

Maternal and Perinatal Mortality in South Australia 2021



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of South Australia**

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Committees

Maternal and Perinatal Mortality Committee

Professor Jodie Dodd	Obstetrician, Chair
Dr Vineesh Bhatia	Neonatal paediatrician
Dr Anthony Colby	Obstetric anaesthetist
Dr Megan Cooper	Midwife
Dr Marion Crompton	General practitioner
Dr Jeff Hillen	Obstetrician
Dr Amanda Poprzeczny	Obstetrician
Ms Toni-Marie Rowe	Midwife, Aboriginal health representative
Dr Aimee Woods	Obstetrician
Dr Stephen Wills	Pathologist
Ms Helen Thomas	Ex-officio
Ms Kylie Bryant	Ex-officio

Maternal Subcommittee

Dr Amanda Poprzeczny	Obstetrician, Chair
Dr Anthony Colby	Obstetric anaesthetist
Dr Megan Cooper	Midwife
Dr Marion Crompton	General practitioner
Professor Jodie Dodd	Obstetrician
Dr Amy Hercus	Obstetrician
Dr Jeff Hillen	Obstetrician
Ms Toni-Marie Rowe	Midwife, Aboriginal health representative
Dr Stephen Wills	Pathologist
Ms Kylie Bryant	Ex-officio

Perinatal Subcommittee

Dr Aimee Woods	Obstetrician, Chair
Dr Anthony Colby	Obstetric anaesthetist
Dr Adele Crowley	Obstetrician
Dr Jenni Goold	General practitioner
Dr Rhiannon Heading	Obstetrician
Ms Claudia Markwart	Neonatal nurse
Dr Theresa Power	Pathologist
Dr Carol Siu	Genetic pathologist
Associate Professor Michael Stark	Neonatologist
Dr Alvin Tan	Neonatologist
Dr Jorien Vercruyssen	Obstetrician
Ms Angie Wilson	Midwife
Vacant	Neonatologist
Vacant	Aboriginal health representative
Ms Kylie Bryant	Ex-officio

Education Subcommittee

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Dr Rachel Earl
Ms Lauren Kleinig
Ms Kim Parker-Gray
Ms Kirsty Roberts
Dr Beth Russ
Ms Renae Williams
Dr Brian Wheatley
Ms Kylie Bryant

Neonatal Paediatrician, Chair
Obstetrician
General practitioner
Obstetrician
Midwife
Midwife
Midwife
Obstetrician
Midwife
Mentor
Ex-officio

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Contents

Committees.....	3
Acknowledgements.....	5
Summary	8
Key Learning Points.....	9
Introduction	10
Reporting of deaths to the State Coroner	11
Maternal Mortality	12
Maternal mortality statistics.....	12
Causes of maternal deaths	13
Maternal Key Learning Points	13
Perinatal Mortality	14
Perinatal mortality statistics	14
National comparisons of perinatal mortality rates.....	17
Birthweight-specific perinatal mortality	19
Gestation-specific perinatal mortality	20
Classification of perinatal deaths.....	21
Classification of neonatal deaths	24
Aboriginal perinatal deaths.....	26
Autopsies in perinatal deaths	27
Perinatal Key Learning Points	28
Education Subcommittee Report.....	29
Useful links	30
Methods and terminology	31
References	33
Appendix 1	34
Terms of reference, Subcommittees of the Maternal and Perinatal Mortality Committee.....	34
Maternal Subcommittee	34
Perinatal Subcommittee	34
Education Subcommittee.....	34
Appendix 2	35
Appendix 3	37
Appendix 4	41
Appendix 5	44

Appendix 6	45
Appendix 7	46
Stillbirth Investigations	46
Write Group Lead.....	46
Write Group Members.....	46
Selective Investigations based on findings of Core Investigations	48
Maternal Blood – Other Investigations.....	49
Termination of pregnancy for fetal abnormalities	50
PSANZ Stillbirth Investigations Algorithm.....	51

Summary

This is the thirty-sixth Annual Report of the Maternal and Perinatal Mortality Committee, for deaths occurring in 2021.

1. There was one maternal death in 2021. The maternal mortality ratio for the last five-year period 2017-2021 was 6.3 deaths per 100,000 women who gave birth, which is low by international standards, and lower than the preceding five-year period where there were 10.0 deaths per 100,000 women.
2. The Committee reviewed the 183 perinatal deaths of babies born in South Australia in 2021. The perinatal mortality rate for all births (stillbirths of at least 400g or 20 weeks gestation and all live births of babies born at or after 20 weeks gestation) was 9.1 per 1,000 births. The stillbirth rate was 7.1 per 1,000 births and the neonatal mortality rate was 2.0 per 1,000 live births. Whilst the neonatal mortality rate has been steadily declining, the stillbirth rate has not changed markedly over the last two decades.
3. One hundred and forty-nine (81.4%) of the perinatal deaths occurred in preterm babies (less than 37 weeks gestation). The leading cause of perinatal death in 2021 was congenital anomalies, which accounted for 30.6% of the deaths. Other leading causes were placental dysfunction or causative placental pathology (16.9%), and spontaneous preterm labour or rupture of membranes (15.8%).
4. Twenty (50.0%) of the 40 neonatal deaths occurred in neonates born at less than 24 weeks gestation. Of the 20 deaths in neonates born at or after 24 weeks, nine (45%) were attributed to conditions arising from pregnancy complications.
5. Fourteen babies of Aboriginal mothers died during the perinatal period. The perinatal mortality rate for Aboriginal women was 16.3 per 1,000 births compared with 8.7 per 1,000 births for non-Aboriginal women. However, the perinatal mortality rate for Aboriginal women has decreased from 21.9 in 2020.
6. The Committee's previous recommendations and key learning points have been incorporated into South Australian policies, standards and guidelines. These recommendations and key learning points are available within previous year's reports available on the Preventive Health SA [website](#).

Data presented in this report should be interpreted with caution as small numbers are prone to fluctuations.

Key Learning Points

- An induction of labour (or Caesarean section if indicated) should be offered no later than 41 weeks gestation in any ongoing pregnancy.
- Diagnosis of ruptured membranes using ferning on microscopy, AmniSure and ActimPROM is best practice. The use of Amnistix should be abandoned.
- If there is a history of preterm birth, cervical monitoring should commence at 14 weeks gestation.
- All those providing care during the perinatal period are recommended to undertake the free [Stillbirth Investigations and Bereavement Care course](#).

Introduction

This is the Thirty-sixth 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:

The Committee with respect to maternal and perinatal mortality will:

- Monitor the pattern and causation of maternal and perinatal deaths in the state.
- Assess 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;
- Assist in the 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.
- Act as a Custodian of the mortality data submitted to, and generated by the Committee.
- Obtain data from the Pregnancy Outcome Unit, Local Health Networks and public and private health entities (where required) in a secure and confidential manner.
- Receive relevant clinical information from other statutory or regulatory bodies such as Births, Deaths and Marriages.

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. Confidential reports on perinatal death, submitted by doctors, midwives and nurses
2. Data linkage with Births, Deaths and Marriages, from medical certificates of cause of perinatal death
3. Data linkage with Births, Deaths and Marriages, from medical certificates of cause of death for maternal deaths
4. Supplementary Birth Records

Further information is obtained from practitioners identified as having been in charge of clinical care through the completion of confidential medical reports (Appendix 2), and these are supplemented by autopsy information from the Coroner's Office and hospital pathology services. Case summaries are prepared by the Committee's secretariat 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-sixth report of the Committee incorporates information on maternal deaths in South Australia in the year 2021 and perinatal deaths of babies born to mothers in South Australia in 2021.

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. The Committee has an Aboriginal health care provider representative to address areas of concern in relation to Aboriginal maternal and perinatal health.

Maternal Mortality

Maternal mortality statistics

Maternal death is defined by The World Health Organization (WHO) as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the cause of death (obstetric and non-obstetric)¹. The definition encompasses direct and indirect maternal deaths. Deaths from accidental and incidental causes are excluded (see Methods and Terminology).

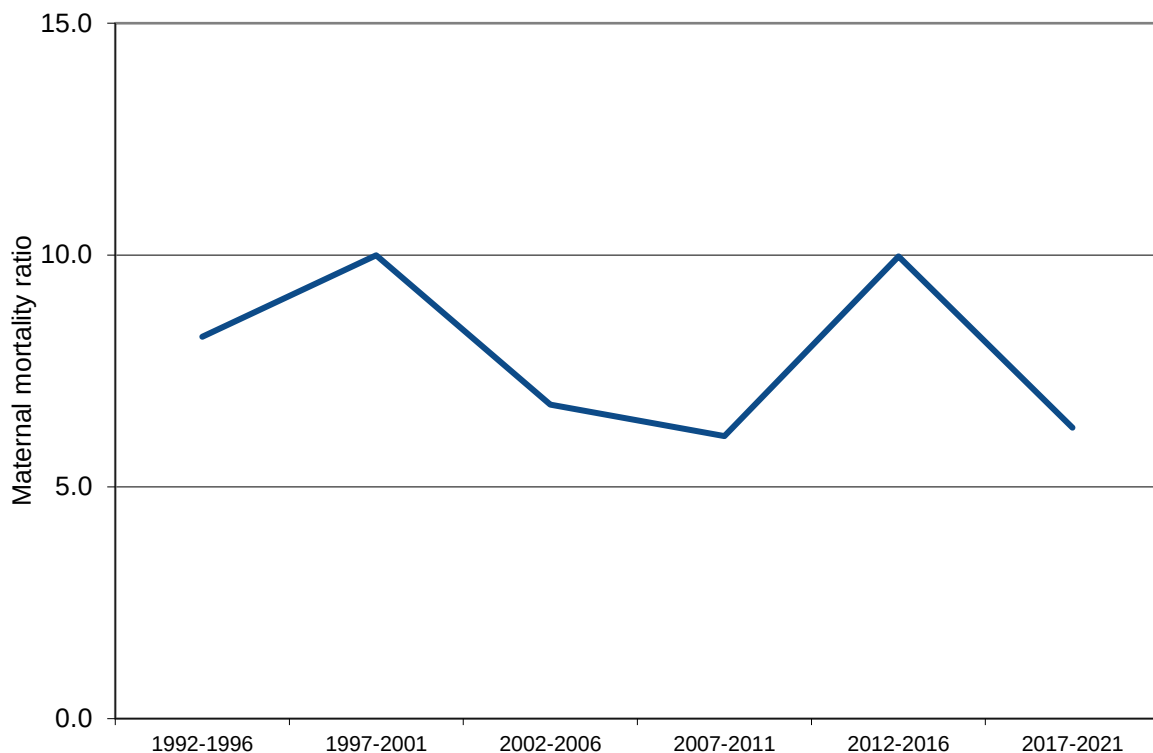
The Australian Institute of Health and Welfare National Advisory Committee on Maternal Mortality complies with international reporting protocols and reports a maternal mortality ratio (see Methods and Terminology) which only includes pregnancy-related deaths, that is, direct and indirect maternal deaths, 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. 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 five late maternal deaths in South Australia in 2021. Data linkage is used to improve detection and enhance reporting on maternal deaths occurring in the state.

Maternal deaths in South Australia for the three categories of deaths from 1992 to 2021 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 five-year period 2017-2021 was 6.3, which was the same as the Australian maternal mortality ratio of 6.3 per 100,000 women for the period 2012-2021. The number of deaths in South Australia is small and has not changed greatly in the last three decades. Of a total of 45 pregnancy-related maternal deaths in the period 1992-2021, 26 were direct deaths and 19 were indirect deaths. In the five-year period from 2017-2021, there has been one indirect death of an Aboriginal woman.

Table 1: Maternal mortality by category of death, in 5-year periods, South Australia, 1992 – 2021

Years	Direct deaths	Indirect deaths	Incidental deaths	Total deaths	Direct and indirect maternal deaths	
	Number	Number	Number	Number	Number	Maternal mortality ratio*
1992-1996	4	4	3	11	8	8.2
1997-2001	3	6	4	13	9	10.0
2002-2006	4	2	1	7	6	6.8
2007-2011	5	1	3	9	6	6.1
2012-2016	6	4	1	11	10	10.0
2017-2021	4	2	0	6	6	6.3

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

Figure 1: Maternal Mortality Ratio, South Australia 1992-2021

Causes of maternal deaths

The cause of the maternal death in 2021 was:

- One direct death due to amniotic fluid embolism

The causes of the late maternal deaths in 2021 were:

- One late direct death due to amniotic fluid embolism
- One late direct death by suicide
- Two late incidental deaths due to cancer
- One late incidental death by suicide

Maternal Key Learning Points

There were no new Key Learning Points for 2021.

The Committee's previous recommendations and key learning points have been incorporated into South Australian policies, practices, standards and guidelines. A document containing previously-made recommendations and key learning points, together with the relevant code of practice, is available from the Preventive Health SA [website](#).

Perinatal Mortality

Perinatal mortality statistics

In 2021 there were 20,181 births in South Australia reported to the Pregnancy Outcome Unit. These included all births of at least 400g birthweight or 20 weeks gestation. There were 143 stillbirths and 20,038 live births. Forty 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 2021 was 9.1 deaths per 1,000 births. The stillbirth rate was 7.1 per 1,000 births and the neonatal mortality rate 2.0 per 1,000 live births. Fifty-five of the 183 perinatal deaths (30.1%) were induced terminations of pregnancy and their exclusion would have resulted in a perinatal mortality rate of 6.4 deaths per 1,000 births.

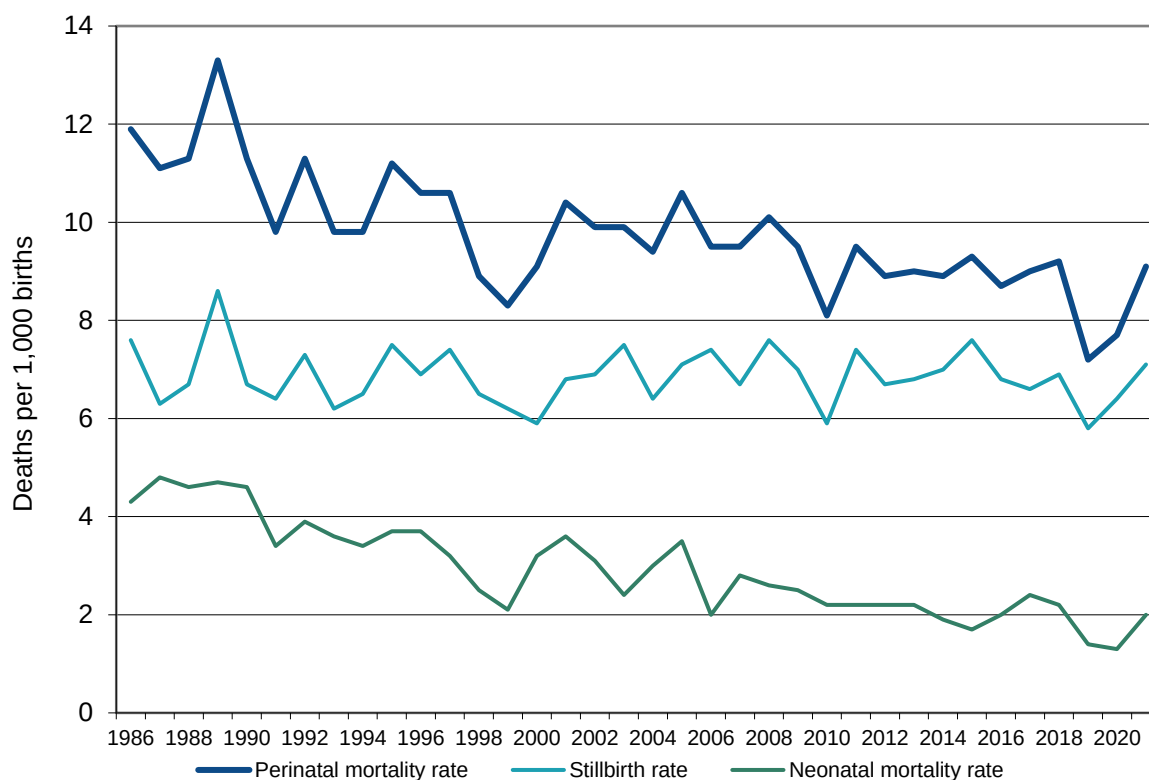
The perinatal mortality rates for other specified minimum birthweights or gestational ages (where birthweight was unavailable) are provided in Table 2. The WHO recommends that national perinatal mortality statistics should only include fetuses and infants weighing at least 500 grams and/or born at 22 weeks or more gestation⁹. For international comparison, inclusion of only fetuses and infants weighing at least 1,000g and/or born at 28 weeks or more gestation is recommended⁹. Using the WHO classification for international reporting, the perinatal mortality rate was 3.4 per 1,000 births in South Australia, with a stillbirth rate of 2.6 per 1,000 births, and neonatal mortality rate of 0.8 per 1,000 live births.

Table 2: Perinatal mortality, South Australia, 2021 (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	20,181	20,038	143	7.1	40	2.0	183	9.1
≥500g/ 22 weeks	20,124	20,029	95	4.7	31	1.5	126	6.3
≥1,000g/ 28 weeks	20,021	19,969	52	2.6	16	0.8	68	3.4

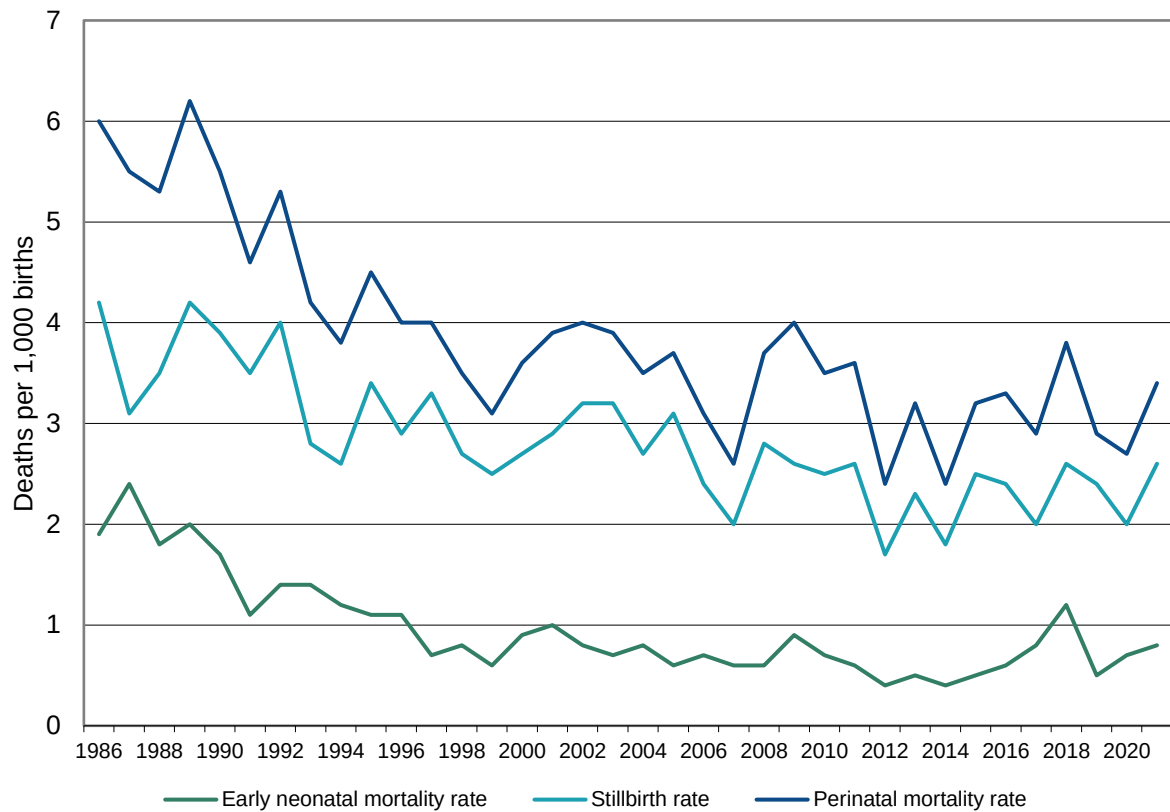
South Australian perinatal mortality rates, including stillbirth and neonatal mortality rates for all births, from 1986-2021 are presented in Figure 2. Whilst the neonatal mortality rate has been steadily declining, the stillbirth rate has not changed markedly over the last two decades.

Figure 2: Perinatal mortality rate (births $\geq$ 400g or 20 weeks gestation), South Australia 1986-2021



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 stillbirths and early neonatal deaths, occurring within the first seven days of life (WHO recommendation for international statistics⁹). In 2021, the early neonatal mortality rate for infants weighing at least 1,000g or having reached 28 weeks gestation was 0.8 per 1,000 live births. When births of at least 1,000g birthweight are considered, in line with WHO recommendations, a decrease in the stillbirth rate is evident from 4.2 deaths per 1,000 births in 1986 to 2.6 deaths per 1,000 births in 2021 (Figure 3).

Figure 3: Perinatal mortality rate (births $\geq 1,000\text{g}$ or 28 weeks gestation & early neonatal deaths within the first seven days of life), South Australia 1986-2021



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. For **South Australia, ABS records do not include stillbirths resulting from 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, 2011 – 2021

Year	NSW	VIC	Qld	SA	WA	Tas	NT	ACT	AUSTRALIA
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
2017	7.1	8.1	9.4	5.1	8.6	9.6	15.1	8.6	8.1
2018	6.9	8.2	7.8	5.5	7.9	10.2	16.8	9.4	7.6
2019	7.4	7.1	10.1	5.5	7.7	8.1	15.4	5.1	7.8
2020	8.1	7.4	10.0	5.1	9.5	10.5	18.8	6.7	8.4
2021	7.7	7.6	10.1	5.1	7.3	8.7	19.0	7.7	8.1

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

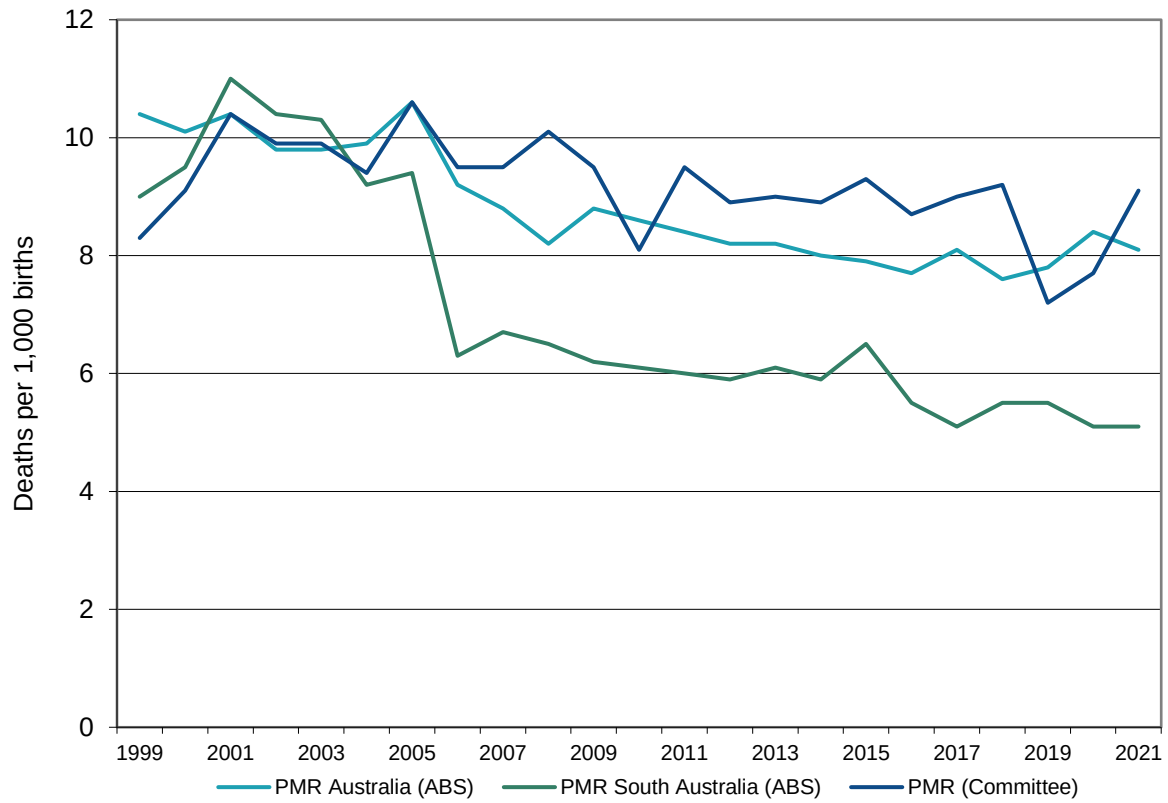
Source: Australian Bureau of Statistics. Catalogue No 3303.0 – Causes of Death, Australia, 2021, 19th October 2022

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 include all live births of any gestation and since 2006 has only included fetal deaths of at least 400 grams birthweight or of 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 of at least 20 weeks gestational age which resulted in neonatal death have been included in the perinatal mortality data.

The ABS perinatal mortality rates (PMR) for South Australia and Australia for 1999-2021 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.

Figure 4: Perinatal Mortality Rates South Australia (ABS), Australia (ABS) and South Australian Maternal and Perinatal Mortality Committee (Committee) 1999-2021 Deaths per 1,000 births¹



Source: Australian Bureau of Statistics. Catalogue No 3303.0 – Causes of Death, Australia, 2021, 19th October 2022

¹Refer above for definitional differences

Birthweight-specific perinatal mortality

The birthweight-specific rates of stillbirths, neonatal deaths and perinatal deaths for 2021 are provided in Table 4. Of the 183 perinatal deaths, 145 (79.2%) were of low birthweight (<2,500g) and 31 (77.5%) of the 40 neonatal deaths were low birthweight babies. Sixty-one of the perinatal deaths (33.3%) were less than 400g birthweight.

Table 4: Perinatal mortality by birthweight, all births, South Australia, 2021

Birthweight (grams)	Stillbirths				Neonatal deaths		Perinatal deaths	
	Total births	Live births	Number	Deaths per 1,000 births	Number	Deaths per 1,000 live births	Number	Deaths per 1,000 births
<400	61	0	53	868.9	8	131.1	61	1,000.0
400-499	32	3	22	687.5	7	218.8	29	906.3
500-749	45	22	16	355.6	7	155.6	23	511.1
750-999	48	39	6	125.0	3	62.5	9	187.5
1,000-1,499	130	122	7	53.8	1	7.7	8	61.5
1,500-1,999	286	276	7	24.5	3	10.5	10	35.0
2,000-2,499	851	846	3	3.5	2	2.4	5	5.9
2,500-2,999	3,129	3,116	11	3.5	2	0.6	13	4.2
3,000-3,499	7,539	7,527	8	1.1	4	0.5	12	1.6
3,500-3,999	6,058	6,049	7	1.2	2	0.3	9	1.5
4,000-4,499	1,768	1,766	1	0.6	1	0.6	2	1.1
≥4,500	234	232	2	8.5	0	0.0	2	8.5
Unknown	0	0	0	0.0	0	0.0	0	0.0
Total	20,181	19,998	143	7.1	40	2.0	183	9.1

The time of perinatal death by birthweight are presented in Table 5. Of the 75 antepartum deaths, 29 were under 750g birthweight (38.7%). Of the intrapartum deaths 88.5% were under 750g birthweight.

Table 5: Time of perinatal death by birthweight, South Australia, 2021 (≥ 400 g birthweight or 20 weeks gestation)

Birthweight (grams)	Stillbirths			Neonatal deaths	Total
	Antepartum	Intrapartum	Uncertain if antepartum or intrapartum		
<500	24	23	28	15	90
500-749	5	0	11	7	23
750-999	4	1	1	3	9
1,000-1,499	7	0	0	1	8
1,500-1,999	6	0	1	3	10
2,000-2,499	3	0	0	2	5
2,500-2,999	10	1	0	2	13
3,000-3,499	6	1	1	4	12
3,500-3,999	7	0	0	2	9
4,000-4,499	1	0	0	1	2
≥ 4500	2	0	0	0	2
Unknown	0	0	0	0	0
Total	75	26	42	40	183

Gestation-specific perinatal mortality

The distribution of perinatal deaths by gestational age is provided in Table 6. There were 149 preterm births (<37 weeks gestation) that resulted in a perinatal death, accounting for 81.4% of all perinatal deaths.

Table 6: Perinatal mortality by gestational age at birth, South Australia, 2021 (≥ 400 g or 20 weeks gestation)

Gestation 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	112	31	81	723.2	20	645.2	101	901.8
24-27	61	48	13	213.1	4	83.3	17	278.7
28-31	188	181	7	37.2	3	16.6	10	53.2
32-36	1,451	1,434	17	11.7	4	2.8	21	14.5
37-41	18,324	18,299	25	1.4	9	0.5	34	1.9
≥ 42	43	43	0	0.0	0	0.0	0	0.0
Unknown	2	2	0	0.0	0	0.0	0	0.0
Total	20,181	20,038	143	7.1	40	2.0	183	9.1

Classification of perinatal deaths

The Perinatal Subcommittee classified each of the 183 perinatal deaths, which occurred in 2021 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 Stillbirth Centre of Research Excellence (Stillbirth CRE) [website](#). The Committee has used this classification system for deaths from 1999 onward. Prior to 2019 perinatal deaths were coded according to PSANZ Perinatal Death Classification version 2.2. From 1st January 2019 all perinatal deaths have been classified according to version 3.2 of the PSANZ-PDC and PSANZ-NDC codes. Consequently, comparison can only be made between 2019 to 2021 data. Table 7 presents the classification of perinatal deaths in 2021 according to PSANZ-PDC.

Table 7: Classification of perinatal deaths, PSANZ-PDC, South Australia, 2021

	PSANZ-PDC	Number	Percent	Deaths per 1,000 births
1	Congenital anomaly	56	30.6	2.8
2	Perinatal infection	10	5.5	0.5
3	Hypertension	6	3.3	0.3
4	Antepartum haemorrhage (APH)	12	6.6	0.6
5	Maternal conditions	4	2.2	0.2
6	Complications of multiple pregnancy	7	3.8	0.3
7	Specific perinatal conditions	7	3.8	0.3
8	Hypoxic peripartum death	5	2.7	0.2
9	Placental dysfunction or causative placental pathology	31	16.9	1.5
10	Spontaneous preterm labour or rupture of membranes (<37 weeks gestation)	29	15.8	1.4
11	Unexplained antepartum fetal death	12	6.6	0.6
12	Neonatal death without obstetric antecedent	4	2.2	0.2
	Total	183	100.0	9.1

Perinatal deaths in 2021 by PSANZ-PDC subgroups are provided in Appendix 3. PSANZ-PDC by birthweight is presented in Appendix 5.

Congenital anomalies were the leading cause of perinatal death in 2021, accounting for 30.6% of all deaths. The next leading cause was placental dysfunction or causative placental pathology (16.9%), followed by spontaneous preterm labour or rupture of membranes (15.8%), antepartum haemorrhage (6.6%) and unexplained antepartum fetal death (6.6%).

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

Congenital anomaly – fifty-six deaths

This group of 56 deaths in 2021 included 50 terminations of pregnancy, at 20 weeks gestation or more, of fetuses with congenital anomalies. The types of anomalies were as follows:

Nervous system – thirteen deaths

- Anencephaly: 2 deaths
- Chiari II malformation: 2 deaths
- Neuronal migration disorder: 2 deaths
- Other anomalies including ventriculomegaly, schizencephaly, holoprosencephaly and Dandy Walker malformation: 7 deaths

Cardiovascular – ten deaths

- Hypoplastic left heart syndrome: 4 deaths
- Atrioventricular septal defect: 3 deaths
- Other cardiovascular anomalies: 3 deaths

Genitourinary System – two deaths

- Hydronephrosis: 1 death
- Multicystic dysplastic kidneys: 1 death

Gastrointestinal system – zero deaths

Musculoskeletal – three deaths

- Gastroschisis: 1 death
- Cleft lip and palate: 1 death
- Spinal anomalies: 1 death

Respiratory system – zero deaths

Haematological – zero deaths

Multiple congenital anomaly – five deaths

- Multiple anomalies including renal agenesis, megacystis, pulmonary hypoplasia, cleft lip and palate, absent cavum septum pellucidum and Gibbus kyphosis of the proximal lumbar spine: 5 deaths

Other congenital anomaly – zero deaths

Chromosomal – fifteen deaths

- Trisomy 21: 2 deaths
- Trisomy 18: 1 death
- Trisomy 13: 2 deaths
- Triploidy: 1 death
- Turner syndrome: 3 deaths
- Other chromosomal deletions and duplications: 6 deaths

Genetic anomaly – eight deaths

- Osteogenesis imperfecta: 3 deaths
- Other genetic anomalies, such as thanatophoric dysplasia, campomelic dysplasia, haemoglobin Barts and Smith-Lemli-Opitz syndrome: 5 deaths

Perinatal infection – ten deaths

Bacterial – eight deaths

- Group B Streptococcal infection: 2 deaths
- Escherichia coli infection: 1 death
- Other bacterial including Ureaplasma urealyticum: 5 deaths

Viral – one death

- Cytomegalovirus: 1 death

Fungal – zero deaths

Other specified organism – one death

- Fetal sepsis with multiple organisms identified: 1 death

Hypertension – six deaths

- Pre-eclampsia: 6 deaths

Antepartum haemorrhage – twelve deaths

- Placental abruption: 12 deaths

Maternal conditions – four deaths

- Maternal diabetes: 3 deaths
- Maternal amniotic fluid embolism: 1 death

Complications of multiple pregnancy – seven deaths

- Twin to twin transfusion syndrome: 3 deaths
- Cord entanglement: 2 deaths
- Selective fetal growth restriction: 1 death
- Other complications of multiple pregnancies: 1 death

Specific perinatal conditions – seven deaths

- Fetomaternal haemorrhage: 4 deaths
- Cord occlusion: 1 death
- Amniotic band syndrome: 1 death
- Maternal fibroids: 1 death

Hypoxic peripartum death – five deaths

- Peripartum hypoxic deaths with evidence of significant fetal compromise: 3 deaths
- Birth trauma: 1 death
- Unspecified hypoxic peripartum death: 1 death

Placental dysfunction or causative placental pathology – thirty-one deaths

- Maternal vascular malperfusion: 10 deaths
- Fetal vascular malperfusion: 14 deaths
- Placental hypoplasia: 5 deaths
- High grade villitis of unknown etiology: 1 death
- Severe chronic intervillitis: 1 death

Spontaneous preterm labour or rupture of membranes (<37 weeks gestation) – twenty-nine deaths

- Spontaneous preterm labour preceded by premature cervical shortening: 12 deaths
- Spontaneous preterm labour or rupture of membranes with histological chorioamnionitis: 14 deaths
- Spontaneous preterm labour or rupture of membranes without histological chorioamnionitis: 3 deaths

Unexplained antepartum fetal deaths – twelve deaths

- Unexplained despite full investigation: 5 deaths
- Unclassifiable with incomplete investigation: 7 deaths

Neonatal death without obstetric antecedent – four deaths

- No obstetric antecedent factors despite full investigation: 3 deaths
- Unclassifiable as to obstetric antecedent with incomplete investigation: 1 death

Classification of neonatal deaths

The classification of the 40 neonatal deaths according to the Perinatal Society of Australia and New Zealand – Neonatal Death Classification (PSANZ-NDC) is provided in Appendix 4. This classification is also available, together with PSANZ-PDC, on the Stillbirth CRE [website](#).

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

20-23 weeks gestation – twenty neonatal deaths

- Not resuscitated, or resuscitation was ultimately unsuccessful: 15 deaths
- Congenital anomalies: 4 deaths
- Bacterial infection: 1 death

24-31 weeks gestation – seven neonatal deaths

- Gastroschisis: 1 death
- Bowel perforations: 2 deaths
- Respiratory distress syndrome: 1 death
- Hypoxic ischaemic encephalopathy: 1 death
- Intraventricular haemorrhage: 1 death
- Sepsis: 1 death

32-36 weeks gestation – four neonatal deaths

- Hypoxic ischaemic encephalopathy after placental abruption or preterm birth: 3 deaths
- Congenital anomaly: 1 death

37 weeks and greater gestation – nine neonatal deaths

- Hypoxic ischaemic encephalopathy: 3 deaths
- Cranial haemorrhage: 1 death
- Multisystem failure: 1 death
- Meconium aspiration syndrome: 1 death
- Non-accidental trauma: 1 death
- SIDS: 1 death
- Genetic condition: 1 death

Aboriginal perinatal deaths

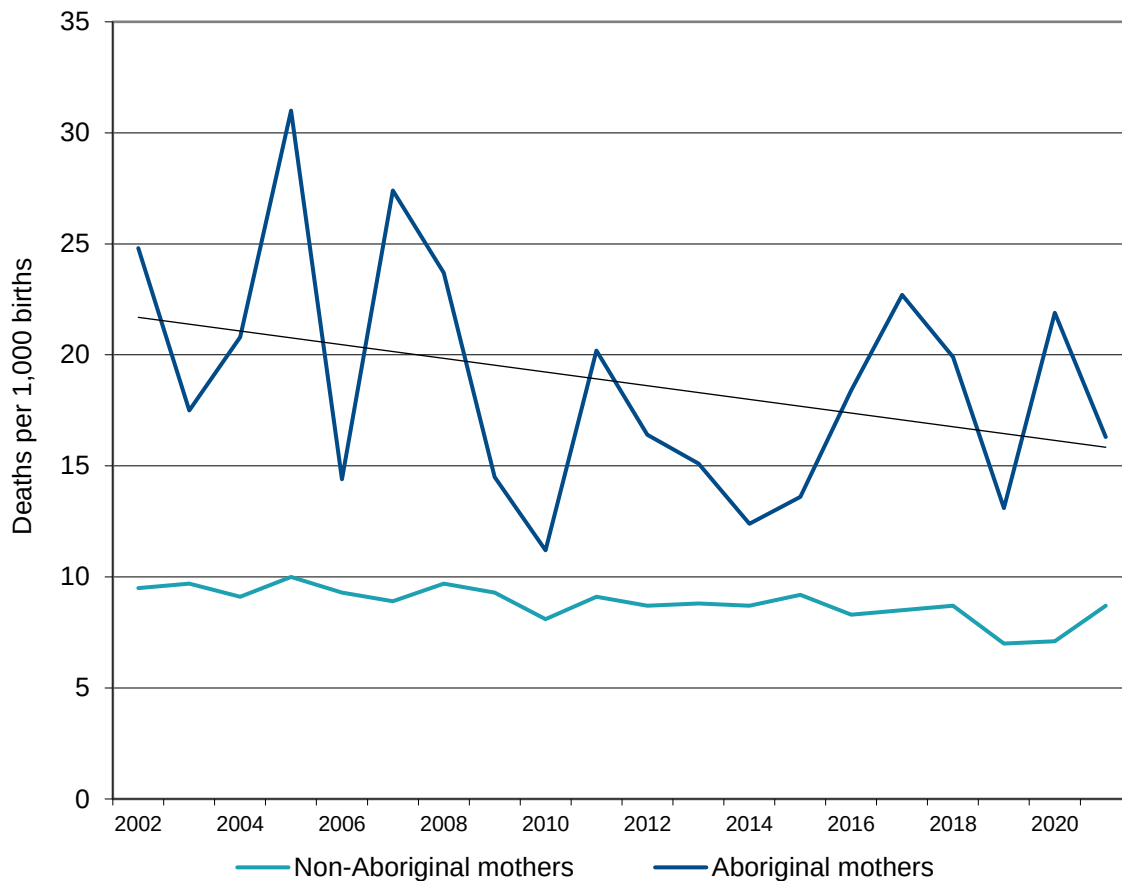
There were fourteen perinatal deaths (8 stillbirths and 6 neonatal deaths) among the births to 860 Aboriginal women.

In 2021 the perinatal mortality rate for births to Aboriginal women was 16.3 per 1,000 births, compared to 8.7 per 1,000 births for births to non-Aboriginal women. The perinatal death rate has increased for Aboriginal women in 2021. Although the perinatal mortality rate for Aboriginal births fluctuates widely due to the small number of deaths, recent years show a decreasing trend (Figure 5).

Thirteen of the 14 infants were born in public metropolitan hospitals, one was born in a country hospital. Twelve of the infants were preterm births, with five born before 24 weeks gestation. Eight of the Fourteen mothers were metropolitan residents, three were country residents and three were from interstate.

The causes of the 14 deaths were attributed to such causes as preterm labour, bacterial infection, maternal diabetes, congenital anomalies and placental abruption.

Figure 5: Perinatal mortality by maternal Aboriginal status, South Australia, 2002 – 2021



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 84 of the 183 perinatal deaths (45.9%), including two 'limited' autopsies. The proportion of autopsies undertaken has decreased compared to 2020 (55.6%). The stillbirth investigations algorithm from the PSANZ Clinical Practice Guideline for Care Around Stillbirth and Neonatal Death is located at Appendix 7.

Additionally, 'Other examinations' were performed for 22 (12.0%) of the perinatal deaths. Placental histological examinations were undertaken for 178 perinatal deaths (97.3%). Please see [Histopathology Management of the Placenta PPG](#) 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, 2021

Place of death	Deaths	Autopsies performed	
	Number	Number	Percent of deaths
Women's & Children's Hospital	92	39	42.4
Lyell McEwin Hospital	21	11	52.4
Flinders Medical Centre	42	21	50.0
Other metropolitan public hospitals	1	1	100.0
Metropolitan private hospitals	8	4	50.0
Country hospitals	16	6	37.5
Other	3	2	66.7
Total	183	84*	45.9

* Includes 2 autopsies with limited dissection

The low proportion of autopsies conducted in perinatal deaths remains a concern. A good quality autopsy is invaluable in confirming antenatal diagnoses, eliciting other findings of clinical significance, particularly significant negative findings, and determining the time course of events leading to death. 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) 8161 6315**.

All hospitals with maternity services receive information on the State Perinatal Autopsy Service. The Department for Health and Wellbeing 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](#).

Additional information on perinatal autopsies and resources for families are available on the SA Health [website](#).

Perinatal Key Learning Points

- An induction of labour (or Caesarean section if indicated) should be offered no later than 41 weeks gestation in any ongoing pregnancy.
- Diagnosis of ruptured membranes using ferning on microscopy, AmniSure and ActimPROM is best practice. The use of Amnistix should be abandoned.
- If there is a history of preterm birth, cervical monitoring should commence at 14 weeks gestation.
- All those providing care during the perinatal period are recommended to undertake the free [Stillbirth Investigations and Bereavement Care](#) course.

The Committee's previous recommendations and key learning points have been incorporated into South Australian policies, practices, standards and guidelines (Appendix 6).

Education Subcommittee Report

The twenty-sixth annual educational meeting - 'The Annual Dr Brian Pridmore Perinatal Forum' - was held on the evening of 27th September 2023. The forum is organized by the Education Subcommittee of the Maternal and Perinatal Mortality Committee.

The forum was titled 'Cultural Kaleidoscope' and explored the perinatal aspects of caring for a cultural diverse community. The 2023 forum was held in the Queen Victoria Lecture Theatre in the Women's and Children's Hospital. For the third consecutive year the forum was also streamed online, via Teams. The forum was presented to an audience of approximately 60 people.

Dr Vineesh Bhatia, Chair of the Education Subcommittee, introduced the topic, followed by a short presentation by each of the panel members. The evening concluded with a question and answer session. Presenters were as follows:

- Associate Professor Zohra Lassi
- Associate Professor Amy Keir
- Ms Monica Diaz
- Ms Toni-Marie Rowe, Ms Skye Dixon and Ms Jenelle Ah Kit Wellington

The audience was comprised mostly of midwives with a small number of medical practitioners, nurses and other health professionals. For the first time the majority (56%) viewed the forum online via Teams, with the remainder attending in person. There was a broad representation across the health services, with employees of seven LHNs as well as private practices and other organisations in attendance. Feedback received from the audience was positive with the majority of attendees satisfied or very satisfied with the presentations. The feedback is used by the Subcommittee to guide future topic choices and improve the event.

This forum was filmed, and an edited version with transcripts can be viewed on the SA Health [website](#).

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 education within South Australia.

Useful links

- The SA Health Pregnancy Information website: <http://www.health.sa.gov.au/pregnancy>
- The South Australian Perinatal Practice Guidelines website: <http://www.sahealth.sa.gov.au/perinata>
- The Child Death and Serious Injury Review Committee reports: <http://www.cdsirc.sa.gov.au>
- The Sudden Infant Death Syndrome website: <https://rednose.org.au/>
- The South Australian Child and Family Health Service website: <https://www.cafhs.sa.gov.au/>
- The South Australian Safe Infant Sleeping Standards: www.sahealth.sa.gov.au/wps/wcm/connect/public+content/sa+health+internet/clinical+resources/clinical+programs+and+practice+guidelines/womens+and+babies+health/safe+infant+sleeping+standards/safe+infant+sleeping+standards
- The Courts Administration Authority of South Australia, Coroners Findings: <https://www.courts.sa.gov.au/court-decisions/coroners-findings/>
- Gestation Network customised birthweight centile calculator: <http://www.gestation.net>
- Perinatal Society of Australia and New Zealand (PSANZ) website: <http://www.psanz.com.au>
- The Centre of Research Excellence in Stillbirth: <https://www.stillbirthcre.org.au>
- SA Health stillbirth resources for parents and families: <https://www.sahealth.sa.gov.au/stillbirth>
- Stillbirth Investigations and Bereavement Care course: <https://launch.sahealth.sa.gov.au/course/details/stillborn-autopsy>

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 from any cause related to or exacerbated by pregnancy, or its management, that occurs during pregnancy and childbirth or within 42 days of the end of pregnancy, regardless of the duration or site of the pregnancy. Deaths from accidental and incidental causes are excluded.

Maternal deaths are classified as follows:

- **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.
- **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.
- **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.

Late maternal deaths: deaths occurring from 43 days postpartum up to and including 365 days postpartum)

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 27 days of birth, where the day of birth is day zero

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

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

In 2023, the Committee's Terms of reference were revised and updated.

Maternal Subcommittee

- To improve maternal outcomes during and after birth and institute systemic safety by providing advice on strategies for system improvement at a statewide level.
- To determine preventable factors involved with deaths associated with pregnancy through further investigation or research into the causes of mortality and morbidity in the state.
- To provide key learning points to the Chief Executive in an annual report through the Maternal and Perinatal Mortality Committee.
- To provide advice to the Chief Executive where requested regarding matters relevant to the safety and quality of health care.
- To support a culture of safety and quality where analysis of adverse events and continuous improvement are central.

Perinatal Subcommittee

- To improve perinatal outcomes during and after birth and institute systemic safety by providing advice on strategies for system improvement at a statewide level.
- To determine preventable factors involved with perinatal deaths associated with pregnancy through further investigation or research into the causes of mortality and morbidity in the state.
- To provide key learning points to the Chief Executive in an annual report through the Maternal and Perinatal Mortality Committee.
- To provide advice to the Chief Executive where requested regarding matters relevant to the safety and quality of health care.
- To support a culture of safety and quality where analysis of adverse events and continuous improvement are central.

Education Subcommittee

- To provide an annual interactive forum for the continuing education of midwives and medical practitioners involved in the provision of perinatal services within metropolitan and regional South Australia.
- To act as an additional means of communication to the above providers, other health professionals and the community generally from the Maternal and Perinatal Mortality Committee.
- The membership and chairperson will be nominated by the chairperson of the Maternal and Perinatal Mortality Committee.
- The Subcommittee may co-opt members as required.

Appendix 2

 Government of South Australia	Wellbeing SA	Confidential Report on Perinatal Death This form should be forwarded to the SOUTH AUSTRALIAN MATERNAL AND PERINATAL MORTALITY COMMITTEE PO BOX 287, Rundle Mall SA 5000 Committee Secretary tel: 7117 9212
Affix patient label here		

The Perinatal Subcommittee meet regularly to determine the cause of death and possible contributing factors for stillbirths (including GTOPs) and neonatal deaths with a gestation of at least **20 weeks** or a birthweight of at least **400g** in South Australia. This form complements data from the Medical Certificate of Cause of Perinatal Death and the Supplementary Birth Record.
 Where available, provide printed electronic records to supplement details. This may include discharge summaries, ultrasounds and pathology results. This is essential where details are not available through the SA Health data systems.
 For multiple gestation, complete a separate form for each baby.

MOTHER DETAILS

Surname _____ Given names _____ Date of birth _____
 Clinician(s) responsible for antenatal care _____
 Clinician(s) responsible for intra and postpartum care (*if different to above*) _____

BABY DETAILS

Surname (*if different to above*) _____ Date of birth _____
 Hospital of birth _____
 Intended place of birth (*if different to above*) _____
 Clinician responsible for care _____
 Multiple birth Yes ☐ No ☐ Birth order 1 ☐ 2 ☐ 3 ☐
 Gestation at birth _____ in weeks+days
 Date of death _____ Time of death _____

PREVIOUS OBSTETRIC MEDICAL AND SOCIAL HISTORY *If yes, provide all details below*

Pre-existing medical conditions? Yes ☐ No ☐ _____

 Previous obstetric complications? Yes ☐ No ☐ _____

 Regular antenatal care attendance? Yes ☐ No ☐ _____
 Referral to Aboriginal Birthing Clinic? Yes ☐ No ☐ _____
 Describe any factors influencing antenatal care (psychosocial/geographic etc) _____

ANTENATAL HISTORY AND IDENTIFIED RISKS *If yes is answered to any question, provide all details below or ensure details are available in OACIS*

Presentations for abnormal fetal movements?	Yes ☐ No ☐	Number of Presentations/Comments
Antenatal CTG's	Yes ☐ No ☐	Results/Comment
GBS screening	Yes ☐ No ☐	Results/Comment
Early OGTT	Yes ☐ No ☐	Results/Comment
Other screening procedures	Yes ☐ No ☐	Comment
Medications taken during this pregnancy	Yes ☐ No ☐	List all medications
Describe other antenatal conditions / complications		Specify

ULTRASOUNDS - Attach copy of reports where available in lieu of below
Record gestation, where the scan was performed, and the results of each scan.

Scan No.	Date	Gestation (<i>weeks</i>)	Site/location	Results
1 st				
2 nd				
3 rd				
4 th				
5 th				
6 th				
7 th				
8 th				

Summary

Summary of events

Membranes ruptured – date/time			
Liquor appearance:	Clear ☐ Pink ☐ Blood stained ☐ Green ☐ MSL ☐	Other/describe	
Signs of maternal or fetal infection?	Yes ☐ No ☐	If yes, provide details	
Were there technical issues with monitoring?	Yes ☐ No ☐	If yes, provide details	
Was this an intrapartum death?	Yes ☐ No ☐	Attach all CTG's	
When was the fetal heart last heard? if intrapartum death			
Labour length	1 st stage <i>hrs</i>	<i>mins</i>	2 nd stage <i>hrs</i> <i>mins</i>
Autopsy	Yes ☐ No ☐	if no, describe external appearance	
Autopsy counselling by senior clinician	Yes ☐ No ☐		
Placenta to histopathology	Yes ☐ No ☐		
Was this a termination of pregnancy?	Yes ☐ No ☐		

Details

A thorough summary of circumstances provided in this space will assist the committee to formulate recommendations to improve the safety and quality of maternity services in South Australia.

Suggested events that may be included in your summary:

- circumstances of discovery ie presentation with decreased fetal movements or at a regular antenatal visit
- any treatments, procedures and complications
- all details of neonatal course
- details of retrievals or transfers

Describe details of events – *this section cannot be left blank*

[illegible]

Name and designation of person completing the form	Date
--	------

Appendix 3

Perinatal Society of Australia and New Zealand-Perinatal Death Classification (PSANZ-PDC), South Australian perinatal deaths, 2021

	Category	Subcategory	Category
	No	No	%
1 Congenital Anomaly	56		30.6
1.1 Structural anomaly	33		18.0
1.11 Nervous system		13	7.1
1.12 Cardiovascular system		10	5.5
1.13 Genitourinary system		2	1.1
1.14 Gastrointestinal system		0	0.0
1.15 Musculoskeletal		2	1.1
1.151 Congenital diaphragmatic hernia		0	0.0
1.152 Gastroschisis/omphalocele		1	0.5
1.16 Respiratory system (include congenital pulmonary airway malformation (CPAM))		0	0.0
1.17 Haematological		0	0.0
1.18 Multiple Congenital anomaly (no chromosomal/genetic cause or not tested)		5	2.7
1.19 Other congenital abnormality		0	0.0
1.192 Idiopathic hydrops fetalis		0	0.0
1.193 Fetal tumour (include sacro-coccygeal teratoma)		0	0.0
1.198 Other specified		0	0.0
1.199 Congenital anomaly, unspecified		0	0.0
1.2 Chromosomal anomaly	15		8.2
1.21 Down syndrome (trisomy 21)		2	1.1
1.22 Edward syndrome and Patau syndrome (trisomy 18, trisomy 13)		3	1.6
1.23 Other trisomies and partial trisomies of the autosomes, not elsewhere classified (includes pathogenic duplications, unbalanced translocations and insertions)		5	2.7
1.24 Monosomies and deletions from the autosomes, not elsewhere classified (includes pathogenic deletions e.g. 22q11.2 deletion syndrome (DiGeorge syndrome), Wolf-Hirschhorn syndrome, Cri-du-Chat syndrome)		1	0.5
1.25 Turner syndrome (monosomy X)		3	1.6
1.26 Other sex chromosome abnormalities (e.g. Klinefelter syndrome)		0	0.0
1.28 Other chromosomal abnormalities, not elsewhere specified (includes Fragile X syndrome, imprinting syndromes, triploidy)		1	0.5
1.29 Unspecified		0	0.0
1.3 Genetic anomaly	8		4.4
1.31 Genetic condition, specified (e.g. Tay-Sachs disease; includes inborn errors of metabolism)		7	3.8
1.32 Syndrome/association with demonstrated chromosomal/gene anomaly.		1	0.5
1.39 Genetic condition, unspecified		0	0.0
2 Perinatal Infection	10		5.5
2.1 Bacterial	8		4.4
2.11 Group B Streptococcus		2	1.1
2.12 E coli		1	0.5
2.13 Listeria monocytogenes		0	0.0
2.14 Spirochaetal e.g. Syphilis		0	0.0

2.18 Other bacterial		5	2.7
2.19 Unspecified bacterial		0	0.0
2.2 Viral	1		0.5
2.21 Cytomegalovirus		1	0.5
2.22 Parvovirus		0	0.0
2.23 Herpes simplex virus		0	0.0
2.24 Rubella virus		0	0.0
2.25 Zika virus		0	0.0
2.28 Other viral		0	0.0
2.29 Unspecified viral		0	0.0
2.3 Protozoal e.g. Toxoplasma		0	0.0
2.5 Fungal	0		0.0
2.8 Other specified organism	1		0.5
2.9 Other unspecified organism	0		0.0
3 Hypertension	6		3.3
3.1 Chronic hypertension: essential	0		0.0
3.2 Chronic hypertension: secondary, e.g. renal disease	0		0.0
3.3 Chronic hypertension: unspecified	0		0.0
3.4 Gestational hypertension	0		0.0
3.5 Pre-eclampsia	6		3.3
3.6 Pre-eclampsia superimposed on chronic hypertension	0		0.0
3.9 Unspecified hypertension	0		0.0
4 Antepartum Haemorrhage (APH)	12		6.6
4.1 Placental abruption	12		6.5
4.2 Placenta praevia	0		0.0
4.3 Vasa praevia	0		0.0
4.9 APH of undetermined origin	0		0.0
5 Maternal Conditions	4		2.2
5.1 Termination of pregnancy for maternal psychosocial indications	0		0.0
5.2 Diabetes	3		1.6
5.21 Gestational diabetes		0	0.0
5.22 Pre-existing diabetes		3	1.6
5.3 Maternal injury	0		0.0
5.31 Accidental		0	0.0
5.32 Non-accidental		0	0.0
5.4 Maternal sepsis	0		0.0
5.5 Antiphospholipid syndrome	0		0.0
5.6 Obstetric cholestasis	0		0.0
5.8 Other specified maternal conditions	1		0.5
6 Complications of multiple pregnancy	7		3.8
6.1 Monochorionic twins	6		3.3
6.11 Twin to twin transfusion syndrome (TTTS)		3	1.6
6.12 Selective fetal growth restriction (FGR) (i.e. affecting only one twin)		1	0.5
6.13 Monoamniotic twins (including cord entanglement)		2	1.1
6.18 Other		0	0.0
6.19 Unknown or unspecified		0	0.0
6.2 Dichorionic twins	1		0.5
6.21 Early fetal death in a multiple pregnancy (<20 weeks gestation)		0	0.0
6.22 Selective fetal growth restriction (FGR)		0	0.0
6.28 Other		0	0.0
6.29 Unknown or unspecified		1	0.5
6.3 Complications of higher order multiples (3 or more fetuses)	0		0.0

6.31 Twin to twin transfusion syndrome (TTTS)	0	0.0
6.32 Selective fetal growth restriction (FGR)	0	0.0
6.33 Monoamniotic multiples (including cord entanglement)	0	0.0
6.34 Early fetal death in a multiple pregnancy (<20 weeks gestation)	0	0.0
6.38 Other	0	0.0
6.39 Unknown or unspecified	0	0.0
6.4 Complications where chorionicity is unknown	0	0.0
6.8 Other	0	0.0
6.9 Unspecified	0	0.0
7 Specific perinatal conditions	7	3.8
7.1 Fetomaternal haemorrhage	4	2.2
7.2 Antepartum cord or fetal vessel complications (excludes monochorionic twins or higher order multiples)	1	0.5
7.21 Cord vessel haemorrhage	0	0.0
7.22 Cord occlusion (True knot with evidence of occlusion or other)	1	0.5
7.28 Other cord complications	0	0.0
7.29 Unspecified cord complications	0	0.0
7.3 Uterine abnormalities	1	0.5
7.31 Developmental anatomical abnormalities (e.g. bicornuate uterus)	0	0.0
7.38 Other	1	0.5
7.39 Unspecified	0	0.0
7.4 Alloimmune disease	0	0.0
7.41 Rhesus isoimmunisation	0	0.0
7.42 Other red cell antibody	0	0.0
7.43 Alloimmune thrombocytopenia	0	0.0
7.48 Other	0	0.0
7.49 Unspecified	0	0.0
7.5 Fetal antenatal intracranial injury	0	0.0
7.51 Subdural haematoma	0	0.0
7.52 Fetal antenatal ischaemic brain injury	0	0.0
7.53 Fetal antenatal haemorrhagic brain injury	0	0.0
7.6 Other specific perinatal conditions	1	0.5
7.61 Complications of antenatal, diagnostic or therapeutic procedures:	0	0.0
7.611 Complications of prenatal diagnostic procedures	0	0.0
7.612 Complications of fetal ultrasound guided needle interventions (e.g. FBS/fetal transfusion, thoracocentesis, vesicocentesis, fetal cardiac valvoplasty, division of amniotic bands, fetal skin biopsy, unipolar/bipolar diathermy, RFA procedures)	0	0.0
7.613 Complications of fetal shunt interventions (e.g. pleuroamniotic shunt, vesicoamniotic shunt)	0	0.0
7.614 Complications of minimally invasive fetoscopic interventions (e.g. fetoscopic laser surgery for TTTS, FETO for CDH, laser ablation of posterior urethral valves)	0	0.0
7.615 Complications of open maternal fetal surgery (e.g. open maternal fetal surgery for spina bifida)	0	0.0
7.618 Other	0	0.0
7.62 Termination of pregnancy for suspected but unconfirmed congenital anomaly.	0	0.0
7.63 Amniotic band	1	0.5
7.68 Other	0	0.0
7.9 Unspecified	0	0.0
8 Hypoxic peripartum death	5	2.7
8.1 With intrapartum complications (sentinel events)	1	0.5
8.11 Uterine rupture	0	0.0

8.12 Cord prolapse		0	0.0
8.13 Shoulder dystocia		0	0.0
8.14 Complications of breech presentation		0	0.0
8.15 Birth trauma		1	0.5
8.16 Intrapartum haemorrhage		0	0.0
8.18 Other		0	0.0
8.2 Evidence of significant fetal compromise (excluding other complications)	3		1.6
8.3 No intrapartum complications recognised and no evidence of significant fetal compromise identified	0		0.0
8.9 Unspecified hypoxic peripartum death	1		0.5
9 Placental dysfunction or causative placental pathology	31		16.9
9.1 Maternal vascular malperfusion	10		5.4
9.2 Fetal vascular malperfusion	14		7.7
9.3 High grade villitis of unknown etiology (VUE)	1		0.5
9.4 Massive perivillous fibrin deposition/maternal floor infarction	0		0.0
9.5 Severe chronic intervillitis (Histiocytic intervillitis)	1		0.5
9.6 Placental hypoplasia	5		2.7
9.7 No causal placental pathology demonstrated, with antenatal evidence of poor placental function identified (such as abnormal fetal umbilical artery Doppler)	0		0.0
9.8 Placental pathological examination was not performed, with antenatal evidence of poor placental function identified (such as abnormal fetal umbilical artery Doppler)	0		0.0
9.9 Other placental pathology (e.g. multiple pathologies with evidence of loss of placental function leading to death)	0		0.0
10 Spontaneous preterm labour or rupture of membranes (<37 weeks gestation)	29		15.8
10.1 Spontaneous preterm	17		9.3
10.11 With histological chorioamnionitis		14	7.7
10.12 Without histological chorioamnionitis		3	1.6
10.13 With clinical evidence of chorioamnionitis, no examination of placenta		0	0.0
10.17 No clinical signs of chorioamnionitis, no examination of placenta		0	0.0
10.19 Unspecified or not known whether placenta examined		0	0.0
10.2 Spontaneous preterm preceded by premature cervical shortening	12		6.5
11 Unexplained antepartum fetal death	12		6.6
11.1 Unexplained antepartum fetal death despite full investigation	5		2.7
11.2 Unclassifiable antepartum fetal death with incomplete investigation	7		3.8
11.3 Unclassifiable antepartum fetal death due to unknown level of investigation	0		0.0
12 Neonatal death without obstetric antecedent	4		2.2
12.1 Neonatal death with no obstetric antecedent factors despite full investigation	3		1.6
12.2 Neonatal death unclassifiable as to obstetric antecedent with incomplete investigation	1		0.5
12.3 Neonatal death unclassifiable as to obstetric antecedent due to unknown level of investigation	0		0.0
Total	183		100.0

Appendix 4

Perinatal Society of Australia and New Zealand-Neonatal Death Classification (PSANZ-NDC), South Australian neonatal deaths, 2021

	Category No	Subcategory No	Category %
1 Congenital Anomaly	7		17.5
1.1 Structural anomaly	3		7.5
1.11 Nervous system		1	2.5
1.12 Cardiovascular system		0	0.0
1.13 Genitourinary system		0	0.0
1.14 Gastrointestinal system		0	0.0
1.15 Musculoskeletal		1	2.5
1.151 Congenital diaphragmatic hernia		0	0.0
1.152 Gastroschisis/omphalocele		1	2.5
1.16 Respiratory system (include congenital pulmonary airway malformation (CPAM))		0	0.0
1.17 Haematological		0	0.0
1.18 Multiple Congenital anomaly (no chromosomal/genetic cause or not tested)		0	0.0
1.19 Other congenital abnormality		0	0.0
1.192 Idiopathic hydrops fetalis		0	0.0
1.193 Fetal tumour (include sacro-coccygeal teratoma)		0	0.0
1.198 Other specified		0	0.0
1.199 Congenital anomaly, unspecified		0	0.0
1.2 Chromosomal anomaly	3		7.5
1.21 Down syndrome (trisomy 21)		0	0.0
1.22 Edward syndrome and Patau syndrome (trisomy 18, trisomy 13)		1	2.5
1.23 Other trisomies and partial trisomies of the autosomes, not elsewhere classified (includes pathogenic duplications, unbalanced translocations and insertions)		1	2.5
1.24 Monosomies and deletions from the autosomes, not elsewhere classified (includes pathogenic deletions e.g. 22q11.2 deletion syndrome (DiGeorge syndrome), Wolff-Hirschorn syndrome, Cri-du-Chat syndrome)		0	0.0
1.25 Turner syndrome (monosomy X)		1	2.5
1.26 Other sex chromosome abnormalities (e.g. Klinefelter syndrome)		0	0.0
1.28 Other chromosomal abnormalities, not elsewhere specified (includes Fragile X syndrome, imprinting syndromes, triploidy)		0	0.0
1.29 Unspecified		0	0.0
1.3 Genetic anomaly	1		2.5
1.31 Genetic condition, specified (e.g. Tay-Sachs disease; includes inborn errors of metabolism)		1	2.5
1.32 Syndrome/association with demonstrated chromosomal/gene anomaly.		0	0.0
1.39 Genetic condition, unspecified		0	0.0
2 Periviable infants (typically <24 weeks)	15		37.5
2.1 Not resuscitated (including infants where there is an antenatal plan for no resuscitation at birth or in the circumstance of re-directed care)	14		35.0
2.2 Unsuccessful resuscitation	1		2.5
2.9 Unspecified or not known whether resuscitation attempted	0		0.0
3 Cardio-respiratory disorders	2		5.0
3.1 Hyaline membrane disease / Respiratory distress syndrome (RDS)	1		2.5
3.2 Meconium aspiration syndrome	1		2.5
3.3 Primary persistent pulmonary hypertension	0		0.0
3.4 Pulmonary hypoplasia	0	0	0.0
3.5 Pulmonary haemorrhage	0	0	0.0
3.6 Air leak syndromes	0		0.0
3.61 Pneumothorax		0	0.0
3.62 Pulmonary interstitial emphysema		0	0.0
3.68 Other		0	0.0

3.7 Patent ductus arteriosus	0	0.0
3.8 Chronic neonatal lung disease (typically, bronchopulmonary dysplasia)	0	0.0
3.9 Other	0	0.0
3.91 Neonatal anaemia/hypovolaemia	0	0.0
4 Neonatal Infection	2	5.0
4.1 Congenital/Perinatal bacterial infection (early onset<48 hrs)	1	2.5
4.11 Blood stream infection/septicaemia	0	0.0
4.111 Positive culture of a pathogen	0	0.0
4.112 Clinical signs of sepsis + ancillary evidence but culture negative	0	0.0
4.12 Bacterial meningitis	0	0.0
4.13 Bacterial pneumonia	0	0.0
4.15 Multiple site bacterial infection	1	2.5
4.18 Other congenital bacterial infection e.g. gastroenteritis, osteomyelitis, cerebral abscess	0	0.0
4.19 Unspecified congenital infection	0	0.0
4.2 Congenital/Perinatal viral infection	0	0.0
4.3 Congenital fungal, protozoan, parasitic infection	0	0.0
4.4 Acquired bacterial infection (late onset>48hrs).	1	2.5
4.41 Blood stream infection/septicaemia	0	0.0
4.411 Positive culture of a pathogen	1	2.5
4.412 Clinical signs of sepsis + ancillary evidence but culture negative	0	0.0
4.42 Bacterial meningitis	0	0.0
4.43 Bacterial pneumonia	0	0.0
4.48 Other acquired bacterial infection e.g. gastroenteritis, osteomyelitis	0	0.0
4.49 Unspecified acquired infection	0	0.0
4.5 Acquired viral infection	0	0.0
4.6 Acquired fungal, protozoan, parasitic infection	0	0.0
5 Neurological	9	22.5
5.1 Hypoxic ischaemic encephalopathy/Perinatal asphyxia	7	17.5
5.2 Cranial haemorrhage	1	2.5
5.21 Intraventricular Haemorrhage	1	2.5
5.22 Subgaleal Haemorrhage	0	0.0
5.23 Subarachnoid Haemorrhage	0	0.0
5.24 Subdural Haemorrhage	0	0.0
5.28 Other intracranial haemorrhage	0	0.0
5.3 Post haemorrhagic hydrocephalus	0	0.0
5.4 Periventricular leukomalacia	0	0.0
5.8 Other	0	0.0
6 Gastrointestinal	2	5.0
6.1 Necrotising enterocolitis (NEC)	1	2.5
6.2 Short gut syndrome	0	0.0
6.3 Gastric or intestinal perforation (excluding NEC)	1	2.5
6.4 Gastrointestinal haemorrhage	0	0.0
6.8 Other	0	0.0
7 Other	3	7.5
7.1 Sudden unexpected death in infancy (SUDI)	1	2.5
7.11 Sudden Infant Death Syndrome (SIDS)	0	0.0
7.112 SIDS Category IA: Classic features of SIDS present and completely documented.	0	0.0
7.113 SIDS Category IB: Classic features of SIDS present but incompletely documented.	0	0.0
7.114 SIDS Category II: Infant deaths that meet category I except for one or more features.	1	2.5
7.12 Unclassified Sudden Infant Death in the neonatal period	0	0.0
7.121 Bed sharing	0	0.0
7.122 Not bed sharing	0	0.0
7.19 Unknown/Undetermined	0	0.0
7.2 Multisystem failure	1	2.5
7.21 Secondary to intrauterine growth restriction	0	0.0
7.28 Other specified	1	2.5
7.29 Unspecified/undetermined primary cause or trigger event	0	0.0
7.3 Trauma	1	2.5

7.31 Accidental		0	0.0
7.32 Non accidental		1	2.5
7.39 Unspecified		0	0.0
7.4 Treatment complications	0		0.0
7.41 Surgical		0	0.0
7.42 Medical		0	0.0
7.5 Unsuccessful resuscitation in infants of 28 weeks gestation or more without an obvious sentinel event	0		0.0
7.8 Other specified	0		0.0
Total	40		100.0

Appendix 5

Perinatal Society of Australia and New Zealand Perinatal Death Classification (PSANZ-PDC),
South Australian perinatal deaths by birthweight, 2021

PSANZ-PDC		Birthweight (g)							Total	
		<500	500-749	750-999	1000-1,499	1500-1,999	2,000-2,499	≥2,500	No	%
1	Congenital abnormality	41	11	0	1	2	1	0	56	30.6
2	Perinatal infection	6	0	1	0	0	0	3	10	5.5
3	Hypertension	0	1	1	0	0	1	3	6	3.3
4	Antepartum haemorrhage	1	4	1	0	1	1	4	12	6.6
5	Maternal conditions	0	0	1	0	0	0	3	4	2.2
6	Complications of multiple pregnancy	4	2	0	1	0	0	0	7	3.8
7	Specific perinatal conditions	2	0	0	1	0	0	4	7	3.8
8	Hypoxic peripartum death	0	0	0	0	0	0	5	5	2.7
9	Fetal growth restriction	10	2	3	3	3	1	9	31	16.9
10	Spontaneous preterm	22	3	2	0	1	0	1	29	15.8
11	Unexplained antepartum death	4	0	0	2	3	1	2	12	6.6
12	No obstetric antecedent	0	0	0	0	0	0	4	4	2.2
Total		90	23	9	8	10	5	38	183	100.0
Percent		49.2	12.6	4.9	4.4	5.5	2.7	20.8	100.0	

Appendix 6

Archived recommendations and key learning points.

Many Committee recommendations and key learning points have been incorporated into South Australian policies, standards and guidelines. For a complete list of recommendations and key learning points made by the Committee in previous years, please see the Archived Recommendations document on the Preventive Health SA website <https://www.preventivehealth.sa.gov.au/evidence-data/explore-and-request-data/reports-and-publications>

Appendix 7

Stillbirth Investigations

Write Group Lead

Rebecca Smith

Write Group Members

A/Prof Rosalie Grivell

Dr T. Yee Khong

A/Prof Chris Wilkinson

Dr Anupam Parange

Dr Danielle Crosby

Introduction

This guideline is adapted with permission from the PSANZ Clinical Practice Guideline for Care Around Stillbirth and Neonatal Death, Chapter 5 – Investigations for Stillbirth.¹

Approximately 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.

Previously several investigations were recommended for all cases of stillbirth, however a number of these are now recommended as selective investigations only. The 'Stillbirth investigations algorithm' summarises the recommended core investigations for all stillbirths, and further selective investigations to be undertaken based on the findings from the core investigations. All women, but in particular, Aboriginal women should be consulted about any decisions in the first instance.

Aboriginal people experience very high levels of Grief and Loss in their communities. Stillbirth demands ceremonial acknowledgement. Discuss with the Aboriginal Health Professional.

Core Investigations to be performed in All Cases of Stillbirth

The following outlines the current investigations recommended routinely for the majority of stillbirths (core investigations) in South Australia (unless the cause of death has been unequivocally determined in pregnancy).

Maternal History

- Medical
- Pregnancy
- Family
- Social

Maternal blood

Kleihauer-Betke test at SA Pathology (preferably prior to birth). If positive, Fluorescence-Activated Cell Sorting (FACS, a type of flow cytometry) to quantify the fetomaternal haemorrhage should also be undertaken.

External examination of the baby

External examination of the baby by the attending clinician should be undertaken as soon as possible after birth and documented in the medical record.

Appendix D – Clinical Examination of Baby Checklist of the PSANZ Clinical Practice Guideline for Care Around Stillbirth and Neonatal Death¹ available at URL <https://sanda.psanz.com.au/clinical-practice/clinical-guidelines/> is a useful guide that can be printed and used by clinicians.

Where consent for autopsy has been given, the information gained along with maternal history should be forwarded to the State Perinatal Autopsy Service.

Autopsy

Clinicians should discuss the value of a full autopsy with parents unless the cause of death is already known. With parental consent, autopsy should be conducted by the State Perinatal Autopsy Service.

Please refer to the *Perinatal Loss PPG* available at www.sahealth.sa.gov.au/perinatal for further details relating to autopsy, including purpose of autopsy, gaining consent, forms to complete and transport requirements.

The booklet, *When a person dies: The Hospital Autopsy Process. Information for family and friends* should be given to the parents to read before any request for autopsy consent from the medical officer.

Appendix N – Information for Health Professionals Seeking Consent of the PSANZ Clinical Practice Guideline for Care Around Stillbirth and Neonatal Death¹ available at URL <https://sanda.psanz.com.au/clinical-practice/clinical-guidelines/> provides useful information on how to approach obtaining consent for autopsy.

If the parents decline a full autopsy:

- A non-invasive autopsy (NIA) or minimally-invasive autopsy (MIA) should be offered:
 - Please contact the SA Perinatal Autopsy Service for detail of available options to discuss with parents
- Parents should be asked for their consent to have a detailed external examination by a perinatal pathologist. If this is not possible, a neonatologist, paediatrician or clinical geneticist should conduct the examination and take clinical photographs.¹
- Clinical photographs (in addition to mementos) should also be undertaken with consent. *Appendix H – Instructions on Taking Clinical Photographs of the PSANZ Clinical Practice Guideline for Care Around Stillbirth and Neonatal Death¹* available at URL <https://sanda.psanz.com.au/clinical-practice/clinical-guidelines/> provides further guidance.
- X-ray if skeletal dysplasia suspected
- Magnetic resonance imaging (MRI) where available

Placental and Cord Investigations

Examination of the placenta and cord by the attending clinician should be undertaken and documented in the medical record. Intramembranous placental swabs should be undertaken for microbiology testing.

Whether or not parents' consent to autopsy, the placenta, membranes and cord should be forwarded to the State Perinatal Autopsy Service following maternal consent. They should be placed in a dry sterile container (no formalin or saline) with the container surrounded in ice for transport.

See *Histopathology Management of the Placenta PPG* available at www.sahealth.sa.gov.au/perinatal for details of gross placental examination, placental swabbing and standardised clinical information to include.

If consent for histopathology of the placenta is declined, sampling of placental and cord tissue for karyotyping should be undertaken by the attending clinician following maternal consent, regardless of whether a prenatal karyotype was obtained.¹

Cytogenetic Investigations

Chromosome microarray (CMA) is superior to standard culture karyotyping and should be undertaken for all stillbirths where the cause is unknown, even if standard karyotyping was undertaken prenatally.

Both fetal and placental tissue should undergo CMA.

Where a specific phenotype is suspected based on family history or examination of the fetus, women should be referred to a clinical geneticist with consideration for additional targeted / extended genetic testing.

Storage of samples

Storage of placental and fetal DNA, blood and amniotic fluid allows for future testing for other potential factors that are not currently identified. ^{1(p12)}

Consent is required for storage of human samples. Consideration should also be given to an agreed and documented timeframe for storage (e.g. until end of woman's anticipated reproductive age where future testing results may affect pregnancy management).

Selective Investigations based on findings of Core Investigations

The need for additional selective investigations may only become apparent following initial assessment of the stillborn baby and/or at autopsy. Clinicians should use their judgement so that all investigations are undertaken around the time of the birth wherever possible, to avoid the need for multiple follow-up appointments.

Congenital Infections

Routine testing of all stillbirths for infection is no longer recommended. Specific testing to be performed as indicated below:

Cytomegalovirus (CMV)

Consider maternal CMV serology in the presence of the following:

- Placental histopathology shows evidence of infection
- Baby is small for gestational age (SGA)
- Ultrasound shows features suggestive of CMV

Toxoplasmosis

Consider maternal toxoplasmosis serology for women who experienced symptoms of acute toxoplasmosis infection (malaise, fever, lymphadenopathy) during pregnancy.

Parvovirus

Maternal parvovirus serology is recommended when antenatal ultrasound or autopsy finds:

- Severe fetal anaemia
- Non-immune hydrops fetalis
- Fetal cardiomyopathy

Rubella

Testing is usually undertaken as part of routine antenatal screening. Only undertake maternal serology for rubella in the following circumstances:

- Antenatal screening indicated the woman is non-immune or was not undertaken AND the woman experienced clinical features of rubella infection during pregnancy (e.g. fever, transient erythematous rash, lymphadenopathy, arthralgia)
- Autopsy finds features consistent with rubella infection (e.g. IUGR, short stature, cardiac anomalies, inflammatory lesions of the brain, lungs, liver and/or bone marrow)

Syphilis

Testing is usually undertaken as part of routine antenatal screening, with additional screening for women in high risk communities. Only undertake maternal serology for syphilis if there was inadequate antenatal screening. See *Syphilis in Pregnancy* PPG for screening requirements (available at www.sahealth.sa.gov.au/perinatal).

Maternal Blood – Other Investigations

Blood group and antibody screen

If baby is:

- Anaemic
- Jaundiced
- Hydropic

Thrombophilia testing

- Antiphospholipid Syndrome (anticardiolipin, lupus anticoagulant and anti-B2 glycoprotein-1 antibodies) if one or more of the following:
 - Family history of thrombosis
 - Personal history of venous thrombosis
 - Fetal growth restriction
 - Placental abruption
 - Placental infarction
- Prothrombin G20210A mutation and Factor V Leiden mutation if:
 - There are multiple factors from the list above or other clinical suspicion that thrombophilia may have been a factor in the stillbirth

Haemoglobin A1c (HbA1c)

If baby is:

- Small for gestational age (< 10th centile)
- Intrauterine growth restricted
- Large for gestational age (> 90th centile)

- Polyhydramnios is an unexplained feature of the pregnancy

Thyroid function test

Is not recommended in clinically euthyroid women.

Liver function tests and non-fasting bile acids

Recommended if there is a clinical suspicion of intrahepatic cholestasis of pregnancy and/or history of maternal pruritus.

Drug screen

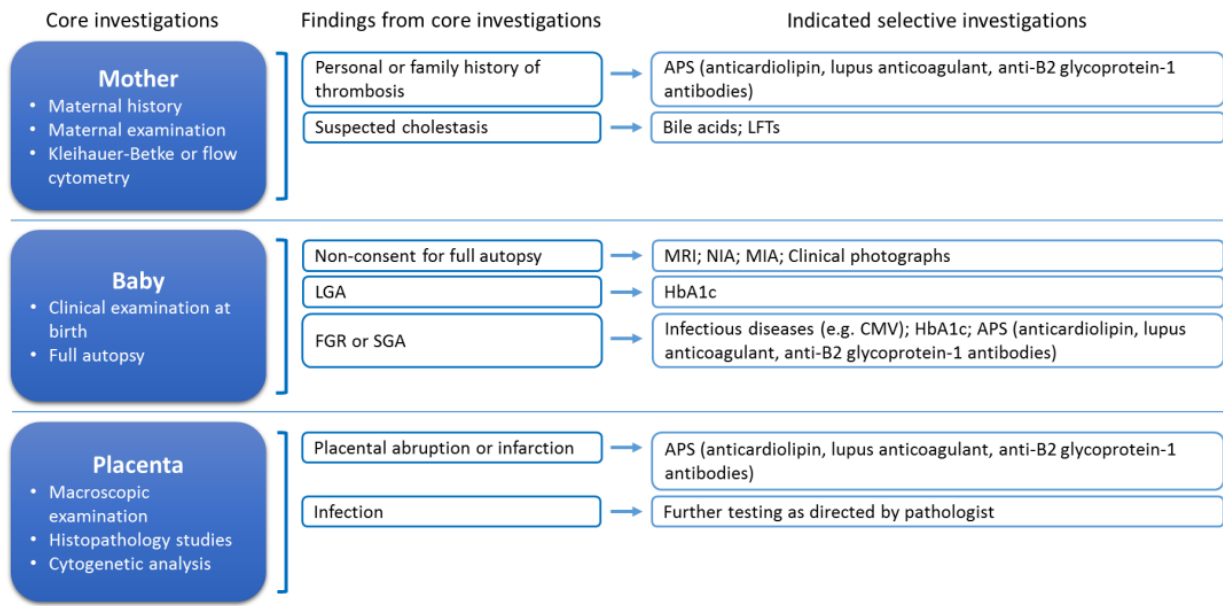
Recommended if there is a suspicion of or known maternal drug use

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 anomalies.

1. Flenady V, Oats J, Gardener G, Masson Vicki, McCowan Lesley, Kent A, Tudehope David, Middleton P, Donnelly N, Boyle F, Horey D, Ellwood D, Gordon A, Sinclair L, Humphrey M, Zuccollo J, Dahlstrom J, Mahomed K, Henry S, Khong Y for the PSANZ Care around the time of stillbirth and neonatal death guidelines group. Clinical Practice Guideline for Care Around Stillbirth and Neonatal Death. Version 3.2, Section 5 – Investigations for Stillbirth. NHMRC Centre of Research Excellence in Stillbirth. Brisbane, Australia, December 2019. Available at <https://sanda.psanz.com.au/clinical-practice/clinical-guidelines/>

PSANZ Stillbirth Investigations Algorithm



APS: Antiphospholipid syndrome; CMA: Chromosomal microarray; CMV: Cytomegalovirus; FGR: Fetal growth restriction; LFTs: Liver Function Tests; LGA: Large-for gestational-age; HbA1c: Haemoglobin A1c; MIA: Minimally-invasive autopsy; MRI: Magnetic Resonance Imaging; NIA: Non-invasive autopsy; SGA: Small for gestational age.

Perinatal Society of Australia and New Zealand Clinical Practice Guideline for Care Around Stillbirth and Neonatal Death, Third Edition, March 2018.

For more information

Pregnancy Outcome Unit
PO Box 287, Rundle Mall SA 5000
Call (08) 71179210 or Email
PreventiveHealthSAPregnancyStats@sa.gov.au
Website: <https://www.preventivehealth.sa.gov.au/>