-3,999	3	0	1	5	9
4,000-4,499	0	1	0	2	3
4,500+	0	0	0	1	1
Unknown	0	1*	0	0	1*
Total	62	62	5	63	192

* this stillbirth occurred at 23 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, 2005 (births of at least 400g or 20 weeks gestation)

Gestational age at birth (weeks)	Total births	Live births	Stillbirths		Neonatal deaths		Perinatal deaths	
			Number	Deaths per 1,000 births	Number	Deaths per 1,000 live births	Number	Deaths per 1,000 births
<24	93	35	58	623.7	29	828.6	87	935.5
24-27	88	74	14	159.1	12	162.2	26	295.5
28-31	187	171	16	85.6	1	5.8	17	90.9
32-36	1,265	1,250	15	11.9	5	4.0	20	15.8
37-41	16,467	16,441	26	1.6	16	1.0	42	2.6
42+	96	96	0	0	0	0	0	0
Total	18,196	18,067	129	7.1	63	3.5	192	10.6

3. Post-neonatal and infant mortality 2005

There were 27 post-neonatal deaths in 2005 among babies born in South Australia. The post-neonatal death rate for South Australia for 2005 was 1.5 deaths per 1,000 live births. The post-neonatal death rate due to Sudden Infant Death Syndrome (SIDS), with two deaths, remained at its lowest level of 0.1 per 1,000 live births. Despite the low incidence of SIDS deaths in 2005, there has been no decrease in recent years in the total number of deaths which were categorised as sudden unexpected infant deaths (SIDS, accidental asphyxiation and 'undetermined'): many of these deaths were associated with unsafe infant sleeping and bedding practices.

The numbers of post-neonatal deaths and infant deaths and death rates for South Australia for all years from 1986 to 2005 are presented in Table 7 and the rates for 1971-2005 in Figure 5, together with the relative contribution from SIDS.

Table 7: Post-neonatal and infant deaths and death rates, South Australia, 1986 – 2005

Year	Post-neonatal deaths, all causes		Post-neonatal deaths from SIDS		Infant deaths, all causes	
	Number	Rate per 1,000 live births	Number	Rate per 1,000 live births	Number	Rate per 1,000 live births
1986	65	3.3	41	2.1	150	7.6
1987	74	3.8	49	2.5	167	8.7
1988	53	2.7	32	1.6	142	7.3
1989	71	3.6	36	1.8	164	8.3
1990	61	3.1	31	1.6	153	7.7
1991	39	2.0	19	1.0	105	5.4
1992	41	2.0	23	1.1	120	6.0
1993	37	1.9	13	0.7	109	5.5
1994	30	1.5	11	0.6	96	4.9
1995	46	2.4	15	0.8	117	6.0
1996	26	1.4	11	0.6	96	5.1
1997	34	1.8	8	0.4	93	5.0
1998	27	1.5	7	0.4	73	3.9
1999	36	2.0	5	0.3	74	4.0
2000	21	1.2	5	0.3	78	4.4
2001	24	1.4	6	0.3	88	5.0
2002	26	1.5	3	0.2	80	4.5
2003	24	1.4	4	0.2	66	3.7
2004	31	1.8	1	0.1	83	4.8
2005	27	1.5	2	0.1	90	5.0

The infant mortality rate for South Australia for 2005 was 5.0 deaths per 1,000 live births, which was higher than the previous three years. This includes all deaths of infants under 1 year of age, that is, the 63 neonatal deaths and the 27 post-neonatal deaths (Appendix 3). *The infant mortality rate for babies of Aboriginal mothers (with four post-neonatal deaths and three neonatal deaths out of 481 live births) was 14.6 deaths per 1,000 live births, which was three times higher than the infant mortality rate of 4.7 deaths per 1,000 live births for babies of non-Aboriginal mothers.* Infant mortality rates for all Australian states for 1987-2004 from the Australian Bureau of Statistics are presented in Table 8: the rates for 2005 are not yet available. Rates for South Australia compared with Australia for 1979-2004 (Figure 6) demonstrate that the South Australian infant mortality rate has generally been lower than the national rate. The ABS includes only registered births and deaths in any year of at least 400g birthweight (or 20 weeks gestation if birthweight unavailable) and adjusts for state of usual residence: hence rates reported may differ from those reported by this Committee.

Figure 5: Post-neonatal death rates, South Australia, 1971 - 2005

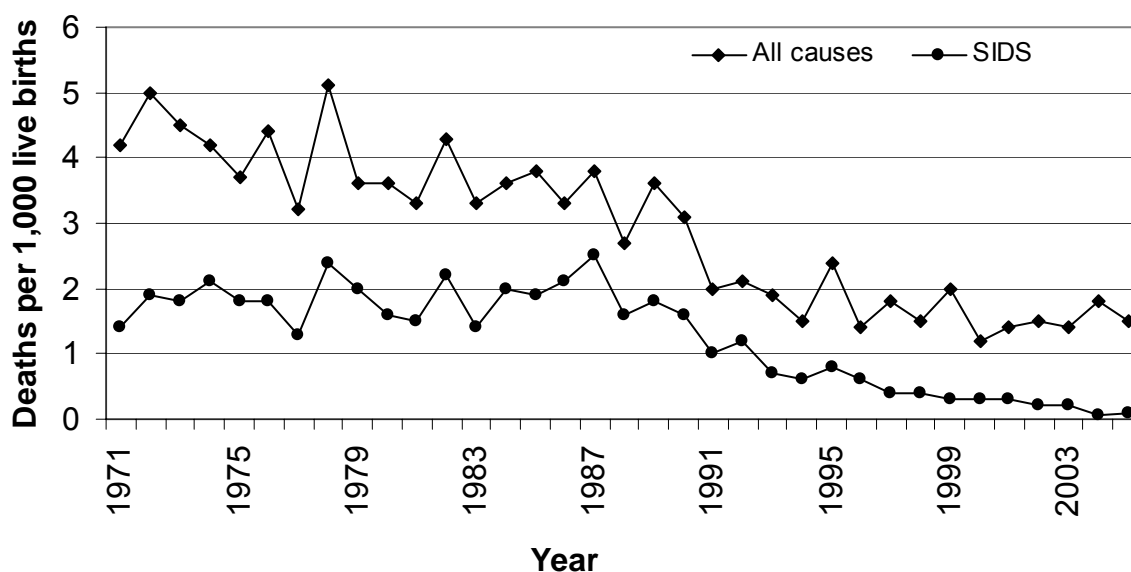
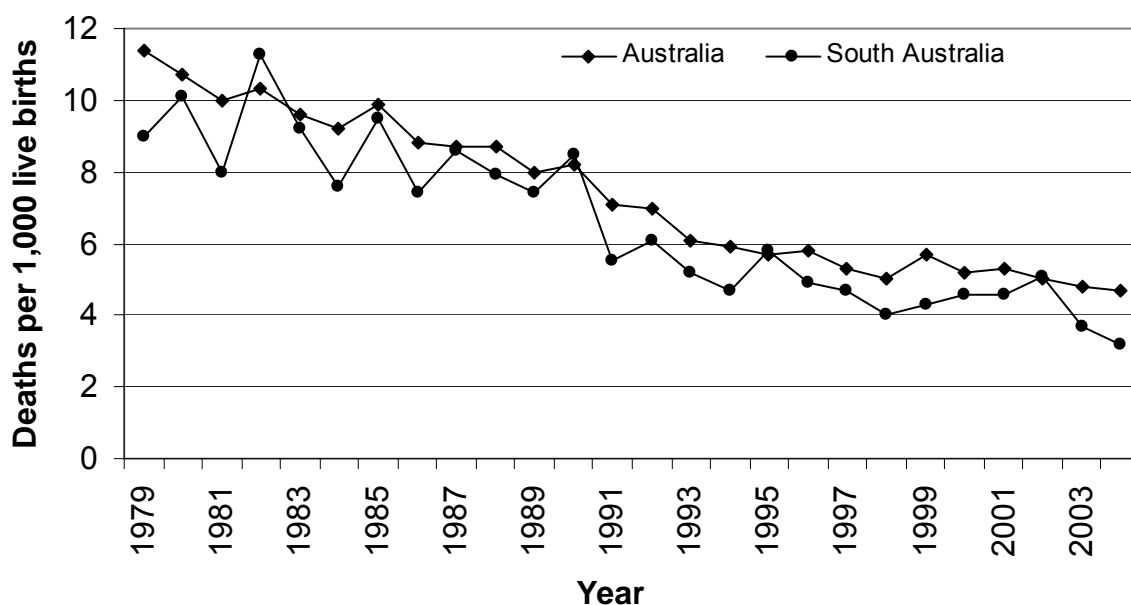


Table 8: Infant mortality rates (per 1,000 live births), Australian states, 1987 - 2004

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

Source: Australian Bureau of Statistics. Deaths Australia 2004. Catalogue No 3302.0. Canberra: ABS 2005

Figure 6: Infant mortality rates, South Australia and Australia, 1979-2004



Source: Australian Bureau of Statistics. Deaths Australia 2004. Catalogue No. 3302.0, 2005

III Causes of death 2005

1. Causes of maternal deaths 2005

The Committee was advised of the death in 2005 of a pregnant woman from multiple injuries sustained in a motor vehicle accident. This was an incidental maternal death. It was reported that the woman was not wearing a seatbelt. It is possible that she had been wearing a seat belt but undid it to attend to her child in the car seat behind. State legislation requires every person travelling in a motor vehicle to use an approved restraint where one is available, properly fastened and adjusted. Pregnancy of itself does not constitute grounds for exemption, nor does the number of months of pregnancy. Transport SA recommends that the lap part of the seat belt should be worn as low as possible, below the unborn child. It should be over the upper thighs and across the pelvis. The sash part of the seat belt passes above the stomach and between the breasts.³ The seat belt should be worn at all times when the vehicle is in motion.

The Committee was also advised of the death in 2003 of a woman five months after she had given birth. This woman in her thirties had been in good health and died in her sleep. At autopsy, the only significant findings were coronary arteries of much smaller calibre than usual, which were noted by the Committee. It was considered that the cause of death was undetermined but not pregnancy-related.

2. Causes of perinatal deaths 2005

(1) Classification of perinatal deaths

The Perinatal Subcommittee classified each of the 192 perinatal deaths which occurred in 2005 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.

³ Transport SA. Seat belts and pregnant women. Adelaide: April 2000.

The classification of perinatal deaths in 2005 according to PSANZ-PDC is as follows (Table 9):

Table 9: Classification of perinatal deaths, PSANZ-PDC, South Australia, 2005

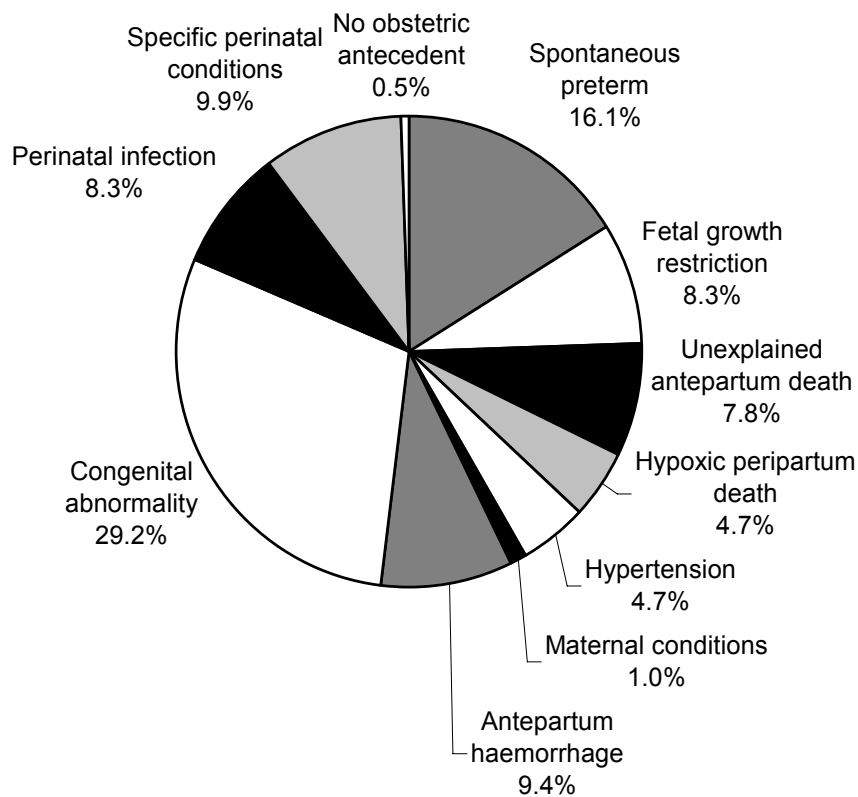
	PSANZ-PDC	Number	Percent	Deaths per 1,000 births
1.	Congenital abnormality	56	29.2	3.1
2.	Perinatal infection	16	8.3	0.9
3.	Hypertension	9	4.7	0.5
4.	Antepartum haemorrhage (APH)	18	9.4	1.0
5.	Maternal conditions	2	1.0	0.1
6.	Specific perinatal conditions	19	9.9	1.0
7.	Hypoxic peripartum death	9	4.7	0.5
8.	Fetal growth restriction	16	8.3	0.9
9.	Spontaneous preterm	31	16.1	1.7
10.	Unexplained antepartum death	15	7.8	0.8
11.	No obstetric antecedent	1	0.5	0.1
	Total	192	100.0	10.6

The PSANZ-PDC for perinatal deaths in 2005 is shown graphically in Figure 7 and its breakdown by subgroups and birthweight groups is provided in Appendix 4 and Appendix 5.

Congenital abnormalities were again the leading cause of perinatal death in 2005, accounting for 29% of all deaths. The next leading cause was preterm birth due to spontaneous labour or pre-labour rupture of membranes (16%). Other leading causes were specific perinatal conditions (10%), antepartum haemorrhage (9%), perinatal infection (8%), fetal growth restriction (8%) and unexplained antepartum death (8%).

The death rate due to unexplained stillbirth has fallen to 0.8 per 1,000 births from 2.0 per 1,000 births in 1995-1998. This is the first year since the Committee started reviewing perinatal deaths in 1986 in which unexplained stillbirth has not been among the three leading causes of perinatal death.

Figure 7: Perinatal deaths in South Australia 2005, by PSANZ-PDC (N=192)



A brief description of each of the 11 groups follows.

1. Congenital abnormality - 56 deaths

This group of 56 deaths includes terminations of pregnancy at 20 weeks gestation or more for fetuses with congenital abnormalities. The types of abnormalities were as follows, with the numbers of terminations of pregnancy shown in parentheses:

Central nervous system	4	(3)
Cardiovascular	11	(3)
Urinary tract	4	(3)
Gastrointestinal tract	1	(1)
Chromosomal	13	(11)
Metabolic	1	(0)
Multiple	16	(10)
Other	6	(3)
Total	56	(34)

Of the four infants with central nervous system abnormalities, two had neural tube defects, one had cerebral infarction associated with severe hydrocephalus

and the fourth had a massive intracranial haemorrhage. The causes of the infarction and haemorrhage, both prenatal events, were undetermined.

The 11 infants with cardiovascular abnormalities had the following:

- Hypoplastic left heart syndrome – two babies: one had associated total anomalous pulmonary venous drainage;
- Total anomalous pulmonary venous drainage;
- Truncus arteriosus with ventricular septal defects (VSDs) and patent ductus arteriosus (PDA): this infant's course was complicated by meconium aspiration syndrome;
- Transposition of the great vessels – four babies: one had a complete transposition, two had incomplete transpositions and one had a corrected transposition with mitral atresia, VSD, hypoplastic left ventricle and heart block: all were associated with other cardiac defects;
- Pulmonary atresia with hypoplastic right ventricle and pulmonary trunk;
- Hypoplastic right heart, tricuspid and pulmonary atresia and pulmonary artery stenosis;
- Ebstein anomaly.

Four babies had the following urinary tract abnormalities:

- Bilateral renal dysplasia;
- Enlarged kidneys associated with oligohydramnios;
- Bladder outlet obstruction and obstructive uropathy - two babies: one case was associated with cystic dysplastic kidneys and the other with anhydramnios.

One baby had gastro-intestinal tract abnormalities.

Thirteen babies had the following chromosomal abnormalities:

- Trisomy 21 - four babies, one of whom was known to have a congenital cardiac abnormality;
- Trisomy 18 - two babies: both had cardiac and other defects and one also had a neural tube defect;
- Triploidy, with multiple defects - two babies;
- Chromosomal deletion, with multiple defects;
- Turner's syndrome;
- Klinefelter's syndrome, with hydrops;
- Sex chromosome anomaly;

- Complex chromosomal anomaly associated with hydrops.

The baby with a metabolic defect had hypophosphatasia with skeletal dysplasia, cardiac and other defects.

There were 16 babies with multiple congenital abnormalities. No specific syndromes were identified except for tuberous sclerosis presenting with multiple cardiac rhabdomyomata, Meckel-Gruber syndrome, limb-body wall complex and fetal akinesia syndrome.

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

- Diaphragmatic hernia (three babies);
- Thoracic lymphangioma;
- Short rib-polydactyly syndrome;
- Cystic adenomatoid malformation associated with hydrops.

2. Perinatal infection – 16 deaths

This group included two stillbirths infected with Group B Streptococcus.

One was a growth-restricted term stillbirth whose placenta showed patchy chorioamnionitis and villitis. The other stillbirth occurred at 30 weeks and was associated with a hypercoiled cord and fetal obstructive vasculopathy noted on placental histology. Group B Streptococcus was isolated from the fetal blood, stomach and lungs.

There were four deaths from E coli sepsis. Two deaths occurred at 22 weeks gestation and were associated with chorioamnionitis and funisitis. E coli was cultured from several sites. One of these fetuses also had a rare chromosomal abnormality and the other was a twin. In the third case, labour occurred at 24 weeks following antepartum haemorrhages for two weeks associated with a dilated cervix. The placenta showed severe chorioamnionitis. There was fetal pneumonia and E coli was cultured from the blood. The fourth case involved preterm labour at 35 weeks and a neonate in poor condition at birth. There was chorioamnionitis and funisitis and blood cultures grew E coli.

Two deaths were attributed to other bacterial infections. Haemophilus influenzae was cultured from the blood and several other sites of a growth-restricted baby born at 38 weeks. Enterococcus was cultured from another infant born at 41 weeks.

Three deaths were attributed to unspecified bacterial infections. All three involved spontaneous preterm labour at 19-23 weeks, chorioamnionitis and funisitis.

One stillbirth was associated with Cytomegalovirus infection. This was diagnosed on amniotic fluid PCR after an ultrasound detected cerebral ventricular dilation, pericardial effusion and polyhydramnios.

One neonatal death was associated with enteroviral myocarditis. This was diagnosed at autopsy in a previously well infant who suddenly developed breathing difficulties.

Three other deaths with chorioamnionitis and funisitis were not associated with specified organisms.

3. Hypertension - nine deaths

One death was associated with pre-existing hypertension, five with pre-eclampsia and three with pre-eclampsia superimposed on pre-existing hypertension.

Fetal growth restriction and death in utero were associated with pre-existing hypertension in a woman with obesity and diabetes. Three of the five cases of pre-eclampsia were associated with fetal growth restriction and three were complicated by abruption.

The three deaths associated with pre-eclampsia superimposed on pre-existing hypertension occurred at 22-26 weeks gestation. All these babies were growth restricted and two were antepartum stillbirths.

4. Antepartum haemorrhage - 18 deaths

There were 17 deaths from placental abruption and one from APH of undetermined origin.

5. Maternal conditions - two deaths

There were two deaths from maternal causes. One stillbirth at term was associated with maternal cholestasis and a slightly elevated glucose tolerance test. The second death occurred following extremely preterm labour in a woman who had gastric surgery complications.

6. Specific perinatal conditions - 19 deaths

These deaths were due to the following:

- Twin-twin transfusion - eight deaths, including three sets of twins; all deaths occurred at 21-28 weeks gestation, although one pregnancy went to term with a live fetus after the death of one twin;
- Fetomaternal haemorrhage - one stillbirth at term;
- Antepartum cord complications - two deaths: both were stillbirths at term: one was associated with an extremely long umbilical cord which was wound tightly round the fetal neck. The other was a true knot in the cord with evidence of occlusion;
- Uterine abnormalities - four deaths. All these pregnancies, including a set of twins, involved cervical incompetence, preterm labour and chorioamnionitis;

- Alloimmune disease – one death from Rhesus isoimmunisation, associated with severe fetal hydrops;
- Idiopathic hydrops fetalis – two deaths. One involved chylothoraces and severe pulmonary hypoplasia. Spontaneous extremely preterm labour occurred in both cases;
- Other perinatal conditions – one death. This involved spontaneous preterm rupture of membranes and amniotic fluid infection some days after amniocentesis.

7. Hypoxic peripartum death – nine deaths.

All but two were term births and three were at 41 weeks gestation. In one case, labour was induced with prostaglandins for a woman who had had a previous caesarean section. Uterine rupture and intrapartum haemorrhage occurred. Two other cases involved other intrapartum complications: in one, there was prolonged preterm rupture of membranes and labour, fetal distress and a difficult delivery due to a contracted uterus. The other also involved a difficult delivery – a contracted uterus, a large baby in an abnormal presentation at 41 weeks and delay in the second stage of labour. There were no apparent intrapartum complications in the remaining six cases. One was at 41 weeks gestation and complicated by meconium aspiration syndrome. A true knot was noted in the cord but there was no evidence of occlusion. There was the possibility of perinatal infection in two other cases.

8. Fetal growth restriction – 16 deaths

In 15 deaths in this group, there was evidence of uteroplacental insufficiency, a small placenta or placental infarction. Some factors associated were: smoking, substance abuse, diabetes and obesity. Amniotic band syndrome with some digital amputations was associated with one case and in another, placental histology showed non-specific chronic villitis and decidual necrosis without established chorioamnionitis.

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

All these were perinatal deaths at 20-28 weeks gestation and seven were multiple births. In 14 deaths the membranes were ruptured for less than 24 hours before birth. In another 14 deaths, the membranes had been ruptured for at least 24 hours. In the remaining three deaths, the duration of membrane rupture was unknown. Chorioamnionitis was a finding in 19 cases.

10. Unexplained antepartum death – 15 deaths

Six of these were term stillbirths. The placenta was examined in all cases and showed no pathology in seven cases. One had evidence of reduced vascular perfusion and four others showed chronic villitis.

11. No obstetric antecedent – one death

This was a case of accidental asphyxiation in a neonate.

Whitfield Classification of perinatal deaths⁴

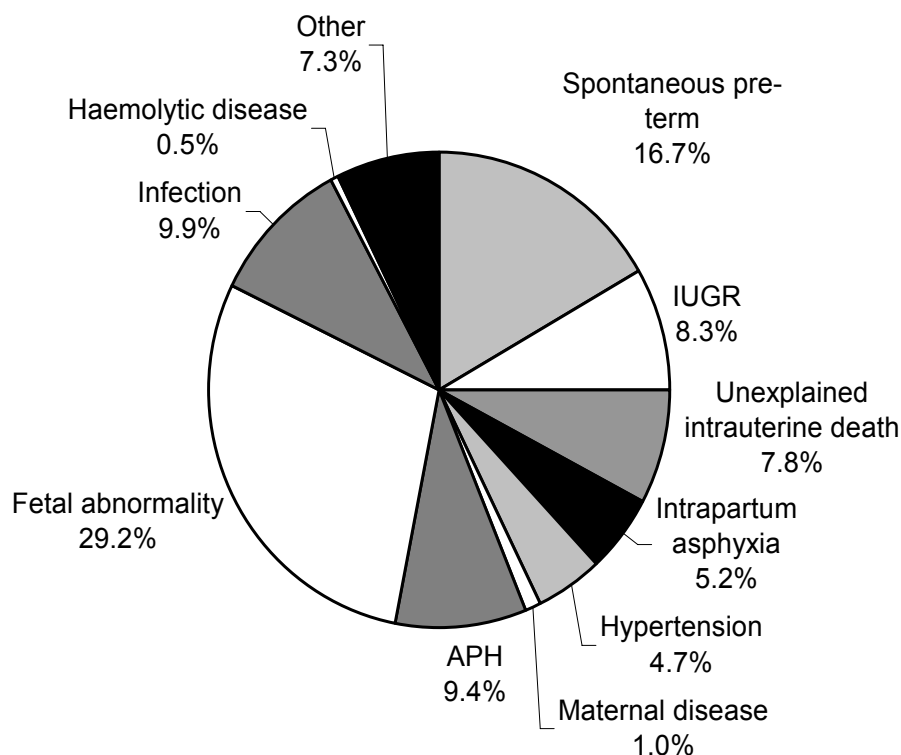
The classification of the 192 perinatal deaths into the 12 groups of the amended Whitfield Classification is presented in Table 10 and Figure 8. Subgroups of the classification are also included in Appendix 6.

Table 10: Amended Whitfield Classification of perinatal deaths, South Australia, 2005

	Amended Whitfield Classification	Number of deaths	%	Deaths per 1,000 births
1.	Spontaneous preterm	32	16.7	1.8
2.	Intrauterine growth restriction (IUGR)	16	8.3	0.9
3.	Unexplained intrauterine death	15	7.8	0.8
4.	Intrapartum asphyxia	10	5.2	0.5
5.	Hypertension	9	4.7	0.5
6.	Maternal disease	2	1.0	0.1
7.	Antepartum haemorrhage (APH)	18	9.4	1.0
8.	Fetal abnormality	56	29.2	3.1
9.	Haemolytic disease	1	0.5	0.1
10.	Infection	19	9.9	1.0
11.	Other	14	7.3	0.8
	Total	192	100.0	10.6

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

Figure 8: Causes of perinatal deaths, amended Whitfield Classification, South Australia 2005



Perinatal Society of Australia and New Zealand - Neonatal Death Classification

The classification of the 63 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 2005

There was one neonatal death in South Australia of a baby born at an interstate hospital. This mother had a history of previous preterm births and gestational diabetes. Spontaneous preterm pre-labour rupture of membranes occurred at 34 weeks and maternal fever and fetal tachycardia developed. The baby was delivered by caesarean section and collapsed shortly after birth. It⁵ was transferred to a Level III hospital in Adelaide the following day with severe encephalopathy and died a week later. There was evidence of intraventricular haemorrhage and raised intracranial pressure.

⁵ The neuter gender is used here and elsewhere in this report for reasons of confidentiality.

(2) Aboriginal perinatal deaths

There were 14 perinatal deaths (11 stillbirths and three neonatal deaths) among the 492 births to Aboriginal mothers. Ten were born in teaching hospitals and four in country hospitals. Twelve were preterm births. Maternal morbidity associated with these deaths included obesity, diabetes, smoking and substance use, asthma, rheumatic heart disease, sexually transmitted disease, anaemia, urinary tract infection and pre-eclampsia. The causes of the 14 deaths were as follows:

- 1. Congenital abnormality – one preterm stillbirth. This baby had multiple abnormalities – central nervous system, cardiovascular and musculo-skeletal. This pregnancy was complicated by preterm rupture of membranes and amniotic fluid infection.*
- 2. Perinatal infection – one preterm neonatal death. This mother was booked to give birth at an interstate hospital, where she attended regularly for antenatal care. She had diabetes and smoked. She went into spontaneous labour at 24 weeks after episodes of abdominal pain and vaginal bleeding for two weeks. Labour was preceded by a large APH. Intrauterine pneumonia was noted at autopsy and E coli was cultured from the infant's blood.*
- 3. Antepartum haemorrhage – one preterm stillbirth. This mother was from the country, smoked and had iron-deficiency anaemia. She first attended antenatal care late in pregnancy and suffered an abruption and fetal death in utero at 34 weeks.*
- 4. Specific perinatal conditions – one preterm stillbirth. This mother from interstate had a previous stillbirth from Rhesus isoimmunisation. She presented at an interstate hospital at 25 weeks with headaches, nausea and vomiting and gross fetal hydrops was noted on ultrasound examination. She was transferred to a level III hospital in Adelaide, where fetal death was detected the following day. This was due to Rhesus isoimmunisation. The infant was in cardiac failure.*
- 5. Fetal growth restriction – two stillbirths. One was a term stillbirth of a non-smoking mother. She was obese and the placenta showed many infarcts. The other was a mother who smoked, was a poor attender for antenatal care and non-compliant with her diabetes management. She presented with an intrauterine fetal death at an antenatal visit at 30 weeks. The placenta was noted to be small.*
- 6. Spontaneous preterm – five stillbirths and one neonatal death. All were born at 20-28 weeks gestation. One mother, who was booked to give birth at an interstate hospital, presented with preterm rupture of membranes followed by spontaneous labour several days later at 24 weeks. Another mother had no antenatal care, smoked and used amphetamines. She presented with a cord prolapse at 28 weeks after membranes ruptured two days earlier. There was evidence of chorioamnionitis and funisitis in both cases. Another mother was from a remote community and smoked. She had no antenatal care until 28 weeks, when fetal hydrops and oligohydramnios were detected: the membranes had probably ruptured days earlier. She had an abruption after the spontaneous onset of labour. Three other mothers from the country went into spontaneous labour at 20 - 24 weeks gestation. Two were smokers.*

7. *Unexplained stillbirth – one death. This mother was a smoker; she had anaemia and a urinary tract infection. She experienced an intrauterine fetal death at 35 weeks of a baby with mild skeletal anomalies. Although it was suspected that she had cytomegalovirus disease, there were no viral inclusions present to support this diagnosis.*
8. *No obstetric antecedents – one neonatal death. This baby died of accidental asphyxiation while being breastfed.*

In 2005, the perinatal mortality rate for births to Aboriginal mothers was 28.5 per 1,000 births compared with 10.1 per 1,000 births for non-Aboriginal mothers.

The Subcommittee notes, with concern, the high proportion of Aboriginal women who smoke during pregnancy. This proportion has increased since 1998, in contrast with the decreasing proportion among non-Aboriginal women. In 2005, this proportion was more than three times higher (63.5% v 18.4%, if women of unknown smoking status are excluded).

The proportions of preterm births and small-for-gestational-age births remained considerably higher than for non-Aboriginal births in 2005 – 20.3% v 8.7% and 15.4% v 8.7%, respectively. As a result, the proportion of low birthweight births remained nearly three times higher than that among non-Aboriginal births – 19.3% v 7.2%.

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

(3) Autopsies in perinatal deaths

Autopsies were performed in 98 of the 192 perinatal deaths (51.0%). Six of the autopsies were limited, which is defined as autopsies which include a detailed external examination of the body and growth parameters, radiological survey, placental histology, and examination and dissection of one or more cavities (such as chest and/or abdomen) or organs, but not the whole body. Microbiology and/or cytogenetic studies may have been undertaken with consent. 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.

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

Table 11: Autopsy status* of perinatal deaths by place of death, South Australia, 2005

Place of death	Deaths	Autopsies performed*	
	Number	Number	Percent of deaths
Metropolitan Level III** hospitals (teaching)	119	61	51.3
Other metropolitan teaching hospitals	20	10	50.0
Metropolitan private hospitals	23	14	60.9
Country hospitals	30	13	43.3
Total	192	98	51.0

*Includes six limited autopsies

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

Placental histological examination was undertaken in 169 perinatal deaths (88.0%) in 2005.

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.^{6 7} 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).

⁶ Gordijn SJ, Erwich JJ, Khong TY. Value of the perinatal autopsy: critique. *Pediatr Dev Pathol* 2002;5:480-488.

⁷ Becher JC, Laing IA, Keeling JW, McIntosh N. Restoring high neonatal autopsy rates. *Lancet* 2004;364:2019-2020.

3. Causes of post-neonatal deaths 2005

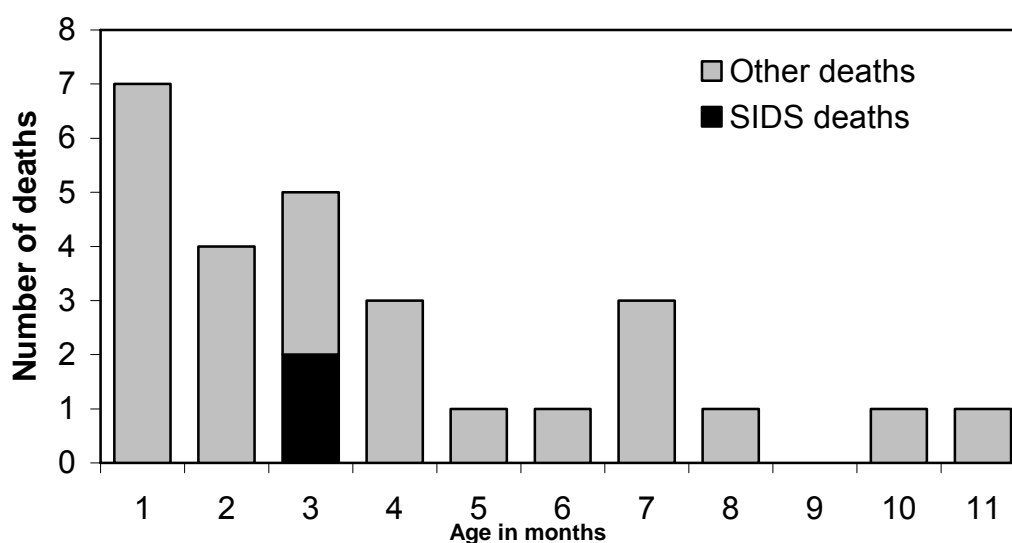
In 2005 there were 27 post-neonatal deaths notified of infants born in South Australia. Autopsies, including one limited autopsy, were performed in 17 out of the 19 coronial cases (89.5%). Five autopsies (including two limited autopsies) were performed in the remaining eight non-coronial cases. The autopsy rate was thus 81.5% (22 out of 27 cases) for post-neonatal deaths in 2005. The causes of death are presented in Table 12, together with comparative statistics for 1986 - 2004.

Table 12: Causes of post-neonatal deaths, South Australia, 1986 - 2005

Causes of death	1986 - 2004		2005	
	Number	Percent	Number	Percent
SIDS	318	41.5	2	7.4
Congenital abnormalities	162	21.1	8	29.6
Conditions originating in the perinatal period	98	12.8	3	11.1
Accidents, poisonings and violence	67	8.7	7	25.9
Infections	62	8.1	3	11.1
Other	59	7.7	4	14.8
Total	766	100.0	27	100.0

Among the 27 post-neonatal deaths in 2005, there were 14 males and 13 females. Three were multiple births. Ten infants (37.0%) were born preterm. The distribution by age at death of the 27 infants (Figure 9) shows that most of the deaths occurred in the earlier months of the post-neonatal period. *Four of the 27 post-neonatal deaths (14.8%) were children of Aboriginal mothers.*

Figure 9: Age Distribution of Post-neonatal Deaths 2005



(1) Congenital abnormalities

Congenital abnormalities accounted for eight post-neonatal deaths (29.6%) in 2005. The types of abnormalities were as follows:

- Noonan's syndrome with cardiac defects, pulmonary lymphangiectasis and renal tract infection;
- Multiple congenital abnormalities, including cerebral and cardiovascular, associated with severe intrauterine growth restriction;
- Ohtahara syndrome or early infantile epileptic encephalopathy;
- Hypoplastic left heart syndrome;
- Dysplastic quadricuspid aortic valve: this rare condition was diagnosed only at autopsy following sudden death.
- Total anomalous pulmonary venous drainage. This infant had occasional irregular breathing and developed severe breathing difficulties just before its death at one month of age. This condition is a rare cause of sudden infant death and can be asymptomatic.
- Total anomalous pulmonary venous drainage, with ventricular septal defects, oesophageal atresia and tracheo-oesophageal fistula. This baby's course was complicated by chronic lung and liver disease.
- Neonatal hepatitis with liver failure, of undetermined cause. This baby was also growth restricted.

(2) Conditions originating in the perinatal period

There were three deaths in this group, all occurring in preterm births. One death was attributed to the baby being born extremely preterm at 26 weeks gestation, following preterm labour with chorioamnionitis. This baby died of fulminant necrotising enterocolitis at one month of age.

Another death in this group was one of twins delivered by emergency caesarean section at 26 weeks for severe twin-twin transfusion. Its other twin died early in the neonatal period. This twin was the donor twin and suffered multiple complications of severe growth restriction, renal failure, necrotising enterocolitis, sepsis, bronchopulmonary dysplasia and progressive hepatic failure. It died at two months of age.

The third death was also one of twins delivered by emergency caesarean section at 32 weeks for twin-twin transfusion. This twin was also the donor twin and suffered the complications of intrauterine growth restriction, anaemia and thrombocytopenia, patent ductus arteriosus, septal defects and congestive cardiac failure, severe gastro-oesophageal reflux, cerebral infarction and bronchopulmonary dysplasia. This twin died at seven months and its other twin at 11 months of age.

(3) Infections

Three infants died of infections. Each had a septicaemia - respectively pneumococcal, meningococcal and Methicillin-resistant *Staphylococcus aureus* (MRSA). *Two were the infants of Aboriginal mothers.*

One infant with partial situs inversus had bowel surgery for gastrointestinal abnormalities and was known to have asplenia. It was on oral penicillin prophylaxis at discharge from hospital but it was not certain for how long this was continued. At eight months of age, it developed a febrile illness and was taken to hospital, where it had a convulsion. It was treated with intravenous fluids and antibiotics, but a petechial rash appeared and it died despite all attempts at resuscitation. Blood cultures showed growth of *Streptococcus pneumoniae* (Pneumococcus) and the white cell count was low.

Another infant aged 11 months developed a febrile illness during the night and was referred by its doctor to hospital as it was noted to have a stiff neck. Antibiotics were commenced after a lumbar puncture. The cerebrospinal fluid was negative for meningococcal polymerase chain reaction (PCR). The infant remained ill, would not take fluids and then developed a rash which quickly spread; it succumbed despite full life support. Blood cultures grew *Neisseria meningitidis* serogroup B.

A third infant developed a cough and symptoms suggestive of an upper respiratory tract infection at four months of age. It was taken to a hospital emergency department on two occasions, diagnosed with a viral infection and discharged. It was seen again with fever three days later and admitted with pneumonia. Blood cultures were taken and intravenous penicillin was given. The infant continued to have respiratory symptoms and antibiotics were changed to cover the possibility of *Staphylococcal* infection, but the infant developed pneumothoraces, deteriorated and died. At autopsy bilateral bronchopneumonia and empyema were found and MRSA was grown from the blood culture.

(4) Sudden Infant Death Syndrome (SIDS)

Only two deaths in the post-neonatal period in 2005 were attributed to SIDS. Both infants were born at term and died at 3 months of age. Both infants were put to sleep on their sides, and one was found face down in a pillow. One had had a cold for a few days.

In 2005, SIDS accounted for 7.4% of post-neonatal deaths in South Australia. The post-neonatal death rate due to SIDS remained at 0.1 per 1,000 live births, the lowest recorded in South Australia. Before the public educational campaign to reduce risk factors for SIDS was commenced in 1990, there were 158 post-neonatal deaths from SIDS in the four-year period 1986-1989, and the SIDS post-neonatal death rate was 2.0 per 1,000 live births. In comparison, in the five-year period 2001-2005, there were only 16 deaths from SIDS, and the SIDS post-

neonatal death rate was 0.2 per 1,000 livebirths. SIDS accounted for 60.1% of post-neonatal deaths in the earlier period and only 12.1% in the later period.

In many of the deaths attributed to SIDS there are often other circumstances such as co-sleeping, which raise the possibility that some of these deaths may be due to accidental asphyxia. As the autopsy findings in cases of infantile asphyxia seem often identical to those found in SIDS, differentiation of these entities may be extremely difficult. **For this reason comprehensive death scene examination and parental interview by trained personnel have become essential features in the assessment of unexpected infant death. Cases have occurred in South Australia where both induced and accidental asphyxia have been initially incorrectly diagnosed as SIDS due to the non-specificity of autopsy pathology. Pertinent information often assists in formulating an initial correct diagnosis.**

(5) Accidents, poisonings and violence

There were seven deaths in this group, which accounted for 25.9% of post-neonatal deaths.

Five infants were considered to have died of **accidental asphyxiation**.

One term infant aged 16 weeks was put to sleep on its back; it was found face down in a deep trough in the very soft mattress of its bassinet. Another infant aged five months was also found face down on a soft U-pillow. A third infant had a history of intrauterine growth restriction and was found face down, covered by a heavy quilt, on a soft mattress: an electric blanket had been switched on. A fourth infant aged five months had been placed to sleep on its side on an inflatable plastic bed. It was found face down with its face against the plastic in the trough between the soft side wall and the firm inflated base. The fifth infant had an upper respiratory tract infection. It was placed to sleep on its side and found face down on a very soft pillow which had a large wet area around its centre. One of these infants had a mother who used intravenous drugs: this infant had withdrawal symptoms at birth and there was a history of co-sleeping.

Another infant who died of accidental causes was able to crawl and drowned in a small fishpond.

The seventh infant in this group of 'Accidents, poisonings and violence' was found to be breathing with difficulty and could not be resuscitated on arrival at hospital. Autopsy showed that death was due to head injuries.

(6) Undetermined cause

There were three deaths of undetermined cause. *One was the infant of an Aboriginal mother.*

One seven month old infant had been slightly unwell, with a mild cough and relatively long daytime sleep periods for a day. It was placed to sleep on two pillows including a child-size tri-pillow because of its cough, and was covered

with a quilt. It was found unresponsive the next morning in the same position. Its bedding and clothing were damp. At autopsy only a mild tracheitis was found with evidence of a viral infection. A three month old infant had a cold a week before its death and had been slightly wheezy. It was placed to sleep on its side in a pusher and found unresponsive in a prone position an hour later. The third infant in this group was born mildly preterm and remained in hospital for about three weeks. At one month of age it was placed to sleep on its back on its mother's arm and found unresponsive in the same position the next morning. Findings at autopsy were not conclusive for a cause of death in both these cases.

One mother in this group was a known user of intravenous drugs.

(7) Other causes

There was only one death in this group. It was an Aboriginal infant. The infant was born mildly preterm and admitted to hospital at one month of age with a history of several episodes of vomiting and diarrhoea. It was noted to be dehydrated and short of breath and had convulsions. A high serum sodium level was found. The infant was intubated, ventilated and managed in intensive care. Cranial magnetic resonance imaging (MRI) showed changes consistent with diffuse white matter abnormality with cystic encephalomalacia. The infant died of the complications of hypernatremia.

Sudden unexpected infant deaths

In 2005, deaths from three of the above groups were 'Sudden unexpected infant deaths'. These deaths were as follows:

SIDS - two deaths;

Accidental asphyxiation - five deaths (a sixth occurred in the neonatal period);

Undetermined cause - three deaths.

The distinction between these deaths can be quite difficult and may be arbitrary. Over the last few years there have been about 10 sudden unexpected post-neonatal deaths a year. 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 SIDS.

Deaths of babies born interstate or overseas

There were two post-neonatal deaths in South Australia in 2005 of infants born interstate and one death of an infant born overseas. A seven week old infant born interstate died from malnutrition and dehydration while travelling between states with its mother. The malnutrition was attributed to maternal neglect. *An Aboriginal infant was born at an interstate hospital at 24 weeks gestation and retrieved to Adelaide for neonatal intensive care. The major problems of prematurity included encephalopathy from perinatal hypoxia, intraventricular haemorrhage, bronchopulmonary dysplasia and necrotising enterocolitis resulting in short gut syndrome, cholestasis and osteopenia. Sepsis was also a problem. The infant finally developed nosocomial infections and multi-organ failure and died at five months of age.*

The infant born overseas was diagnosed with congenital pulmonary stenosis, pulmonary hypertension and right heart failure at birth. At four months of age the infant travelled to Adelaide for medical treatment. Investigations confirmed the diagnoses and valvuloplasty was not successful. Cardiac surgery was not considered to be an option. The infant's condition deteriorated despite treatment with ventilation and nitric oxide and it died less than a week after arrival.

IV Recommendations

1. Maternal Subcommittee recommendations

A recommendation is renewed about the need for pregnant women travelling in motor vehicles to wear seatbelts at all times for safety.

Two recommendations from the previous years were:

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

2. Perinatal Subcommittee recommendations

The Perinatal Subcommittee has three new recommendations for 2005:

1. 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.
2. Pregnant women with a Body Mass Index (BMI) greater than 35 are at higher risk from anaesthesia and should have a timely referral for an

anaesthetic consultation, in particular before any obstetric intervention in pregnancy or labour.⁸

3. Ultrasound determination of chorionicity is advised for twin pregnancies, followed by further surveillance for twin-twin transfusion in monochorionic pregnancies.

Some recommendations made in recent years remain relevant:

1. The Subcommittee would like to advise practitioners of the importance of caring for pregnant women in a setting appropriate for the level of risk the pregnancy presents for the mother and/or the baby. For example, women with severe hypertension or insulin-dependent diabetes should be managed in at least a level II hospital with 24 hour on-site medical cover. Similarly, planned home birth for twins, breech presentations and post-term infants is associated with unacceptably high risks.^{9,10}
2. The need for development of evidenced-based statewide protocols for level I, II and III maternity services with an emphasis on timely recognition and appropriate management of common obstetric problems such as fetal growth restriction, preterm rupture of membranes, meconium-stained liquor, antepartum haemorrhage and pre-eclampsia. Practitioners must ensure that pregnant women with a higher level of risk than defined for their level of care setting are referred promptly and appropriately.
3. Vigilance in the recognition of fetal growth restriction. Fetal growth restriction was the cause of death for 8.3% of perinatal deaths in 2005. Practitioners are asked to be vigilant so that fetal growth restriction is not missed.
4. Implementation of effective strategies to reduce smoking in pregnancy, including culturally appropriate smoking cessation interventions for Aboriginal women. Smoking in pregnancy has been associated with fetal growth restriction. Smoking cessation programs implemented during pregnancy have been demonstrated to reduce smoking significantly, with reductions in the frequency of low birthweight and preterm birth and an increase in mean birthweight.¹¹ *The proportion of women smoking in pregnancy*

⁸ 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 Nov 27, 2006).

⁹ Bastian H, Keirse MJNC, Lancaster PAL. Perinatal death associated with planned home birth in Australia: population based study. *BMJ* 1998; 317: 384-388.

¹⁰ Mel-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

¹¹ Lumley J, Oliver SS, Chamberlain C, Oakley L. Interventions for promoting smoking cessation during pregnancy. *The Cochrane Database of Systematic Reviews* 2004, Issue 4.

has decreased in South Australia, but not among Aboriginal women, whose proportion in 2005 was 64% compared with 18% among non-Aboriginal women. Births to Aboriginal women continue to be associated with rates of preterm and small-for-gestational-age birth about twice those of births to non-Aboriginal women. The proportion of low birthweight births is nearly three times higher.

5. Appropriate training and maintenance of competence in cardiotocograph (CTG) interpretation for all levels of medical and midwifery staff.
6. The institution of streamlined arrangements between rural/level I hospitals and their regional level II/III maternity service in situations where there is a lack of on-site CTG expertise. In essence this means easier access of rural practitioners to the consultant on call.
7. Antibiotic prophylaxis during labour for women carrying Group B Streptococcus has been shown to be effective in preventing Group B streptococcal transmission to the neonate and to reduce early onset Group B streptococcal sepsis. A policy of screening for Group B Streptococcus in late pregnancy and giving intrapartum antibiotic prophylaxis to carrier mothers is recommended in the South Australian Perinatal Practice Guidelines (www.health.sa.gov.au/ppg).
8. The Committee recommends use of the recently revised guidelines for investigating stillbirths including a more systematic approach to investigate the potential involvement of thrombophilias (Appendix 8). This statewide protocol for the investigation of all stillbirths has been sent to all maternity units in South Australia.
9. Autopsy often provides considerable information that is not available otherwise and should be strongly recommended. The 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 photographic and X-ray documentation be obtained. It is also important to document the clinical appearance of the infant in the case record in all cases of perinatal death. **The State Perinatal Autopsy Service is available at no cost to parents, including parents in country areas, and may be contacted on (08) 8161-7333.**
10. Placentas should be sent for examination in all cases of perinatal death (See Appendix 9). Histopathological examination of the placenta provides considerable additional information and should be attainable for 100% of perinatal deaths. It was performed in 88% of cases in 2005.

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

- 1) All stillborn infants, early neonatal deaths and mid-trimester miscarriages.
- 2) All multiple pregnancies with same sex infants.

- 3) All triplet and higher order multiple pregnancies.
 - 4) All cases of discordant twin growth with greater than 20% weight difference.
 - 5) All cases of prolonged rupture of membranes or suspected chorioamnionitis or maternal fever (any cause).
 - 6) All preterm deliveries.
 - 7) All cases where birthweight is less than the 10th percentile or greater than the 95th percentile for gestational age.
 - 8) All cases of fetal malformation.
 - 9) All cases of pregnancy complicated by oligohydramnios, polyhydramnios or placental abnormalities detected prenatally (vascular channels, chorioangioma, etc).
 - 10) All cases with a physical abnormality in the placenta (eg. a mass, abnormal colour, malodour).
 - 11) All cases subjected to chorion villus sampling or amniocentesis, if complications occur.
 - 12) All cases of pre-existing diabetes, pre-eclampsia, systemic lupus erythematosus and documented thrombophilias known to be associated with fetal hazard.
 - 13) All cases of placental abruption.
 - 14) All 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).
 - 15) All instances where either mother or baby is retrieved shortly after birth.
 - 16) All cases of maternal death.
11. The Subcommittee also recommends the use of the birthweight for gestational age percentile charts for singletons¹² and twins¹³ 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.

¹² Roberts CL, Lancaster PAL. Australian national birthweight percentiles by gestational age. Med J Aust 1999;170:114-118.

¹³ Roberts C, Lancaster P. National birthweight percentiles by gestational age for twins born in Australia. J Paediatr Child Health 1999;35:278-282.

3. Post-neonatal Subcommittee recommendations

In reviewing the causes of death in 2005 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 2005:

1. Health professionals providing care both in the antenatal and postnatal period should ensure that women are provided with information about safe infant sleeping practices and prevention of SIDS.
 - Babies should be placed on their backs to sleep, unless there is a contra-indication. Sleeping supine is not contraindicated in babies with gastro-oesophageal reflux.
 - Falling asleep with the infant at the breast may be hazardous. Other forms of co-sleeping or bed sharing may be hazardous, particularly if the adults are intoxicated or sedated (see Appendix 11).
 - Potential hazards must be removed from the infant's sleeping environment.
 - Babies must not be placed in cots with any pillows, U-pillows, cot bumpers, large soft toys, thick blankets or quilts or other items which may overheat or suffocate the infant. Infants should not be left to sleep unattended in stroller-prams or bouncinettes.
 - Ensure that all new cots meet Australian Standards and only use old ones that do. Mattresses which do not fit cots properly should not be used, especially in cots that have unsupported webbing. 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.

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 SIDS.

2. Vigilance is needed to ensure that potential hazards in the home are removed from the infant's environment. These include long hanging curtain cords, which may catch around the neck, and water in containers or baths in which an infant may drown. Infants should never be left unattended in a bath or near water, even for a minute. 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.

3. An effective system of appropriate and ongoing support, supervision and referral should be offered to families with known risk factors for adverse child outcome, such as parental substance abuse, parental psychiatric illness, household violence, extreme youth of the mother and poor social circumstances. This should be continued at least throughout the first year of life, if not for a longer period of time.
4. Urgent medical advice should be sought for all infants who are excessively drowsy, irritable and/or are feeding poorly. These infants, who may not be showing the classical signs of infection, should be considered seriously ill until proven otherwise. Small infants also become dehydrated very rapidly. 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.
5. 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.
6. Consideration should be given to better ways of identifying serious underlying illness in children presenting to clinicians, for example, by Medic Alert bracelets.
7. Hospitals with high levels of paediatric throughput need provision of 24-hour paediatric expertise. Appropriate protocols regarding detection and management of potentially life-threatening paediatric conditions need to be developed, reviewed, distributed to and supported by all hospitals treating children.

The following recommendations made in previous reports are still relevant:

1. Vigilance is always needed to ensure safe feeding for children under four years of age. Foods which can break off into pieces and cause choking should not be given, e.g. raw carrot, celery sticks, grapes, pieces of apple, cherry tomatoes, sausages, frankfurts, popcorn, nuts, hard lollies and corn chips. Food for toddlers should be finely chopped. Children should be supervised while eating. If they run, play, laugh or cry while eating, they are more likely to choke on their food. The Committee was pleased to note that there were no deaths in 2005 from feeding accidents.
2. 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.

3. 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.¹⁴

4. Reporting of deaths to the State Coroner

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

- a death by unusual, unexpected, unnatural, violent or unknown cause.
 - a death during, as a result of or within 24 hours of a surgical, invasive or diagnostic procedure including the administration of an anaesthetic for the carrying out of the procedure.
 - a death within 24 hours of being discharged from a hospital or having sought emergency treatment at a hospital.
 - a death in a hospital or treatment facility for the treatment for a drug addiction.
 - a death of a child subject to a custody or guardianship order under the Children's Protection Act 1993.
 - a patient death in an approved treatment centre under the Mental Health Act 1993 and
 - a resident death in a licensed supported residential facility.
5. The Subcommittee would like to draw attention once again to the importance of autopsy in eliciting the cause of death, which should always be carefully recorded in the clinical history.
 - 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

¹⁴ 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.

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 tenth annual educational meeting was organized on the evening of 12th September 2006 by the Education Subcommittee of the Maternal, Perinatal and Infant Mortality Committee.

These meetings commenced in 1997 to facilitate a recommendation that private perinatal units in the metropolitan area be involved in some form of regular peer review and continuing professional education for their midwifery and medical staff. Initially these meetings were annual events organized by an ad hoc group chaired by the late Dr. Brian Pridmore, then Chair of the Perinatal Subcommittee. The enthusiastic response to the meetings from midwives and medical practitioners led to their expansion to include personnel from all the perinatal services within the state.

The desire to 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 tenth meeting, held at the Women's and Children's Hospital, was titled 'How long do I have to wait...?'. An electronic voting system was used initially to obtain audience responses to questions on the management of prolonged pregnancy. The responses generated an interactive discussion between the panel members and the audience of 100 people. The panel members were Ms Ros Donnellan-Fernandez (midwife), Dr John Svigos (obstetrician), Dr Chris Barnett (neonatal paediatrician) and Ms Andrea Mcleay (midwife). Ms Phillipa Middleton presented a synopsis of the findings of the latest Cochrane Review

on prolonged pregnancy. The audience included hospital and community midwives, midwifery lecturers and students, general practitioners, obstetric registrars and obstetricians, and was video-conferenced to six country sites.

Dr Brian Wheatley, Chair of the Education Subcommittee also communicated the main recommendations of the Committee made in the 2004 report.

There were technical problems with the video-conferencing, as a result of which the forum was not video-recorded as in the previous year. The Subcommittee will continue to work towards making the forum available to practitioners around the state who cannot attend in Adelaide.

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

APPENDIX 1

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

Maternal Subcommittee

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

Perinatal Subcommittee

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

Post-neonatal Subcommittee

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

Education Subcommittee

1. To provide an annual interactive forum for the continuing education of midwives and medical practitioners involved in the provision of perinatal services within the metropolitan and regional South Australia.

2. To act as an additional means of communication to the above providers, other health professionals and the community generally from the other subcommittees of the Maternal, Perinatal and Infant Mortality Committee.
3. The membership and chairperson will be nominated by the chairperson of the Maternal, Perinatal and Infant Mortality Committee.
4. The membership shall consist of:
 - An obstetrician in metropolitan private practice.
 - A neonatal paediatrician in metropolitan private practice.
 - A midwife from the metropolitan private hospital services.
 - An epidemiologist / medical secretary from the Pregnancy Outcome Unit.
5. The Subcommittee may co-opt members as required.

APPENDIX 2A

Medical Certificate of Cause of Perinatal Death

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



Births, Deaths and Marriages Registration Act, 1966-1980

Form 14
To be completed
by a Medical
Practitioner



Births, Deaths and Marriages Registration
Act, 1966-1980

Form 12

COUNTERFOIL

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

Name of deceased.....
.....
.....

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

Attended child before death
Viewed body after death

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

CAUSE OF DEATH

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

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

MEDICAL CERTIFICATE OF CAUSE OF PERINATAL DEATH

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

A. Particulars Relating to the Mother

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

B. Details of Previous Pregnancies

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

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

C. Details of Present Pregnancy

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

D. Particulars Relating to the Child

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

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

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

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

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

Signature..... Date...../...../19.....
Surname (BLOCK letters)..... Address.....

Qualifications.....

NOTICE OF SIGNING OF MEDICAL CERTIFICATE OF CAUSE OF PERINATAL DEATH

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

concerning the death of.....

who died at.....

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

Signature of Medical Practitioner

Surname of Medical Practitioner.....

Address.....

Date.....

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

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

OR

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

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

82174

APPENDIX 2B

Doctor's Certificate of Cause of Death

07326



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

NOTICE OF DEATH

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

To the Registrar of Births, Deaths and Marriages

Surname (BLOCK LETTERS).....

Given names.....

Sex MALE FEMALE

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

at

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

Signature of doctor

Surname of doctor in BLOCK LETTERS

Address.....

Post code.....

Date / / 19

This Notice of Death must be forwarded to:

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

07326



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

DOCTOR'S CERTIFICATE OF CAUSE OF DEATH

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

DETAILS OF DECEASED

Surname (BLOCK LETTERS)

Given names

Sex MALE FEMALE

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

Date of death / / 19 Age at death

Place of death

Was a *post mortem* conducted? YES NO

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

If Yes, give details

CAUSE OF DEATH

Part I
Conditions leading to death and duration between onset and death :
(Show direct cause first followed by antecedent causes, stating the underlying condition last. PLEASE USE BLOCK LETTERS AND DO NOT ABBREVIATE)

Duration

Disease

A

B

C

D

E

Part II
Other significant conditions and duration:

CONTINUE ON REVERSE

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

Name of deceased.....

Age.....

Died on / / 19

at

CAUSE OF DEATH

A.....

B.....

C.....

D.....

E.....

Signed.....

SURNAME IN BLOCK LETTERS

Date / / 19

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

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

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

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

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

Date of injury / /19

Injury at work YES NO

Description of injury

Place where injury occurred

Certification

I certify that - *I was responsible for the deceased's medical care immediately before death
*I examined the body of the deceased after death
*I have made a *post mortem* examination of the remains of the deceased
and that the particulars and cause of death written above are true to the best of my knowledge
and belief.

Signature Date / /19

Surname and initials in BLOCK LETTERS

Address

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

Telephone (business hours)

(* Strike out those which are not applicable)

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

APPENDIX 3

Definitions

Maternal death is defined as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.¹⁵

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.

¹⁵ 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, 2005

	No.	%
1. CONGENITAL ABNORMALITY (including terminations for congenital abnormalities)	56	29.2
1.1 Central nervous system	4	2.1
1.2 Cardiovascular system	11	5.7
1.3 Urinary tract	4	2.1
1.4 Gastrointestinal tract	1	0.5
1.5 Chromosomal	13	6.8
1.6 Metabolic	1	0.5
1.7 Multiple/ non chromosomal syndromes	16	8.3
1.8 Other	6	3.1
1.81 Musculoskeletal	1	
1.82 Respiratory	0	
1.83 Diaphragmatic hernia	3	
1.84 Haematological	0	
1.85 Tumours	2	
1.88 Other specified congenital abnormality	0	
1.9 Unspecified	0	0
2. PERINATAL INFECTION	16	8.3
2.1 Bacterial	11	5.7
2.11 Group B Streptococcus	2	
2.12 E coli	4	
2.13 Listeria monocytogenes	0	
2.14 Spirochaetal, e.g. Syphilis	0	
2.18 Other bacterial	2	
2.19 Unspecified bacterial	3	
2.2 Viral	2	1.0
2.21 Cytomegalovirus	1	
2.22 Parvovirus	0	
2.23 Herpes simplex virus	0	
2.24 Rubella virus	0	
2.28 Other viral	1	
2.29 Unspecified viral	0	
2.3 Protozoal e.g. Toxoplasma	0	0
2.5 Fungal	0	0
2.8 Other specified organism	0	0
2.9 Other unspecified organism	3	1.6

	No.	%
3. HYPERTENSION	9	4.7
3.1 Chronic hypertension: essential	0	0
3.2 Chronic hypertension: secondary, e.g. renal disease	0	0
3.3 Chronic hypertension: unspecified	1	0.5
3.4 Gestational hypertension	0	0
3.5 Pre-eclampsia	5	2.6
3.51 <i>With laboratory evidence of thrombophilia</i>		
3.6 Pre-eclampsia superimposed on chronic hypertension	3	1.6
3.61 <i>With laboratory evidence of thrombophilia</i>		
3.9 Unspecified hypertension	0	0
4. ANTEPARTUM HAEMORRHAGE (APH)	18	9.4
4.1 Placental abruption	17	8.9
4.11 <i>With laboratory evidence of thrombophilia</i>		
4.2 Placenta praevia	0	0
4.3 Vasa praevia	0	0
4.8 Other APH	0	0
4.9 APH of undetermined origin	1	0.5
5. MATERNAL CONDITIONS	2	1.0
5.1 Termination of pregnancy (other than for congenital (fetal) abnormality)	0	0
5.2 Diabetes / Gestational diabetes	0	0
5.3 Maternal injury	0	0
5.31 <i>Accidental</i>		
5.32 <i>Non-Accidental</i>		
5.4 Maternal sepsis	0	0
5.5 Lupus obstetric syndrome	0	0
5.6 Obstetric cholestasis	1	0.5
5.8 Other specified maternal conditions	1	0.5
6. SPECIFIC PERINATAL CONDITIONS	19	9.9
6.1 Twin-twin transfusion	8	4.2
6.2 Fetomaternal haemorrhage	1	0.5
6.3 Antepartum cord complications (e.g. cord haemorrhage, true knot with evidence of occlusion)	2	1.0
6.4 Uterine abnormalities, eg bicornuate uterus, cervical incompetence	4	2.1
6.5 Birth trauma (typically infants of >24 weeks gestation or >600g birthweight)	0	0
6.6 Alloimmune disease	1	0.5
6.61 <i>Rhesus</i>	1	
6.62 <i>ABO</i>	0	
6.63 <i>Kell</i>	0	
6.64 <i>Alloimmune thrombocytopenia</i>	0	
6.68 <i>Other</i>	0	
6.69 <i>Unspecified</i>	0	

		No	%
6.7	Idiopathic hydrops	2	1.0
6.8	Other specific perinatal conditions (includes iatrogenic conditions such as rupture of membranes after amniocentesis, termination of pregnancy for suspected but unconfirmed congenital abnormality)	1	0.5
7.	HYPOXIC PERIPARTUM DEATH (typically infants of >24 weeks gestation or > 600g birthweight)	9	4.7
7.1	With intrapartum complications	3	1.6
	7.11 Uterine rupture	1	
	7.12 Cord prolapse	0	
	7.13 Shoulder dystocia	0	
	7.18 Other	2	
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)	4	2.1
7.3	No intrapartum complications and no evidence of non-reassuring fetal status	2	1.0
7.9	Unspecified hypoxic peripartum death	0	0
8.	FETAL GROWTH RESTRICTION (FGR)	16	8.3
8.1	With evidence of reduced vascular perfusion on Doppler studies and/or placental histopathology (e.g. significant infarction, acute atherosclerosis, maternal and or fetal vascular thrombosis or maternal floor infarction)	13	6.8
8.2	With chronic villitis	0	0
8.3	No placental pathology	1	0.5
8.4	No examination of placenta	0	0
8.8	Other specified placental pathology	2	1.0
8.9	Unspecified or not known whether placenta examined	0	0
9.	SPONTANEOUS PRETERM (<37 weeks gestation)	31	16.1
9.1	Spontaneous preterm with intact membranes, or membrane rupture <24 hours before delivery	14	7.3
	9.11 With chorioamnionitis on placental histopathology	5	
	9.12 Without chorioamnionitis on placental histopathology	9	
	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	14	7.3
	9.21 With chorioamnionitis on placental histology	12	
	9.22 Without chorioamnionitis on placental histology	2	
	9.23 With clinical evidence of chorioamnionitis, no examination of placenta	0	
	9.27 No clinical signs of chorioamnionitis, no examination of placenta	0	
	9.29 Unspecified or not known whether placenta examined	0	

		No	%
9.3	Spontaneous preterm with membrane rupture of unknown duration before delivery	3	1.6
9.31	<i>With chorioamnionitis on placental histology</i>	2	
9.32	<i>Without chorioamnionitis on placental histology</i>	1	
9.33	<i>With clinical evidence of chorioamnionitis, no examination of placenta</i>	0	
9.37	<i>No clinical signs of chorioamnionitis, no examination of placenta</i>	0	
9.39	<i>Unspecified or not known whether placenta examined</i>	0	
10.	UNEXPLAINED ANTEPARTUM DEATH	15	7.8
10.1	With evidence of reduced vascular perfusion on Doppler studies and/or placental histopathology (e.g. significant infarction, acute atherosclerosis, maternal and/or fetal vascular thrombosis or maternal floor infarction)	1	0.5
10.2	With chronic villitis	4	2.1
10.3	No placental pathology	7	3.6
10.7	No examination of placenta	0	0
10.8	Other specified placental histology	3	1.6
10.9	Unspecified unexplained antepartum death or not known whether placenta examined	0	0
11.	NO OBSTETRIC ANTECEDENT	1	0.5
11.1	SIDS	0	0
	<i>11.11 SIDS Category IA: Classic features of SIDS present and completely documented.</i>		
	<i>11.12 SIDS Category IB: Classic features of SIDS present but incompletely documented.</i>		
	<i>11.13 SIDS Category II: Infant deaths that meet Category I except for one or more features.</i>		
11.2	Postnatally acquired infection	0	0
11.3	Accidental asphyxiation	1	0.5
11.4	Other accident, poisoning or violence (postnatal)	0	0
11.8	Other specified	0	0
11.9	Unknown / Unexplained	0	0
	<i>11.91 Unclassified Sudden Infant Death</i>		
	<i>11.92 Other Unknown / Undetermined</i>		
TOTAL		192	100.0

APPENDIX 5

Perinatal Society of Australia and New Zealand Perinatal Death Classification (PSANZ-PDC), SA perinatal deaths by birthweight, 2005

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	27*	10	1	0	1	5	12	56	29.2
2	Perinatal infection	4	4	0	1	0	0	7	16	8.3
3	Hypertension	5	2	1	0	1	0	0	9	4.7
4	Antepartum haemorrhage	4	4	1	4	2	1	2	18	9.4
5	Maternal conditions	0	1	0	0	0	0	1	2	1.0
6	Specific perinatal conditions	8	4	0	2	1	2	2	19	9.9
7	Hypoxic peripartum death	0	1	0	0	0	0	8	9	4.7
8	Fetal growth restriction	4	2	1	3	1	1	4	16	8.3
9	Spontaneous preterm	16	10	2	3	0	0	0	31	16.1
10	Unexplained antepartum death	2	0	1	2	1	3	6	15	7.8
11	No obstetric antecedent	0	0	0	0	0	0	1	1	0.5
Total		70*	38	7	15	7	12	43	192	100
%		36.5	19.8	3.6	7.8	3.6	6.3	22.4	100	%

* includes one stillbirth of unknown birthweight born at 23 weeks gestation

APPENDIX 6

Obstetric cause-specific classification of perinatal deaths, SA perinatal deaths, 2005 (Amended Whitfield)

	No	%
1. SPONTANEOUS PRETERM <37 weeks, normally formed, appropriately grown.	32	16.7
1.1 Multiple pregnancy	7	
1.2 Previous bleeding	5	
1.3 Previous spontaneous rupture of membranes >12 hours before labour	11	
1.4 Cervical incompetence	4	
1.5 Other, eg uterine malformation	1	
1.6 Idiopathic	4	
2. INTRAUTERINE GROWTH RESTRICTION (IUGR) <10th percentile for gestational age	16	8.3
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	15	7.8
4. BIRTH TRAUMA \geq1,500g, with evidence of lethal trauma at autopsy even when labour and delivery were not complicated by mechanical difficulty	0	0
4.1 Cord complication	0	
4.2 Breech delivery	0	
4.3 Caesarean section	0	
4.4 Forceps delivery	0	
4.5 Ventouse delivery	0	
4.6 Other delivery	0	
5. INTRAPARTUM ASPHYXIA \geq1,500g with evidence of intrapartum hypoxia and confirmed by hypoxic changes at autopsy	10	5.2
5.0 Vaginal	3	
5.1 Cord complication	1	
5.2 Breech delivery	0	
5.3 Caesarean section	5	
5.4 Forceps delivery	1	
5.5 Ventouse delivery	0	
5.6 Other delivery & unspecified	0	

		No.	%
6.	HYPERTENSION	9	4.7
6.0	Unspecified	0	
6.1	Pre-existing hypertension	1	
6.2	Pre-eclampsia	5	
6.3	Pre-existing hypertension and pre-eclampsia	3	
7.	MATERNAL DISEASE	2	1.0
7.0	Unspecified	0	
7.1	Maternal injury	0	
7.2	Abdominal operation	0	
7.3	Diabetes/Gestational diabetes	0	
7.4	Malignancy	0	
7.5	Infection	0	
7.8	Maternal death	0	
7.9	Other	2	
8.	ANTEPARTUM HAEMORRHAGE (APH)	18	9.4
8.1	Placental abruption	17	
8.2	Placenta praevia	0	
8.3	APH undetermined origin	1	
8.4	Vasa praevia	0	
9.	FETAL ABNORMALITY	56	29.2
9.1	Central nervous system	4	
9.2	Cardiovascular system	11	
9.3	Urinary tract	4	
9.4	Gastrointestinal tract	1	
9.5	Chromosomal	13	
9.6	Metabolic	1	
9.7	Multiple	16	
9.9	Other	6	
10.	HAEMOLYTIC DISEASE	1	0.5
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.	19	9.9
11.0 Unspecified	4	
11.1 Streptococcus, Group B	2	
11.2 Escherichia coli	4	
11.3 Other bacterial	4	
11.4 Toxoplasma	0	
11.5 Syphilis	0	
11.6 Cytomegalovirus	1	
11.7 Other viral	1	
11.8 Fungal	0	
11.9 Other	3	
12. OTHER	14	7.3
12.1 Non-immune hydrops	2	
12.2 Feto-maternal haemorrhage	1	
12.3 Twin-twin transfusion	8	
12.4 Accident, poisoning or violence (Postnatal)	1	
12.5 SIDS	0	
12.8 Unknown / unexplained	0	
12.9 Other	2	
TOTAL	192	100.0

APPENDIX 7

Perinatal Society of Australia and New Zealand-Neonatal Death Classification (PSANZ-NDC), SA neonatal deaths, 2005

	No	%
1. CONGENITAL ABNORMALITY	19	30.2
1.1 Central nervous system	1	1.6
1.2 Cardiovascular system	6	9.5
1.3 Urinary tract	1	1.6
1.4 Gastrointestinal tract	0	0
1.5 Chromosomal	3	4.8
1.6 Metabolic	1	1.6
1.7 Multiple/ non chromosomal syndromes	4	6.3
1.8 Other congenital abnormality	3	4.8
1.81 Musculoskeletal		
1.82 Respiratory		
1.83 Diaphragmatic hernia		
1.84 Haematological		
1.85 Tumours		
1.88 Other specified congenital abnormality		
1.9 Unspecified congenital abnormality	0	0
2 EXTREME PREMATURITY	25	39.7
(typically infants of <=24 weeks gestation or <=600g birthweight)		
2.1 Not resuscitated		
2.2 Unsuccessful resuscitation		
2.9 Unspecified or not known whether resuscitation attempted		
3 CARDIO-RESPIRATORY DISORDERS	2	3.2
3.1 Hyaline membrane disease / Respiratory distress syndrome (RDS)	1	1.6
3.2 Meconium aspiration syndrome	0	0
3.3 Primary persistent pulmonary hypertension	0	0
3.4 Pulmonary hypoplasia	1	1.6
3.5 Chronic neonatal lung disease (typically, bronchopulmonary dysplasia)	0	0
3.8 Other	0	0

	No.	%
INFECTION	8	12.7
4.1 Bacterial	6	9.5
4.11 Congenital bacterial	6	
4.12 Acquired bacterial	0	
4.2 Viral	1	1.6
4.21 Congenital viral	1	
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	1	1.6
5. NEUROLOGICAL	7	11.1
5.1 Hypoxic ischaemic encephalopathy / Perinatal asphyxia (typically infants of >24 weeks gestation or >600g birthweight)	6	9.5
5.2 Intracranial haemorrhage	1	1.6
5.8 Other	0	0
6. GASTROINTESTINAL	1	1.6
6.1 Necrotising enterocolitis	1	1.6
6.8 Other	0	0
7. OTHER	1	1.6
7.1 Sudden Infant Death Syndrome (SIDS)	0	0
7.11 <i>SIDS Category IA: Classic features of SIDS present and completely documented.</i>		
7.12 <i>SIDS Category IB: Classic features of SIDS present but incompletely documented.</i>		
7.13 <i>SIDS Category II: Infant deaths that meet category I except for one or more features.</i>		
7.2 Multi-system failure - only if unknown primary cause or trigger event	0	0
7.3 Trauma	0	0
7.8 Other specified	0	0
7.9 Undetermined / Unknown	1	1.6
7.91 <i>Unclassified Sudden Infant Death</i>		
7.92 <i>Other Unknown / Undetermined</i>		
TOTAL	63	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 2005 of 3.7 deaths per 1,000 births for infants of at least 1,000g birthweight or 28 weeks gestation is low by international standards. The rate for infants of at least 400g birthweight or 20 weeks gestation was 10.6 deaths per 1,000 births that year. Sixty-seven 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 2005, 12% 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.¹⁶

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.

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

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

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

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

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

Unexplained stillbirths

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

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

APPENDIX 9

Placental histology guidelines

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

As a guide, placentas should be sent to Pathology at least from:

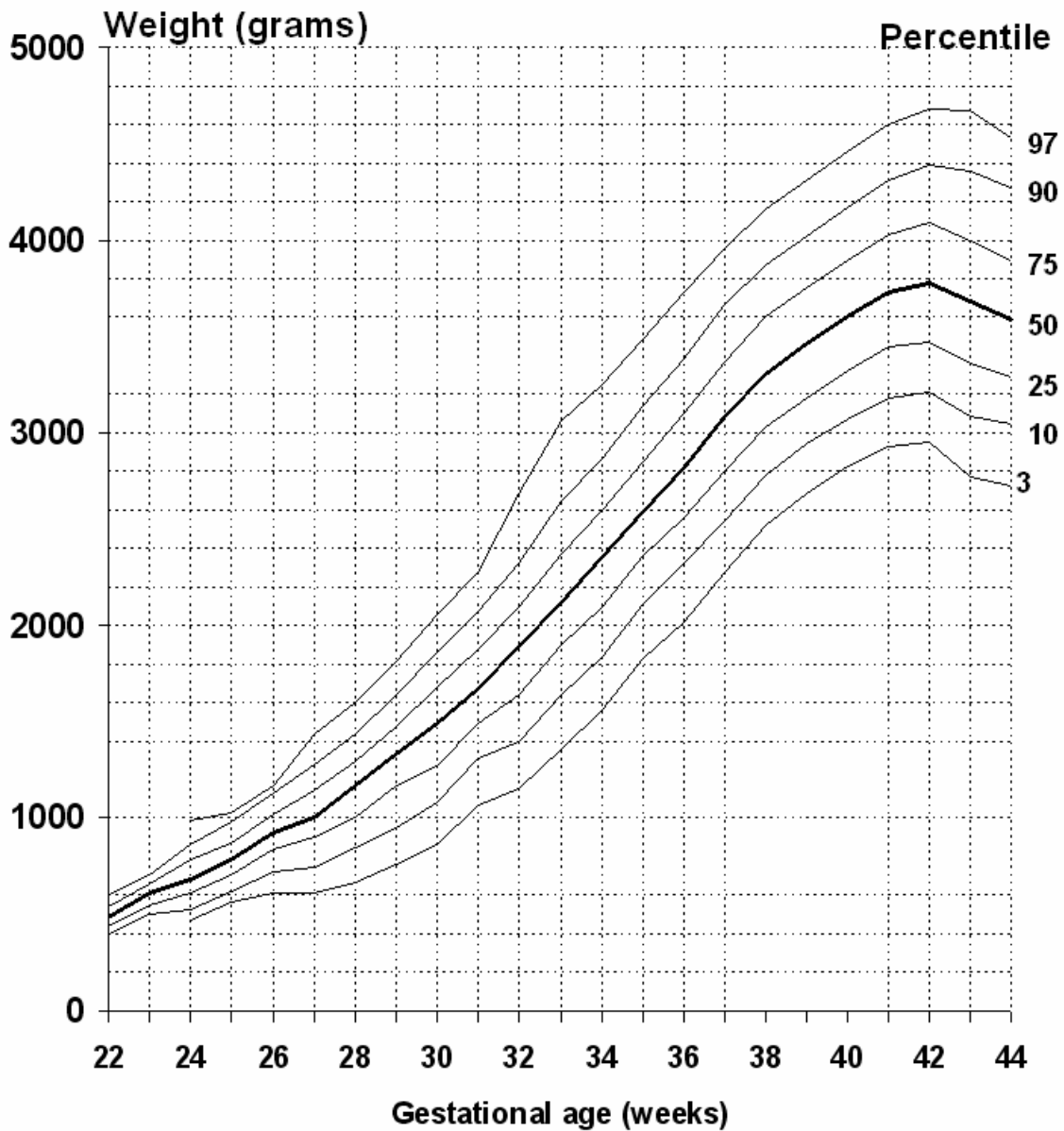
1. All stillborn infants, early neonatal deaths and mid-trimester miscarriages.
2. All multiple pregnancies with same sex infants.
3. All triplet and higher order multiple pregnancies.
4. All cases of discordant twin growth with greater than 20% weight difference.
5. All cases of prolonged rupture of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

APPENDIX 10

Australian birthweight percentiles

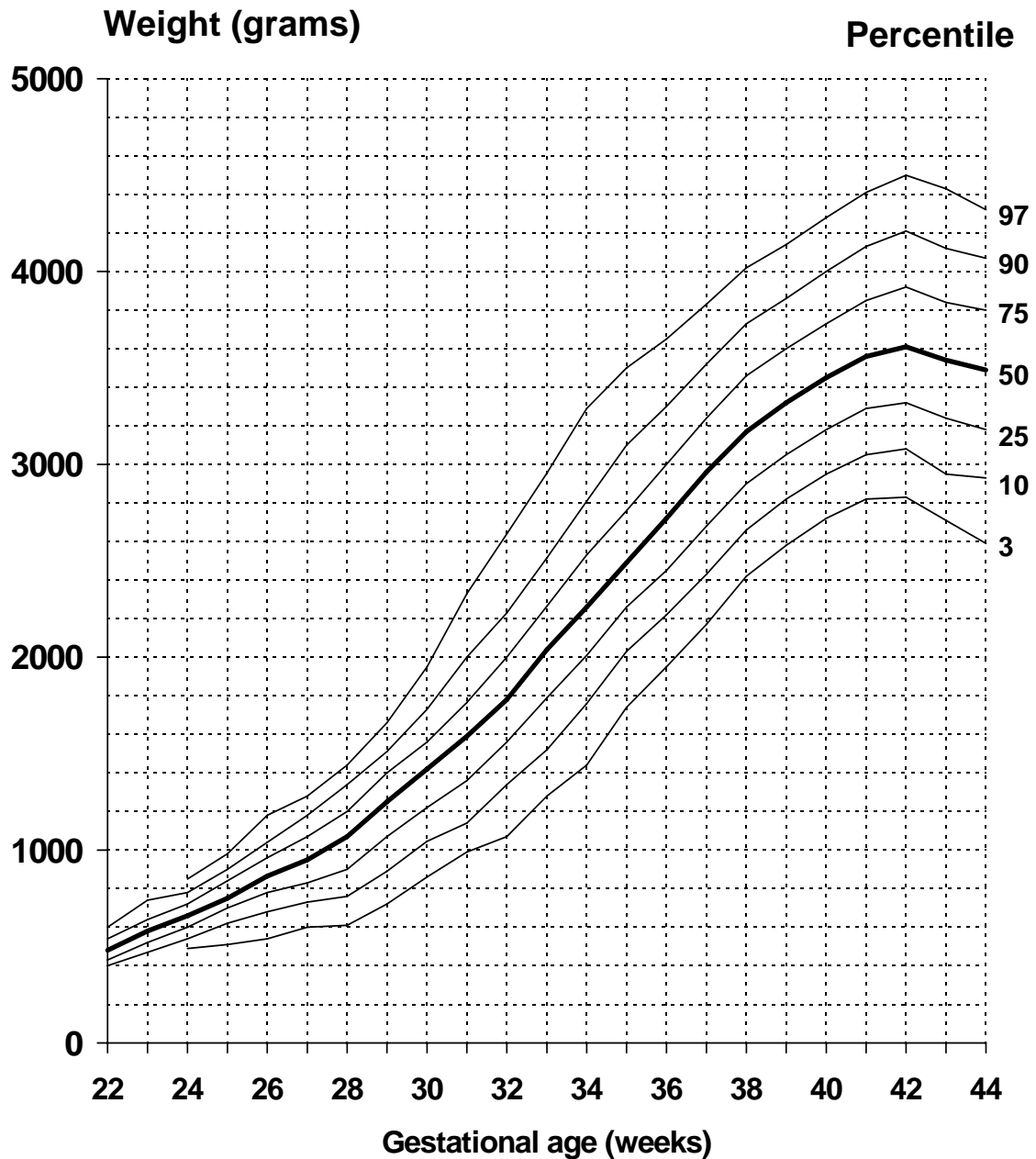
APPENDIX 10

Australian birthweight percentiles for singleton boys



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

Australian birthweight percentiles for singleton girls



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Table 13: Birthweight percentile values (g) for live singleton males, Australia, 1991-1994

Gestation (weeks)	No. births	Mean (gm)	Standard Deviation	Percentile (gm)										
				1st	3rd	5th	10th	25th	50th	75th	90th	95th	97th	99th
20	27	385	76					330	380	430				
21	43	447	66					410	440	490				
22	74	495	80				400	440	490	540	600			
23	95	607	92			470	500	550	610	660	710	780		
24	135	690	129		470	480	520	610	680	780	860	930	990	
25	180	791	132		560	580	620	700	785	870	980	1000	1030	
26	235	921	158		610	620	720	840	920	1020	1130	1160	1170	
27	284	1017	209		610	650	740	900	1000	1140	1280	1350	1440	
28	361	1157	240	570	670	720	850	1000	1170	1300	1440	1550	1600	1790
29	397	1316	261	670	760	840	950	1170	1340	1480	1640	1740	1810	1900
30	571	1477	313	730	860	960	1080	1270	1490	1680	1860	1950	2050	2270
31	743	1682	311	910	1070	1130	1310	1490	1670	1870	2070	2170	2280	2450
32	1117	1875	378	1020	1150	1230	1400	1640	1890	2100	2320	2470	2690	2980
33	1471	2142	415	1210	1360	1450	1640	1900	2120	2370	2650	2920	3060	3300
34	2657	2358	418	1310	1560	1670	1840	2100	2350	2600	2870	3080	3250	3530
35	4092	2610	413	1600	1830	1960	2110	2360	2590	2850	3140	3330	3490	3770
36	8788	2835	432	1780	2020	2150	2320	2560	2820	3100	3380	3570	3730	3960
37	18660	3089	442	2030	2270	2380	2550	2800	3080	3370	3660	3840	3960	4200
38	51404	3317	431	2310	2520	2620	2780	3030	3310	3600	3870	4050	4160	4390
39	72871	3471	426	2500	2690	2790	2940	3180	3460	3750	4020	4200	4310	4520
40	141553	3610	432	2630	2830	2920	3070	3320	3600	3890	4170	4340	4460	4680
41	55946	3739	443	2730	2930	3030	3180	3440	3730	4030	4310	4490	4600	4820
42	14781	3787	463	2730	2950	3040	3210	3470	3780	4090	4390	4570	4680	4910
43	1267	3698	501	2510	2770	2910	3080	3360	3680	4000	4360	4580	4670	4970
44	409	3612	474	2620	2720	2850	3050	3290	3590	3900	4270	4440	4530	4790

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

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

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

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

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APPENDIX 11

Co-sleeping while breastfeeding: advice to health professionals

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

Recommendations

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

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

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

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

Recommendations

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

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