Maternal and Perinatal Mortality in South Australia 2022

Government of South Australia

Published March 2025

Thirty-seventh Report of the Maternal and Perinatal
Mortality Committee on maternal and perinatal deaths

ISSN 1032-4801

Suggested citation:
Maternal and Perinatal Mortality in South Australia 2022. Adelaide: Pregnancy Outcome Unit, Population Data Registries, Epidemiology and Research Division, Preventive Health SA, Government of South Australia, 2025

Committees

Maternal and Perinatal Mortality Committee

Dr Amanda Poprzeczny	Obstetrician, Acting Chair
Dr Vineesh Bhatia	Neonatal paediatrician
Dr Anthony Colby	Obstetric anaesthetist
Dr Megan Cooper	Midwife
Dr Marion Crompton	General practitioner
Dr Jeff Hillen	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
Dr Amy Hercus	Obstetrician
Dr Jeff Hillen	Obstetrician
Dr Maleeka Ladhani	Physician
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 Jenni Goold	General practitioner
Dr Rhiannon Heading	Obstetrician
Ms Claudia Markwart	Neonatal nurse
Dr Theresa Power	Pathologist
Associate Professor Michael Stark	Neonatologist
Dr Alvin Tan	Neonatologist
Dr Jojy Varghese	Neonatologist
Dr Jorien Vercruyssen	Obstetrician
Ms Angie Wilson	Midwife
Vacant	Aboriginal health representative
Vacant	Obstetrician
Vacant	Genetic pathologist
Ms Kylie Bryant	Ex-officio

Education Subcommittee

Dr Vineesh Bhatia	Neonatal Paediatrician, Chair
Dr Karen Chandler	Obstetrician
Dr Marion Crompton	General practitioner
Dr Rachel Earl	Obstetrician
Ms Lauren Kleinig	Midwife
Ms Kim Parker-Gray	Midwife
Ms Kirsty Roberts	Midwife
Dr Beth Russ	Obstetrician
Ms Renae Williams	Midwife
Dr Brian Wheatley	Mentor
Ms Kylie Bryant	Ex-officio

A Dr Brian Pridmore Forum was not held in 2024.

Acknowledgements

The Committee would like to thank:

- Medical practitioners, Midwives and Nurses who completed confidential reports on maternal and perinatal deaths
- SA Pathology and Forensic Science SA for providing autopsy reports
- The staff of Births, Deaths and Marriages for providing Medical Certificates of Cause of Perinatal Death
- State Coroner's Office, Courts Administration Authority of South Australia

Contents

Summary

This is the thirty-seventh Annual Report of the Maternal and Perinatal Mortality Committee, for deaths occurring in 2022.

1. There were three indirect and no direct maternal deaths in 2022. The maternal mortality ratio for the last five-year period 2018-2022 was 10.1 deaths per 100,000 women who gave birth, which is low by international standards, but higher than the preceding five-year period where there were 6.7 deaths per 100,000 women.

2. The Committee reviewed the 171 adjusted perinatal deaths of babies born in South Australia in 2022. The adjusted perinatal mortality rate (stillbirths of at least 400g or 20 weeks gestation and neonatal deaths of babies born at or after 20 weeks gestation, excluding terminations performed for psychosocial or unknown reasons) was 8.7 per 1,000 births. The adjusted stillbirth rate was 6.5 per 1,000 births and the adjusted neonatal mortality rate was 2.3 per 1,000 live births. Whilst the adjusted neonatal mortality rate has been steadily declining, the adjusted stillbirth rate has not changed markedly over the last two decades.

3. One hundred and forty-seven (86.0%) of the adjusted perinatal deaths occurred in preterm babies (less than 37 weeks gestation). The leading cause of adjusted perinatal death in 2022 was congenital anomalies, which accounted for 41.5% of the deaths. Other leading causes were spontaneous preterm labour or rupture of membranes (13.5%) and placental dysfunction or causative placental pathology (9.9%).

4. Thirteen (29.5%) of the 44 adjusted neonatal deaths occurred in neonates born at less than 24 weeks gestation. Of the 31 deaths in neonates born at or after 24 weeks, 14 (45.2%) were attributed to congenital anomalies.

5. Ten babies of Aboriginal mothers died during the perinatal period. The adjusted perinatal mortality rate for Aboriginal women was 11.8 per 1,000 births compared with 8.6 per 1,000 births for non-Aboriginal women. The adjusted perinatal mortality rate for Aboriginal women has decreased from 16.3 in 2021.

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

- Clinicians referring patients for radiology must ensure they receive and review the final report. If a report is amended, the person amending should contact the referring clinician to ensure they are aware of the final results.
- At the first presentation during pregnancy, clinicians should review all recent investigations performed.
- Aortic dissection should be considered in the differential diagnosis of women, with or without pre-existing aneurysmal dilatation/connective tissue disorder, presenting with chest pain.
- All services involved in the care of postnatal women should be aware of the potential of postnatal depression in any pregnancy and make appropriate referral.
- Consideration should be given to psychiatric referral in cases of severe postnatal depression.
- Consideration should be given to whether pregnancy is in the best medical interests of the patient prior to commencing or continuing IVF.
- Where clinically appropriate in pregnancy, a chest x-ray should be performed, irrespective of gestation.
- A diagnosis of asthma should not be underestimated.
- All prescribers should be aware of the risks and potential harms of polypharmacy, and should consider risk reducing in their prescribing including the use of script checking programs (ScriptCheck SA) and clear communication with GPs and other members of the health care team.
- Reminder: the Clinical Practice Guideline for Care Around Stillbirth and Neonatal Death produced by the Stillbirth CRE and PSANZ was updated in 2019 with new recommendations regarding the recommended stillbirth investigations. This has been incorporated into the SA PPG.
- Review of maternal medication and supplementation use, particularly in early pregnancy, is advised to ensure prompt identification of teratogenic substances and timely cessation or referral to appropriate specialists for counselling.
- Patients presenting with significant abdominal pain, particularly non-responsive to opioids, should have a timely review by the most senior available clinician.
- Monochorionic pregnancies are associated with significant perinatal morbidity and mortality. Early US to confirm choronicity, good quality US surveillance including MCA Dopplers, senior obstetric care and consideration of MFM is recommended.
- All patients should be counselled and offered aneuploidy screening in the first trimester (NIPT or combined first trimester screening), including information regarding gestational cut-offs for cFTS screening. High probability aneuploidy screening results should be promptly referred to a centre or clinician capable of arranging diagnostic testing.
- All patients should be counselled and offered screening for autosomal recessive conditions, ideally pre-pregnancy or in the early first trimester. This includes screening for haemoglobinopathies.

Introduction

This is the Thirty-seventh Annual Report of the South Australian Maternal and Perinatal Mortality Committee (the 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.

Terminology

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-seventh report of the Committee incorporates information on maternal deaths in South Australia in the year 2022 and perinatal deaths of babies born to mothers in South Australia in 2022.

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.

The terms woman, women and mother are used in this report as most pregnant and birthing people identify with their birth sex. However, the committee acknowledges these terms include people who do not identify as women, including those with a non-binary identity.

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.*

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 seven late maternal deaths in South Australia in 2022. Data linkage is used to improve detection and enhance reporting on maternal deaths occurring in the state.

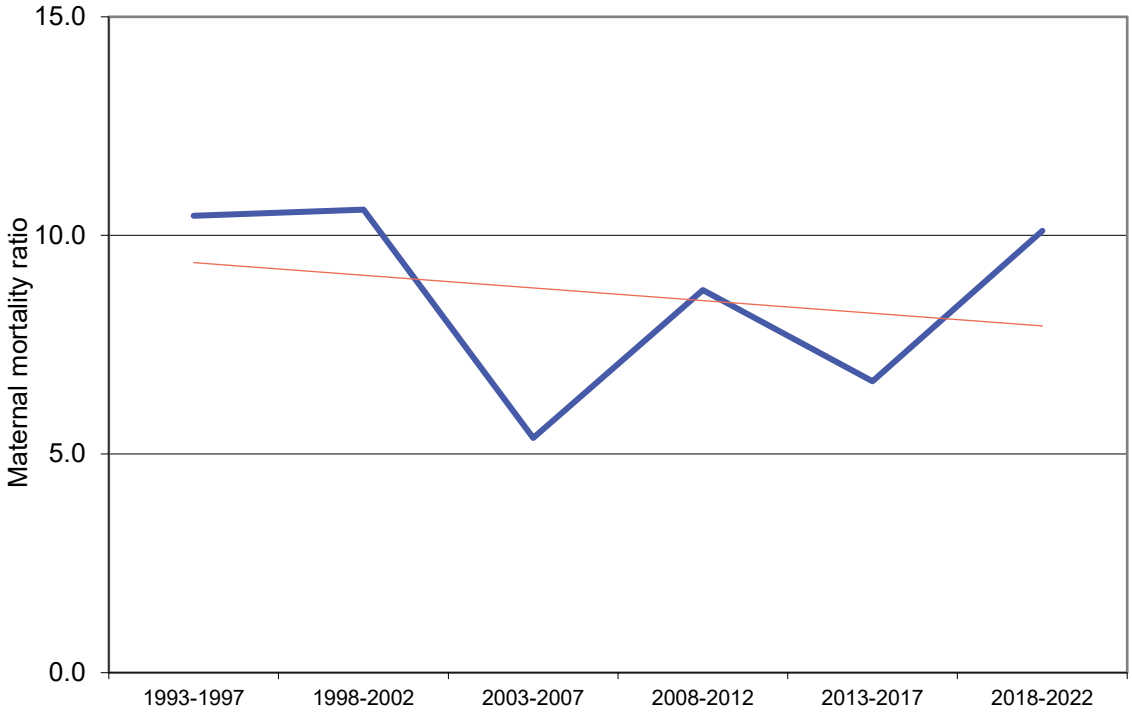
Maternal deaths in South Australia for the three categories of deaths from 1993 to 2022 are presented in Table 1 by five-year periods. Maternal mortality ratios have been calculated for direct and indirect deaths (Table 1 and Figure 1). The maternal mortality ratio for the last five-year period 2018-2022 was 10.1, which was higher than the Australian maternal mortality ratio of 6.0 per 100,000 women for the period 2013-2022. The number of deaths in South Australia is small and has not changed greatly in the last three decades, however a decreasing trend is shown (Figure 1). Of a total of 50 pregnancy-related maternal deaths in the period 1993-2022, 26 were direct deaths and 24 were indirect deaths.

Table 1: Maternal mortality by category of death, in 5-year periods, South Australia, 1993 – 2022

Years	Direct deaths	Indirect deaths	Incidental deaths	Total deaths	Direct and indirect maternal deaths	
	Number	Number	Number	Number	Number	Maternal mortality ratio*
1993-1997	5	5	4	14	10	10.5
1998-2002	3	7	3	13	10	10.6
2003-2007	5	0	1	6	5	5.4
2008-2012	7	1	3	11	8	8.8
2013-2017	2	4	1	7	6	6.7
2018-2022	4	5	0	9	9	10.1

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

Figure 1: Maternal Mortality Ratio, South Australia 1993-2022



Causes of maternal deaths

The causes of the maternal deaths in 2022 were:

- One indirect death due to thoracic aortic aneurysm dissection with hemopericardium
- One indirect death due to acute asthma
- One indirect death by suicide

The causes of the late maternal deaths in 2022 were:

- One late direct death by suicide
- One late incidental death by suicide
- Two late incidental deaths due to cancer
- One late incidental death in a motor vehicle accident
- One late incidental death due to complications of elective surgery for congenital heart disease
- One late incidental death due to presumed accidental polypharmacy prescription drug overdose

Maternal Key Learning Points

- Clinicians referring patients for radiology must ensure they receive and review the final report. If a report is amended, the person amending should contact the referring clinician to ensure they are aware of the final results.
- At the first presentation during pregnancy, clinicians should review all recent investigations performed.
- Aortic dissection should be considered in the differential diagnosis of women, with or without pre-existing aneurysmal dilatation/connective tissue disorder, presenting with chest pain.
- All services involved in the care of postnatal women should be aware of the potential of postnatal depression in any pregnancy and make appropriate referral.
- Consideration should be given to psychiatric referral in cases of severe postnatal depression.
- Consideration should be given to whether pregnancy is in the best medical interests of the patient prior to commencing or continuing IVF.
- Where clinically appropriate in pregnancy, a chest x-ray should be performed, irrespective of gestation.
- A diagnosis of asthma should not be underestimated.
- All prescribers should be aware of the risks and potential harms of polypharmacy, and should consider risk reducing in their prescribing including the use of script checking programs (ScriptCheck SA) and clear communication with GPs and other members of the health care team.

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 2022, there were 19,584 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 200 perinatal deaths, including 156 stillbirths and 44 neonatal deaths. The perinatal mortality rate was 10.2 per 1,000 births, the stillbirth rate was 8.0 per 1,000 births and the neonatal mortality rate was 2.3 per 1,000 live births.

A procedural change in 2022 increased the ascertainment of births and perinatal deaths particularly for terminations of pregnancy. As the focus of the Committee is to assess avoidable mortality, the following section uses an 'adjusted' perinatal mortality definition from 2022 onwards, where terminations of pregnancy for psychosocial or unknown reasons are excluded. This maintains consistency with previous South Australian reports and allows for comparisons with other jurisdictions both nationally and internationally.

In 2022, there were 19,555 adjusted births and include 171 adjusted perinatal deaths, 127 adjusted stillbirths and 44 adjusted neonatal deaths. Table 2 shows the numbers of adjusted stillbirths and adjusted neonatal deaths for specified birthweights or gestations.

The adjusted perinatal mortality rate for all births in 2022 was 8.7 deaths per 1,000 births. The adjusted stillbirth rate was 6.5 per 1,000 births and the adjusted neonatal mortality rate 2.3 per 1,000 live births. Fifty-six of the 171 adjusted perinatal deaths (32.7%) were induced terminations of pregnancy and their exclusion would have resulted in an adjusted perinatal mortality rate of 5.9 deaths per 1,000 births.

The adjusted 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 gestation[2]. For international comparison, inclusion of only fetuses and infants weighing at least 1,000g and/or born at 28 weeks or more gestation is recommended[2]. Using the WHO classification for international reporting, the adjusted perinatal mortality rate was 3.7 per 1,000 births in South Australia, with an adjusted stillbirth rate of 2.3 per 1,000 births and adjusted neonatal mortality rate of 1.3 per 1,000 live births.

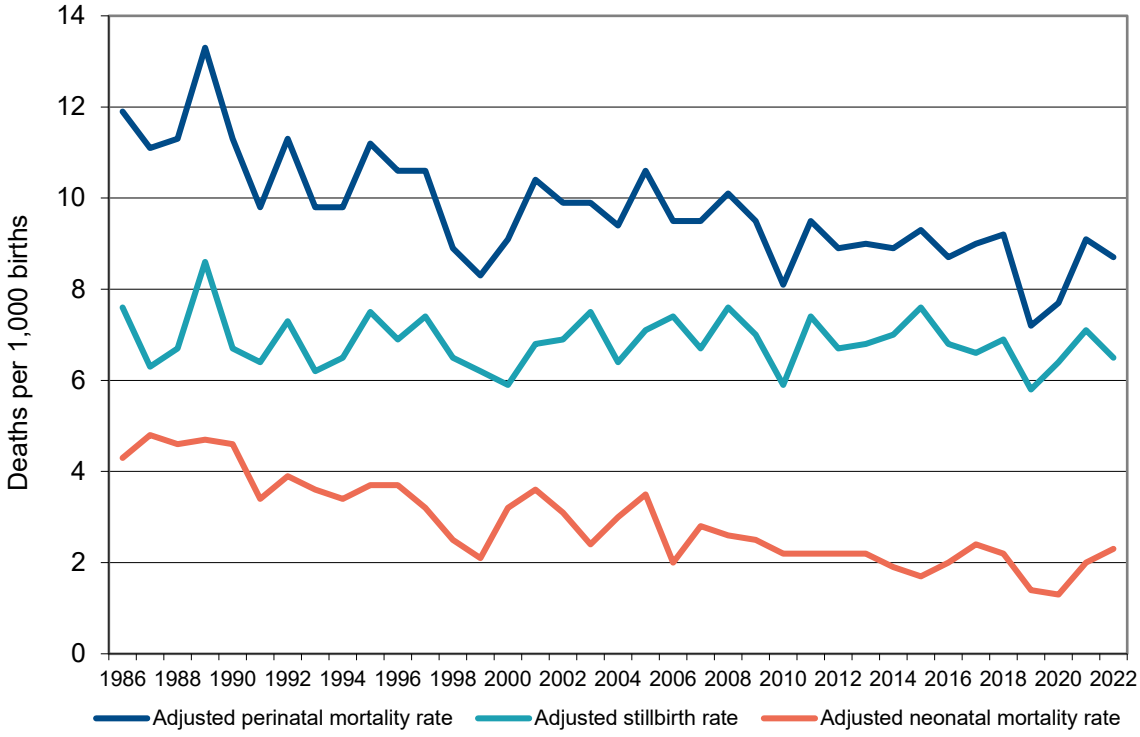
Table 2: Adjusted perinatal mortality, South Australia, 2022 (all births of specified birthweight/gestation)

			Adjusted stillbirths		Adjusted neonatal deaths		Adjusted perinatal deaths	
Specified birthweight/ gestation	**Adjusted total births**	**Live births**	**Number**	**Deaths per 1,000 births**	**Number**	**Deaths per 1,000 live births**	**Number**	**Deaths per 1,000 births**
≥400g/ 20 weeks	19,555	19,428	127	6.5	44	2.3	171	8.7
≥500g/ 22 weeks	19,516	19,423	93	4.8	39	2.0	132	6.8
≥1,000g/ 28 weeks	19,415	19,370	45	2.3	26	1.3	71	3.7

South Australian adjusted perinatal mortality rates, including adjusted stillbirth and adjusted neonatal mortality rates for all births, from 1986-2022 are presented in Figure 2. Whilst the adjusted neonatal

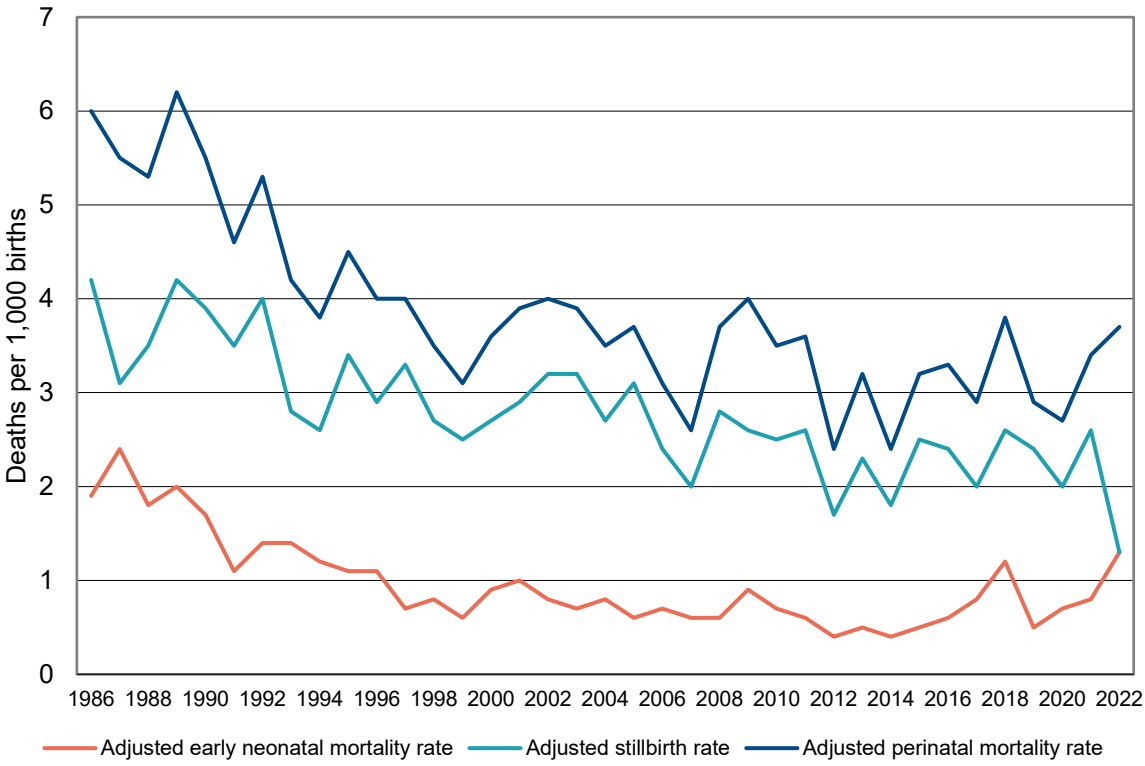
mortality rate has been steadily declining, the adjusted stillbirth rate has not changed markedly over the last two decades.

Figure 2: Adjusted perinatal mortality rate (births ≥ 400g or 20 weeks gestation), South Australia 1986-2022



For international comparison, WHO[2] recommends presenting perinatal mortality rates for births of at least 1,000g birthweight (or when birthweight is unavailable, 28 weeks gestation) and early neonatal deaths occurring within the first seven days of life. Adjusted perinatal mortality rate, adjusted stillbirth rate and adjusted early neonatal mortality rate are presented in Figure 3. By these criteria, a decrease in the adjusted stillbirth rate is evident from 4.2 deaths per 1,000 births in 1986 to 1.3 deaths per 1,000 births in 2022. The adjusted early neonatal mortality rate was 1.3 per 1,000 live births.

Figure 3: Adjusted perinatal mortality rate (births ≥1,000g or 28 weeks gestation & early neonatal deaths within the first seven days of life), South Australia 1986-2022



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 terminations of pregnancy for any reason, including congenital anomalies and medical reasons.** The Committee data includes terminations of pregnancy for congenital anomalies and medical reasons. 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, 2012 – 2022

Year	NSW	VIC	Qld	SA	WA	Tas	NT	ACT	AUSTRALIA
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	11.6	11.4	6.6	7.8
2017	7.1	8.1	9.4	5.7	8.6	9.7	15.1	8.8	8.1
2018	6.8	8.3	7.8	5.5	7.9	9.8	16.8	9.4	7.7
2019	7.4	7.0	10.1	4.9	7.7	8.1	15.4	5.1	7.8
2020	8.1	7.4	10.0	5.1	9.5	9.6	18.8	6.7	8.4
2021	7.7	7.6	10.1	5.1	7.3	8.2	19.0	7.7	8.1
2022	7.0	6.8	11.5	4.6	8.2	10.4	19.9	6.9	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.

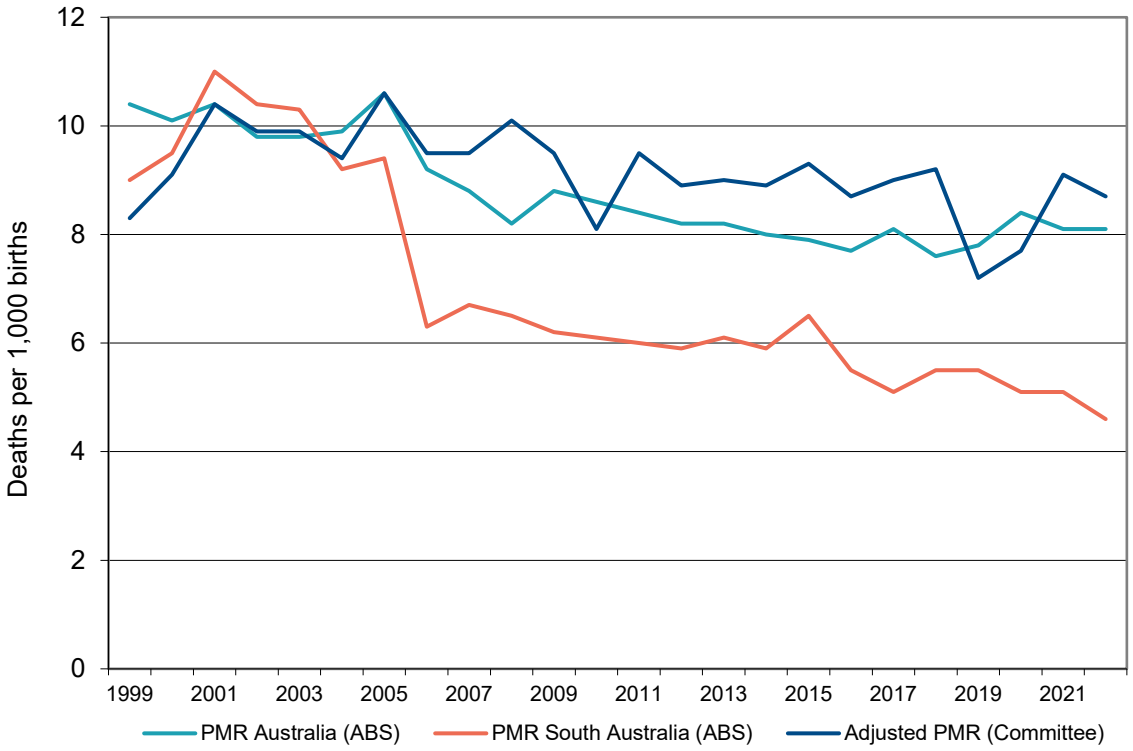
Source: Australian Bureau of Statistics. (2023). *Causes of Death, Australia*. ABS. https://www.abs.gov.au/statistics/health/causes-death/causes-death-australia/2023.

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 adjusted perinatal deaths of babies born 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 adjusted perinatal deaths of babies born in South Australia in the year in which the birth occurred.
- The ABS data include all live births of any gestation, whereas since 2012 the Committee rates include only live births of at least 400g birthweight or of at least 20 weeks gestation which resulted in neonatal death.

The ABS perinatal mortality rates (PMR) for South Australia and Australia for 1999-2022 are presented in Figure 4, together with the adjusted 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 adjusted perinatal mortality rates South Australian Maternal and Perinatal Mortality Committee (Committee) 1999-2022 Deaths per 1,000 births[1]



Source: Australian Bureau of Statistics. (2023). *Causes of Death, Australia*. ABS. https://www.abs.gov.au/statistics/health/causes-death/causes-death-australia/2023.

[1]Refer above for definitional differences

Birthweight-specific adjusted perinatal mortality

The birthweight-specific adjusted rates of stillbirths, neonatal deaths and perinatal deaths for 2022 are provided in Table 4. Of the 171 adjusted perinatal deaths, 134 (78.4%) were of low birthweight (<2,500g) and 32 (72.7%) of the 44 adjusted neonatal deaths were low birthweight babies. Forty of the adjusted perinatal deaths (23.4%) were less than 400g birthweight.

Table 4: Adjusted perinatal mortality by birthweight, all births, South Australia, 2022

			Adjusted stillbirths		Adjusted neonatal deaths		Adjusted perinatal deaths	
Birthweight (grams)	**Adjusted total births**	**Live births**	**Number**	**Deaths per 1,000 births**	**Number**	**Deaths per 1,000 live births**	**Number**	**Deaths per 1,000 births**
<400	40	3	37	925.0	3	75.0	40	1,000.0
400-499	32	10	22	687.5	6	187.5	28	875.0
500-749	51	29	22	431.4	6	117.6	28	549.0
750-999	35	30	5	142.9	3	85.7	8	228.6
1,000-1,499	98	94	4	40.8	1	10.2	5	51.0
1,500-1,999	259	254	5	19.3	3	11.6	8	30.9
2,000-2,499	874	867	7	8.0	10	11.4	17	19.5
2,500-2,999	3,215	3,203	12	3.7	4	1.2	16	5.0
3,000-3,499	7,296	7,290	6	0.8	5	0.7	11	1.5
3,500-3,999	5,869	5,868	1	0.2	2	0.3	3	0.5
4,000-4,499	1,580	1,579	1	0.6	0	0.0	1	0.6
≥4,500	200	200	0	0.0	0	0.0	0	0.0
Unknown	6	1	5	833.3	1	166.7	6	1,000.0
Total	**19,555**	**19,428**	**127**	**6.5**	**44**	**2.3**	**171**	**8.7**

The time of adjusted perinatal death by birthweight are presented in Table 5. Of the 61 adjusted antepartum deaths, 21 were under 750g birthweight (41.0%). Of the adjusted intrapartum deaths 92.9% were under 750g birthweight.

Table 5: Time of adjusted perinatal death by birthweight, South Australia, 2022 (≥400g birthweight or 20 weeks gestation)

Birthweight (grams)	Adjusted stillbirths			Adjusted neonatal deaths	Adjusted total
	Antepartum	Intrapartum	Uncertain if antepartum or intrapartum		
<500	12	12	35	9	68
500-749	9	1	12	6	28
750-999	4	0	1	3	8
1,000-1,499	3	0	1	1	5
1,500-1,999	5	0	0	3	8
2,000-2,499	6	1	0	10	17
2,500-2,999	11	0	1	4	16
3,000-3,499	6	0	0	5	11
3,500-3,999	1	0	0	2	3
4,000-4,499	1	0	0	0	1
≥4,500	3	0	2	1	6
Unknown	0	0	0	0	0
Total	**61**	**14**	**52**	**44**	**171**

Gestation-specific adjusted perinatal mortality

The distribution of adjusted perinatal deaths by gestational age is provided in Table 6. There were 147 adjusted preterm births (<37 weeks gestation) that resulted in a perinatal death, accounting for 86.0% of all adjusted perinatal deaths.

Table 6: Adjusted perinatal mortality by gestational age at birth, South Australia, 2022 (≥ 400g or 20 weeks gestation)

Gestation at birth (weeks)	Adjusted total births	Live births	Adjusted stillbirths		Adjusted neonatal deaths		Adjusted perinatal deaths	
			Number	Deaths per 1,000 births	Number	Deaths per 1,000 live births	Number	Deaths per 1,000 births
<24	95	20	75	789.5	13	650.0	88	926.3
24-27	61	50	11	180.3	5	100.0	16	262.3
28-31	143	137	6	42.0	2	14.6	8	55.9
32-36	1,430	1,410	20	14.0	15	10.6	35	24.5
37-41	17,779	17,764	15	0.8	9	0.5	24	1.3
≥42	44	44	0	0.0	0	0.0	0	0.0
Unknown	3	3	0	0.0	0	0.0	0	0.0
Total	**19,555**	**19,428**	**127**	**6.5**	**44**	**2.3**	**171**	**8.7**

Classification of adjusted perinatal deaths

The Perinatal Mortality Subcommittee classified each of the 200 perinatal deaths, which occurred in 2022 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 2022 data. Table 7 presents the classification of adjusted perinatal deaths in 2022 according to PSANZ-PDC.

Table 7: Classification of adjusted perinatal deaths, PSANZ-PDC, South Australia, 2022

	PSANZ-PDC	Number	Percent	Deaths per 1,000 births
1	Congenital anomaly	71	41.5	3.6
2	Perinatal infection	9	5.3	0.5
3	Hypertension	4	2.3	0.2
4	Antepartum haemorrhage (APH)	9	5.3	0.5
5	Maternal conditions	7	4.1	0.4
6	Complications of multiple pregnancy	6	3.5	0.3
7	Specific perinatal conditions	6	3.5	0.3
8	Hypoxic peripartum death	2	1.2	0.1
9	Placental dysfunction or causative placental pathology	17	9.9	0.9
10	Spontaneous preterm labour or rupture of membranes (<37 weeks gestation)	23	13.5	1.2
11	Unexplained antepartum fetal death	15	8.8	0.8
12	Neonatal death without obstetric antecedent	2	1.2	0.1
	Total	**171**	**100.0**	**8.7**

Adjusted perinatal deaths in 2022 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 adjusted perinatal death in 2022, accounting for 41.5% of all deaths. The next highest cause was spontaneous preterm labour or rupture of membranes (13.5%), followed by placental dysfunction or causative placental pathology (9.9%), unexplained antepartum fetal death (8.8%), perinatal infection (5.3%) and antepartum haemorrhage (5.3%).

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

Congenital anomaly – 71 deaths

This group of 71 deaths in 2022 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 – 18 deaths

- Anencephaly: 1 death
- Neural tube defect and Chiari II malformation: 6 deaths
- Ventriculomegaly: 2 deaths
- Other anomalies including agenesis of corpus callosum, hydrocephalus and encephalocele: 9 deaths

Cardiovascular – 11 deaths

- Tetralogy of Fallot: 3 deaths
- Hypoplastic right heart: 2 deaths
- Other cardiovascular anomalies including VSD, hypoplastic left heart syndrome, and transposition of the great arteries: 6 deaths

Genitourinary System – 2 deaths

- Bladder outlet obstruction: 2 deaths

Gastrointestinal system – 0 deaths

Musculoskeletal – 6 deaths

- Congenital diaphragmatic hernia: 4 deaths
- Other musculoskeletal anomalies: 2 deaths

Respiratory system – 1 death

- Congenital pulmonary airway malformation: 1 death

Haematological – 1 death

- Fetal thrombocytopaenia: 1 death

Multiple congenital anomaly – 7 deaths

- Multiple anomalies including VACTERL, Tetralogy of Fallot, hypoplastic left heart syndrome, and cleft lip and palate: 7 deaths

Other congenital anomaly – 0 deaths

Chromosomal – 13 deaths

- Trisomy 21: 2 deaths
- Trisomy 18: 1 death
- Turner syndrome: 1 death
- 22q11.2 microdeletion syndrome: 2 deaths
- Other chromosomal deletions and duplications: 7 deaths

Genetic anomaly – 12 deaths

- Thanatophoric dysplasia: 3 deaths
- Other genetic anomalies, such as Freeman Sheldon syndrome, Sotos syndrome, Myasthenia gravis, Jeune syndrome, arthrogryposis and Smith-Lemli-Opitz syndrome: 9 deaths

Perinatal infection – 9 deaths

Bacterial – 9 deaths

- Group B Streptococcal infection: 4 deaths
- Escherichia coli infection: 3 deaths
- Other bacterial including Ureaplasma urealyticum: 2 deaths

Viral – 0 deaths

Fungal – 0 deaths

Other specified organism – 0 deaths

Hypertension – 4 deaths

- Pre-eclampsia: 4 deaths

Antepartum haemorrhage – 9 deaths

- Placental abruption: 9 deaths

Maternal conditions – 7 deaths

- Maternal diabetes: 3 deaths
- Obstetric cholestasis: 2 deaths
- Accidental injury: 1 death
- COVID-19: 1 death

Complications of multiple pregnancy – 6 deaths

- Twin to twin transfusion syndrome: 3 deaths
- Conjoined twins: 1 death
- Other complications of multiple pregnancies: 2 deaths

Specific perinatal conditions – 6 deaths

- Fetomaternal haemorrhage: 1 death
- Cord occlusion: 2 deaths
- Amniotic band syndrome: 2 deaths
- Fetal hydrops: 1 death

Hypoxic peripartum death – 2 deaths

- Uterine rupture: 1 death
- Other hypoxic peripartum death: 1 death

Placental dysfunction or causative placental pathology – 17 deaths

- Maternal vascular malperfusion: 3 deaths
- Fetal vascular malperfusion: 3 deaths
- Placental hypoplasia: 3 deaths
- High grade villitis of unknown etiology: 2 deaths
- Severe chronic intervillositis: 2 deaths
- Other placental pathology: 4 deaths

Spontaneous preterm labour or rupture of membranes (<37 weeks gestation) – 23 deaths

- Spontaneous preterm labour preceded by premature cervical shortening: 9 deaths
- Spontaneous preterm labour or rupture of membranes with histological chorioamnionitis: 10 deaths
- Spontaneous preterm labour or rupture of membranes without histological chorioamnionitis: 4 deaths

Unexplained antepartum fetal deaths – 15 deaths

- Unexplained despite full investigation: 12 deaths
- Unclassifiable with incomplete investigation: 3 deaths

Neonatal death without obstetric antecedent – 2 deaths

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

Classification of adjusted neonatal deaths

The classification of the 44 adjusted 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 adjusted neonatal deaths by gestational age grouping follows:

20-23 weeks gestation – 13 deaths

- Not resuscitated, or resuscitation was ultimately unsuccessful: 10 deaths
- Congenital anomalies: 1 death
- Cardio-respiratory disorders: 1 death
- Intraventricular haemorrhage: 1 death

24-31 weeks gestation – 7 deaths

- Unsuccessful resuscitation: 1 death
- Congenital anomalies: 2 deaths
- Cardio-respiratory disorders: 2 deaths
- Intraventricular haemorrhage: 2 deaths

32-36 weeks gestation – 15 deaths

- Hypoxic ischaemic encephalopathy after placental abruption: 2 deaths
- Congenital anomaly: 9 deaths
- Cardio-respiratory disorders: 2 deaths
- Necrotising enterocolitis: 2 deaths

37 weeks and greater gestation – 9 deaths

- Hypoxic ischaemic encephalopathy: 3 deaths
- Congenital anomalies: 3 deaths
- Sepsis: 1 death
- Multisystem failure: 1 death
- Unclassified awaiting further information: 1 death

Aboriginal adjusted perinatal deaths

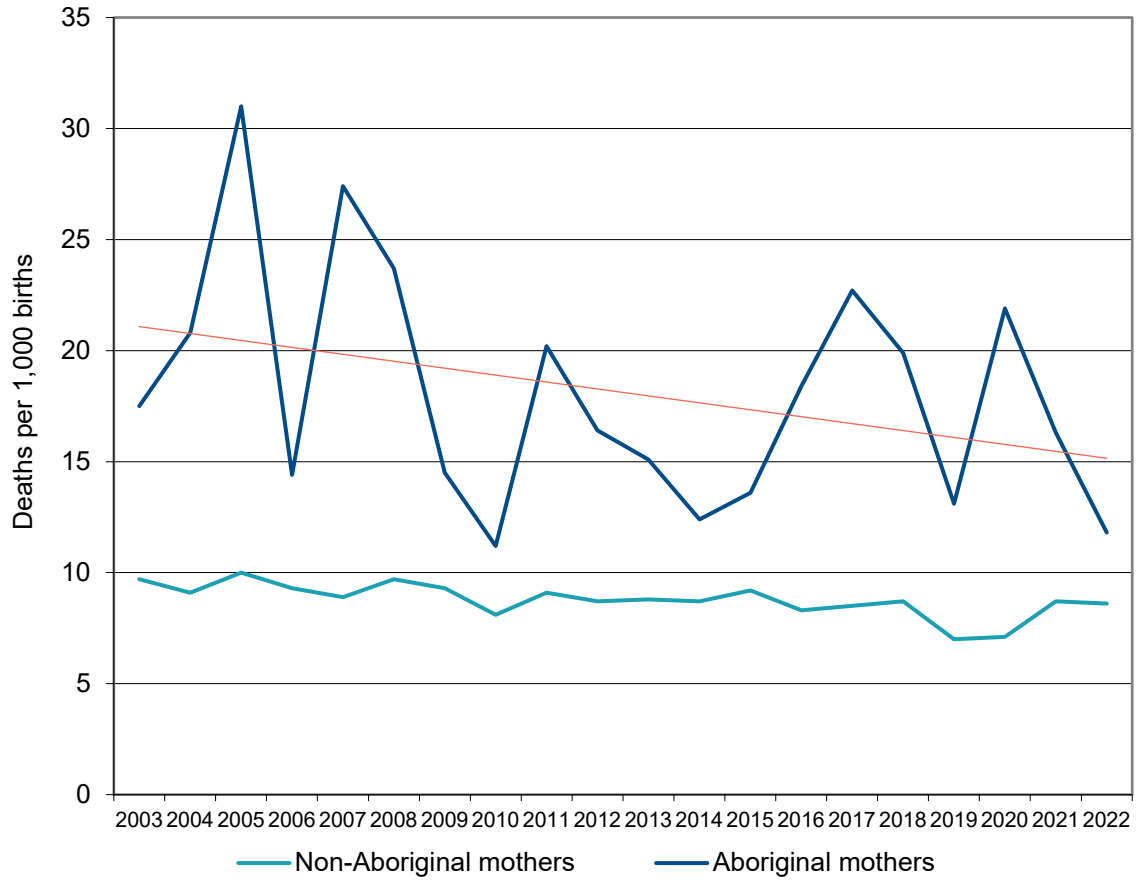
There were ten adjusted perinatal deaths (5 adjusted stillbirths and 5 adjusted neonatal deaths) among births to 850 Aboriginal women.

In 2022, the adjusted perinatal mortality rate for births to Aboriginal women was 11.8 per 1,000 births, compared to 8.6 per 1,000 births for births to non-Aboriginal women. The adjusted perinatal death rate has decreased for Aboriginal women in 2022. Although the adjusted perinatal mortality rate for Aboriginal births fluctuates widely due to the small number of deaths, recent years show a decreasing trend (Figure 5).

Eight of the 10 infants of Aboriginal mothers were born in public metropolitan hospitals, and two were born in country hospitals. Eight of the infants were preterm births, with four born before 24 weeks gestation. Six of the 10 mothers were metropolitan residents, and four were country residents.

The causes of the 10 deaths of infants of Aboriginal mothers were attributed to such causes as preterm labour, bacterial infection, congenital anomalies and placental abruption.

Figure 5: Adjusted perinatal mortality by maternal Aboriginal status, South Australia, 2003 – 2022



Autopsies in adjusted 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 171 adjusted perinatal deaths (49.1%), including four 'limited' autopsies. The proportion of autopsies undertaken has increased compared to 2021 (45.9%). The stillbirth investigations algorithm from the PSANZ Clinical Practice Guideline for Care Around Stillbirth and Neonatal Death is located in Appendix 6.

Additionally, 'Other examinations' were performed for 20 (11.7%) of the adjusted perinatal deaths. Placental histological examinations were undertaken for 163 adjusted perinatal deaths (95.3%). 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 adjusted perinatal deaths by place of death, South Australia, 2022

Place of death	Adjusted deaths	Autopsies performed	
	Number	Number	Percent of deaths
Women's & Children's Hospital	105	48	45.7
Lyell McEwin Hospital	18	9	50.0
Flinders Medical Centre	23	12	52.2
Other metropolitan public hospitals	0	0	0.0
Metropolitan private hospitals	6	5	83.3
Country hospitals	14	9	64.3
Other	5	1	20.0
Total	**171**	**84**	**49.1**

* Includes 4 autopsies with limited dissection

The low proportion of autopsies conducted in adjusted perinatal deaths remains a concern. A high-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 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

- Reminder: the Clinical Practice Guideline for Care Around Stillbirth and Neonatal Death produced by the Stillbirth CRE and PSANZ was updated in 2019 with new recommendations regarding the recommended stillbirth investigations. This has been incorporated into the SA PPG.
- Review of maternal medication and supplementation use, particularly in early pregnancy, is advised to ensure prompt identification of teratogenic substances and timely cessation or referral to appropriate specialists for counselling.
- Patients presenting with significant abdominal pain, particularly non-responsive to opioids, should have a timely review by the most senior available clinician.
- Monochorionic pregnancies are associated with significant perinatal morbidity and mortality. Early US to confirm choronicity, good quality US surveillance including MCA Dopplers, senior obstetric care and consideration of MFM is recommended.
- All patients should be counselled and offered aneuploidy screening in the first trimester (NIPT or combined first trimester screening), including information regarding gestational cut-offs for cFTS screening. High probability aneuploidy screening results should be promptly referred to a centre or clinician capable of arranging diagnostic testing.
- All patients should be counselled and offered screening for autosomal recessive conditions, ideally pre-pregnancy or in the early first trimester. This includes screening for haemoglobinopathies.

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

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/perinatal
- 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 of at least 20 weeks gestation or with a birthweight of 400g 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.

Adjusted neonatal death rate: the number of neonatal deaths, excluding those resulting from a termination of pregnancy performed for psychosocial or unknown reasons, 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.

Adjusted perinatal mortality rate: the number of stillbirths and neonatal deaths, excluding those resulting from a termination of pregnancy performed for psychosocial or unknown reasons, in a

defined time period, divided by the total number of stillbirths 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.

Adjusted stillbirth rate: the number of stillbirths, excluding those resulting from a termination of pregnancy for psychosocial or unknown reasons, 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.

VACTERL: Vertebral defects, anal atresia, cardiac defects, tracheo-esophageal fistula, renal anomalies, and limb abnormalities.

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

PPG: Perinatal Practice Guideline.

References

1. World Health Organization. *Indicator Metadata Registry List: Maternal deaths.* World Health Organization. https://www.who.int/data/gho/indicator-metadata-registry/imr-details/4622

2. World Health Organization. (2006). *Neonatal and perinatal mortality: country, regional and global estimates*. World Health Organization. https://apps.who.int/iris/handle/10665/43444.

3. Australian Bureau of Statistics. (2023). *Causes of Death, Australia*. ABS. https://www.abs.gov.au/statistics/health/causes-death/causes-death-australia/2023.

4. Australian Institute of Health and Welfare (AIHW). (2021). *Australia's mothers and babies*. AIHW. https://www.aihw.gov.au/reports/mothers-babies/australias-mothers-babies.

5. Australian Institute of Health and Welfare. (2024). *Maternal deaths.* Retrieved from https://www.aihw.gov.au/reports/mothers-babies/maternal-deaths-australia

6. Becher JC, Laing IA, Keeling JW, McIntosh N. (2004). Restoring high neonatal autopsy rates. *Lancet, 364*(9450), 2019-2020.

7. Flenady V, Oats J, Gardener G, Masson Vicki, McCowan Lesley, Kent A, Tudehope David, Middleton P, Donnolley 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. (2020). *Clinical Practice Guideline for Care Around Stillbirth and Neonatal Death. Version 3.4*. NHMRC Centre of Research Excellence in Stillbirth. https://stillbirthcre.org.au/researchers-clinicians/download-resources/clinical-practice-guidelines-and-position-statements/

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

9. Smith R, Grivell R, Khong TY, Wilkinson C, Parange A, Crosby D. (2022). South Australian perinatal practice guideline: Stillbirth Investigations. SA Health.

10. Statewide Service Strategy Division. (2015). *Standards for Maternal and Neonatal Services in South Australia 2015*. Department of Health and Wellbeing: Adelaide.

11. World Health Organization. (1993). *International Statistical Classification of Diseases and Related Health Problems*. Tenth Revision. Volume 2. Geneva: WHO.

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

Affix patient label here

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

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 (*weeks*)	Site/location	Results
1st				
2nd				
3rd				
4th				
5th				
6th				
7th				
8th				

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 1st stage *hrs* _____ *mins* _____ 2nd stage *hrs* _____ *mins* _____

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*

Name and designation of person completing the form _____ Date _____

Appendix 3

The Committee reviewed all 200 perinatal deaths of South Australian born babies in 2022. The PSANZ Perinatal Death Classification for the 171 adjusted perinatal deaths are given in the table below.

Perinatal Society of Australia and New Zealand-Perinatal Death Classification (PSANZ-PDC), South Australian adjusted perinatal deaths, 2022

	Category No	Subcategory No	Category %
1 Congenital Anomaly	71		41.5
1.1 Structural anomaly	46		26.9
1.11 Nervous system		18	10.5
1.12 Cardiovascular system		11	6.4
1.13 Genitourinary system		2	1.2
1.14 Gastrointestinal system		0	0.0
1.15 Musculoskeletal		2	1.2
1.151 Congenital diaphragmatic hernia		4	2.3
1.152 Gastroschisis/omphalocele		0	0.0
1.16 Respiratory system (include congenital pulmonary airway malformation (CPAM))		1	0.6
1.17 Haematological		1	0.6
1.18 Multiple Congenital anomaly (no chromosomal/genetic cause or not tested)		7	4.1
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	13		7.6
1.21 Down syndrome (trisomy 21)		3	1.8
1.22 Edward syndrome and Patau syndrome (trisomy 18, trisomy 13)		1	0.6
1.23 Other trisomies and partial trisomies of the autosomes, not elsewhere classified (includes pathogenic duplications, unbalanced translocations and insertions)		4	2.3
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)		3	1.8
1.25 Turner syndrome (monosomy X)		1	0.6
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	0.6
1.29 Unspecified		0	0.0
1.3 Genetic anomaly	12		7.0
1.31 Genetic condition, specified (e.g. Tay-Sachs disease; includes inborn errors of metabolism)		7	4.1
1.32 Syndrome/association with demonstrated chromosomal/gene anomaly.		5	2.9
1.39 Genetic condition, unspecified		0	0.0
2 Perinatal Infection	9		5.3
2.1 Bacterial	9		5.3
2.11 Group B Streptococcus		4	2.3

2.12 E coli		3	1.8
2.13 Listeria monocytogenes		0	0.0
2.14 Spirochaetal e.g. Syphilis		0	0.0
2.18 Other bacterial		2	1.2
2.19 Unspecified bacterial		0	0.0
2.2 Viral	0		0.0
2.21 Cytomegalovirus		0	0.0
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	0		0.0
2.9 Other unspecified organism	0		0.0
3 Hypertension	4		2.3
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	4		2.3
3.6 Pre-eclampsia superimposed on chronic hypertension	0		0.0
3.9 Unspecified hypertension	0		0.0
4 Antepartum Haemorrhage (APH)	9		5.3
4.1 Placental abruption	9		5.3
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	7		4.1
5.1 Termination of pregnancy for maternal psychosocial indications	0		0.0
5.2 Diabetes	3		1.8
5.21 Gestational diabetes		1	0.6
5.22 Pre-existing diabetes		2	1.2
5.3 Maternal injury	1		0.6
5.31 Accidental		1	0.6
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	2		1.2
5.8 Other specified maternal conditions	1		0.6
6 Complications of multiple pregnancy	6		3.5
6.1 Monochorionic twins	5		2.9
6.11 Twin to twin transfusion syndrome (TTTS)		3	1.8
6.12 Selective fetal growth restriction (FGR) (i.e. affecting only one twin)		0	0.0
6.13 Monoamniotic twins (including cord entanglement)		1	0.6
6.18 Other		0	0.0
6.19 Unknown or unspecified		1	0.6
6.2 Dichorionic twins	1		0.6
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	0.6
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	6		3.5
7.1 Fetomaternal haemorrhage	1		0.6
7.2 Antepartum cord or fetal vessel complications (excludes monochorionic twins or higher order multiples)	2		1.2
7.21 Cord vessel haemorrhage		0	0.0
7.22 Cord occlusion (True knot with evidence of occlusion or other)		2	1.2
7.28 Other cord complications		0	0.0
7.29 Unspecified cord complications		0	0.0
7.3 Uterine abnormalities	0		0.0
7.31 Developmental anatomical abnormalities (e.g. bicornuate uterus)		0	0.0
7.38 Other		0	0.0
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	3		1.8
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		2	0.5
7.68 Other		1	0.6
7.9 Unspecified	0	0	0.0

8 Hypoxic peripartum death	2		1.2
8.1 With intrapartum complications (sentinel events)	1		0.6
8.11 Uterine rupture		1	0.6
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		0	0.0
8.16 Intrapartum haemorrhage		0	0.0
8.18 Other		0	0.0
8.2 Evidence of significant fetal compromise (excluding other complications)	1		0.6
8.3 No intrapartum complications recognised and no evidence of significant fetal compromise identified	0		0.0
8.9 Unspecified hypoxic peripartum death	0		0.0
9 Placental dysfunction or causative placental pathology	17		9.9
9.1 Maternal vascular malperfusion	3		0.6
9.2 Fetal vascular malperfusion	3		1.8
9.3 High grade villitis of unknown etiology (VUE)	2		1.2
9.4 Massive perivillous fibrin deposition/maternal floor infarction	1		0.6
9.5 Severe chronic intervillositis (Histiocytic intervillositis)	1		0.5
9.6 Placental hypoplasia	3		1.8
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)	3		1.8
10 Spontaneous preterm labour or rupture of membranes (<37 weeks gestation)	23		13.5
10.1 Spontaneous preterm	14		8.2
10.11 With histological chorioamnionitis		10	5.8
10.12 Without histological chorioamnionitis		4	1.8
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	9		5.3
11 Unexplained antepartum fetal death	15		8.8
11.1 Unexplained antepartum fetal death despite full investigation	12		7.0
11.2 Unclassifiable antepartum fetal death with incomplete investigation	3		1.8
11.3 Unclassifiable antepartum fetal death due to unknown level of investigation	0		0.0
12 Neonatal death without obstetric antecedent	2		1.2
12.1 Neonatal death with no obstetric antecedent factors despite full investigation	1		0.6
12.2 Neonatal death unclassifiable as to obstetric antecedent with incomplete investigation	1		0.6
12.3 Neonatal death unclassifiable as to obstetric antecedent due to unknown level of investigation	0		0.0
Total	171		100.0

Appendix 4

The Committee reviewed all 44 neonatal deaths of South Australian born babies in 2022. The PSANZ Perinatal Death Classification for the 44 adjusted neonatal deaths are given in the table below.

Perinatal Society of Australia and New Zealand-Neonatal Death Classification (PSANZ-NDC), South Australian adjusted neonatal deaths, 2022

	Category No	Subcategory No	Category %
1 Congenital Anomaly	17		38.6
1.1 Structural anomaly	8		18.2
1.11 Nervous system		2	4.5
1.12 Cardiovascular system		4	9.1
1.13 Genitourinary system		0	0.0
1.14 Gastrointestinal system		0	0.0
1.15 Musculoskeletal		0	0.0
1.151 Congenital diaphragmatic hernia		0	0.0
1.152 Gastroschisis/omphalocele		0	0.0
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)		2	4.5
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	5		11.4
1.21 Down syndrome (trisomy 21)		2	4.5
1.22 Edward syndrome and Patau syndrome (trisomy 18, trisomy 13)		0	0.0
1.23 Other trisomies and partial trisomies of the autosomes, not elsewhere classified (includes pathogenic duplications, unbalanced translocations and insertions)		1	2.3
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)		1	2.3
1.25 Turner syndrome (monosomy X)		0	0.0
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	2.3
1.29 Unspecified		0	0.0
1.3 Genetic anomaly	4		9.1
1.31 Genetic condition, specified (e.g. Tay-Sachs disease; includes inborn errors of metabolism)		4	9.1
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)	10		22.7
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)	9		20.5
2.2 Unsuccessful resuscitation	1		2.3
2.9 Unspecified or not known whether resuscitation attempted	0		0.0
3 Cardio-respiratory disorders	5		11.4
3.1 Hyaline membrane disease / Respiratory distress syndrome (RDS)	1		2.3
3.2 Meconium aspiration syndrome	0		0.0
3.3 Primary persistent pulmonary hypertension	0		0.0
3.4 Pulmonary hypoplasia	2		4.5

3.5 Pulmonary haemorrhage	0		0.0
3.6 Air leak syndromes	1		2.3
3.61 Pneumothorax		0	0.0
3.62 Pulmonary interstitial emphysema		1	2.3
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		1	2.3
4 Neonatal Infection	1		2.3
4.1 Congenital/Perinatal bacterial infection (early onset<48 hrs)	0		0.0
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		0	0.0
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		2.3
4.41 Blood stream infection/septicaemia		0	0.0
4.411 Positive culture of a pathogen		1	2.3
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	8		18.2
5.1 Hypoxic ischaemic encephalopathy/Perinatal asphyxia	5		11.4
5.2 Cranial haemorrhage	3		6.8
5.21 Intraventricular Haemorrhage		3	6.8
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		4.5
6.1 Necrotising enterocolitis (NEC)	2		4.5
6.2 Short gut syndrome	0		0.0
6.3 Gastric or intestinal perforation (excluding NEC)	0		0.0
6.4 Gastrointestinal haemorrhage	0		0.0
6.8 Other	0		0.0
7 Other	1		2.3
7.1 Sudden unexpected death in infancy (SUDI)	1		2.3
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.		0	0.0
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		1	2.3

7.2 Multisystem failure	0		0.0
7.21 Secondary to intrauterine growth restriction		0	0.0
7.28 Other specified		0	0.0
7.29 Unspecified/undetermined primary cause or trigger event		0	0.0
7.3 Trauma	0		0.0
7.31 Accidental		0	0.0
7.32 Non accidental		0	0.0
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	44		100.0

Appendix 5

Perinatal Society of Australia and New Zealand Perinatal Death Classification (PSANZ-PDC), South Australian adjusted perinatal deaths by birthweight, 2022

	PSANZ-PDC	Birthweight (g)							Total	
		<500	500-749	750-999	1,000-1,499	1,500-1,999	2,000-2,499	≥2,500	No	%
1	Congenital abnormality	34	16	3	1	2	8	7	71	41.5
2	Perinatal infection	3	0	0	0	1	0	5	9	5.3
3	Hypertension	1	0	1	2	0	0	0	4	2.3
4	Antepartum haemorrhage	2	1	0	1	1	1	3	9	5.3
5	Maternal conditions	2	1	0	0	0	0	4	7	4.1
6	Complications of multiple pregnancy	2	2	0	0	1	0	1	6	3.5
7	Specific perinatal conditions	0	1	1	0	0	0	4	6	3.5
8	Hypoxic peripartum death	0	0	0	0	0	0	2	2	1.2
9	Placental dysfunction or causative placental pathology	7	0	0	1	2	3	4	17	9.9
10	Spontaneous preterm labour or rupture of membranes	15	4	3	0	0	1	0	23	13.5
11	Unexplained antepartum death	2	3	0	0	1	4	5	15	8.8
12	Neonatal death without obstetric antecedent	0	0	0	0	0	0	2	2	1.2
	Total	68	28	8	5	8	17	37	171	100.0
	Percent	39.8	16.4	4.7	2.9	4.7	9.9	21.6	100.0	

Appendix 6

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 Death[1] 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 Death[1] 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 Death*[1] 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

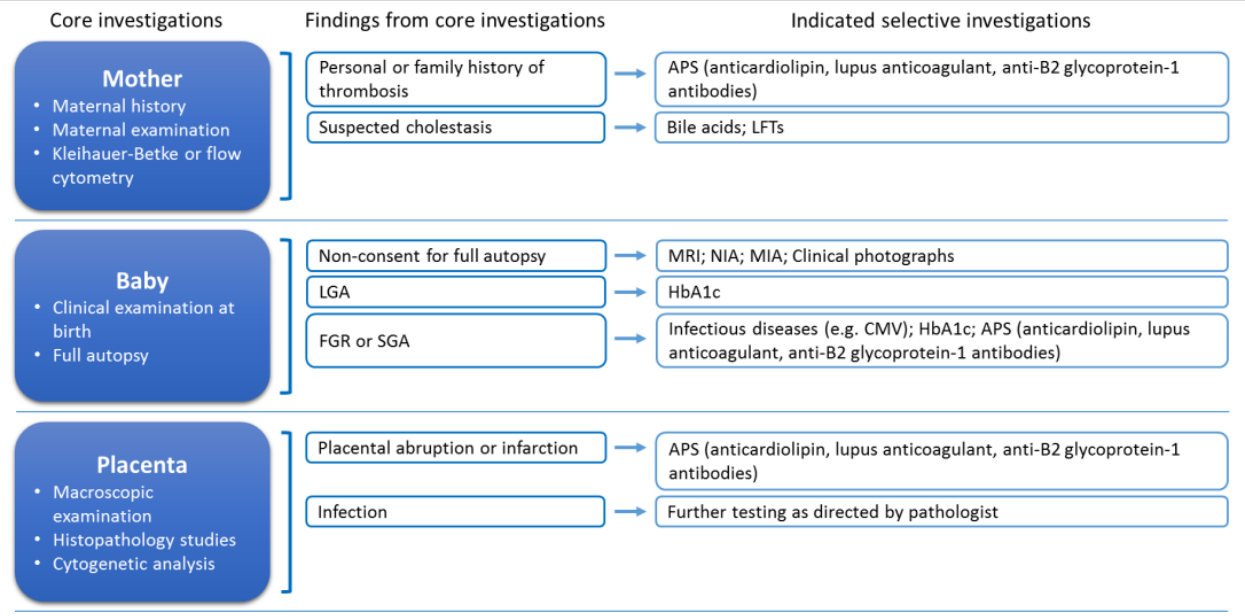
Recommended if there is a suspicion of or known maternal drug use

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, Donnolley 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/