Maternal and Perinatal Mortality in South Australia 2016

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Pregnancy Outcome Unit,
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Thirty-first Report of the Maternal and Perinatal
Mortality Committee on maternal and perinatal deaths

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Maternal and Perinatal Mortality Committee

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Dr Elinor Atkinson	Obstetrician
Dr Vineesh Bhatia	Neonatal paediatrician
Professor Gustaaf Dekker	Obstetrician
Ms Jackie Kitschke	Midwife
Professor William Hague	Obstetric physician
Professor T. Yee Khong	Pathologist
Dr Tim Porter	Obstetric anaesthetist
Dr Mojgan Vatani	Obstetrician
Dr Kenan Wanguhu	General Practitioner
Dr Wendy Scheil	Public health physician, Medical Secretary

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Professor Gustaaf Dekker	Obstetrician
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Acknowledgements

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The Committee would also like to thank:

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Summary

This is the thirty-first Annual Report of the Maternal and Perinatal Mortality Committee, for deaths occurring in 2016.

1. There were two maternal deaths in 2016. The maternal mortality ratio for the last six-year period 2011-2016 was 9.1 deaths per 100,000 women who gave birth, which is low by international standards, but higher than in the preceding five-year period where there were 6.2 deaths per 100,000 women.

2. The Committee reviewed the 175 perinatal deaths of babies born in South Australia in 2016. The perinatal mortality rate for all births (stillbirths of at least 400g or 20 weeks gestation and all live births) was 8.7 per 1,000 births. The stillbirth rate was 6.8 per 1,000 births and the neonatal mortality rate was 2.0 per 1,000 live births.

3. Eighty-eight percent (88%) of the perinatal deaths occurred in preterm babies (less than 37 weeks gestation). The leading cause of perinatal death in 2016 was congenital abnormalities, which accounted for 36.0% of the deaths. Other leading causes were specific perinatal conditions, which included conditions such as cervical incompetence, twin-twin transfusion and idiopathic hydrops.

4. Fourteen (35.8%) of the 39 neonatal deaths occurred in neonates born between 20 to 23 weeks gestation. Of the 25 deaths in neonates born at or after 24 weeks, nine (36%) were associated with congenital abnormalities. Four (40.0%) of the ten term infants died from peripartum hypoxia.

5. *Thirteen babies of Aboriginal mothers died during the perinatal period. The perinatal mortality rate was 17.1 per 1,000 births compared with 13.7 in 2015, and compared with 8.4 per 1,000 births for non-Aboriginal women*.

6. The Committee's previous recommendations have been incorporated into South Australian policies, standards or guidelines. These recommendations are available within previous year's reports or from the Pregnancy Outcome Unit website. From the review of maternal and perinatal deaths in 2016, the Committee has made two new recommendations.

Recommendations

1. Consultation with an obstetric provider should be sought for any woman presenting with hypertension and/or headache in the two weeks following birth.

2. Pregnant women who contact the hospital with atypical abdominal pain and/or repeatedly with complaints of worsening abdominal pain should be assessed in person, not by telephone.

Introduction

This is the Thirty-first Annual Report of the South Australian Maternal and Perinatal Mortality Committee, which was established in 1985. An earlier Committee collected maternal death data from 1961 and perinatal death data from 1979. The South Australian Maternal and Perinatal Mortality Committee is an authorised quality improvement body established under Part 7 of the *South Australian Health Care Act 2008*. Its terms of reference are as follows:

To advise the Chief Executive of SA Health on:

1. the pattern and causation of maternal and perinatal 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 and perinatal morbidity and mortality in the state.

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

The Subcommittees receive notifications of deaths from the following sources:

1. The Registrar of Births, Deaths and Marriages, from medical certificates of cause of perinatal death
2. The Coroner's Office, from Coroner's findings
3. Hospitals and medical practitioners, in cases of maternal death.

Legislation governing the registration of births, deaths and marriages in South Australia requires that the medical certificate of cause of death identifies pregnancy within three months before death and *whether the deceased was of Aboriginal or Torres Strait Islander origin.*

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

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*:

- 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

Definitions used by the Committee are provided in the Methods and Terminology section of this report. The Committee receives notifications of maternal and perinatal deaths occurring in South Australia. However, statistics presented for perinatal deaths relate only to 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 Thirty-first report of the Committee incorporates information on maternal deaths in South Australia in the year 2016 and perinatal deaths of babies born to mothers in South Australia in 2016.

The term Aboriginal is used respectfully in this report as an all-encompassing term for Aboriginal or Torres Strait Islander people living in South Australia. Data relating to Aboriginal mothers and babies have been italicised for easy identification in response to the request of the Aboriginal Health Council of South Australia. The Aboriginal Health Division of SA Health has a nominee on the Committee to address areas of concern in relation to Aboriginal maternal and perinatal health.

Maternal Mortality

Maternal mortality statistics

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 Methods and Terminology).

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

There were two maternal deaths in South Australia in 2016. Maternal deaths in South Australia for the three categories of deaths from 1986 to 2016 are presented in Table 1 by five-year periods. Maternal mortality ratios have been calculated for direct and indirect deaths (Table 1 and Figure 1). The maternal mortality ratio for the last six-year period 2011-2016 was 9.1, which was higher than the Australian maternal mortality ratio of 6.8 per 100,000 women for the period 2012-2014[2]. The number of deaths in South Australia is small and has not changed greatly in the last three decades.

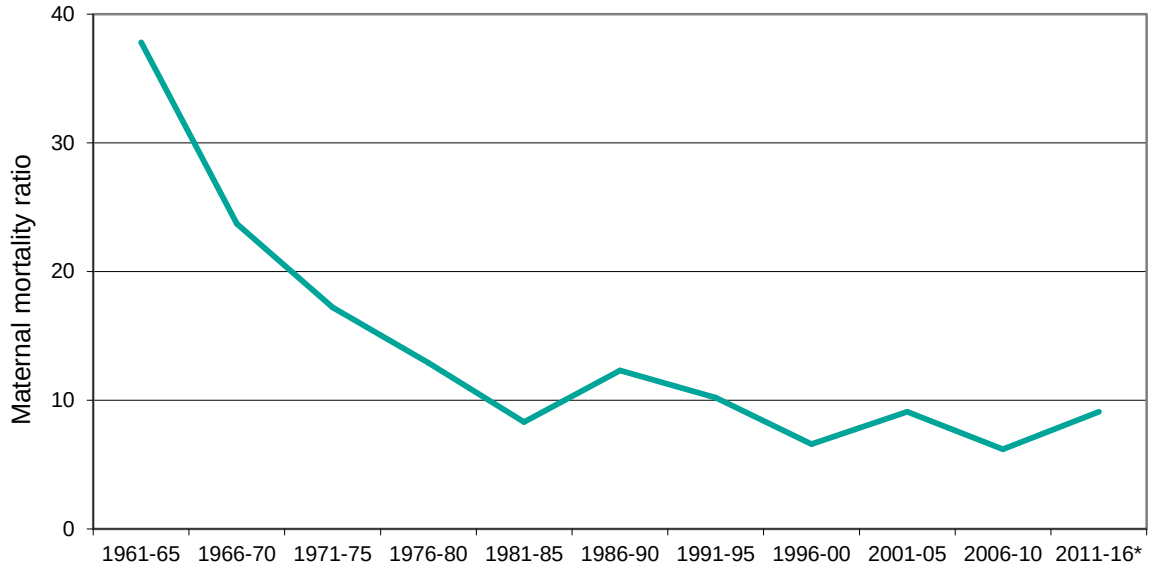
Of a total of 53 pregnancy-related maternal deaths in the period 1986-2016, 26 were direct deaths and 27 were indirect deaths. *Three of the 26 direct deaths and two of the 27 indirect deaths were of Aboriginal women.*

Table 1: Maternal mortality by category of death, in 5-year periods, South Australia, 1986 – 2016

Years	Direct deaths	Indirect deaths	Incidental deaths	Total deaths	Direct and indirect maternal deaths	
	Number	Number	Number	Number	Number	Maternal mortality ratio*
1986 – 1990	4	8	4	16	12	12.3
1991 – 1995	4	6	5	15	10	10.2
1996 - 2000	2	4	4	10	6	6.6
2001 – 2005	4	4	1	9	8	9.1
2006 – 2010	5	1	2	7	6	6.2
2011 – 2016**	7	4	3	14	11	9.1

*Expressed as deaths per 100,000 women who gave birth
** Expressed as a 6 year period.

Figure 1: Maternal Mortality Ratio, South Australia 1961-2016



Confidential enquiries into all maternal deaths in South Australia have been conducted since 1961 with the Minister of Health appointing a Special Medical Committee on Maternal Mortality. Reports published since this time show that between 1961 and 1969 there were 15 maternal deaths related to induced abortion.[3,4] Following the 1970 legislative amendment requiring induced abortions to be conducted under medical supervision, there were 4 deaths due to induced abortion in the following decade 1970 to 1979.[5,6] Over the past 36 years, since 1980, there was one maternal death in 2003 associated with an induced abortion.

Causes of maternal deaths

The causes of the two maternal deaths in 2016 were as follows:

- One direct maternal death was attributed to amniotic fluid embolism occurring at the time of caesarean section.
- One indirect maternal death was attributed to a thalamic infarction occurring 19 days postpartum.

New Maternal Subcommittee recommendations

The Committee's previous recommendations have been incorporated into South Australian policies, practices, standards or guidelines. A document containing previously-made recommendations, together with the relevant code of practice is available from the Pregnancy Outcome Unit website. From the review of maternal deaths in 2016, the Committee makes the following new recommendation:

1. Consultation with an obstetric provider should be sought for any woman presenting with hypertension and/or headache in the two weeks following birth.

Perinatal Mortality

Perinatal mortality statistics

In 2016 there were 20,069 births in South Australia reported to SA Health. These included all births of at least 400g birthweight or 20 weeks gestation. There were 136 stillbirths and 19,933 live births. Thirty-nine live born infants 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 2016 was 8.7 deaths per 1,000 births. The stillbirth rate was 6.8 per 1,000 births and the neonatal mortality rate 2.0 per 1,000 live births. Forty-six of the 175 perinatal deaths (26.2%) were induced terminations of pregnancy and their exclusion would have resulted in a perinatal mortality rate of 6.4 deaths per 1,000 births.

The perinatal mortality rates for other specified minimum birthweights or gestational ages (where birthweight was unavailable) are provided in Table 2. The WHO recommends that fetuses and infants weighing between 500 grams and 1,000 grams should be included in national perinatal mortality statistics. For international comparison, fetuses and infants weighing at least 1,000g and/or 28 weeks gestation is recommended. It is recommended that early neonatal deaths include neonatal deaths that occur during the first seven days of life (0-6 days).[7] Using the WHO classification for international reporting, the perinatal mortality rate was 3.3 per 1,000 births in South Australia, with a stillbirth rate of 2.4 per 1,000 births, and neonatal mortality rate of 0.9 per 1,000 live births.

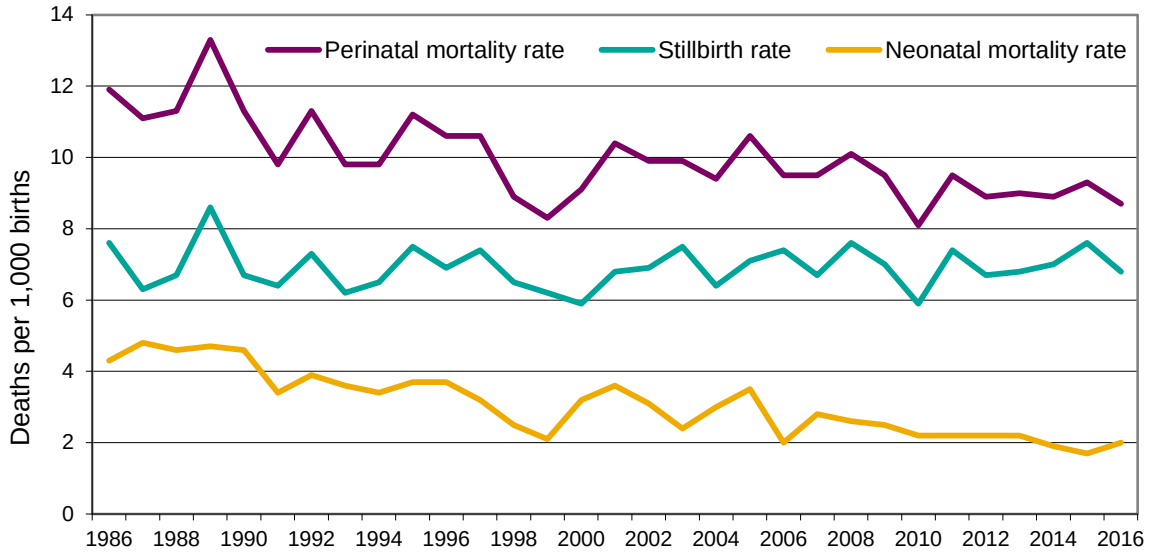
Table 2: Perinatal mortality, South Australia, 2016 (all births of specified birthweight/gestation)*

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	20,061	19,925	136	6.8	39	2.0	175	8.7
≥500g/ 22 weeks	20,009	19,918	91	4.5	32	1.6	123	6.1
≥1,000g/ 28 weeks	19,896	19,848	48	2.4	18	0.9	66	3.3

*Includes 8 babies who were excluded from analysis due to lack of birthweight/gestational age.

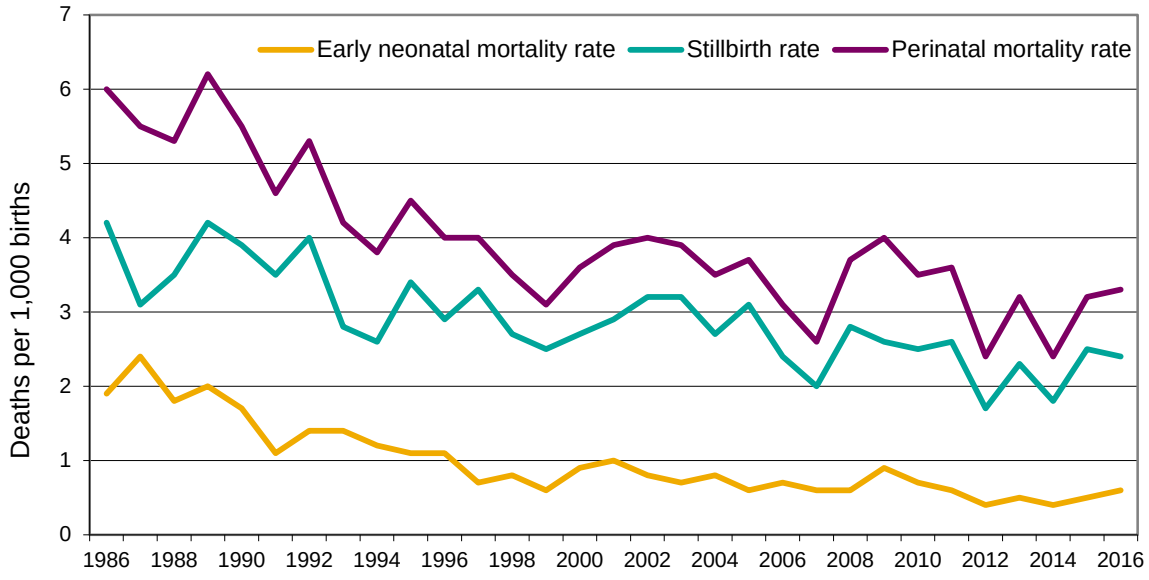
South Australian perinatal mortality rates, including stillbirth and neonatal mortality rates for all births, for 1986-2016 from Committee data are presented in Figure 2. The stillbirth rate for all births has not changed markedly over the last two decades.

Figure 2: Perinatal mortality rate (births >= 400g or 20 weeks gestation), South Australia 1986-2016



Perinatal mortality rates for births of at least 1,000g birthweight (or when birthweight was unavailable, 28 weeks gestation) are presented in Figure 3. Figure 3 includes only early neonatal deaths, occurring within the first seven days of life (WHO recommendation for international statistics). The early neonatal mortality rate for infants weighing at least 1000g or reached 28 weeks of gestation was 0.6 per 1,000 live births. If only births of at least 1,000g birthweight are considered, a decrease in the stillbirth rate is evident from 4.2 deaths per 1,000 births in 1986 to 2.4 in 2016 (Figure 3).

Figure 3: Perinatal mortality rate (births >=1,000g or 28 weeks gestation & early neonatal deaths within the first seven days of life), South Australia 1986-2016



National comparisons of perinatal mortality rates

Perinatal mortality rates for Australian States and Territories from the Australian Bureau of Statistics (ABS) are shown in Table 3. The ABS derives this information from the State and Territory Births, Deaths and Marriages Registry data. In **South Australia, ABS records do not include stillbirths resulting from induced termination of pregnancy.** This difference most likely accounts for the lower South Australian perinatal mortality rates published by the ABS.

Table 3: Perinatal mortality rate* by State or Territory of usual residence of mother, Australian states, 2007 – 2016

Year	NSW	VIC	Qld	SA	WA	Tas	NT	ACT	AUSTRALIA
2007	8.1	8.6	10.6	6.7	6.9	9.2	12.7	9.4	8.6
2008	7.8	7.9	9.9	6.5	8.1	9.1	7.8	6.4	8.2
2009	7.9	8.9	10.4	6.2	8.8	10.6	14.8	7.0	8.8
2010	7.6	8.0	10.5	6.1	8.0	10.9	12.5	16.7	8.6
2011	8.0	8.1	9.1	6.0	9.7	10.1	12.8	7.2	8.4
2012	7.5	7.7	10.0	5.9	8.4	10.1	9.4	10.0	8.2
2013	8.1	8.2	9.1	6.1	7.5	9.5	14.4	7.0	8.2
2014	7.0	7.4	9.8	5.9	8.1	15.5	11.3	9.7	8.0
2015	7.8	6.4	9.5	6.5	8.4	9.6	14.1	7.5	7.9
2016	6.8	7.4	9.5	5.5	8.2	11.5	11.4	6.6	7.7

*Rates are expressed as stillbirths and neonatal deaths within the first 28 days of life per 1,000 births for births of at least 400g birthweight (or if birthweight is unavailable, 20 weeks gestation), based on registered births according to the usual residence of the mother.
** Perinatal mortality rate in South Australia inclusive of GTOPs is 8.7 per 1000.

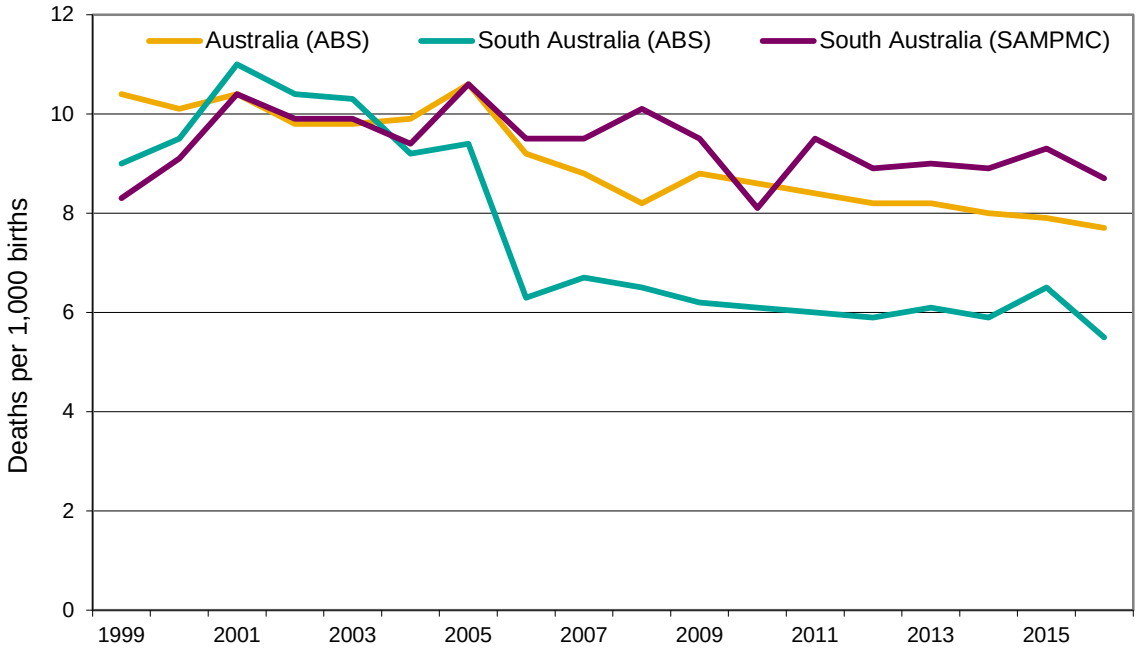
Source: Australian Bureau of Statistics. Catalogue No 3303.0 – Causes of Death, Australia, 2015, 28th September 2016

There are other minor differences between the perinatal deaths that the ABS include, compared with the Committee:

- The ABS rates report State and Territory perinatal deaths according to the usual residence of the mother, whereas the Committee rates include all perinatal deaths occurring in South Australia, irrespective of the mother's usual State or Territory of residence.
- The ABS rates are based on deaths registered in Australia in the year in which they are registered, whereas the Committee rates include all perinatal deaths which occurred in South Australia in the year in which the birth occurred.
- The South Australian ABS data includes all live births of any gestation and since 2006 has only included fetal deaths of at least 400 grams birthweight or at least 20 weeks gestation. Prior to 2011, the Committee's perinatal mortality rate also included all live births which resulted in a neonatal death, irrespective of birthweight or gestation. From 2012 and onwards, only live births of at least 400 grams birthweight or 20 weeks gestational age which resulted in neonatal death have been included in the perinatal mortality data.

The Australian Bureau of Statistics (ABS) rates for South Australia and Australia for 1999-2016 are presented in Figure 4, together with the perinatal mortality rate in South Australia based on notifications to the South Australian Maternal and Perinatal Mortality Committee (SAMPMC).

Figure 4: Perinatal Mortality Rates South Australia, Australia and SAMPMC 1999-2016 Deaths per 1,000 births



Source: Australian Bureau of Statistics. Catalogue No 3303.0 – Causes of Death, Australia, 2015, 28th September 2016

Birthweight-specific perinatal mortality

The birthweight-specific rates of stillbirths, neonatal deaths and perinatal deaths for 2016 are provided in Table 4. Of the 175 perinatal deaths, 152 (86.9%) were of low birthweight (<2,500g) and 30 (76.9%) of the 39 neonatal deaths were low birthweight babies. Fifty-one of the perinatal deaths (29.1%) were less than 400g birthweight.

Table 4: Perinatal mortality by birthweight, all births, South Australia, 2016

			Stillbirths		Neonatal deaths		Perinatal deaths	
Birthweight (grams)	Total births	Live births	Number	Deaths per 1,000 births	Number	Deaths per 1,000 live births	Number	Deaths per 1,000 births
<400	52	7	45	865.4	6	857.1	51	980.8
400-499	31	7	24	774.2	4	571.4	28	903.2
500-749	69	48	21	304.3	9	187.5	30	434.8
750-999	38	32	6	157.9	2	62.5	8	210.5
1,000-1,499	131	121	10	76.3	2	16.5	12	91.6
1,500-1,999	291	282	9	30.9	4	14.2	13	44.7
2,000-2,499	925	918	7	7.6	3	3.3	10	10.8
2,500-2,999	3226	3223	3	0.9	2	0.6	5	1.5
3,000-3,499	7410	7402	8	1.1	3	0.4	11	1.5
3,500-3,999	5996	5994	2	0.3	3	0.5	5	0.8
4,000-4,499	1654	1653	1	0.6	1	0.6	2	1.2
≥4,500	235	235	0	0.0	0	0.0	0	0.0
Unknown	11	11	0	0.0	0	0.0	0	0.0
Total	**20,069**	**19,933**	**136**	**6.8**	**39**	**2.0**	**175**	**8.7**

There were 136 stillbirths, accounting for 77.7% of the perinatal deaths in 2016. Of the 55 intrapartum deaths, 50 were under 750g birthweight (Table 5).

Table 5: Time of perinatal death by birthweight, South Australia, 2016 (=>400g birthweight or 20 weeks gestation)

Birthweight (grams)	Stillbirths			Neonatal deaths	Total
	Antepartum	Intrapartum	Uncertain if antepartum or intrapartum		
<500	21	41	7	10	79
500-749	10	9	2	9	30
750-999	4	1	1	2	8
1,000-1,499	10	0	0	2	12
1,500-1,999	9	0	0	4	13
2,000-2,499	6	1	0	3	10
2,500-2,999	3	0	0	2	5
3,000-3,499	7	1	0	3	11
3,500-3,999	2	0	0	3	5
4,000-4,499	0	1	0	1	2
Total	**72**	**54**	**10**	**39**	**175**

Gestation-specific perinatal mortality

The distribution of perinatal deaths by gestational age is provided in Table 6. There were 154 preterm births (<37 weeks gestation) that resulted in a perinatal death, accounting for 88% of all perinatal deaths.

Table 6: Perinatal mortality by gestational age at birth, South Australia, 2016 (=> 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	108	27	81	750.0	14	518.5	95	879.6
24-27	72	62	10	138.9	8	129.0	18	250.0
28-31	177	163	14	79.1	2	12.3	16	90.4
32-36	1557	1537	20	12.8	5	3.3	25	16.1
37-41	18106	18095	11	0.6	10	0.6	21	1.2
42+	38	38	0	0.0	0	0.0	0	0.0
Unknown	11	11	0	0.0	0	0.0	0	0.0
TOTAL	**20,069**	**19,933**	**136**	**6.8**	**39**	**2.0**	**175**	**8.7**

Classification of perinatal deaths

The Perinatal Subcommittee classified each of the 175 perinatal deaths, which occurred in 2016, according to the Perinatal Society of Australia and New Zealand – Perinatal Death Classification (PSANZ-PDC). This hierarchical classification, together with the Australian birthweight/gestation percentile charts (for singletons and twins), is available on the Perinatal Society of Australia and New Zealand (PSANZ) website. The Committee has used this classification system for deaths from 1999 onward. The South Australian Protocol for investigation of stillbirths is also available at Appendix 6. The classification of perinatal deaths in 2016 according to PSANZ-PDC is as follows (Table 7):

Table 7: Classification of perinatal deaths, PSANZ-PDC, South Australia, 2016

	PSANZ-PDC	Number	Percent	Deaths per 1,000 births
1.	Congenital abnormality	63	36.0	3.2
2.	Perinatal infection	15	8.6	0.8
3.	Hypertension	6	3.4	0.3
4.	Antepartum haemorrhage (APH)	14	8.0	0.7
5.	Maternal conditions	4	2.3	0.2
6.	Specific perinatal conditions	21	12.0	1.1
7.	Hypoxic peripartum death	4	2.3	0.2
8.	Fetal growth restriction	7	4.0	0.4
9.	Spontaneous preterm	19	10.9	1.0
10.	Unexplained antepartum death	20	11.4	1.0
11.	No obstetric antecedent	2	1.1	0.1
	Total	**175**	**100.0**	**9.0**

The PSANZ-PDC for perinatal deaths in 2016 is shown in Figure 5 and its breakdown by subgroups and birthweight groups is provided in Appendix 2 and Appendix 3. PSANZ perinatal cause of death by birthweight is located in Appendix 4.

Congenital abnormalities were the leading cause of perinatal death in 2016, accounting for 36% of all deaths. The next leading cause was specific perinatal conditions (12.0%) and unexplained antepartum deaths (11.4%); the predominant conditions were cervical incompetence, twin-twin transfusion and idiopathic hydrops. This was followed by spontaneous preterm birth (10.9%) and perinatal infection (8.6%), including six deaths attributed to Group B Streptococcus. Antepartum haemorrhage was the next most common (8.0%, Table 7).

The rate of unexplained antepartum deaths (1.0 per 1,000 births) compares with 0.7 per 1,000 births in 2015.

The proportion of perinatal deaths from spontaneous preterm birth has increased this year from 6.4% in 2014 to 10.3% in 2015. In 2016 this proportion increased again to 10.9%. The proportion of perinatal deaths from fetal growth restriction was 4.0%, decreasing from 9.6% in 2015 (noting that this figure can vary dependent upon being recorded as a primary or secondary cause of death).

A brief description of each of the 11 PSANZ categories follows.

Congenital abnormality – sixty-three deaths

This group of 63 deaths included 46 terminations of pregnancy, at 20 weeks gestation or more, of fetuses with congenital abnormalities. The types of abnormalities were as follows:

Central nervous system – seventeen deaths

- Four had abnormalities of the corpus callosum
- Five had neural tube defects
- Four had abnormalities of the cerebellum
- Four others had various other CNS anomalies

Cardiovascular – eight deaths

- Three had hypoplastic left heart syndrome
- Five had other cardiovascular complications including premature closure of the ductus arteriosus, transposition of the great vessels and dilated cardiomyopathy

Urinary System – four deaths

- Two had bilateral renal agenesis
- Two had multicystic dysplastic kidneys

Gastrointestinal system – two deaths

- Both had complications related to oomphalocele

Chromosomal – fourteen deaths

- Three had Trisomy 18
- Three had Trisomy 13
- Three had Trisomy 21
- Five others had various chromosomal abnormalities

Metabolic – one death

- Metabolic dysfunction was found to have a genetic cause in postnatal investigations.

Multiple – thirteen deaths

- Thirteen had multiple congenital anomalies

Other – four deaths

- These deaths were attributed to osteogenesis imperfecta, hydrops and lymphangiomatosis

Perinatal infection – fifteen deaths

Bacterial – twelve deaths

- These deaths were attributed to various bacteria including Group B Streptococcal infection, and Escherichia coli amongst others

Viral – two deaths

- These deaths were attributed to Cytomegalovirus

Other unspecified organisms – one death

Hypertension – six deaths

- These six deaths were all attributed to complications of pre-eclampsia or eclampsia, including superimposed chronic hypertension

Antepartum haemorrhage – fourteen deaths

- Eleven deaths were due to placental abruption
- Three were associated with other placental conditions

Maternal Conditions – four deaths

- Two deaths were due to maternal diabetes
- The others were caused by other maternal complications

Specific perinatal conditions – twenty-one deaths

- Eight deaths were associated with cervical incompetence
- Six deaths were due to twin to twin transfusion syndrome
- The other deaths were due to various conditions such as idiopathic hydrops and cord complications

Hypoxic peripartum death – four deaths

- These four deaths were attributed to events such as cord prolapse and uterine rupture

Fetal growth restriction – seven deaths

- All seven of these deaths were associated with placental pathology including chronic villitis, fetal thrombotic vasculopathy

Spontaneous preterm (<37 weeks gestation) – nineteen deaths

- Seven of these deaths were associated with chorioamnionitis
- The other deaths include babies whose membranes were ruptured for longer than 24 hours and babies who had unknown duration of membrane rupture

Unexplained antepartum deaths – twenty deaths

- Sixteen of these deaths were associated with placental pathologies including, long umbilical cords, circumvallate placenta, marginal haemorrhage, irregular cord coiling, chronic villitis and fetal thrombotic vasculopathy
- Four of the deaths had no placental pathology

No obstetric antecedent – two deaths

- These two deaths were unrelated to any obstetric related complication

Classification of neonatal deaths

The classification of the 39 neonatal deaths according to the Perinatal Society of Australia and New Zealand – Neonatal Death Classification (PSANZ-NDC) is provided in Appendix 3. This classification is also available, together with PSANZ-PDC, on the PSANZ website.

A brief description of these neonatal deaths by gestational age grouping follows:

20-23 weeks gestation – fourteen neonatal deaths

- Eight neonates had no resuscitation, or resuscitation was ultimately unsuccessful
- The others died from complications such as intraventricular haemorrhage and necrotising enterocolitis.

24-31 weeks gestation – ten neonatal deaths

- Five deaths were attributed to intraventricular haemorrhage
- The other deaths were attributed to cardiovascular complications, urinary system abnormalities, necrotising enterocolitis and growth restriction

32-36 weeks gestation – five neonatal deaths

- These neonates were affected by conditions such as multiple congenital anomalies and intraventricular haemorrhage

37 weeks and greater gestation – ten neonatal deaths

- Four of these deaths were attributed to congenital anomalies
- Four deaths were due to hypoxic-ischaemic encephalopathy
- One of these deaths was unable to be classified

Aboriginal perinatal deaths

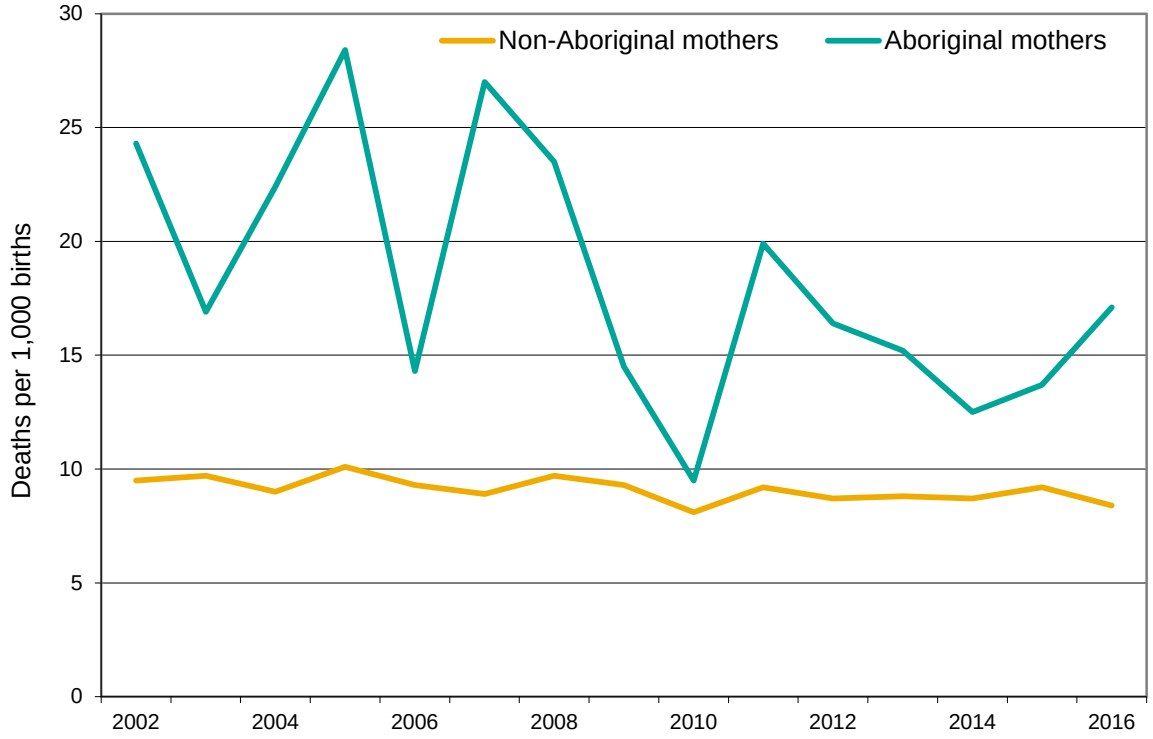
There were thirteen perinatal deaths (13 stillbirths and no neonatal death) among the births to 759 Aboriginal women.

In 2016 the perinatal mortality rate for births to Aboriginal women was 17.1 per 1,000 births, compared to 8.4 per 1,000 births for births to non-Aboriginal women. The perinatal death rate has increased for Aboriginal women in 2016. Although the perinatal mortality rate for Aboriginal births fluctuates widely due to the small number of deaths, recent years show an overall downward trend (Figure 6).

Eight of the thirteen infants were born in public metropolitan hospitals and five infants were born in a country hospital. Twelve of the infants were preterm births, with seven born at or before 23 weeks gestation. Eight of the thirteen mothers were country residents and one mother resided in another state.

The causes of the thirteen deaths were attributed to such causes as congenital abnormalities, perinatal infection, spontaneous preterm birth and unexplained antepartum deaths.

Figure 5: Perinatal mortality by maternal Aboriginal status, South Australia, 2002 - 2016



Autopsies in perinatal deaths

Pathological examinations were undertaken at the State Perinatal Autopsy Service, provided by SA Pathology at the Women's and Children's Hospital. The different types of pathological examinations were categorised as follows:

- full autopsy – examination of all cavities and dissection of all organs
- limited autopsy – examination of one or more cavities (such as chest and/or abdomen) and dissection of one or more organs, but not the whole body
- other examination – external examination of the body and growth parameters in conjunction with any other relevant investigations such as radiological survey, genetic testing, placental histology, virology and microbiology

Autopsies were performed for 95 of the 175 perinatal deaths (54.3%), including two 'limited' autopsies. This proportion has decreased slightly from 2015 (55.3%).

Additionally, 'Other examinations' were performed for 17 (9.7%) of perinatal deaths. Placental histological examinations were undertaken for 166 perinatal deaths (94.9%). Please see Appendix 7 for placental histology guidelines.

The distribution of autopsies by place of death is presented in Table 8. Both Women's and Children's and Flinders Medical Centre hospitals have Level 6 neonatal services, and Lyell McEwin has a Level 5 neonatal service. Service delineations in South Australia are set out in the Standards for Maternal and Neonatal Services in South Australia document, available from the SA Health website here.

Table 8: Autopsy status of perinatal deaths by place of death, South Australia, 2016

Place of death	Deaths	Autopsies performed	
	Number	Number	Percent of deaths
Women's & Children's Hospital	101	56	55.4
Lyell McEwin Hospital	18	8	44.4
Flinders Medical Centre	29	16	55.2
Other metropolitan public hospitals	1	1	100.0
Metropolitan private hospitals	8	6	75.0
Country hospitals	16	6	37.5
Home	2	2	100
Total	**175**	**95**	**54.3**

* Includes 2 autopsies with limited dissection

The low proportion of autopsies conducted in perinatal deaths (54.3%) remains a concern. A good quality autopsy is invaluable in confirming antenatal diagnoses, eliciting other findings of clinical significance, particularly significant negative findings, and determining the time course of events leading to death.[8,9] 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 for autopsy should therefore be sought as often as possible by senior staff. There have been several cases in which an 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.

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 on **(08) 81616315**.

All hospitals with maternity services receive information on the State Perinatal Autopsy 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 must be used and are available from the State Perinatal Autopsy Service.

Perinatal Subcommittee recommendations

The Committee's previous recommendations have been incorporated into South Australian policies, practices, standards or guidelines (Appendix 5). From the review of perinatal deaths in 2016, the Committee makes the following new recommendation:

New recommendation

1. Pregnant women who contact the hospital with atypical abdominal pain and/or repeatedly with complaints of worsening abdominal pain should be assessed in person, not by telephone.

Education Subcommittee Report

The twenty-first annual educational meeting - 'The Annual Dr Brian Pridmore Perinatal Forum' - was held on the evening of 9th August 2017. The forum is organized by the Education Subcommittee of the Maternal and Perinatal Mortality Committee.

The forum was titled 'Pills, Potions and Pregnancy' and included an interactive forum about the pharmacology of common over-the-counter and prescribed medications used in pregnancy and during breastfeeding.

The 2017 forum was held in Room 102 in the Napier Building at the University of Adelaide, attracting approximately 100 people.

Dr Aimee Wiltshire introduced the topic, followed by a short presentation by each of the panel members. The evening concluded with a question and answer session. Major topics were as follows:

- Ms Cath Leggett – Medicines Information Manager, WCH. Who uses the service? Why do people call?
- Dr Claire Whitehead – Maternal Fetal Medicine. Medication use and birth defects.
- Ms Donna Mansell – Eligible Midwife in private practice. A breastfeeding case study.

The forum was well received by the audience both at the time and from formal feedback, although most agreed the presentations could be shortened. The audience included midwives from the private and public sector, obstetricians, university staff and trainee medical officers. The feedback is used by the Subcommittee to guide future topic choices and improve the event.

New recommendations made by the Maternal and Perinatal Mortality Committee, following review of the deaths in 2015, were presented to the audience. These recommendations were published in the 30th annual report in September 2017.

This forum was filmed. An edited version with transcripts can be viewed on the SA Health online website by visiting www.sahealth.sa.gov.au/perinatal

The Subcommittee wishes to thank the panel and participants for their continued support and will endeavour to ensure that the event continues to be an important part of perinatal services within South Australia.

Useful links

- The SA Health Pregnancy Information website: www.health.sa.gov.au/pregnancy
- The South Australian Perinatal Practice Guidelines website: http://www.sahealth.sa.gov.au/wps/wcm/connect/public+content/sa+health+internet/clinical+resources/clinical+topics/perinatal
- The Child Death and Serious Injury Review Committee reports: www.cdsirc.sa.gov.au
- The Sudden Infant Death Syndrome website: https://rednose.com.au/
- The South Australian Parenting and Child Health website: www.cyh.com.au
- The South Australian Safe Infant Sleeping Standards http://www.sahealth.sa.gov.au/wps/south+australian+safe+infant+sleeping+standards
- The Courts Administration Authority of South Australia, Coroners Findings: www.courts.sa.gov.au/CoronersFindings/Pages/default.aspx
- Gestation Network customised birthweight centile calculator: www.gestation.net/cc/about.htm
- Perinatal Society of Australia and New Zealand (PSANZ) website (www.psanz.org.au)

Methods and terminology

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

This report does not include live births less than 20 weeks gestation and less than 400g birthweight.

Maternal death: 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.[10]

Maternal deaths are classified as follows:

1. **Direct obstetric deaths:** 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:** 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**: the pregnancy is unlikely to have contributed significantly to the death, although it may be possible to postulate a remote association. Examples of incidental deaths are drowning and road accidents.

In order to avoid missing indirect deaths which may be difficult to distinguish from incidental deaths occurring in pregnant women, the Maternal and Perinatal 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: the number of direct and indirect maternal deaths in a defined time period, divided by the total number of women who gave birth in the same time period, multiplied by 100,000

Neonatal death: death of a live born infant within 28 days of birth

Neonatal death rate: the number of neonatal deaths in a defined time period, divided by the total number of live births in the same time period, multiplied by 1,000

Perinatal death: stillbirths and neonatal deaths combined

Perinatal mortality rate: the number of stillbirths and neonatal deaths in a defined time period, divided by the total number of still births and live births in the same time period, multiplied by 1,000

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

Stillbirth rate: the number of stillbirths in a defined time period, divided by the total number of live births and stillbirths in the same time period, multiplied by 1,000

Sudden Infant Death Syndrome (SIDS): the sudden unexpected death of an infant less than one year of age, with onset of the fatal episode apparently occurring during sleep, that remains unexplained after a thorough investigation, including performance of a complete autopsy and review of the circumstances of death and the clinical history.[11]

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

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Appendix 1

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

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 and Perinatal Mortality Committee.
3. The membership and chairperson will be nominated by the chairperson of the Maternal and Perinatal Mortality Committee.
4. The Subcommittee may co-opt members as required.

Appendix 2

Perinatal Society of Australia and New Zealand-Perinatal Death Classification (PSANZ-PDC), South Australian perinatal deaths, 2016

		Category No	Subcategory No	Category %
1	**CONGENITAL ABNORMALITY (including terminations for congenital abnormalities)**	**63**		**36.0**
	1.1 Central nervous system	17		9.7
	1.2 Cardiovascular system	8		4.6
	1.3 Urinary system	4		2.3
	1.4 Gastrointestinal system	2		1.1
	1.5 Chromosomal	14		8.0
	1.6 Metabolic	1		0.6
	1.7 Multiple/non chromosomal syndromes	13		7.4
	1.8 Other congenital abnormality			
	1.81 Musculoskeletal		1	0.6
	1.82 Respiratory		1	0.6
	1.83 Diaphragmatic hernia			
	1.84 Haematological			
	1.85 Tumours		1	0.6
	1.88 Other specified congenital abnormality		1	0.6
	1.9 Unspecified congenital abnormality			
2	**PERINATAL INFECTION**	**15**		**8.6**
	2.1 Bacterial			
	2.11 Group B Streptococcus		6	3.4
	2.12 E coli		1	0.6
	2.13 Listeria monocytogenes			
	2.14 Spirochaetal e.g. Syphilis			
	2.18 Other bacterial		4	2.3
	2.19 Unspecified bacterial		1	0.6
	2.2 Viral			
	2.21 Cytomegalovirus		2	1.1
	2.22 Parvovirus			
	2.23 Herpes simplex virus			
	2.24 Rubella virus			
	2.28 Other viral			
	2.29 Unspecified viral			
	2.3 Protozoal e.g. Toxoplasma			
	2.5 Fungal			
	2.8 Other specified organism			
	2.9 Other unspecified organism	1		0.6

		Category No	Subcategory No	Category %
3	**HYPERTENSION**	**6**		**3.4**
	3.1 Chronic hypertension: essential			
	3.2 Chronic hypertension: secondary, e.g. renal disease			
	3.3 Chronic hypertension: unspecified			
	3.4 Gestational hypertension			
	3.5 Pre-eclampsia	3		1.7
	3.51 With laboratory evidence of thrombophilia		1	0.6
	3.6 Pre-eclampsia superimposed on chronic hypertension	2		1.1
	3.61 With laboratory evidence of thrombophilia			
	3.9 Unspecified hypertension			
4	**ANTEPARTUM HAEMORRHAGE (APH)**	**14**		**8.0**
	4.1 Placental abruption	9		5.1
	4.11 With laboratory evidence of thrombophilia		2	1.1
	4.2 Placenta praevia	2		1.1
	4.3 Vasa praevia			
	4.8 Other APH	1		0.6
	4.9 APH of undetermined origin			
5	**MATERNAL CONDITIONS**	**4**		**2.3**
	5.1 Termination of pregnancy (other than for congenital fetal abnormality)			
	5.2 Diabetes / Gestational diabetes	2		1.1
	5.3 Maternal injury			
	5.31 Accidental			
	5.32 Non-accidental			
	5.4 Maternal sepsis			
	5.5 Antiphospholipid syndrome	1		0.6
	5.6 Obstetric cholestasis			
	5.8 Other specified maternal conditions	1		0.6

		Category No	Subcategory No	Category %
6	**SPECIFIC PERINATAL CONDITIONS**	**21**		**12.0**
	6.1 Twin-twin transfusion	6		3.4
	6.2 Fetomaternal haemorrhage	2		1.1
	6.3 Antepartum cord complications			
	6.31 Cord haemorrhage			
	6.32 True knot with evidence of occlusion		1	0.6
	6.38 Other			
	6.39 Unspecified			
	6.4 Uterine abnormalities, eg bicornuate uterus, cervical incompetence	8		4.6
	6.5 Birth trauma (typically infants of >24 weeks gestation or >600g birthweight)			
	6.6 Alloimmune disease			
	6.61 Rhesus			
	6.62 ABO			
	6.63 Kell			
	6.64 Alloimmune thrombocytopenia		1	0.6
	6.68 Other			
	6.69 Unspecified			
	6.7 Idiopathic hydrops	2		1.1
	6.8 Other specific perinatal conditions			
	6.81 Rupture of membranes after amniocentesis			
	6.82 Termination of pregnancy for suspected but unconfirmed congenital abnormality		1	0.6
	6.83 Fetal subdural haematoma			
	6.88 Other			
	6.89 Unspecified			
7	**HYPOXIC PERIPARTUM DEATH (typically infancts of >24 weeks gestation or >600g birthweight**	**4**		**2.3**
	7.1 With intrapartum complications			
	7.11 Uterine rupture		1	0.6
	7.12 Cord prolapse		1	0.6
	7.13 Shoulder dystocia			
	7.18 Other			
	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)			
	7.3 No intrapartum complications and no evidence of non-reassuring fetal status			
	7.9 Unspecified hypoxic peripartum death	2		1.1

		Category No	Subcategory No	Category %
8	**FETAL GROWTH RESTRICTION (FGR)**	**7**		**4.0**
	8.1 With evidence of reduced vascular perfusion on Doppler studies and /or placental histopathology (e.g. significant infarction, acute atherosis, maternal and or fetal vascular thrombosis or maternal floor infarction)	5		2.9
	8.11 With placental or laboratory evidence of thrombophilia			
	8.12 With smoking			
	8.13 With substance abuse			
	8.14With alcohol abuse			
	8.15 With diabetes/gestational diabetes			
	8.2 With chronic villitis	1		0.6
	8.3 No placental pathology			
	8.4 No examination of placenta			
	8.8 Other specified placental pathology	1		0.6
	8.9 Unspecified or not known whether placenta examined			
9	**SPONTANEOUS PRETERM (<37 weeks gestation)**	**19**		**10.9**
	9.1 Spontaneous preterm with intact membranes, or membrane rupture <24 hours before delivery			
	9.11 With chorioamnionitis on placental histopathology		7	4.0
	9.12 Without chorioamnionitis on placental histopathology		2	1.1
	9.13 With clinical evidence of chorioamnionitis, no examination of placenta			
	9.17 No clinical signs of chorioamnionitis, no examination of placenta		1	0.6
	9.19 Unspecified or not known whether placenta examined			
	9.2 Spontaneous preterm with membrane rupture >=24 hours before delivery			
	9.21 With chorioamnionitis on placental histopathology		6	3.4
	9.22 Without chorioamnionitis on placental histopathology		1	0.6
	9.23 With clinical evidence of chorioamnionitis, no examination of placenta			
	9.27 No clinical signs of chorioamnionitis, no examination of placenta			
	9.29 Unspecified or not known whether placenta examined			
	9.3 Spontaneous preterm with membrane rupture of unknown duration before delivery			
	9.31 With chorioamnionitis on placental histopathology		1	0.6
	9.32 Without chorioamnionitis on placental histopathology		1	0.6
	9.33 With clinical evidence of chorioamnionitis, no examination of placenta			
	9.37 No clinical signs of chorioamnionitis, no examination of placenta			
	9.39 Unspecified or not known whether placenta examined			

		Category No	Subcategory No	Category %
10	**UNEXPLAINED ANTEPARTUM DEATH**	**20**		**11.4**
	10.1 With evidence of reduced vascular perfusion on Doppler studies and or placental histopathology (e.g. significant infarction , acute atherosis, maternal and or fetal vascular thrombosis or maternal floor infarction)	4		2.3
	10.11 And thrombophilia			
	10.12 And smoking			
	10.13 And substance abuse			
	10.14 And alcohol abuse			
	10.15 And diabetes/gestational diabetes			
	10.2 With chronic villitis	1		0.6
	10.3 No placental pathology	4		2.3
	10.4 No examination of placenta			
	10.8 Other specified placental pathology	11		6.3
	10.9 Unspecified or not known whether placenta examined			
11	**NO OBSTETRIC ANTECEDENT**	**2**		**1.1**
	11.1 Sudden Infant Death Syndrome (SIDS)			
	11.11 SIDS Category IA: Classic features of SIDS present and completely documented			
	11.12 SIDS Category IB: Classic features of SIDS present but incompletely documented			
	11.13 SIDS Category II: Infant deaths that meet Category I except for one or more features			
	11.2 Postnatally acquired infection	1		0.6
	11.3 Accidental asphyxiation			
	11.4 Other accident, poisoning or violence (postnatal)			
	11.8 Other specified			
	11.9 Unknown/Undetermined			
	11.91 Unclassified Sudden Infant Death		1	0.6
	11.92 Other Unknown/Undetermined			
	TOTAL	**175**		**100.0**

Appendix 3

Perinatal Society of Australia and New Zealand-Neonatal Death Classification (PSANZ-NDC), South Australian neonatal deaths, 2016

		Category No	Subcategory No	Category %
1	**CONGENITAL ABNORMALITY**	**11**		**28.2**
	1.1 Central nervous system			
	1.2 Cardiovascular system	3		7.7
	1.3 Urinary system	2		5.1
	1.4 Gastrointestinal system			
	1.5 Chromosomal	3		7.7
	1.6 Metabolic			
	1.7 Multiple/non chromosomal syndromes	3		7.7
	1.8 Other congenital abnormality			
	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			
2	**EXTREME PREMATURITY**	**8**		**20.5**
	2.1 Not resuscitated	7		17.9
	2.2 Unsuccessful resuscitation	1		2.6
	2.9 Unspecified or unknown whether resuscitation attempted			
3	**CARDIO-RESPIRATORY DISORDERS**			
	3.1 Hyaline membrane disease / Respiratory Distress Syndrome (RDS)			
	3.2 Meconium aspiration syndrome			
	3.3 Primary persistent pulmonary hypertension			
	3.4 Pulmonary hypoplasia			
	3.5 Chronic neonatal lung disease (typically bronchopulmonary dysplasia)			
	3.6 Pulmonary haemorrhage			
	3.7 Pneumothorax			
	3.8 Other			

		Category No	Subcategory No	Category %
4	**INFECTION**	**2**		**5.1**
	4.1 Bacterial			
	4.11 Congenital bacterial			
	4.111 Group B Streptococcus			
	4.112 E coli			
	4.113 Listeria monocytogenes			
	4.114 Spirochaetal, eg syphilis			
	4.118 Other bacterial			
	4.119 Unspecified bacterial			
	4.12 Acquired bacterial			
	4.121 Group B Streptococcus			
	4.122 E coli			
	4.125 Other Gram negative bacilli (other than E coli)			
	4.126 Staphylococcus aureus			
	4.127 Coagulase negative Staphylococcus			
	4.128 Other specified bacterial		1	2.6
	4.129 Unspecified bacterial			
	4.2 Viral			
	4.21 Congenital viral			
	4.211 Cytomegalovirus			
	4.213 Herpes simplex virus			
	4.214 Rubella virus			
	4.218 Other specified viral			
	4.219 Unspecified viral			
	4.22 Acquired viral			
	4.221 Cytomegalovirus			
	4.223 Herpes simplex virus			
	4.224 Rubella virus			
	4.228 Other specified viral		1	2.6
	4.229 Unspecified viral			
	4.3 Protozoal e.g. Toxoplasma			
	4.5 Fungal			
	4.8 Other specified organism			
	4.9 Unspecified organism			

		Category No	Subcategory No	Category %
5	**NEUROLOGICAL**	**13**		**33.3**
	5.1 Hypoxic ischaemic encephalopathy / Perinatal asphyxia (typically infants of >24 weeks gestation or >600g birthweight)	5		12.8
	5.2 Intracranial haemorrhage			
	5.21 Intraventricular haemorrhage		7	17.9
	5.22 Subgaleal haemorrhage			
	5.23 Subarachnoid haemorrhage			
	5.24 Subdural haemorrhage			
	5.28 Other Intracranial haemorrhage		1	2.6
	5.8 Other			
6	**GASTROINTESTINAL**	**4**		**10.3**
	6.1 Necrotising enterocolitis	2		5.1
	6.8 Other	2		5.1
7	**OTHER**	**1**		**2.6**
	7.1 Sudden Infant Death Syndrome (SIDS)			
	7.11 SIDS Category IA: Classic features of SIDS present and completely documented			
	7.12 SIDS Category IB: Classic features of SIDS present but incompletely documented			
	7.13 SIDS Category II : Infant deaths that meet category I except for one or more features			
	7.2 Multisystem failure			
	7.21 Secondary to intrauterine growth restriction			
	7.28 Other specified			
	7.29 Unspecified/undetermined primary cause or trigger event			
	7.3 Trauma			
	7.31 Accidental			
	7.32 Non-accidental			
	7.39 Unspecified			
	7.4 Treatment complications			
	7.41 Surgical			
	7.42 Medical			
	7.8 Other specified			
	7.9 Undetermined/Unknown			
	7.91 Unclassified Sudden Infant Death			
	7.92 Other Unknown/Undetermined		1	2.6
	TOTAL	**39**		**100.0**

Appendix 4

Perinatal Society of Australia and New Zealand Perinatal Death Classification (PSANZ-PDC), South Australian perinatal deaths by birthweight, 2016

		Birthweight (g)							Total	
	PSANZ-PDC	**<500**	**500-749**	**750-999**	**1000-1,499**	**1500-1,999**	**2,000-2,499**	**2,500+**	**No**	**%**
1	Congenital abnormality	38	8	0	4	3	6	4	63	36
2	Perinatal infection	4	2	1	3	1	2	2	15	8.6
3	Hypertension	2	0	1	2	1	0	0	6	3.4
4	Antepartum haemorrhage	6	4	1	0	1	0	2	14	8
5	Maternal conditions	3	0	0	0	0	0	1	4	2.3
6	Specific perinatal conditions	10	4	2	0	1	1	3	21	12
7	Hypoxic peripartum death	0	0	0	0	1	0	3	4	2.3
8	Fetal growth restriction	3	1	0	1	2	0	0	7	4
9	Spontaneous preterm	11	7	0	1	0	0	0	19	10.9
10	Unexplained antepartum death	2	4	3	1	3	1	6	20	11.4
11	No obstetric antecedent	0	0	0	0	0	0	2	2	1.1
	Total	**79**	**30**	**8**	**12**	**13**	**10**	**23**	**175**	**100.0**
	Percent	45.1	17.1	4.6	6.9	7.4	5.7	13.1	100.0	%

Appendix 5

Archived recommendations

Many Committee recommendations have been incorporated into South Australian policies, standards or guidelines. For a complete list of recommendations made by the Committee in previous years, please see the Archived Recommendations document on the Pregnancy Outcome Unit web page.

Appendix 6

South Australian Protocol for investigation of stillbirths

Working party members (August 2012):

Professor G Dekker (Chair)

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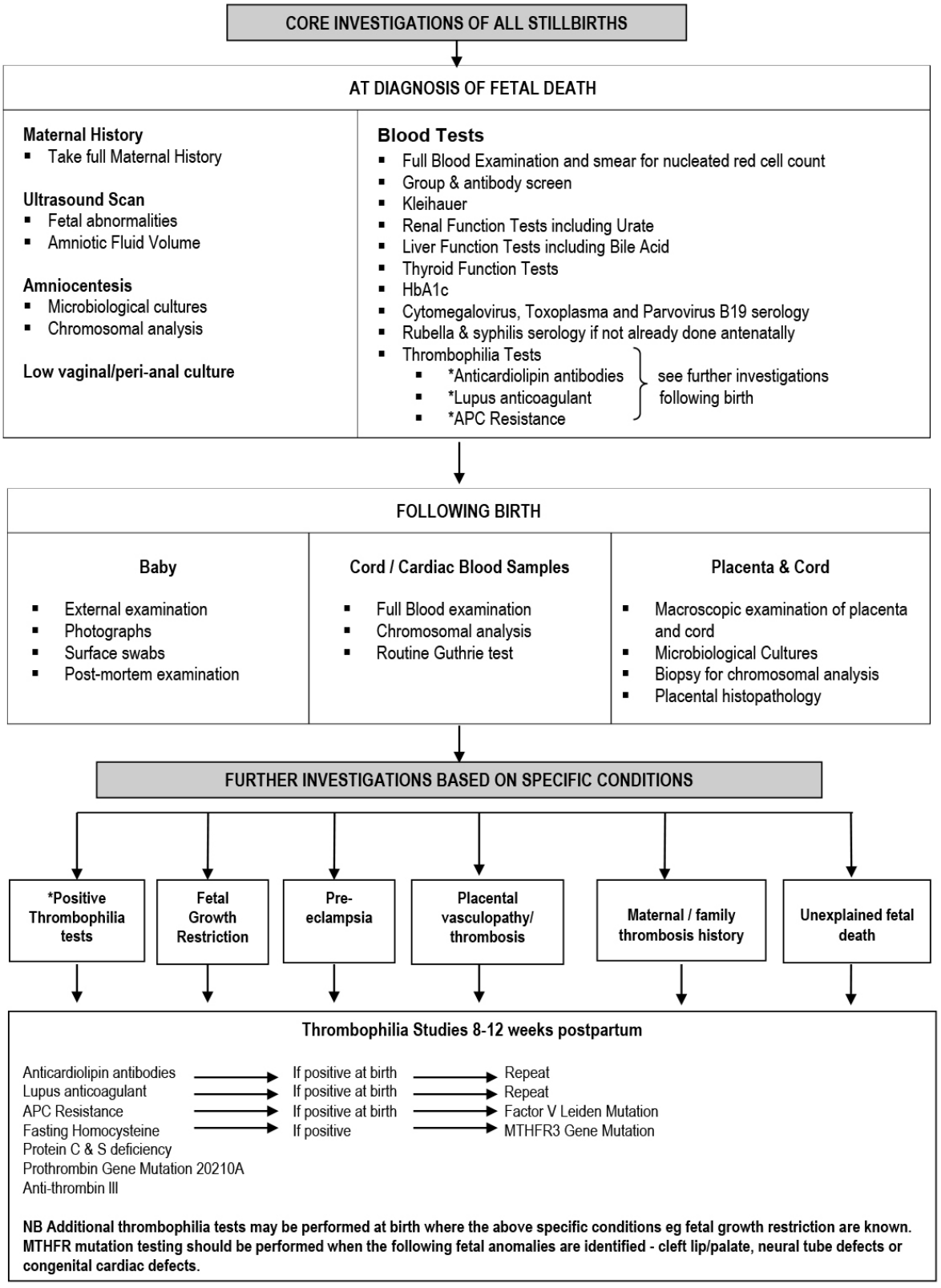
Introduction

About 75% of the overall perinatal mortality in South Australia is related to stillbirths. Over the past several years approximately 11% 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 vasculopathy.

The 'Stillbirth investigations algorithm' of the Perinatal Society of Australia and New Zealand (PSANZ) on the following page summarises the recommended core investigations for all stillbirths, and further investigations to be undertaken based on specific conditions.

It is important that clinicians initiate a comprehensive approach to all cases of stillbirth; however, as in all aspects of clinical medicine common sense should prevail. In order to adequately assess causative and contributing factors in cases of stillbirth, certain core investigations will be required in all cases as outlined in the 'Core Investigations of All Stillbirths' section in the 'Stillbirth investigations algorithm' on the following page. South Australian specific considerations are summarised in the pages following the 'Stillbirth investigations algorithm'. Some investigations are best suited to those cases in which no cause of death is apparent.

Stillbirth investigations algorithm



Perinatal Society of Australia and New Zealand Perinatal Mortality Audit Guideline; Second Edition, Version 2.2, April 2009. Section 5: Investigation of Stillbirths; Appendix 1
http://www.psanz.com.au/special-interest/perinatal-mortality-group/psanzcpg

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

The following outlines the current South Australian recommended core investigations into stillbirth.

- **A detailed history and examination of the mother and careful review of the antenatal record** – This can often provide clues to intercurrent infection, previously undiagnosed pre-eclampsia, drug use, obstetric cholestasis or missed intrauterine growth restriction.
- **Maternal blood** - In addition to the blood tests listed in the core investigations section of the 'Stillbirth investigation algorithm', a blood glucose test should be done. Testing for fetomaternal haemorrhage involves a Kleihauer test at SA Pathology and, if positive, Fluorescence-Activated Cell Sorting (FACS, a type of flow cytometry) to quantify the fetomaternal haemorrhage.
- **Autopsy of the stillbirth** - With parental consent, an autopsy should be conducted by the State Perinatal Autopsy Service. In those cases where parents give full consent with regard to autopsy, the perinatal pathologists will take appropriate samples for genetic testing, and there is no need for the obstetrician to take separate fetal samples.
- **External examination of the baby** - In cases where parental consent for autopsy cannot be obtained, where possible, external examination of the baby by a pathologist experienced in this area 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.
- **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 may provide a diagnosis and information that can be helpful in planning another pregnancy.
- **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 can be drawn from a heel prick or from the cut end of the umbilical cord of the placenta in the case of a fresh stillbirth (<7 days between intrauterine death and birth).

Termination of pregnancy for fetal abnormalities

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 abnormality

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

- **Genetic testing** - 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.
- **Maternal serology** - for syphilis, cytomegalovirus, toxoplasma, herpes and parvovirus. Serum should be taken and forwarded with the baby. Investigation for congenital infection should be pursued if abnormalities indicative of infection are found (for example, hydrocephalus, hepatomegaly, cataracts, fetal hydrops, calcification of brain or placenta).
- **Maternal screen for blood group antibodies** – forward serum with baby for later investigation if hydrops is evident at autopsy.

Vasculopathies

Pre-eclampsia, placental abruption and intrauterine growth restriction.

All should have a thrombophilia screen comprising –

At time of delivery:

- Anti-cardiolipin antibody
- Lupus anticoagulant (Diagnosis of antiphospholipid antibody syndrome requires a least two positive tests of moderate to high titre)

- Factor V Leiden gene mutation, prothrombin gene mutation.

At three months post-partum:

- Homocysteine - may be done earlier if follow-up uncertain
- Protein S (a formal diagnosis of protein S deficiency requires 2 abnormal results at least six weeks apart outside of pregnancy).

(Note: MTHFR testing, as listed in the 'Thrombophilia studies 8-12 weeks postpartum' section of the 'Stillbirth investigations algorithm', is no longer routinely performed in South Australia)

Pre-eclampsia

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

- Anti-nuclear antibody
- Fetal genetic testing (see "Congenital abnormality")

Placental abruption

In cases of placental abruption:

- A history of trauma, including domestic or other violence, should be sought.
- Testing for fetomaternal haemorrhage and D-dimers is indicated if the diagnosis is in doubt.

Intrauterine growth restriction (IUGR)

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

- maternal serology for cytomegalovirus, toxoplasma and rubella (if not immune) on held maternal serum
- fetal genetic testing (see "Congenital abnormality")
- maternal urinary drug screen as well as a drug-related history.

Intrapartum stillbirths

- If associated with pre-eclampsia, intrauterine growth restriction and/or abruption follow the placental vasculopathy protocol.
- In the absence of obvious causes, test for fetomaternal haemorrhage and cord (or heart) blood for haemoglobin, platelets and nucleated red blood cells.

Unexplained stillbirths

In the absence of discernible factors pertaining to fetal demise, or any obvious congenital abnormality, in addition to the "Core investigations" the following should be conducted:

- cord blood bile acids if possible
- maternal thyroid stimulating hormone
- maternal serology for syphilis, cytomegalovirus, toxoplasma herpes, parvovirus and rubella (if not immune) on held maternal serum
- 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 is Rhesus negative)
- maternal antibody screen
- fetomaternal haemorrhage testing
- check the mother's history for the possibility of tropical infectious disorders. Where there is a history of a recent visit to a tropical area, contact an infectious disease specialist with regard to required investigations.

Appendix 7

Placental histology guidelines

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

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

- stillborn infants, early neonatal deaths and mid-trimester miscarriages
- multiple pregnancies with same sex infants
- triplet and higher order multiple pregnancies
- cases of discordant twin growth with greater than 20% weight difference
- cases of prolonged rupture of membranes or suspected chorioamnionitis or maternal fever (any cause)
- preterm births
- cases where birthweight is less than the 10^{th} percentile or greater than the 95^{th} percentile for gestational age
- cases of fetal malformation
- cases of pregnancy complicated by oligohydramnios, polyhydramnios or placental abnormalities detected prenatally (vascular channels, chorioangioma, etc)
- cases with a physical abnormality in the placenta (eg. a mass, abnormal colour, malodour)
- cases subjected to chorion villus sampling or amniocentesis, if complications occur
- cases of pre-existing diabetes, pre-eclampsia, systemic lupus erythematosus and documented thrombophilias known to be associated with fetal hazard
- cases of placental abruption
- cases where the infant is transferred to a Level 6 nursery or the infant is severely depressed at birth (Apgar score <5 at five minutes)
- instances where either mother or baby is retrieved shortly after birth
- cases of maternal death.

For more information

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