Maternal and Perinatal Mortality in South Australia 2020

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Mortality Committee on maternal and perinatal deaths

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Dr Megan Cooper	Midwife
Dr Marion Crompton	General practitioner
Professor Gustaaf Dekker	Obstetrician
Professor William Hague	Obstetric physician
Professor T. Yee Khong	Pathologist
Ms Toni-Marie Rowe	Midwife, Aboriginal health representative
Dr Tom Vaughan	Obstetric anaesthetist

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- The staff of the Births, Deaths and Marriages Registration Division
- State Coroner's Office, Courts Administration Authority of South Australia

Summary

This is the thirty-fifth Annual Report of the Maternal and Perinatal Mortality Committee, for deaths occurring in 2020.

1. There were no maternal deaths in 2020. The maternal mortality ratio for the last five-year period 2016-2020 was 6.3 deaths per 100,000 women who gave birth, which is low by international standards, and slightly lower than the preceding five-year period where there were 8.9 deaths per 100,000 women.

2. The Committee reviewed the 144 perinatal deaths of babies born in South Australia in 2020. The perinatal mortality rate for all births (stillbirths of at least 400g or 20 weeks gestation and all live births) was 7.7 per 1,000 births. The stillbirth rate was 6.4 per 1,000 births and the neonatal mortality rate was 1.3 per 1,000 live births.

3. One hundred and twenty-three (85.5%) of the perinatal deaths occurred in preterm babies (less than 37 weeks gestation). The leading cause of perinatal death in 2020 was congenital anomalies, which accounted for 41.7% of the deaths. Other leading causes were placental dysfunction or causative placental pathology (11.1%), perinatal infection (8.3%) and antepartum haemorrhage (8.3%).

4. Eleven (44.0%) of the 25 neonatal deaths occurred in neonates born at less than 24 weeks gestation. Of the 14 deaths in neonates born at or after 24 weeks, nine (64.3%) were associated with congenital anomalies.

5. Seventeen babies of Aboriginal mothers died during the perinatal period. The perinatal mortality rate for Aboriginal women was 21.9 per 1,000 births compared with 13.1 in 2019, and compared with 7.1 per 1,000 births for non-Aboriginal women.

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 Pregnancy Outcome Unit website.

Introduction

This is the Thirty-fifth 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. Data linkage with the Births, Deaths and Marriages Division, from medical certificates of cause of perinatal death
2. Data linkage with the Births, Deaths and Marriages Division, from medical certificates of cause of death for maternal deaths
3. Notification from the Supplementary Birth Record, both electronic and paper
4. The Coroner's Office, from Coroner’s findings

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

Further information is obtained from practitioners identified as having been in charge of clinical care through the completion of confidential medical reports (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-fifth report of the Committee incorporates information on maternal deaths in South Australia in the year 2020 and perinatal deaths of babies born to mothers in South Australia in 2020.

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 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. 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 no late maternal deaths in South Australia in 2020. In 2017, the South Australian Maternal and Perinatal Mortality Committee commenced using data linkage to improve detection and enhance reporting on maternal deaths occurring in the state. This has resulted in an increased number of maternal deaths being reviewed, particularly late maternal deaths.

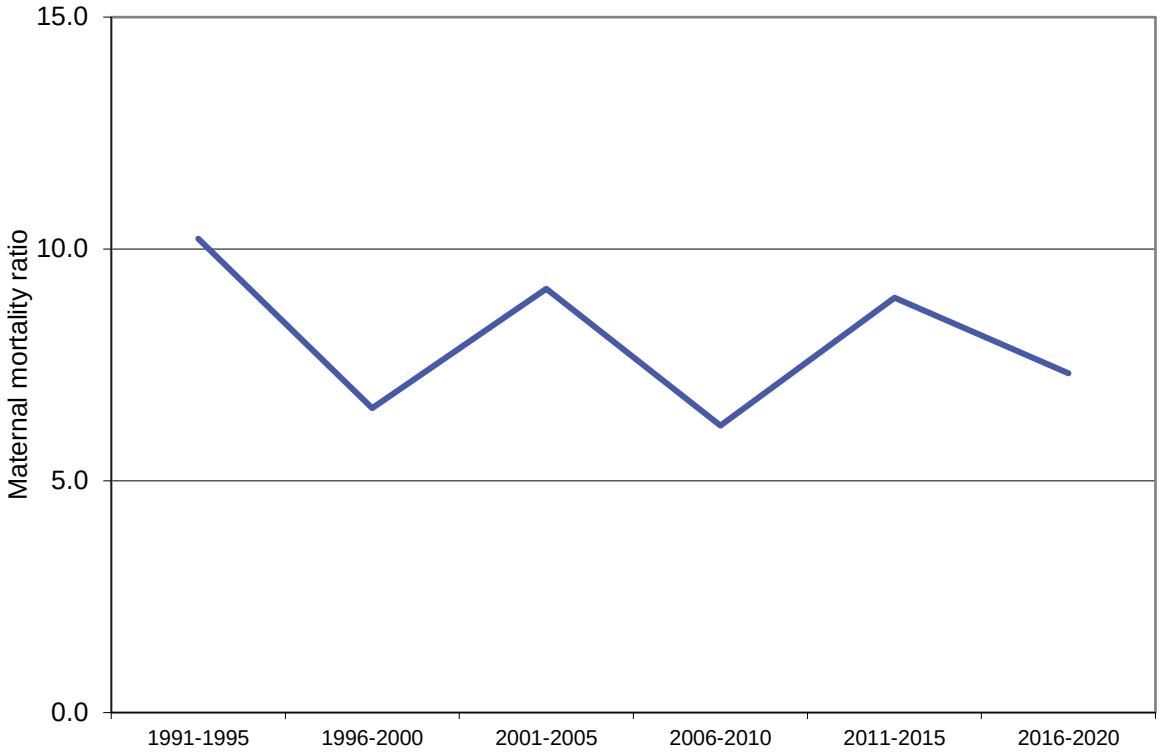
Maternal deaths in South Australia for the three categories of deaths from 1991 to 2020 are presented in Table 1 by five-year periods. Maternal mortality ratios have been calculated for direct and indirect deaths (Table 1 and Figure 1). The maternal mortality ratio for the last five-year period 2016-2020 was 6.3, which was similar to the Australian maternal mortality ratio of 6.4 per 100,000 women for the period 2011-2020. The number of deaths in South Australia is small and has not changed greatly in the last three decades. Of a total of 46 pregnancy-related maternal deaths in the period 1991-2020, 25 were direct deaths and 21 were indirect deaths. In the five year period from 2016-2020, there has been one indirect death of an Aboriginal woman.

Table 1: Maternal mortality by category of death, in 5-year periods, South Australia, 1991 – 2020

Years	Direct deaths	Indirect deaths	Incidental deaths	Total deaths	Direct and indirect maternal deaths	
	Number	Number	Number	Number	Number	Maternal mortality ratio*
1991-1995	4	6	5	15	10	10.2
1996-2000	2	4	4	10	6	6.6
2001-2005	4	4	1	9	8	9.1
2006-2010	5	1	2	8	6	6.2
2011-2015	6	3	2	11	9	8.9
2016-2020	4	3	0	7	7	7.3

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

Figure 1: Maternal Mortality Ratio, South Australia 1991-2020



Causes of maternal deaths

There were no maternal deaths identified in 2020.

There was one maternal death in 2019 that was awaiting classification at the time of the last report. This death has been classified as a direct maternal death. The cause of this death was sepsis.

Key Learning Points

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 Wellbeing SA website.

There were no new key learning points for 2020.

Perinatal Mortality

Perinatal mortality statistics

In 2020 there were 18,738 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 119 stillbirths and 18,619 live births. Twenty-five 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 2020 was 7.7 deaths per 1,000 births. The stillbirth rate was 6.4 per 1,000 births and the neonatal mortality rate 1.3 per 1,000 live births. Fifty of the 144 perinatal deaths (34.7%) were induced terminations of pregnancy and their exclusion would have resulted in a perinatal mortality rate of 5.0 deaths per 1,000 births.

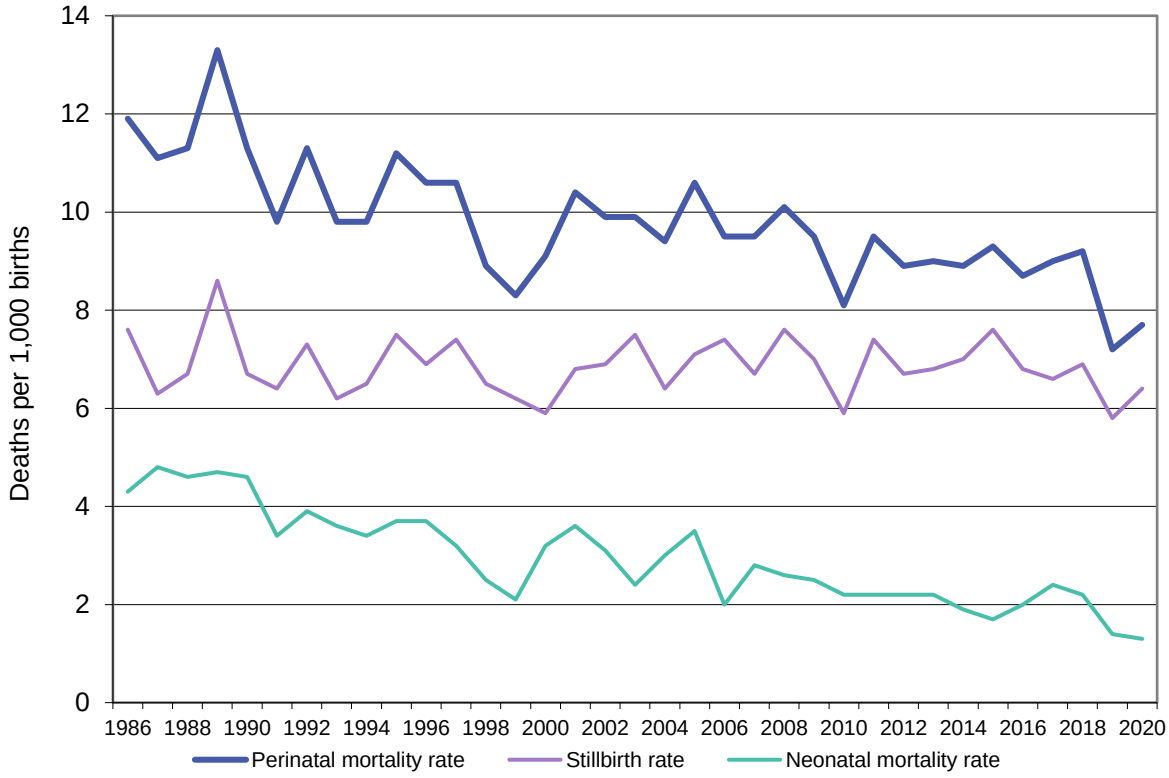
The perinatal mortality rates for other specified minimum birthweights or gestational ages (where birthweight was unavailable) are provided in Table 2. The WHO recommends that national perinatal mortality statistics should only include fetuses and infants weighing at least 500 grams and/or born at 22 weeks or more gestation. 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. Using the WHO classification for international reporting, the perinatal mortality rate was 2.7 per 1,000 births in South Australia, with a stillbirth rate of 2.0 per 1,000 births, and neonatal mortality rate of 0.7 per 1,000 live births.

Table 2: Perinatal mortality, South Australia, 2020 (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	18,738	18,619	119	6.4	25	1.3	144	7.7
≥500g/ 22 weeks	18,684	18,613	71	3.8	19	1.0	90	4.8
≥1,000g/ 28 weeks	18,600	18,563	37	2.0	13	0.7	50	2.7

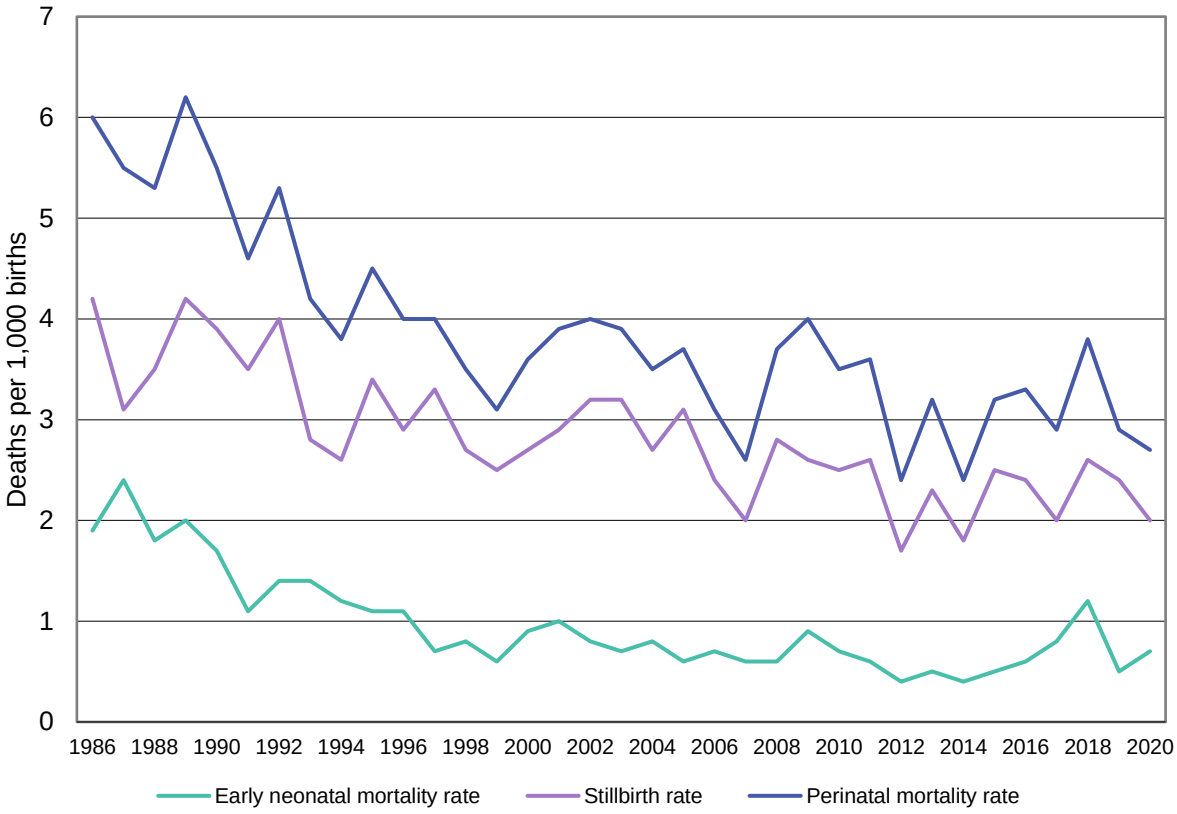
South Australian perinatal mortality rates, including stillbirth and neonatal mortality rates for all births, from 1986-2020 are presented in Figure 2. Whilst the neonatal mortality rate has been steadily declining, the stillbirth rate has not changed markedly over the last two decades.

Figure 2: Perinatal mortality rate (births ≥ 400g or 20 weeks gestation), South Australia 1986-2020



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 statistics). In 2020, the early neonatal mortality rate for infants weighing at least 1,000g or having reached 28 weeks gestation was 0.5 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 2.0 in 2020 (Figure 3).

Figure 3: Perinatal mortality rate (births ≥1,000g or 28 weeks gestation & early neonatal deaths within the first seven days of life), South Australia 1986-2020



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, 2010 – 2020

Year	NSW	VIC	Qld	SA	WA	Tas	NT	ACT	AUSTRALIA
2010	7.6	8.0	10.5	6.1	8.0	10.9	12.5	16.7	8.6
2011	8.0	8.1	9.1	6.0	9.7	10.1	12.8	7.2	8.4
2012	7.5	7.7	10.0	5.9	8.4	10.1	9.4	10.0	8.2
2013	8.1	8.2	9.1	6.1	7.5	9.5	14.4	7.0	8.2
2014	7.0	7.4	9.8	5.9	8.1	15.5	11.3	9.7	8.0
2015	7.8	6.4	9.5	6.5	8.4	9.6	14.1	7.5	7.9
2016	6.8	7.4	9.5	5.5	8.2	11.5	11.4	6.6	7.7
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	5.1	9.5	10.5	18.8	6.7	8.4

*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.

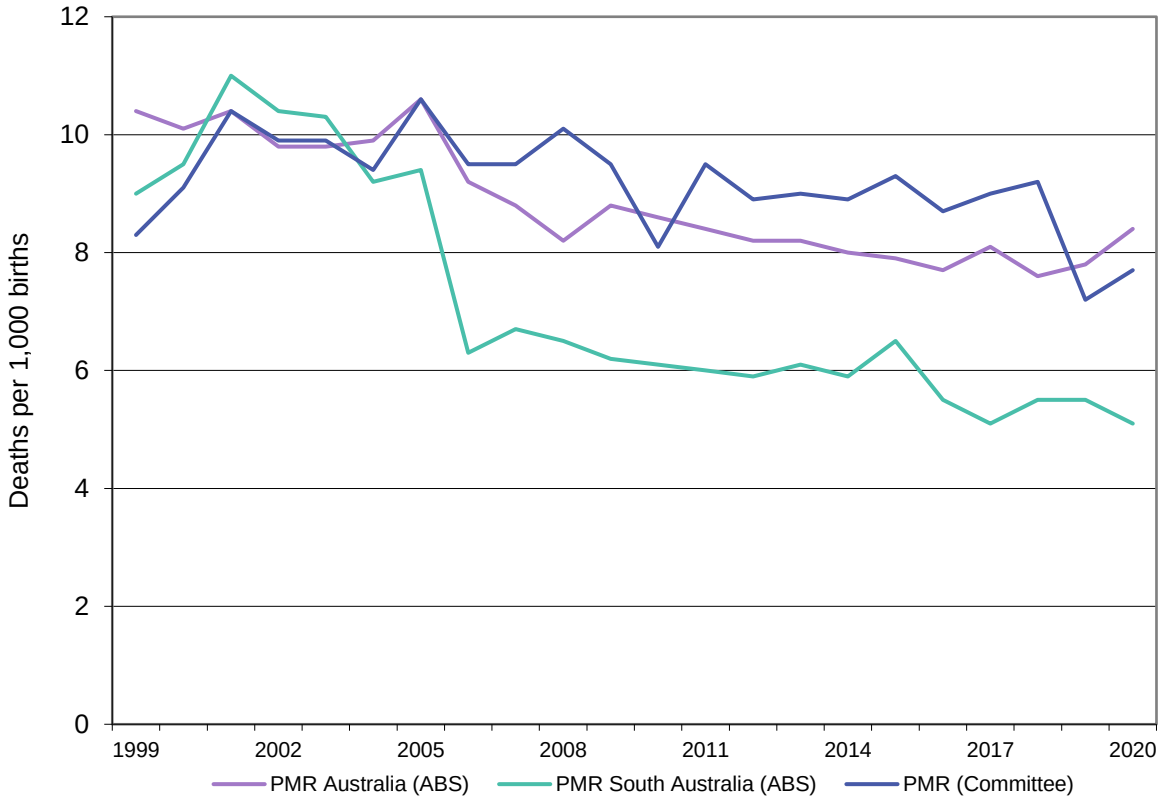
Source: Australian Bureau of Statistics. Catalogue No 3303.0 – Causes of Death, Australia, 20120, 29th September 2021

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 1999-2020 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) 1999-2020 Deaths per 1,000 births



Birthweight-specific perinatal mortality

The birthweight-specific rates of stillbirths, neonatal deaths and perinatal deaths for 2020 are provided in Table 4. Of the 144 perinatal deaths, 121 (84.0%) were of low birthweight (<2,500g) and 19 (76.0%) of the 25 neonatal deaths were low birthweight babies. Forty-one of the perinatal deaths (28.5%) were less than 400g birthweight.

Table 4: Perinatal mortality by birthweight, all births, South Australia, 2020

			Stillbirths		Neonatal deaths		Perinatal deaths	
Birthweight (grams)	Total births	Live births	Number	Deaths per 1,000 births	Number	Deaths per 1,000 live births	Number	Deaths per 1,000 births
<400	42	7	35	833.3	6	142.9	41	976.2
400-499	36	7	29	805.6	3	83.3	32	888.9
500-749	40	25	15	375	2	50	17	425.0
750-999	33	27	6	181.8	2	60.6	8	242.4
1,000-1,499	121	115	6	49.6	1	8.3	7	57.9
1,500-1,999	256	250	6	23.4	1	3.9	7	27.3
2,000-2,499	819	814	5	6.1	4	4.9	9	11.0
2,500-2,999	2,990	2,985	5	1.7	2	0.7	7	2.3
3,000-3,499	7,052	7,045	7	1	3	0.4	10	1.4
3,500-3,999	5,623	5,621	2	0.4	1	0.2	3	0.5
4,000-4,499	1,532	1,530	2	1.3	0	0	2	1.3
≥4,500	193	193	0	0	0	0	0	0.0
Unknown	1	0	1	1,000	0	0	1	1,000.0
Total	**18,738**	**18,619**	**119**	**6.4**	**25**	**1.3**	**144**	**7.7**

The time of perinatal death by birthweight are presented in Table 5. Of the 62 antepartum deaths, 27 were under 750g birthweight (43.5%). Of the intrapartum deaths 95.7% were under 750g birthweight.

Table 5: Time of perinatal death by birthweight, South Australia, 2020 (≥400g birthweight or 20 weeks gestation)

Birthweight (grams)	Stillbirths			Neonatal deaths	Total
	Antepartum	Intrapartum	Uncertain if antepartum or intrapartum		
400-499	21	20	23	9	73
500-749	6	2	7	2	17
750-999	5	0	1	2	8
1,000-1,499	5	0	1	1	7
1,500-1,999	5	1	0	1	7
2,000-2,499	4	0	1	4	9
2,500-2,999	5	0	0	2	7
3,000-3,499	6	0	1	3	10
3,500-3,999	2	0	0	1	3
4,000-4,499	2	0	0	0	2
≥4500	1	0	0	0	1
Unknown	0	0	0	0	0
Total	**62**	**23**	**34**	**25**	**144**

Gestation-specific perinatal mortality

The distribution of perinatal deaths by gestational age is provided in Table 6. There were 123 preterm births (<37 weeks gestation) that resulted in a perinatal death, accounting for 85.4% of all perinatal deaths.

Table 6: Perinatal mortality by gestational age at birth, South Australia, 2020 (≥ 400g or 20 weeks gestation)

Gestational age at birth (weeks)	Total births	Live births	Stillbirths		Neonatal deaths		Perinatal deaths	
			Number	Deaths per 1,000 births	Number	Deaths per 1,000 live births	Number	Deaths per 1,000 births
20-24	91	18	73	802.2	11	611.1	84	923.1
24-27	64	52	12	187.5	1	19.2	13	203.1
28-31	141	132	9	63.8	2	15.2	11	78.0
32-36	1,383	1,370	13	9.4	2	1.5	15	10.8
37-41	17,029	17,017	12	0.7	9	0.5	21	1.2
≥42	27	27	0	0.0	0	0.0	0	0.0
Unknown	3	3	0	0.0	0	0.0	0	0.0
Total	**18,738**	**18,619**	**119**	**6.4**	**25**	**1.3**	**144**	**7.7**

Classification of perinatal deaths

The Perinatal Subcommittee classified each of the 144 perinatal deaths, which occurred in 2020 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, only comparison to 2019 is possible. Table 7 presents the classification of perinatal deaths in 2020 according to PSANZ-PDC.

Table 7: Classification of perinatal deaths, PSANZ-PDC, South Australia, 2020

	PSANZ-PDC	Number	Percent	Deaths per 1,000 births
1	Congenital anomaly	60	41.7	3.2
2	Perinatal infection	12	8.3	0.6
3	Hypertension	3	2.1	0.2
4	Antepartum haemorrhage (APH)	12	8.3	0.6
5	Maternal conditions	7	4.9	0.4
6	Complications of multiple pregnancy	2	1.4	0.1
7	Specific perinatal conditions	9	6.3	0.5
8	Hypoxic peripartum death	1	0.7	0.1
9	Placental dysfunction or causative placental pathology	16	11.1	0.9
10	Spontaneous preterm labour or rupture of membranes (<37 weeks gestation)	10	6.9	0.5
11	Unexplained antepartum fetal death	12	8.3	0.6
12	Neonatal death without obstetric antecedent	0	0.0	0.0
	Total	**144**	**100**	**7.7**

The PSANZ-PDC for perinatal deaths in 2020 is shown in Table 7 and its breakdown by subgroups in Appendix 3. PSANZ-PDC by birthweight is located in Appendix 5.

Congenital anomalies were the leading cause of perinatal death in 2020, accounting for 41.7% of all deaths. The next leading cause was placental dysfunction or causative placental pathology (11.1%), followed by perinatal infection (8.3%), antepartum haemorrhage (8.3%) and unexplained antepartum fetal death (8.3%). There has been a reduction in the number of cases attributed to spontaneous preterm labour or rupture of membranes (<37 weeks gestation) from 11.6% in 2019 to 6.9% in 2020.

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

Congenital anomaly – sixty deaths

This group of 60 deaths included 47 terminations of pregnancy, at 20 weeks gestation or more, of fetuses with congenital anomalies. The types of anomalies were as follows:

Nervous system – fifteen deaths

- Two had anencephaly
- Two had Dandy-Walker malformation
- Three had Chiari malformation
- Two had spina bifida
- Six others had various nervous system anomalies, including ventriculomegaly, posterior periventricular nodular heterotopia, schizencephaly, semilobar holoprosencephaly and hypoplastic corpus callosum

Cardiovascular – six deaths

- Two had hypoplastic left heart syndrome
- One had Tetralogy of Fallot
- One had hypoplastic right heart
- Two had multiple cardiovascular abnormalities, such as hypoplastic aortic arch, ventriculoseptal defect and hypoplastic tricuspid valve
- One had transposition of the great vessels
- Six had various other cardiovascular anomalies

Genitourinary System – four deaths

- These deaths were attributed to multiple genitourinary abnormalities, including multicystic dysplastic kidneys, megacystis, bilateral pelviureteric junction obstruction, absent kidney and absent bladder

Gastrointestinal system – zero deaths

Musculoskeletal – five deaths

- Two were due to arthrogryposis
- One was due to forearm and hand abnormalities
- One was due to skeletal dysplasia
- One was due to a congenital diaphragmatic hernia

Respiratory system – two deaths

- One was due to congenital high airway obstructive syndrome
- One death was due to congenital pulmonary airway malformation

Multiple congenital anomaly – three deaths

- Three had multiple anomalies which included different combinations of hypoplastic right heart, upper limb reduction defect, horseshoe kidney, Tetralogy of Fallot and segmentation anomalies of the spine

Other congenital anomaly – five deaths

- Three had cleft lip and/or palate
- One had idiopathic hydrops fetalis
- One had restrictive dermopathy

Chromosomal – fourteen deaths

- Two had Trisomy 21
- Six had Trisomy 18
- Two had 22q microdeletion syndrome
- One had triploidy
- One had Turner syndrome
- Two had other chromosomal deletions and duplications

Genetic anomaly – six deaths

- Six had various genetic anomalies, such as Apert syndrome, mucopolysaccharidosis type VII, Dandy Walker continuum, spinocerebellar ataxia type 47 and thanatophoric dysplasia type 1

Perinatal infection – twelve deaths

Bacterial – ten deaths

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

Viral – one death

- This death was attributed to cytomegalovirus

Fungal – one death

- This death was due to Candida albicans infection

Hypertension – three deaths

- These deaths were associated with complications of pre-eclampsia

Antepartum haemorrhage – twelve deaths

- Eleven deaths were due to placental abruption
- One death was attributed to an antepartum haemorrhage of undetermined origin

Maternal Conditions – seven deaths

- Three deaths were due to maternal diabetes
- Two deaths were due to maternal antiphospholipid syndrome
- One death was due to maternal sepsis
- One death was due to maternal uterine fibroids

Complications of multiple pregnancy – two deaths

- These deaths were due to twin to twin transfusion syndrome

Specific perinatal conditions – nine deaths

- One death was attributed to fetomaternal haemorrhage
- Four deaths were associated with cord occlusion or other cord complications
- Two deaths were due to fetal antenatal haemorrhagic brain injury
- One death was due to amniotic band
- One death was a termination of pregnancy for suspected, but unconfirmed, congenital anomaly

Hypoxic peripartum death – one death

- This death was due to maternal uterine rupture

Placental dysfunction or causative placental pathology – sixteen deaths

- Three deaths were attributed to maternal vascular malperfusion
- Five deaths were attributed to fetal vascular malperfusion
- Five deaths were attributed to placental hypoplasia
- One death was attributed to high grade villitis of unknown etiology
- Two deaths was associated with other placental pathology

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

- Four deaths were due to spontaneous preterm labour preceded by premature cervical shortening
- Five deaths were due to spontaneous preterm labour or rupture of membranes with histological chorioamnionitis
- One death was due to spontaneous preterm labour or rupture of membranes without histological chorioamnionitis

Unexplained antepartum fetal deaths – twelve deaths

- Six of these deaths were unexplained despite full investigation
- The remaining six deaths were unclassifiable with incomplete investigation

Neonatal death without obstetric antecedent – zero deaths

Classification of neonatal deaths

The classification of the 25 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 – eleven neonatal deaths

- Eight neonates had no resuscitation, or resuscitation was ultimately unsuccessful
- Three deaths were attributed to congenital anomalies

24-31 weeks gestation – three neonatal deaths

- One neonate had no resuscitation
- Two deaths were attributed to intraventricular haemorrhage and congenital anomalies

32-36 weeks gestation – two neonatal deaths

- These deaths were due to congenital anomalies

37 weeks and greater gestation – nine neonatal deaths

- Six of these deaths were attributed to congenital anomalies
- Two deaths were due to hypoxic ischaemic encephalopathy
- One death was due to septicaemia

Aboriginal perinatal deaths

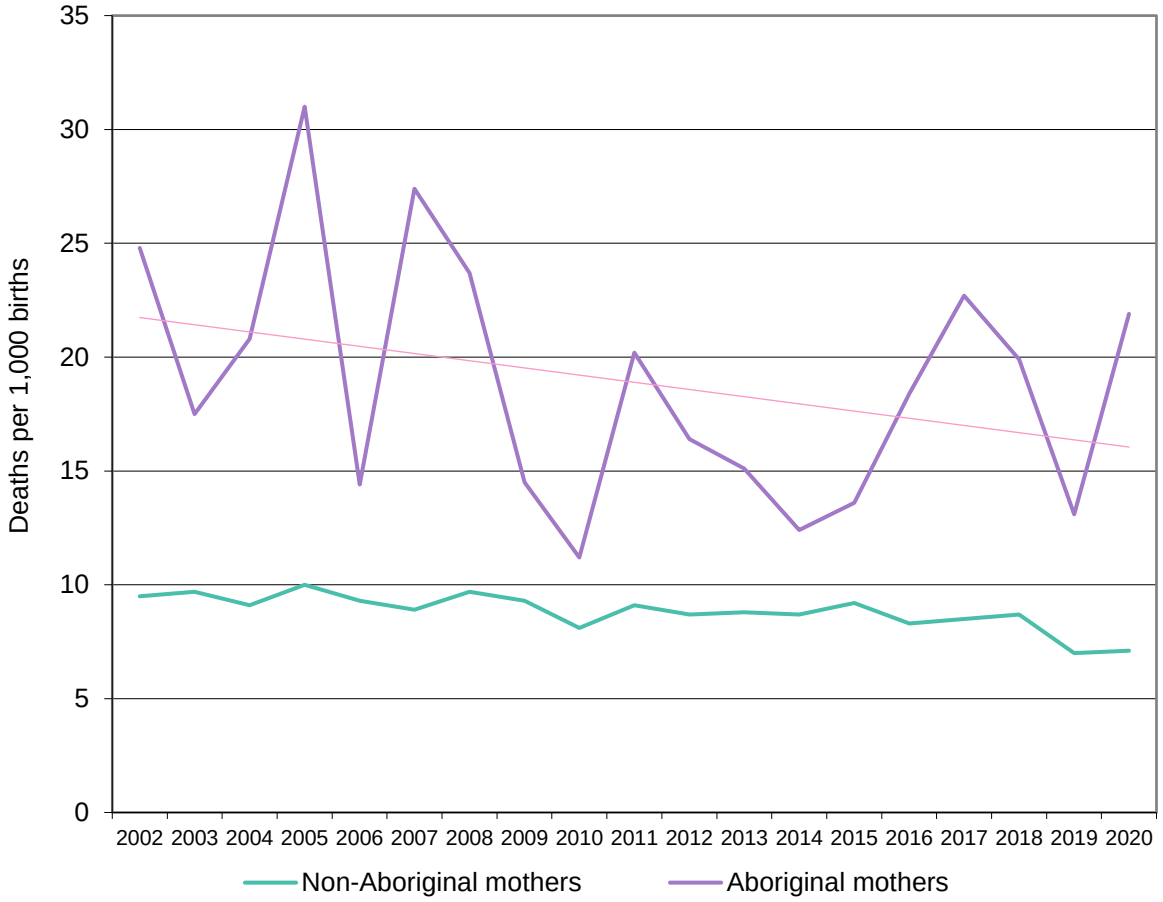
There were seventeen perinatal deaths (13 stillbirths and 4 neonatal deaths) among the births to 776 Aboriginal women.

In 2020 the perinatal mortality rate for births to Aboriginal women was 21.9 per 1,000 births, compared to 7.1 per 1,000 births for births to non-Aboriginal women. The perinatal death rate has increased for Aboriginal women in 2020. 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).

Eleven of the 17 infants were born in public metropolitan hospitals, one was born in a metropolitan private hospital and five were born in country hospitals. Fourteen of the infants were preterm births, with eight born at or before 23 weeks gestation. Ten of the 17 mothers were metropolitan residents, six were country residents and one was from interstate.

The causes of the 17 deaths were attributed to such causes as bacterial infection, maternal diabetes, placental dysfunction, congenital anomalies and placental abruption.

Figure 5: Perinatal mortality by maternal Aboriginal status, South Australia, 2002 – 2020



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 80 of the 144 perinatal deaths (55.6%), including five 'limited' autopsies. The proportion of autopsies undertaken has increased compared to 2019 (46.4%). 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 16 (11.1%) of the perinatal deaths. Placental histological examinations were undertaken for 136 perinatal deaths (94.4%). 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, 2020

Place of death	Deaths	Autopsies performed	
	Number	Number	Percent of deaths
Women's & Children's Hospital	77	44	57.1
Lyell McEwin Hospital	20	11	55.0
Flinders Medical Centre	27	16	59.3
Other metropolitan public hospitals	0	0	0.0
Metropolitan private hospitals	6	2	33.3
Country hospitals	13	6	46.2
Home	1	1	100.0
Total	**144**	**80**	**55.6**

* 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) 81616315**.

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.

Key Learning Points

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

There were no new key learning points for 2020.

Education Subcommittee Report

The twenty-fifth annual educational meeting - 'The Annual Dr Brian Pridmore Perinatal Forum' - was held on the evening of 14th September 2022. The forum is organized by the Education Subcommittee of the Maternal and Perinatal Mortality Committee.

The forum was titled 'Mitotic Melody and Malady' and was an interactive forum regarding the challenges of cancer in pregnancy. The 2022 forum was held in the Joe Verco Lecture Theatre in the Adelaide Health and Medical Sciences Building in the University of Adelaide. For the second consecutive year the forum was also streamed online, this year via Zoom. The forum was presented to an audience of approximately 70 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:

- Professor Graeme Suthers – Genetic Pathologist
- Ms Linda Howell, Dr Catherine O'Doherty and Ms Emma Eckersley – Founder and members of The BEAT Movement
- Dr Alice Robinson – Obstetrician
- Professor Martin Oehler – Gynaecological Oncologist
- Dr Kristina Sibbin – Neonatologist

The audience was comprised mostly of midwives with a small number of medical practitioners, nurses and other health professionals. The majority (64%) attended in person, with the remainder viewing the forum via Zoom. 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 very satisfied with the presentations. The feedback is used by the Subcommittee to guide future topic choices and improve the event.

New recommendations made by the Maternal and Perinatal Mortality Committee, following review of the deaths in 2019, were presented to the audience. These recommendations were published in the 34th annual report in August 2022. 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/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

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 2020, 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 recommendations 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 recommendations 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 the 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 other subcommittees of 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 388, Rundle Mall, ADELAIDE SA, 5001
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

Perinatal Society of Australia and New Zealand-Perinatal Death Classification (PSANZ-PDC), South Australian perinatal deaths, 2020

	Category No	Subcategory No	Category %
1 Congenital Anomaly	**60**		**41.7**
1.1 Structural anomaly	40		27.8
1.11 Nervous system		15	10.4
1.12 Cardiovascular system		6	4.2
1.13 Genitourinary system		4	2.8
1.14 Gastrointestinal system		0	0.0
1.15 Musculoskeletal		4	2.8
1.151 Congenital diaphragmatic hernia		1	0.7
1.152 Gastroschisis/omphalocele		0	0.0
1.16 Respiratory system		2	1.4
1.17 Haematological		0	0.0
1.18 Multiple Congenital anomaly		3	2.1
1.19 Other congenital anomaly		3	2.1
1.192 Idiopathic hydrops fetalis		1	0.7
1.193 Fetal tumour		0	0.0
1.198 Other specified		1	0.7
1.199 Congenital anomaly, unspecified		0	0.0
1.2 Chromosomal anomaly	14		9.7
1.21 Down syndrome		2	1.4
1.22 Edward syndrome and Patau syndrome		6	4.2
1.23 Other trisomies and partial trisomies of the autosomes, not elsewhere classified		1	0.7
1.24 Monosomies and deletions from the autosomes, not elsewhere classified		3	2.1
1.25 Turner syndrome		1	0.7
1.26 Other sex chromosome abnormalities		0	0.0
1.28 Other chromosomal abnormalities, not elsewhere specified		1	0.7
1.29 Unspecified		0	0.0
1.3 Genetic anomaly	6		4.2
1.31 Genetic condition, specified		3	2.1
1.32 Syndrome/association with demonstrated chromosomal/gene anomaly.		3	2.1
1.39 Genetic condition, unspecified		0	0.0
2 Perinatal Infection	**12**		**8.3**
2.1 Bacterial	10		6.9
2.11 Group B Streptococcus		3	2.1
2.12 E coli		1	0.7
2.13 Listeria monocytogenes		0	0.0
2.14 Spirochaetal e.g. Syphilis		0	0.0
2.18 Other bacterial		6	4.2
2.19 Unspecified bacterial		0	0.0
2.2 Viral	1		0.7
2.21 Cytomegalovirus		1	0.7
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	1		0.7
2.8 Other specified organism	0		0.0
2.9 Other unspecified organism	0		0.0
3 Hypertension	**3**		**2.1**
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	2		1.4
3.6 Pre-eclampsia superimposed on chronic hypertension	1		0.7
3.9 Unspecified hypertension	0		0.0
4 Antepartum Haemorrhage (APH)	**12**		**8.3**
4.1 Placental abruption	11		7.6
4.2 Placenta praevia	0		0.0
4.3 Vasa praevia	0		0.0
4.9 APH of undetermined origin	1		0.7
5 Maternal Conditions	**7**		**4.9**
5.1 Termination of pregnancy for maternal psychosocial indications	0		0.0
5.2 Diabetes	3		2.1
5.21 Gestational diabetes		0	0.0
5.22 Pre-existing diabetes		3	2.1
5.3 Maternal injury	0		0.0
5.31 Accidental		0	0.0
5.32 Non-accidental		0	0.0
5.4 Maternal sepsis	1		0.7
5.5 Antiphospholipid syndrome	2		1.4
5.6 Obstetric cholestasis	0		0.0
5.8 Other specified maternal conditions	1		0.7
6 Complications of multiple pregnancy	**2**		**1.4**
6.1 Monochorionic twins	2		1.4
6.11 Twin to twin transfusion syndrome		2	1.4
6.12 Selective fetal growth restriction		0	0.0
6.13 Monoamniotic twins (including cord entanglement)		0	0.0
6.18 Other		0	0.0
6.19 Unknown or unspecified		0	0.0
6.2 Dichorionic twins	0		0.0
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		0	0.0
6.3 Complications of higher order multiples	0		0.0
6.31 Twin to twin transfusion syndrome		0	0.0
6.32 Selective fetal growth restriction		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	**9**		**6.3**
7.1 Fetomaternal haemorrhage	1		0.7
7.2 Antepartum cord or fetal vessel complications	4		2.8
7.21 Cord vessel haemorrhage		0	0.0
7.22 Cord occlusion		3	2.1
7.28 Other cord complications		1	0.7
7.29 Unspecified cord complications		0	0.0
7.3 Uterine abnormalities	0		0.0
7.31 Developmental anatomical abnormalities		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	2		1.4
7.51 Subdural haematoma		0	0.0
7.52 Fetal antenatal ischaemic brain injury		0	0.0
7.53 Fetal antenatal haemorrhagic brain injury		2	1.4
7.6 Other specific perinatal conditions	2		1.4
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		0	0.0
7.613 Complications of fetal shunt interventions		0	0.0
7.614 Complications of minimally invasive fetoscopic interventions		0	0.0
7.615 Complications of open maternal fetal surgery		0	0.0
7.618 Other		0	0.0
7.62 Termination of pregnancy for suspected but unconfirmed congenital anomaly.		1	0.7
7.63 Amniotic band		1	0.7
7.68 Other		0	0.0
7.9 Unspecified	0		0.0
8 Hypoxic peripartum death	**1**		**0.7**
8.1 With intrapartum complications (sentinel events)	1		0.7
8.11 Uterine rupture		1	0.7
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	0		0.0
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	**16**		**11.1**
9.1 Maternal vascular malperfusion	3		2.1
9.2 Fetal vascular malperfusion	5		3.5
9.3 High grade villitis of unknown etiology	1		0.7
9.4 Massive perivillous fibrin deposition/maternal floor infarction	0		0.0

9.5 Severe chronic intervillositis (Histiocytic intervillositis)	0		0.0
9.6 Placental hypoplasia	5		3.5
9.7 No causal placental pathology demonstrated, with antenatal evidence of poor placental function identified	0		0.0
9.8 Placental pathological examination was not performed, with antenatal evidence of poor placental function identified	0		0.0
9.9 Other placental pathology	2		1.4
10 Spontaneous preterm labour or rupture of membranes (<37 weeks gestation)	**10**		**6.9**
10.1 Spontaneous preterm	6		4.2
10.11 With histological chorioamnionitis		5	3.5
10.12 Without histological chorioamnionitis		1	0.7
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	4		2.8
11 Unexplained antepartum fetal death	**12**		**8.3**
11.1 Unexplained antepartum fetal death despite full investigation	6		4.2
11.2 Unclassifiable antepartum fetal death with incomplete investigation	6		4.2
11.3 Unclassifiable antepartum fetal death due to unknown level of investigation	0		0.0
12 Neonatal death without obstetric antecedent	**0**		**0.0**
12.1 Neonatal death with no obstetric antecedent factors despite full investigation	0		0.0
12.2 Neonatal death unclassifiable as to obstetric antecedent with incomplete investigation	0		0.0
12.3 Neonatal death unclassifiable as to obstetric antecedent due to unknown level of investigation	0		0.0
Total	**144**		**100.0**

Appendix 4

Perinatal Society of Australia and New Zealand-Neonatal Death Classification (PSANZ-NDC), South Australian neonatal deaths, 2020

	Category No	Subcategory No	Category %
1 Congenital Anomaly	**14**		**56**
1.1 Structural anomaly	8		32.0
1.11 Nervous system		2	8.0
1.12 Cardiovascular system		3	12.0
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		1	4.0
1.17 Haematological		0	0.0
1.18 Multiple Congenital anomaly (no chromosomal/genetic cause or not tested)		1	4.0
1.19 Other congenital anomaly		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		1	4.0
1.199 Congenital anomaly, unspecified		0	0.0
1.2 Chromosomal anomaly	**6**		24.0
1.21 Down syndrome (trisomy 21)		1	4.0
1.22 Edward syndrome and Patau syndrome (trisomy 18, trisomy 13)		2	8.0
1.23 Other trisomies and partial trisomies of the autosomes, not elsewhere classified (includes pathogenic duplications, unbalanaced translocations and insertions)		0	0.0
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		2	8.0
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	4.0
1.29 Unspecified		0	0.0
1.3 Genetic anomaly	0		0.0
1.31 Genetic condition, specified (e.g. Tay-Sachs disease; includes inborn errors of metabolism)		0	0.0
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)	**7**		**28.0**
2.1 Not resuscitated (including infants where there is an antenatal plan for no resuscitation at birth or in the circumstanc	6		24.0
2.2 Unsuccessful resuscitation	1		4.0
2.9 Unspecified or not known whether resuscitation attempted	0		0.0
3 Cardio-respiratory disorders	**0**		**0.0**
3.1 Hyaline membrane disease / Respiratory distress syndrome (RDS)	0		0.0
3.2 Meconium aspiration syndrome	0		0.0
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	**1**		**4.0**
4.1 Congenital/Perinatal bacterial infection (early onset<48 hrs)	1		4.0
4.11 Blood stream infection/septicaemia		0	0.0
4.111 Positive culture of a pathogen		1	4.0
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).	0		0.0
4.41 Blood stream infection/septicaemia		0	0.0
4.411 Positive culture of a pathogen		0	0.0
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	**3**		**12.0**
5.1 Hypoxic ischaemic encephalopathy/Perinatal asphyxia	2		8.0
5.2 Cranial haemorrhage	1		4.0
5.21 Intraventricular Haemorrhage		1	4.0
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	**0**		**0.0**
6.1 Necrotising enterocolitis (NEC)	0		0.0
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	**0**		**0.0**
7.1 Sudden unexpected death in infancy (SUDI)	0		0.0
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		0	0.0
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	**25**		**100.0**

Appendix 5

Perinatal Society of Australia and New Zealand Perinatal Death Classification (PSANZ-PDC), South Australian perinatal deaths by birthweight, 2020

		Birthweight (g)							Total	
	PSANZ-PDC	<500	500-749	750-999	1000-1,499	1500-1,999	2,000-2,499	≥2,500	No	%
1	Congenital anomaly	37	9	4	0	3	4	3	60	41.7
2	Perinatal infection	6	2	0	1	0	0	3	12	8.3
3	Hypertension	2	0	0	0	1	0	0	3	2.1
4	Antepartum haemorrhage	7	0	1	1	1	0	2	12	8.3
5	Maternal conditions	2	0	1	0	1	0	3	7	4.9
6	Specific perinatal conditions (multiple births)	1	1	0	0	0	0	0	2	1.4
7	Specific perinatal conditions	2	1	1	1	0	0	4	9	6.3
8	Hypoxic peripartum death	0	0	0	0	0	1	0	1	0.7
9	Fetal growth restriction	8	1	0	2	1	1	3	16	11.1
10	Spontaneous preterm	7	2	0	0	0	1	0	10	6.9
11	Unexplained antepartum death	1	1	1	2	0	2	5	12	8.3
12	No obstetric antecedent	0	0	0	0	0	0	0	0	0.0
	Total	**73**	**17**	**8**	**7**	**7**	**9**	**23**	**144**	**100.0**
	Percent	**50.7**	**11.8**	**5.6**	**4.9**	**4.9**	**6.3**	**16.0**	**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 Wellbeing SA website.

Appendix 7

Stillbirth Investigations

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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

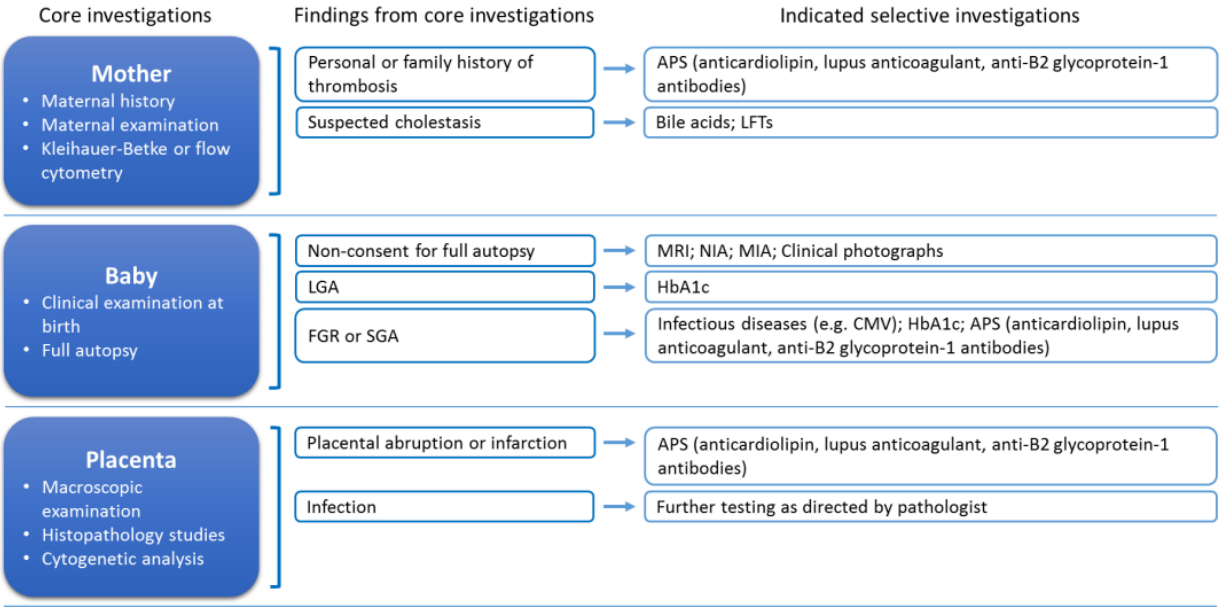
Recommended if there is a suspicion of or known maternal drug use

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
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