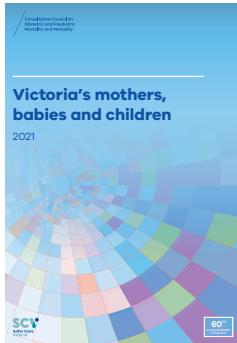


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# Victoria's mothers, babies and children

2021

## ABOUT THE COVER IMAGE



The 'radar' on the front cover signifies the multifaceted and interconnected focus of the Consultative Council on Obstetric and Paediatric Mortality and Morbidity (CCOPMM), leading to a central focus point or learning.

The layers symbolise the depth of analysis and review that leads to identifying the underlying circumstances that contributed to the adverse outcomes we see in this report. The central point of the radar also represents a focus on performance improvement for individual care and the broader health system, like a lens in a camera focusing on its subject.

## ACKNOWLEDGEMENT OF COUNTRY

We proudly acknowledge Victoria's Aboriginal communities and their rich culture and pay respect to their Elders past and present.

We acknowledge Aboriginal people as Australia's First Peoples and as the Traditional Owners and custodians of the land and water on which we rely.

We recognise and value the ongoing contribution of Aboriginal people and communities to Victorian life and how this enriches us.

We embrace the spirit of reconciliation, working towards the equality of outcomes and ensuring an equal voice.



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## LOOKING AFTER YOURSELF

This report contains information and data on deaths and harm occurring for women, babies, children and adolescents. While it is important to share the findings from our reviews, we acknowledge this information can be confronting to read.

We encourage all readers, including consumers, women, families, patients and clinicians, to look after themselves and to reach out to their own support networks, specific support networks and websites, and any relevant employee assistance program, for support and guidance. Additional resources available to help include:

- Beyond Blue [beyondblue.org.au](https://www.beyondblue.org.au)
- Headspace 1800 650 890 [headspace.org.au](https://www.headspace.org.au)
- Kids Helpline: 1800 551 800 [kidshelpline.com.au](https://www.kidshelpline.com.au)
- Lifeline 13 11 14 [www.lifeline.org.au](https://www.lifeline.org.au)
- Red Nose [rednosegriefandloss.org.au](https://www.rednosegriefandloss.org.au)
- SANDS [www.sands.org.au](https://www.sands.org.au)

## ACKNOWLEDGEMENT OF LIVED EXPERIENCE

We acknowledge the lived experience of families, individuals and communities who have been affected by death and harm occurring to women, babies, children and adolescents. These tragic events have a deep impact on the lives of many.

To honour those affected, we have a duty to learn from these tragic events. We are committed to improving and creating a system that is safe for all mothers, babies and children in Victoria.

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## Abbreviations

BMI – body mass index
CCOPMM – Consultative Council on Obstetric and Paediatric Mortality and Morbidity
COVID-19 – coronavirus disease 2019
GPPs – good practice points
IMR – infant mortality rate
MMR – maternal mortality ratio
NICU – Neonatal Intensive Care Unit
NMR – neonatal mortality rate
PMR – perinatal mortality rate
PPH – postpartum haemorrhage
PPROM – preterm premature rupture of membranes
PSANZ – Perinatal Society of Australia and New Zealand
SAMM – severe acute maternal morbidity
SARS-CoV-2 – severe acute respiratory syndrome coronavirus 2
SUDI – sudden unexpected death in infants
VCAR – Victorian Congenital Anomalies Register
VPDC – Victorian Perinatal Data Collection

## Terminology

This report uses the terms ‘woman’ and ‘women’ when referring to data collected in the Victorian Perinatal Data Collection and the CCOPMM mortality database. Information on gender is not recorded in these data collections. The terms ‘women’ and ‘mothers’ refers to people who were pregnant and within the scope of these data collections.

We respectfully acknowledge that this report includes people who do not identify as women or mothers and that individual parents and families may use different words from those used in this report. This may include women, transgender men, intersex people, non-binary and gender diverse people.

# Message from the chair



The Consultative Council on Obstetric and Paediatric Mortality and Morbidity (CCOPMM) was established in 1952 by Professor Lance Townsend and his colleagues. CCOPMM functions as an advisory body to the Victorian Minister for Health

and consists of five subcommittees: Maternal, Neonatal, Stillbirth, Child and Adolescent, and Research and Reporting.

CCOPMM conducts research and analysis into the incidence and causes of maternal deaths, stillbirths and deaths of children up to the age of 18 years of age in Victoria, as well as reviewing all maternity patients admitted to an intensive care unit. Information provided to CCOPMM is privileged under legislation and is not accessible to any third party, including the courts.

This annual report contains a series of recommendations and good practice points that have been developed by the subcommittees following case reviews by their expert members. Again this year, we see the recurring theme of vulnerability contributing significantly to many adverse outcomes.

CCOPMM is increasingly focused on specific factors that contribute to adverse outcomes. We are particularly interested in identifying areas where system improvements have the potential to improve outcomes for women and children throughout our community.

CCOPMM and its subcommittees are expertly advised by senior clinical advisors, healthcare workers across the state and increasingly by our consumers. I am grateful for the hard work and diligence of the Consultative Councils Unit at Safer Care Victoria, whose staff integrate information from many sources to assist us in our deliberations.

In 2022, Professor Peter McDougall retired from CCOPMM after 38 years of exemplary service. Peter was part of CCOPMM from 1991 to 2018, a member of the neonatal subcommittee from 1984 to 2018, chair of the subcommittee from 2012 to 2018 and then took on the role of Senior Clinical Advisor. We are indebted to Peter for his contribution over this time.

To all those who have contributed to CCOPMM, I express my gratitude. In particular, I want to acknowledge the extraordinary effort of Adjunct Professor Tanya Farrell for her work as chair from 2018 to 2023. Tanya steered CCOPMM through the COVID-19 pandemic. This was the most challenging time Victorians have experienced in health care, with profound impacts on women, partners, babies, children and our healthcare workers, as well as the general community. CCOPMM shares Tanya's passion to reduce preventable harm, and this will continue into the future.

I commend this report to you on behalf of CCOPMM, whose members are determined to ensure Victoria stays one of the safest places in the world for women to give birth and for our children to thrive.

**Professor Mark Umstad AM**

Chair, Consultative Council on Obstetric and Paediatric Mortality and Morbidity

# Summary

*The Victoria's mothers, babies and children 2021 report presents data and trends on births and deaths and recommendations by the Consultative Council on Obstetric and Paediatric Mortality and Morbidity (CCOPMM) to improve the quality and safety of care provided to Victoria's mothers, babies and children. This report, the slide packs and the supplementary tables that support it highlight areas that need more focus and improvement priorities for clinical practice, health and community policy development, service delivery and planning for care of women, babies and children across Victoria.*

Each year CCOPMM provides expert independent advice, reports on the state's annual birth data and makes recommendations based on our in-depth case reviews. Alongside the recommendations, CCOPMM develops good practice points to guide best practice in service delivery and clinical care.

Implementation of the recommendations and good practice points occurs in close collaboration with our key partners including consumers, Safer Care Victoria, the Department of Health, clinicians and Victorian health services.

CCOPMM applies a whole healthcare and human systems approach when developing recommendations and good practice points. Our systems of care are complex. This approach recognises that the interactions and relationships between different aspects of the system affect outcomes in a variety of ways. It particularly acknowledges that clinical care is complex and the associated outcomes for women, babies and children are often due to the interaction of multiple contributing factors, rather than one factor alone.

In developing the recommendations for this year's report, CCOPMM members have discussed emerging issues and themes from the 2021 case reviews and considered how these align with issues and themes from previous years and those identified by other stakeholders that CCOPMM communicates with as part of our work.

## KEY FINDINGS

### SNAPSHOT OF BIRTHS IN VICTORIA

Victoria continues to be a safe place to give birth. However, we still see disparities in outcomes between different groups of women that are complex and based on a variety of factors.

- In 2021, 80,322 women gave birth to 81,434 babies. This is compared with 75,870 women who gave birth to 76,990 babies in 2020.
- The median age of women giving birth in 2021 was 32 years. The median age of women having a first birth was 31.
- 76.8 per cent of women gave birth under the care of a public maternity service, including 73 public home births. 22.7 per cent gave birth in a private hospital and 0.5 per cent of women had a planned homebirth under the care of a private midwife.
- Of the women giving birth in 2021, 37.0 per cent were born outside of Australia.
- 7.2 per cent of women reported smoking at some time during their pregnancy (a decrease from 8.0 per cent of women in 2020).
- The proportion of women giving birth by caesarean section continues to increase, with 39.2 per cent in 2021 compared with 37.2 per cent in 2020.
- In 2021, 7.7 per cent of babies were born before 37 weeks.

During the COVID-19 pandemic, CCOPMM measured and reported key outcomes for women and babies at the statewide level. These preliminary findings were reported in the CCOPMM COVID-19 communique. Subsequently, Safer Care Victoria, in partnership with the University of Melbourne, has published a follow-up report COVID-19 communique: a report on maternal and newborn outcomes during the COVID-19 pandemic.

This report used CCOPMM data and compared the pre-pandemic period (January 2018 to March 2020) with the pandemic period (April 2020 to June 2022). This report will be used to inform further areas where priority research needs to occur.

### MATERNAL MORTALITY AND MORBIDITY

In Australia maternal deaths are rare, so it is important that all maternal deaths are reviewed to determine the likely cause and the presence of factors that contributed to the death. The audit of severe acute maternal mortality (SAMM) outcomes acts as a quality indicator of obstetric care. The focus until recently was on maternal mortality reporting, but this only gives insight to a fraction of the burden of maternal morbidity.

- There were 16 maternal deaths in 2021, with 31 deaths now reported in the 2019–2021 triennium.
- The Victorian maternal mortality ratio for the three years between 2019 and 2021 is 8.1 deaths per 100,000 women who gave birth.
- 259 SAMM cases were reported in 2021.
- The mean age of women with SAMM was 31 years. Nine women with SAMM were over 40 years of age.

CCOPMM has identified women with complex social circumstances and mental health issues as over-represented in maternal mortalities. Their access to care is often lacking or fragmented; this is particularly the case for those who are not eligible for free health care. Early intervention and integration of care between primary carers, hospitals and community support services during and following pregnancy for women, and in a manner that is acceptable to them, is vital to ensuring their safety.

## PERINATAL MORTALITY

- In 2021, 81,651 babies were born with a gestation greater than or equal to 20 weeks (or, if gestation unknown, greater than or equal to 400 grams birthweight) (adjusted total births).
- There were 696 adjusted perinatal deaths, 498 adjusted stillbirths and 198 adjusted neonatal deaths.
- Victoria's adjusted perinatal mortality rate was 8.5 per 1,000 births, which was slightly lower than in 2020 (8.9 per 1,000 births).
- The stillbirth mortality rate was 6.1 per 1,000 births (slightly lower than 6.4 per 1,000 births in 2020) and the neonatal mortality rate was 2.4 per 1,000 births (slightly lower than 2.5 per 1,000 births in 2020).
- The leading cause of adjusted stillbirth (excluding terminations for congenital anomalies) was unexplained antepartum fetal death (18.3 per cent), where a definitive cause could not be established.
- Extreme prematurity (32.3 per cent) and congenital anomalies (17.2 per cent) were the most common causes of neonatal deaths (excluding terminations for congenital anomalies).
- The perinatal mortality rate in women who smoked during pregnancy was higher (10.1 per 1,000 births) than in those who did not smoke while pregnant (8.4 per 1,000 births).

Strategies to improve smoking cessation rates are likely to lead to a reduction in stillbirth rates and are a key component in many stillbirth reduction initiatives. Women from socially disadvantaged backgrounds have lower smoking cessation rates reported. Programs that support women to stop smoking should be prioritised in any initiative aiming to reduce stillbirths.

CCOPMM recommendations have previously focused on improving the functioning of the healthcare system. CCOPMM has identified the need to improve health literacy and the shared decision-making capability of pregnant women. It is essential to recognise the importance of healthcare literacy on the outcomes for expectant mothers and families. CCOPMM strongly believes that expectant mothers should be provided with tools to make informed decisions about their own care.



## ABORIGINAL BIRTHS, MORTALITY AND MORBIDITY

Perinatal outcomes are improving for Victoria's Aboriginal mothers and babies, however we can do more to continue closing the gap. Care that centres on the person, the family and community lie at the heart of good Aboriginal health service delivery.

A Department of Health initiative, the Koori Maternity Services program focuses on increasing access to antenatal care, postnatal support and hospital liaison to improve the health and wellbeing outcomes for Koori and Torres Strait Islander women and babies.

- In 2021, 1,250 women who identified as Aboriginal gave birth to 1,271 babies in Victoria (1.6 per cent of all women and 1.6 per cent of all babies born).
- For the 2019–2021 triennium, the perinatal mortality rate of babies born to Aboriginal women was higher than that of non-Aboriginal women (11.2 and 8.6 per 1,000 births respectively).
- For the 2019–2021 triennium, the stillbirth rate of babies born to Aboriginal women was higher than that of non-Aboriginal women (7.9 and 6.3 per 1,000 births respectively).
- For the 2019–2021 triennium, the neonatal mortality rate of babies born to Aboriginal women was higher than that of non-Aboriginal women (3.4 and 2.4 per 1,000 births respectively).

- In 2021, 7.2 per cent of all women reported smoking during pregnancy, with 38 per cent of Aboriginal women reporting smoking during pregnancy. The gap has decreased between Aboriginal and non-Aboriginal smoking rates during pregnancy since the 2020 report.
- Babies of Aboriginal women were more likely to be born with a birthweight less than 2,500 grams than non-Aboriginal women (10.9 per cent compared with 6.2 per cent respectively) and be born prematurely (12.4 per cent compared with 7.7 per cent respectively).

Because the numbers of Aboriginal women and babies are small, there is a high degree of variability from year to year. Further analysis of this data is important to understand these outcomes and prioritise areas where improvements are required.

CCOPMM will continue to support research and quality improvement initiatives, informed by Aboriginal health partners and with the Aboriginal community to improve health outcomes for all Victorian Aboriginal women, babies and children.

The Victorian Government has committed to further new Early Parenting Centres (EPCs) through its 2023-24 State Budget investment. New centres will be established in Shepparton and Northcote, and an Aboriginal dedicated EPC in Frankston will provide culturally safe early parenting supports. In addition, the Aboriginal Maternal & Child Health (MCH) services and early years health co-design project is underway and due for completion early 2024. Safer Care Victoria have also successfully appointed two Aboriginal MCH consumer partners.

## CHILD AND ADOLESCENT MORTALITY

*Child and adolescent mortality includes post-neonatal infant, child and adolescent deaths between the ages of 28 days and 17 years and 364 days.*

In Victoria, child and adolescent mortality rates are low, but there are some deaths that can be prevented. From the review of these deaths there are important findings that inform improvements that need to be made by both our health services and our community to prevent further deaths.

- In 2021, CCOPMM was notified of 214 Victorian residents aged 28 days to 17 years who died. This is 33 more deaths than in 2020.
- These 214 deaths include 143 deaths in children aged one to 17 years and 71 deaths of infants aged 28 to 364 days.
- In 2020, the Victorian infant and under-five-year mortality rates were 2.9 and 3.4 deaths per 1,000 live births, respectively.

Areas of focus identified by CCOPMM include more diligence around malnutrition and neglect and listening to caregivers when they express concern.

The important role of maternal and child health nurses, general practitioners, other primary care practitioners and general paediatricians in assessing infant and child growth, development and wellbeing (and not just acute or chronic illness) cannot be underestimated.

The importance of listening to families when they escalate concerns is critical to timely assessment and care. The Minister for Health has committed to implementing a number of initiatives, many previously recommended by CCOPMM, including:

- a central, parent-led escalation system
- a virtual paediatric consultation system
- mandating the use of standardised and age-specific charts whenever a child's vital signs are recorded.

# About CCOPMM

## CCOPMM FUNCTIONS

CCOPMM was established in 1962 under the *Health Act 1958*, which has been repealed and replaced by the *Public Health and Wellbeing Act 2008* (the Act). CCOPMM is an advisory body to the Minister for Health on maternal, perinatal and paediatric mortality and morbidity, with members being appointed by the Minister for Health.

As described in the Act, CCOPMM's functions are to:

- conduct study, research and analysis into the incidence and causes in Victoria of maternal deaths, stillbirths and the deaths of children
- conduct study, research and analysis into the incidence and causes of obstetric and paediatric morbidity
- conduct a perinatal data collection unit for the purpose of:
  - collecting, studying, researching and interpreting information on and in relation to births in Victoria
  - identifying and monitoring trends in respect of perinatal health including birth defects and disabilities
  - providing information to the Secretary of the Department of Health on the requirements for and the planning of neonatal care units
  - providing information for research into the epidemiology of perinatal health including birth defects and disabilities
  - establishing and maintaining a register of birth defects and disabilities
- provide to health service providers:
  - information on obstetrics and paediatrics
  - strategies to improve obstetric and paediatric care
- consider, investigate and report on any other matters in respect of obstetric and paediatric mortality and morbidity referred to CCOPMM by the Minister or the Secretary
- liaise with any other consultative council (whether or not prescribed) on any matter relevant to CCOPMM's functions
- publish an annual report on the research and activities of CCOPMM
- perform any other prescribed function
- collect information for the purpose of performing its functions as outlined in the Act.

## Review of deaths

CCOPMM's primary role is to:

- review all maternal, perinatal and paediatric deaths in Victoria
- review all cases of severe acute maternal morbidity
- determine factors that may have contributed to these deaths and morbidities
- provide advice and recommend effective strategies to prevent harm and improve clinical outcomes.

All perinatal deaths from 20 weeks' gestation (or 400 grams birthweight if gestation is not known) and all child deaths under the age of 18 years that occur in Victoria are reviewed. We collect information from multiple sources, including the Victorian Perinatal Data Collection (VPDC), hospital case records, individual doctors and midwives, pathology services, the State Coroner, Ambulance Victoria and Paediatric Infant Perinatal Emergency Retrieval (PIPER). The clinical features of each case are considered and then classified according to the relevant system. Perinatal deaths are classified in line with the PSANZ's Perinatal Mortality Classification System and post-neonatal infant, child and adolescent deaths are classified using the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification (Sixth Edition).

CCOPMM has multiple sources of information available regarding children (including health, welfare and education records) and does not limit the cause of death classification to the cause of death recorded in postmortem reports or death certificates. In some cases, new information may become available that leads to a change in the classification assigned to a particular death or group of deaths.

Complex or contentious mortality cases are referred to CCOPMM's specialist subcommittees for review. CCOPMM assesses preventability and makes recommendations to improve clinical

practice and systems based on the findings from each review and the best available evidence. We cannot always identify avoidable factors from the information available during case review, meaning that the actual number of cases that may have preventable factors could be higher.

## Review of births

The Act requires all births that occur in Victoria to be reported to CCOPMM within a prescribed period. This period is defined in the *Public Health and Wellbeing Regulations 2019* as 30 days after the birth.

CCOPMM has statutory responsibility for the VPDC and Victorian Congenital Anomalies Register (VCAR). The department and Safer Care Victoria manage the data collections on behalf of CCOPMM. The data collections enable information about the health of women, babies and children to be analysed and help support improvements in care provided and policy development. Information is collected on obstetric conditions, procedures and outcomes, neonatal morbidity and congenital anomalies relating to every birth in Victoria of at least 20 weeks' gestation or, if gestation is unknown, at least 400 grams birthweight.

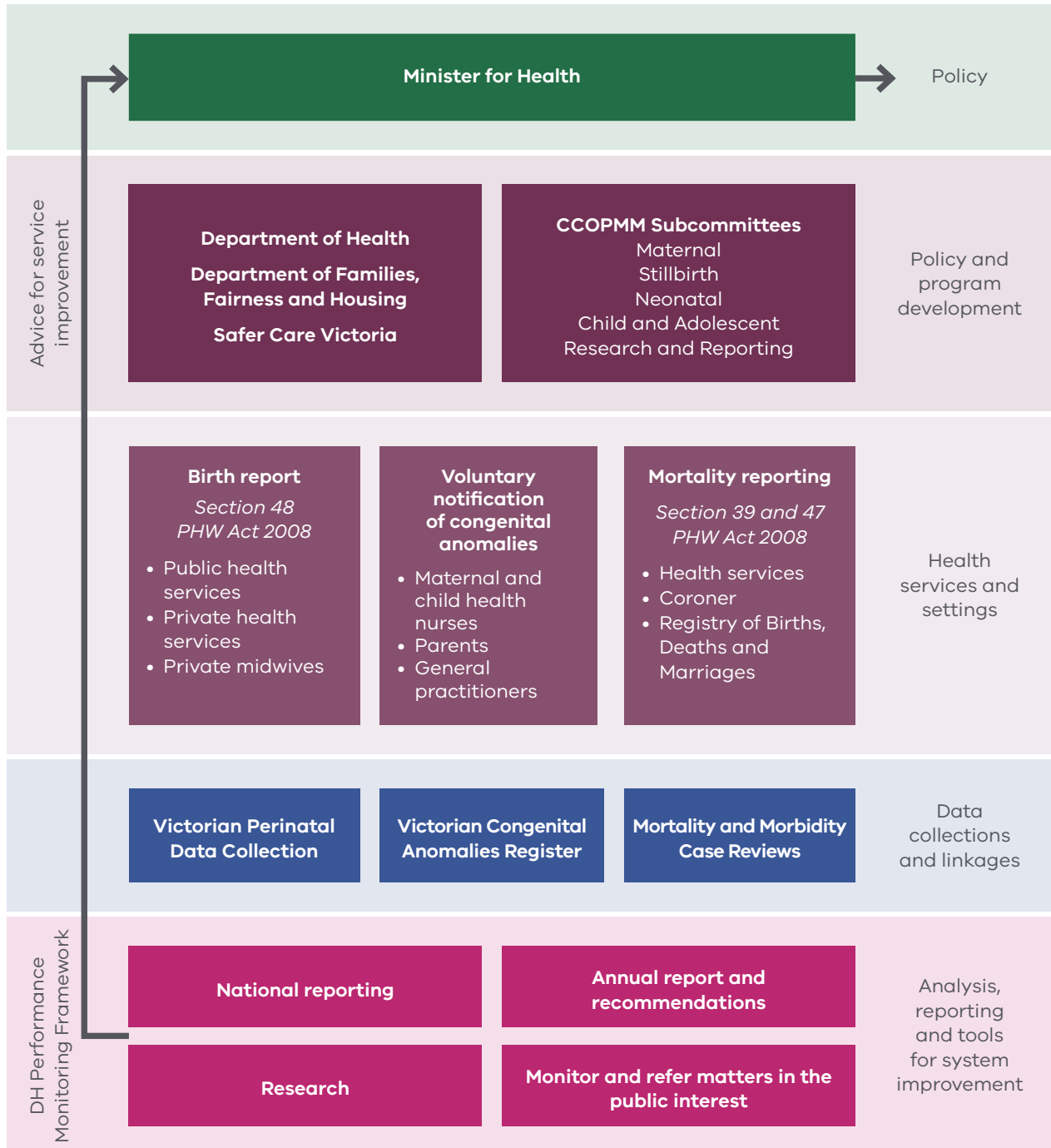
## Reporting and analysis

The VPDC contributes to the Australian Institute of Health and Welfare's National Perinatal Data Collection, which informs the annual report *Australia's mothers and babies*. CCOPMM also supports strategic research that informs clinical outcome improvements, as described in the 'Research and quality improvement' chapter.

You can find previous editions of this annual report, *Victoria's mothers, babies and children*, on the Safer Care Victoria website.

An illustration of CCOPMM's relationships, accountabilities and role is shown in Figure 1.

**Figure 1: CCOPMM's relationships, accountabilities and role**



## CCOPMM DATA

CCOPMM is responsible for maintaining the following data collections established under the Act.

### Victorian Perinatal Data Collection

The VPDC is a register established in 1982 that records sociodemographic characteristics and clinical outcome data on all births in Victoria of at least 20 weeks' gestation or, if gestation is unknown, 400 grams birthweight. Data is collected from public and private hospitals, birth centres and homebirth practitioners from their clinical and patient administrative system via secure data exchange. Find more information about the VPDC on the [Department of Health website](#).

### Victorian Congenital Anomalies Register

The VCAR contains information on all congenital anomalies in livebirths, stillbirths and terminations of pregnancy diagnosed before birth to six years old, voluntarily notified to CCOPMM. The data collected in this register provide the necessary information to monitor, research and plan clinical improvement initiatives and includes suspected or confirmed congenital anomalies.

Data are obtained from multiple sources including the VPDC, hospital records, perinatal death certificates, autopsy reports, cytogenetics reports, clinicians and others in the community (such as parents). Any person has the ability to notify to the VCAR via CCOPMM's website. Find more information about the VCAR on the [Safer Care Victoria website](#).

### CCOPMM Mortality Database

The CCOPMM Mortality Database contains health and personal information on all cases of maternal, perinatal and paediatric mortality in Victoria. All Victorian health services must report mortality cases to CCOPMM. CCOPMM uses the information in this database to conduct study, research and analysis into the incidence and causes of maternal and neonatal deaths, stillbirths and the deaths of children under 18 in Victoria. CCOPMM shares the lessons learned from this data each year in this report to help health services and medical practitioners improve clinical practice and systems of care. Find more information on what and how to report to CCOPMM on the [Safer Care Victoria website](#).

### Severe acute maternal morbidity (SAMM) dataset

Victoria was the first jurisdiction in Australia to introduce mandatory reporting of SAMM cases. CCOPMM's severe acute maternal morbidity dataset includes information on maternal admissions to intensive care during pregnancy and up to 42 days after birth or pregnancy end. Admission to intensive care is used because it is a simple, identifiable criterion and captures the most severe cases. Data are obtained from health services, which are obligated to report these cases under the Act. Find more information on what and how to report to CCOPMM on the [Safer Care Victoria website](#).

# Recommendations

*CCOPMM began using systems-thinking goals to develop recommendations in 2020. The objective was to enhance systems thinking when undertaking case reviews, ensure consistency of case reviews, strengthen CCOPMM's contributing factors framework and ultimately identify stronger sustainable systems-based recommendations that can be measured over time.*

In developing the recommendations for the *Victoria's mothers, babies and children 2021* report, CCOPMM discussed emerging issues and themes from the 2021 case reviews and considering how these align with issues and themes from previous years and those identified by other stakeholders that CCOPMM communicates with as part of its work.

As well as the following four recommendations from the 2021 case reviews, CCOPMM's subcommittees developed GPPs as detailed in the addendums to this report.

## RECOMMENDATION 1

**The Victorian Government funds whole exome sequence testing for families of children who have died from undiagnosed conditions.**

Whole exome sequencing (WES) can help identify a rare genetic condition, but the cost can be prohibitive for some families.

The main conditions for WES include:

- neuromuscular diseases
- syndromic cardiovascular malformations
- hypertrophic cardiomyopathy
- skeletal malformations and/or dysplasia
- neonatal cholestasis and liver failure
- cystic renal disease
- metabolic disorders with lactic acidosis
- immunodeficiency or bone marrow failure
- sudden unexpected death in infancy that is not explained by environmental or other conditions
- necrotising encephalitis.

## RECOMMENDATION 2

### **Support health literacy and shared decision-making capability.**

Expectant mothers should be provided with tools to make informed decisions about their own care. It is essential to recognise the importance of healthcare literacy on the outcomes of expectant mothers and families.

Improvements in health literacy are required to:

- improve clinician and consumer awareness of the safety and benefits of vaccination in preventing serious perinatal mortality and morbidity
- improve women's awareness, during the childbearing years, of the importance to access early pregnancy care, including awareness of painful abdominal symptoms or bleeding and the consideration of an ectopic pregnancy
- support clinicians to communicate effectively and support shared decision making. CCOPMM recommends a multimedia program be created to support this.
- alert parents, carers and families to the increased risk of sudden unexpected death in infants when sleeping at different locations e.g. while on holidays or visiting family
- provide education/support for women who choose to "free birth" and for the sector to understand the reason why women are "free birthing".

## RECOMMENDATION 3

### **Malnutrition in children is a high risk factor for morbidity and mortality. There is an urgent need to strengthen primary healthcare systems including maternity, maternal and child health and general practice services to detect, monitor and treat malnutrition, especially in vulnerable families.**

CCOPMM has seen several deaths in children 0–4-years of age from malnutrition and its complications. These deaths occurred in vulnerable and marginalised families who were either minimally, or not at all, engaged with maternal and child health services and general practitioners. The limited face-to-face consultations with primary care providers and a lack of recorded weight and growth monitoring resulted in these children suffering unrecognised severe malnutrition.

When nutritional status is borderline, severe acute malnutrition and death can occur within a few weeks if a child is underfed. For children who are living in high-risk social environments where they are vulnerable to neglect, growth monitoring and assessment of risk are essential. The mortality rate of children with severe malnutrition is high. Severe malnutrition may be complicated by sepsis, hypoglycaemia, hypophosphataemia, hypothermia and dehydration.



Areas for improvement include:

- in-person appointments – telehealth consultations are a barrier to recognising failure to thrive and/or severe malnutrition because physical observations and growth monitoring cannot be adequately completed
- awareness of the complications of syringe-feeding babies – although widespread, it potentially clouds recognition of a baby’s incapacity to suck feed, which needs to be considered when there are growth concerns
- diagnosis awareness – in a highly developed country, the diagnosis of malnutrition is less considered than other causes of poor growth
- strengthening the transition of care from maternity to maternal and child health services
- strengthening the **Electronic Client Development Information System** flagging tool for maternal and child health nurses and general practitioners. This tool identifies vulnerable families and prioritises them for appointments and follow-up if they fail to attend booked appointments
- referral to Child Protection if families disengage with services and there is a risk of malnutrition that can result in morbidity and mortality.

Community service agencies involved following a Child Protection referral should ensure there is support for families to remain engaged. If they disengage then referral back to Child Protection is necessary. Across all types of deaths and all age groups, CCOPMM continues to observe an overrepresentation of children from vulnerable families. CCOPMM is concerned that the recent increase in economic pressures on families will worsen this problem.

## RECOMMENDATION 4 – UPDATE TO 2017 RECOMMENDATION

**Consider admitting to hospital an infant, child or adolescent who has presented three times to a hospital.**

Repeat presentation to any health service during the same acute illness is a red flag.

Repeated presentations (that are not planned reviews) may indicate:

- The child is deteriorating.
- The child is developing complications (for example, secondary bacterial infection with viral illness).
- The severity of the illness has not been appreciated by healthcare staff and/or the diagnosis needs to be reviewed.
- The parents or caregivers are extremely concerned about their child.

Parents often seek health care from several health services, especially when they are very concerned. It is important to establish how many times a child has presented for the same illness.

A child who presents a second time for the same acute illness should be reviewed by a senior doctor.

If the child presents unexpectedly for a third time during the same illness, there should be serious consideration for hospital admission, even if the child does not look unwell at the time.

# Introduction

*Victoria's mothers, babies and children 2021 presents data and trends on the births and deaths reported to and reviewed by the Consultative Council on Obstetric and Paediatric Mortality and Morbidity (CCOPMM) and its subcommittees. The report includes recommendations for government, health and community services, clinicians and the wider health and community sectors. Good practice points are also developed for services and clinicians to review, implement and evaluate, supporting continuous improvement.*

Rates of maternal, perinatal and child mortality in Victoria are among the lowest in the world. While this is reassuring for all Victorians, we can and must always strive to improve health outcomes and experiences for women, babies, children and their families.

Through its legislative functions, CCOPMM captures birth data, identifies trends and instances of preventable mortality and morbidity and highlights factors that contribute to preventable harm. Monitoring trends and reporting instances of preventability ensures we can collectively continually improve the quality and safety of care and experiences for Victoria's mothers, babies and children.

The report has six specific sections:

1. Mothers and babies
2. Maternal mortality and morbidity
3. Perinatal mortality
4. Aboriginal births, mortality and morbidity
5. Child and adolescent mortality
6. Research and quality improvement

## WHAT IS CCOPMM AND WHAT DOES IT DO?

CCOPMM is an advisory body to the Victorian Minister for Health. The functions of CCOPMM are legislated in the *Public Health and Wellbeing Act 2008* and are supported by the *Public Health and Wellbeing Regulations 2019*.

These functions include collecting perinatal data, reviewing all cases of maternal, perinatal and paediatric mortality, and severe acute maternal morbidity (SAMM).

CCOPMM reviews occur in one of four subcommittees:

1. Stillbirth Subcommittee
2. Neonatal Subcommittee
3. Maternal Subcommittee
4. Child and Adolescent Subcommittee.

The work of CCOPMM is also supported by the Research and Reporting Subcommittee, a multidisciplinary group combining specialist clinical and research knowledge to drive CCOPMM's research function.

CCOPMM undertakes research and reports on its activities annually through a range of publications and resources. These include this annual report, a series of PowerPoint presentations for health services and clinicians to easily share good practice points, and supplementary data tables that complement this report.

CCOPMM provides independent advice and information on quality and safety monitoring to the Victorian Government. This helps prioritise improvement activities, contributes to policy and guideline development and provides feedback to the Victorian health and human services systems and to the general community. More information is available in the 'About CCOPMM' section of this report.

## CCOPMM reporting

This report is part of a series of tools aimed at improving the use of data and supporting you to share our recommendations and good practice points.

## Resources in the 2021 reporting suite

1. This *Victoria's mothers, babies and children 2021* report contains annual Victorian perinatal data and summary data on the deaths of mothers, babies, children and adolescents as well as selected morbidity for mothers. This report also includes the 2021 CCOPMM recommendations. The births flow diagram (Appendix 2) outlines the scope of the data collections and case inclusions and exclusions.
2. An update on the progress of 2020 CCOPMM recommendations (provided as an addendum to this report).
3. A slide pack with additional summary data, trends, recommendations and good practice points.
4. Supplementary tables with more detailed 2021 data.

All resources will be available on the [Safer Care Victoria website](#).

## CCOPMM recommendations and good practice points

Our recommendations and good practice points reflect the findings of CCOPMM's review of all cases of maternal, perinatal and paediatric mortality and SAMM for 2021.

In Victoria, these recommendations and good practice points are shared, and implementation occurs through close collaborations with Safer Care Victoria, the Department of Health, health services, the Coroners Court of Victoria and the Victorian Managed Insurance Authority.

Good practice points (GPPs) are designed to direct local health services and clinicians towards the improvements required in their services and/or in their own clinical practice. All health services and clinicians should develop a plan to consider the GPPs in the context of their settings and implement those that will improve the care they provide.

To ensure ongoing improvement and prioritisation of areas on which to focus service and/or clinician action plans, all health services must review all maternal, perinatal, child and adolescent deaths and significant morbidity that occur in their service to determine contributing factors. This should be done by a multidisciplinary mortality and morbidity committee that is accountable to review all incidents, action any lessons and monitor ongoing performance.

Health services should ensure their clinical governance system:

- has a clearly defined and documented process for case investigation
- is multidisciplinary and includes consumers
- can identify contributing factors and make recommendations that are actioned and evaluated in a timely manner
- shares findings and lessons.

## Data informing our work

The Victorian Perinatal Data Collection (VPDC) provides CCOPMM with information about mothers and their babies, including maternal and baby characteristics, medical conditions and complications of pregnancy. This includes details about the labour, birth, neonatal and postnatal periods for every birth in Victoria, whether the baby was born in a public or private hospital or at home. This information helps us:

- monitor and report on the safety and quality of care
- inform our improvement programs
- plan and conduct research activities
- make policy and planning decisions across Victoria.

VPDC data is analysed for this report.

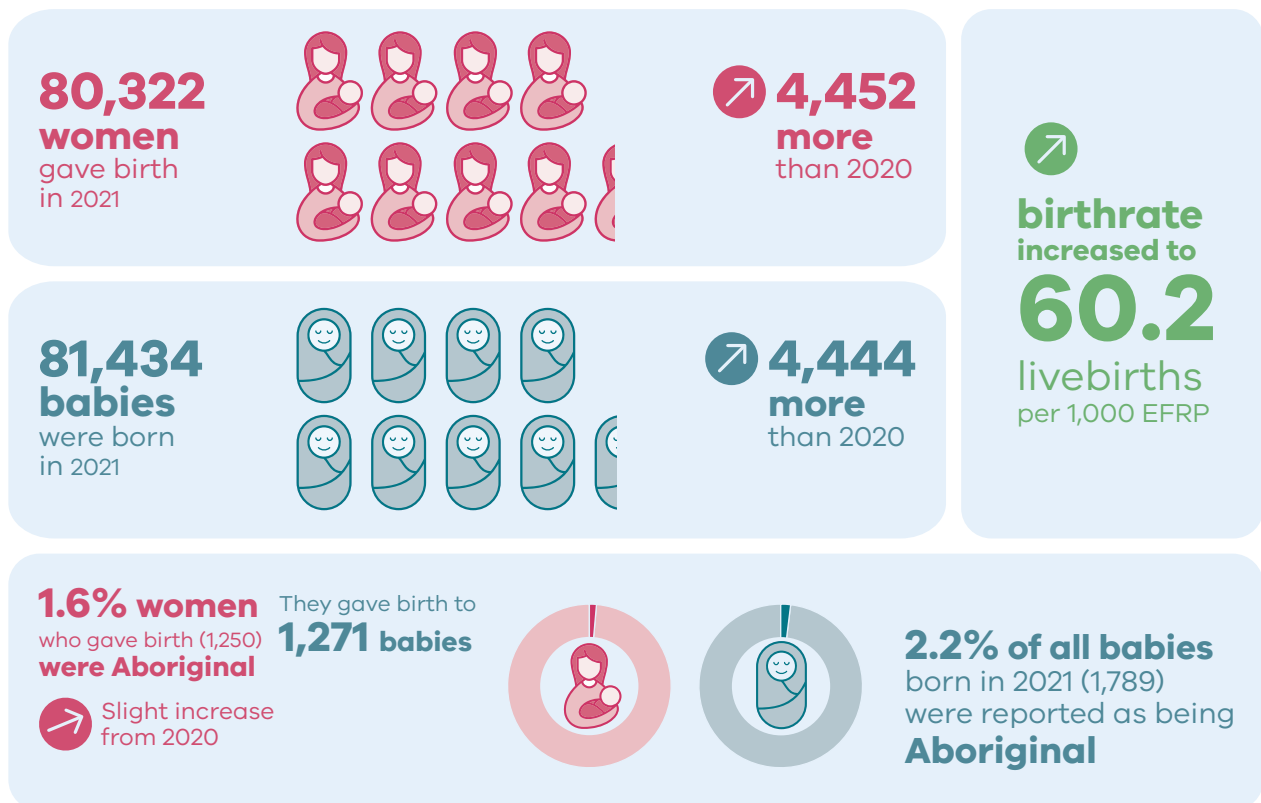
The data provided by the VPDC is also used to produce the annual Perinatal Services Performance Indicators report. This report provides benchmarks and transparent site-specific outcome data across public and private maternity services. Services use these reports to prioritise their improvement programs.

# Mothers and babies

*Victoria continues to be a safe place to give birth. However, we still see disparities in outcomes between different groups of women that are complex and based on a variety of factors. Aboriginal women, non-English speaking women, women of low socioeconomic status or without access to free health care, those who are affected by family violence and those with mental health challenges continue to have less favourable outcomes.*

*It is important for these disparities to be identified and addressed to ensure all women birthing in Victoria always receive high-quality care.*

This chapter excludes terminations of pregnancy for congenital anomalies and for maternal psychosocial indications.



## PREGNANCY AND BIRTH

- In 2021, 80,322 women gave birth to 81,434 babies. This is compared with 75,870 women who gave birth to 76,990 babies in 2020.
- There were 4,452 more women giving birth and 4,444 more babies in 2021 than in 2020.

**12,103 women**  
(15.1%) instrumental  
vaginal births 2021

↘ Down from 15.9% in 2021

**31,456 women**  
(39.2%) caesarean  
section births 2021

↗ Up from 38.4% in 2020



**36,762 women**  
(45.8%) unassisted  
vaginal births 2021

→ Similar to 2020

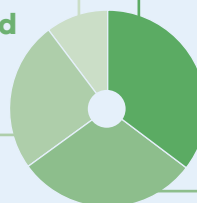
## onset of labour

of 80,322 women  
who gave birth

**10.2% women**  
had spontaneous and  
augmented labour

**24.5% women**  
had no labour

↗ Slight increase  
from 2020



**35.4% women**  
had labour induced

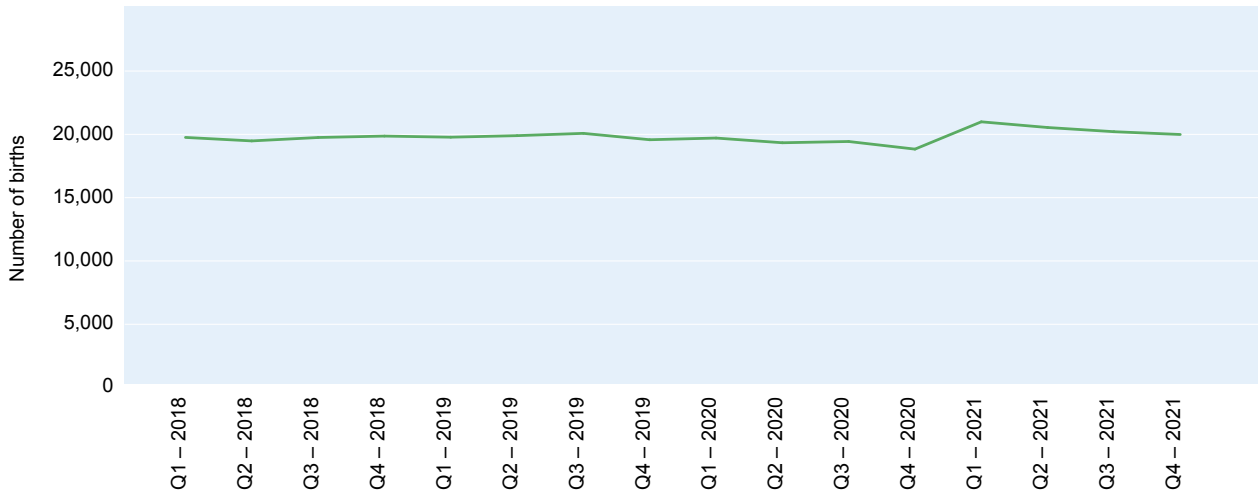
↘ Slight decrease  
from 2020

**29.8% women**  
had spontaneous and  
not augmented labour

- 40.1 per cent of women started labour spontaneously; just over one-quarter of these went on to have labour augmented.
- 35.4 per cent of women had labour induced (this includes 1.9 per cent who experienced no labour following a failed induction of labour), and 24.5 per cent of women had no labour.
- Victoria continues to see an increase in caesarean rates (31,456 women, 39.2 per cent), with unassisted vaginal birth rates (36,762 women, 45.8 per cent) similar to 2020.
- 1,250 Aboriginal women gave birth to 1,271 babies (1.6 per cent of all women and 1.6 per cent of all babies born in Victoria). 1,789 babies (2.2 per cent) were reported as being Aboriginal<sup>1</sup>.

<sup>1</sup> For trends and comparisons specifically related to Aboriginal women and babies please refer to the 'Aboriginal births, mortality and morbidity' section.

**Figure 2: Number of births per quarter, 2018–2021**



- During the first quarter of 2021, there was an increase in the number of births, although the rest of the year remained quite similar to previous years (Figure 2).
- 76.8 per cent of women gave birth under the care of a public maternity service, including 73 public home births. 22.7 per cent gave birth in a private hospital and 0.5 per cent of women had a planned homebirth under the care of a private midwife. There were 35 fewer public homebirths in 2021 compared with 2020.

CCOPMM fully supports qualified and registered medical and midwifery professionals as the most appropriate maternity care providers. We are concerned by the significant increase in adverse outcomes where women have engaged unregistered/unregulated birth attendants when choosing to birth at home or in hospital.

Emotional and practical assistance to women during pregnancy and birth is invaluable. However, there have been reports of some practitioners acting beyond this important supportive role.

CCOPMM is working with Safer Care Victoria and consumers to provide best guidance and advice to support women and families in pregnancy and birth.

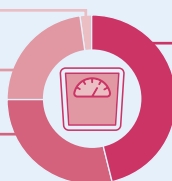
- 5,750 women smoked at some time during their pregnancy (7.2 per cent).
- 5,564 women smoked in the first half of pregnancy (6.9 per cent) and 3,467 women smoked in the second half of pregnancy (4.3 per cent).
- The rate of maternity or newborn readmissions during 2021 has remained steady since 2018, while there was a reduction in the rate of babies admitted to a Special Care Nursery or Neonatal Intensive Care Unit at term (excluding congenital anomalies) in 2021.

At booking:

**2.1% women underweight**

**22.0% women obese**

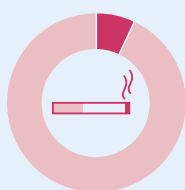
**27.9% women overweight**



**44.6% women healthy weight**

→ Similar to 2020

**7.2% women smoked**  
at some time during their pregnancy in 2021



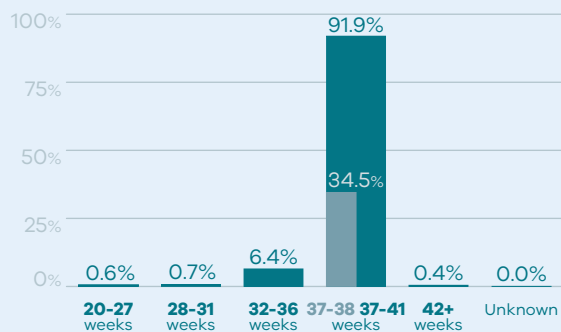
**6.9% women smoked**  
in first half pregnancy

**4.3% women smoked**  
in second half pregnancy



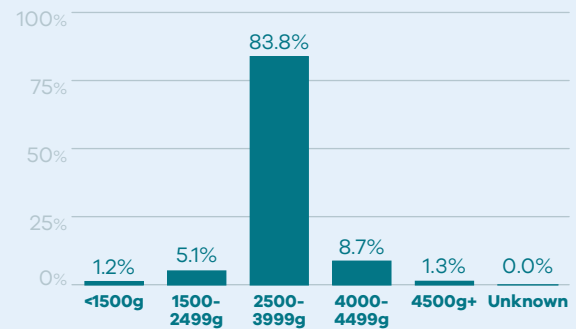
## gestation

of 81,434 babies born



## birth weights

of 81,434 babies born



## MOTHERS

- The median age of women giving birth in 2021 was 32 years. The median age of women having a first birth was 31.
- Over the past 10 years there has been an increase in women giving birth at 32–36 weeks; however, 2021 saw a slight decrease from 6.6 per cent of birthing episodes in 2020 to 6.4 per cent in 2021.
- Almost half of all pregnant women were overweight (27.9 per cent) or obese (22.0 per cent).
- 37.0 per cent of women giving birth were born outside of Australia.
- There was no observed increase in the rate of women with severe pre-eclampsia or eclampsia during pregnancy (since 2018).
- Since 2018, there has been a marginal increase in the number of women giving birth before arrival at hospital for a planned hospital birth.
- 27.9 per cent of women who gave birth experienced a postpartum haemorrhage (blood loss of 500 mL or more in the first 24 hours following birth), including 2.3 per cent who experienced blood loss of 1,500 mL or more.

## BABIES

- Of 490 babies born at 20–27 weeks (0.6 per cent of all births), 217 were born at 20–23 weeks and 273 were born at 24–27 weeks.
- Research on the impact of COVID-19 on pre-term births (birth before 37 weeks of gestation) has shown mixed results. Our data for 2021 shows a continued decrease in the rate of pre-term births, from 8.5 per cent in 2018, 8.2 per cent in 2019, 7.9 per cent in 2020 and 7.7 per cent in 2021.
- Since 2018, the rate of babies born with severe fetal growth restriction has decreased slightly. In contrast, the rate of singleton babies born large for gestational age and sex increased.
- Since 2018, the rate of babies with an Apgar score less than 7 at five minutes has remained steady.
- In 2021, 3.3 per cent of babies were born with a congenital anomaly. This is similar to previous years, with 3.5 per cent reported in 2020 and 3.1 per cent in 2019.

**Table 1: Trends in birthing episodes (number of women giving birth) and gestation (%), 2000–2021**

Gestation	2000	2005	2010	2015	2016	2017	2018	2019	2020	2021
20–27 weeks	0.7	0.6	0.6	0.5	0.6	0.5	0.6	0.6	0.5	0.5
28–31 weeks	0.7	0.6	0.7	0.7	0.6	0.7	0.6	0.7	0.6	0.6
32–36 weeks	5.5	5.5	5.8	6.4	6.2	6.4	6.4	7.0	5.9	5.7
37–41 weeks	91.8	91.9	91.6	92.0	92.2	92.1	92.1	91.5	92.7	92.8
42+ weeks	1.3	1.3	1.2	0.5	0.4	0.3	0.2	0.3	0.3	0.4
Not reported	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

There has been increasing interest in births at early term, particularly before 39 weeks. In 2021, 28,107 babies (34.5 per cent) were born at 37 or 38 weeks and, of those, 9,722 (34.6 per cent) had labour induced. Another 10,360 (36.9 per cent) had a pre-labour caesarean section. Of those who were induced at 37 or 38 weeks, no medical indication was reported for 3.3 per cent.

Table 1 shows trends in birthing episodes and gestation.

## NEW MEASURES IN 2021

### COVID-19 vaccination rates

- Pregnant women have a higher risk of severe illness from COVID-19. Their babies also have a higher risk of being born prematurely.
- In June 2021, advice was issued to routinely recommend messenger Ribonucleic Acid (mRNA) vaccines for women who were trying to conceive (either spontaneously, or through IVF) for pregnant women or those breastfeeding.
- Prior to June 2021, COVID-19 vaccines were not routinely recommended in pregnancy. However, they were not contraindicated.
- 19.9 per cent of women giving birth in 2021 had received a COVID-19 vaccination at some time before giving birth (or 40.4 per cent of those who gave birth after 1 July 2021).

### Unplanned caesarean section urgency

- The median time from deciding on a category 1 urgent caesarean section (immediate threat to the life of the women or baby) to birth was 43 minutes, with one-quarter born in 21 minutes or less, and one-quarter born after more than 69 minutes.
- 20.2 per cent of unplanned caesarean sections with an urgency category reported were due to an urgent threat to the life of a woman or baby (Category 1).
- Over half of unplanned caesarean sections (50.4 per cent) with an urgency category reported were due to maternal or fetal compromise that was not immediately life threatening (Category 2).

# Maternal mortality and morbidity

*Maternal mortality includes all maternal deaths during pregnancy and within a year of birth. Maternal morbidity includes all intensive care unit (ICU) admissions during pregnancy and up to 42 days after birth or pregnancy end.*

## Victorian maternal mortality ratio (MMR)

**8.1** deaths per 100,000 women who gave birth during 2019-21 triennium **this is more than 6.9** deaths per 100,000 women who gave birth during 2018-20 triennium



In Australia maternal deaths are rare, so it is important that all maternal deaths are reviewed to determine the likely cause and the presence of factors that contributed to the death. A maternal death is defined as the death of a woman during pregnancy or within 12 months of the end of pregnancy, from any cause.

In this report, maternal deaths occurring during pregnancy or up to six weeks after the end of pregnancy are classified as:

- **direct** – resulting from obstetric complications of pregnancy or its management
- **indirect** – resulting from diseases or conditions that were not due to a direct obstetric cause but were aggravated by the physiological effects of pregnancy
- **coincidental** – causally unrelated to the pregnancy or birth.

Maternal deaths occurring more than 42 days after the end of the pregnancy and up to one year after birth are reported as '**late**'. These deaths may have direct, indirect or coincidental causes.

The incidence of maternal deaths is expressed as the maternal mortality ratio, which is calculated using direct and indirect deaths that occur during pregnancy or within 42 days of the end of pregnancy. Late and coincidental deaths are not included in this calculation.<sup>1</sup>

By reviewing every maternal death, and understanding contributing factors, recommendations can be made and safety opportunities shared with health and community services and clinicians to improve outcomes for women and their families.

## 2021

16 maternal deaths



**2 early direct** deaths



**6 early indirect** deaths



**2 early coincidental** deaths



**6 late** deaths

## 2019-21

33 maternal deaths



**5 early direct** deaths



**14 early indirect** deaths

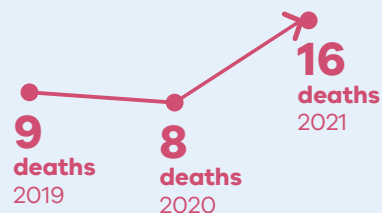


**4 early coincidental** deaths



**10 late** deaths

## Maternal deaths per year



## SNAPSHOT

- In 2021 there were 16 maternal deaths, compared with eight reported deaths in 2020 and nine in 2019.
- Of the 16 deaths in 2021, two were direct, six were indirect, two were coincidental and six were late.
- In the 2019–2021 triennium there were 33 deaths, of which five were direct, 14 were indirect, four were coincidental and 10 were late.
- Of these 33 deaths, seven were considered preventable by the Maternal Mortality and Morbidity Subcommittee.
- The Victorian maternal mortality ratio from 2019 to 2021 was 8.1 per 100,000 women who gave birth.
- In the 2019–2021 period, the top causes of maternal mortality were non-obstetric haemorrhage, cardiovascular causes, respiratory causes and suicide. There was no maternal death in 2021 related to SARS-CoV-2 infection.

## CONTRIBUTING FACTORS IDENTIFIED IN MATERNAL DEATHS

The review of maternal deaths over the most recent triennium (2019–2021) revealed a range of contributing factors and, in many cases, multiple contributing factors. Sadly, women with specific vulnerabilities continue to appear in the cases we review.

Suicide remains a major cause of maternal death in Victoria. Complex social circumstances and mental health issues are frequently identified in these women. Their access to care is often lacking or fragmented. Integration of care between primary carers, hospitals and support services during and following pregnancy in women at risk, and in a manner that is acceptable to them, is vital to ensuring their safety.

Recurrent themes that have emerged from analysis of the maternal mortality cases include:

- mental health issues or social circumstances that limit women’s ability to access and engage with care
- access to care, in particular ineligibility for free care
- poor antenatal attendance
- lack of recognition of severity of illness by the woman, her family or by healthcare workers
- substance abuse
- family violence
- obesity.

## SEVERE ACUTE MATERNAL MORBIDITY

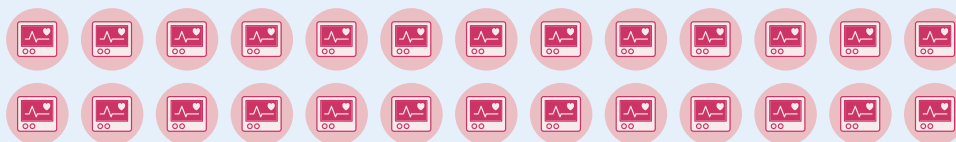
The audit of SAMM outcomes acts as a quality indicator of obstetric care. The focus until recently was on maternal mortality reporting, but this only provides insights to a fraction of the burden of maternal morbidity.

A concise and detailed review of SAMM (‘maternal near misses’ or ‘near hits’ or ‘safety opportunities’) is an important step towards promoting reflective practice and safe pregnancy care. It affords learning opportunities to identify underlying and/or preventable causes and contributing factors, and allows for identification of systems improvement strategies which, in turn, lead to an improvement of pregnancy care and maternal outcomes.

Victoria was the first jurisdiction in Australia to introduce mandatory reporting of SAMM cases in 2017. SAMM is measured as an admission to an ICU during pregnancy and up to 42 days after birth or end of pregnancy. Each ICU admission is then categorised into one of 17 morbidities. Women who do not meet criteria for defined morbidities remain unclassified.

In 2021, CCOPMM introduced a context-specific framework to assign contributing factors to each clinical case on a systems level. Currently not all SAMM cases are comprehensively reviewed by local quality and safety teams, which limits insight into each case.

**259**  
women were  
admitted  
to an ICU  
with SAMM

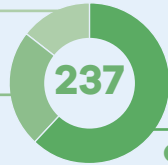


## SAMM cases

(Of the babies born  $\geq 20$  weeks' gestation)

**Instrumental birth**  
(14.3%)

**Vaginal birth  
(non-instrumental)**  
(23.6%)



**Caesarean section**  
(62%)

Of these 259 women

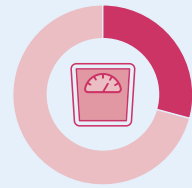
**39.9%** (95)  
**were born overseas**

Of these 259 women

**3.4%** (8)  
**were Aboriginal**

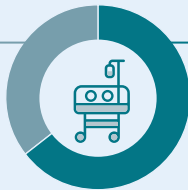
Of these 259 women

**29.4%** (70)  
**had a BMI of 30 or higher**



Of these 237 births

**35.5% were pre-term**  
( $< 37$  weeks' gestation)



**64.5% born at or after 37 weeks' gestation**

Of these 259 women

**the mean length of stay in ICU was**

**3.4 days**

Of these 167 births at  $\geq 37$  weeks' gestation

**6.6%** of babies  
**were born under the 10<sup>th</sup> percentile**



## SUMMARY OF SEVERE ACUTE MATERNAL MORBIDITY

In 2021:

- There were 259 SAMM cases among 80,322 women who gave birth in 2021, accounting for one in 310 women being admitted to an adult ICU during or after pregnancy.
- 125 were affected by one morbidity (73.1 per cent), 32 by two morbidities (18.7 per cent) and 14 by three or more morbidities (8.2 per cent); 88 remained unclassified because they did not meet criteria.
- Of the 259 women with SAMM, 84 were pregnant at the time of admission to ICU (32.4 per cent), 11 were in the first trimester (13.1 per cent), 35 were in the second trimester (41.7 per cent) and 38 were in the third trimester of pregnancy (45.2 per cent).
- 175 women were admitted to an ICU in the postpartum period (67.6 per cent).
- The primary causes of morbidity were major obstetric haemorrhage (29.8 per cent), acute respiratory dysfunction (29.8 per cent), renal or liver dysfunction (mostly in the context of pre-eclampsia or of haemolysis, elevated liver enzymes and low platelet count (HELLP)) (12.9 per cent) and septicaemic shock (8.8 per cent).
- The mean length of stay in ICU was 3.4 days.

Table 2: SAMM Classification

SAMM Classification	Count of Classifications <sup>2</sup>
Major obstetric hemorrhage	52
Uterine rupture	1
Peripartum hysterectomy	7
Eclampsia	5
Renal or liver dysfunction	28
Pulmonary oedema	9
Acute respiratory dysfunction	74
Pulmonary embolism	4
Cardiac arrest	5
Coma	0
Cerebro-vascular event	3
Status epilepticus	2
Septicaemic shock	19
Anaesthetic problem	1
Anaphylactic shock	4
Other severe morbidity	20
Interventional radiology	6

<sup>2</sup> Overall morbidity is measured as the total count of each classification irrespective of whether it is the primary or secondary cause of morbidity, meaning the total number of classifications will not equate to the total number of SAMM cases.

### Maternal characteristics:

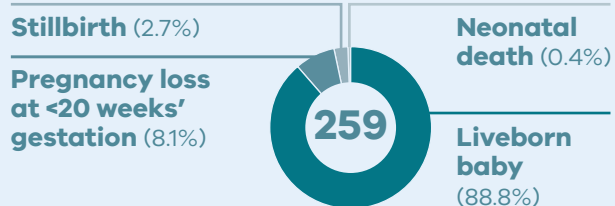
- The mean age of women with SMM was 31 years. Nine women with SMM were over 40 years of age.
- Of all SMM cases, 95 were born overseas (39.9 per cent) compared with 37.0 per cent of all women giving birth in 2021 who were not born overseas.
- Eight of the SMM cases were Aboriginal or Torres Strait Islander women (3.4 per cent), compared with Aboriginal or Torres Strait Islander accounting for 1.6 per cent of all women giving birth.
- 119 women admitted to ICU had a contributing factor identified (45.9 per cent).
- 70.6 per cent of the contributing factors identified can be categorised as patient-related factors.
- 29.4 per cent of women admitted to ICU had a body mass index (BMI) of 30 or higher compared with 22.1 per cent of all women who gave birth in 2021.
- 9.2 per cent had a BMI over 40 compared with 3.4 per cent of women overall giving birth in Victoria.

### Birth outcomes:

- 230 SMM cases had a liveborn baby (88.8 per cent). 21 SMM cases experienced a pregnancy loss at less than 20 weeks' gestation (8.1 per cent). There were seven stillbirths (2.7 per cent) and one neonatal death (0.4 per cent).
- Pregnancy loss prior to 20 weeks' gestation was related to first trimester miscarriages, ectopic pregnancies and preterm premature rupture of membranes (PPROM). The single neonatal death occurred at 20 weeks and 5 days gestation, with chorioamnionitis in the setting of PPRM.
- Of the 237 babies born at or after 20 weeks' gestation, 62.0 per cent were born via caesarean section, 23.6 per cent vaginal birth (non-instrumental) and 14.3 per cent as an instrumental birth.
- 92 births were pre-term (< 37 weeks' gestation) (35.5 per cent), with the remaining 64.5 per cent born at or after 37 weeks' gestation.
- Eleven babies were born under the 10th percentile (6.6 per cent).

### SMM cases

(birth outcomes)



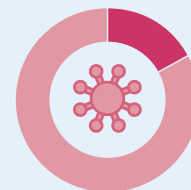


## SARS-CoV-2 infection and severe acute maternal morbidity

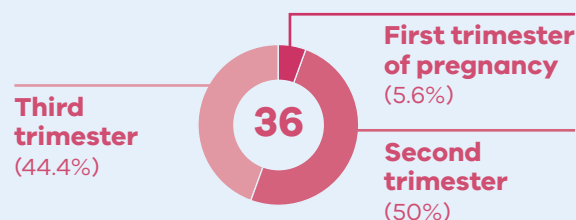
- Of the 259 SAMM cases in 2021, 44 of the admissions to ICU were related to SARS-CoV-2 infection (17.0 per cent).
- Most admissions for SARS-CoV-2 received invasive or non-invasive ventilation; none required extracorporeal membrane oxygenation, and there were no maternal deaths in 2021 related to SARS-CoV-2.
- 21.1 per cent of women admitted to ICU with SARS-CoV-2 were born overseas.
- 36 women admitted to ICU with SARS-CoV-2 were pregnant and eight were postpartum. Of those who were pregnant, 5.6 per cent were admitted to ICU with SARS-CoV-2 in the first trimester of pregnancy, 50.0 per cent in the second trimester of pregnancy and 44.4 per cent in the third trimester. The remainder of women were admitted in the postpartum period.
- None of the 44 women admitted to ICU with SARS-CoV-2 had received two doses of a COVID-19 vaccine. However, we note that the nation-wide recommendation from the Australian Technical Advisory Group on Immunisation and the Royal Australian and New Zealand College of Obstetricians and Gynaecologists to vaccinate pregnant women against COVID-19 only came into action on 9 June 2021.
- All women admitted to ICU with SARS-CoV-2 gave birth to a live infant, although 13.6 per cent had a pre-term birth (< 37 weeks' gestation).

Of the 259 SAMM cases

**17%**  
had COVID-19



## COVID-19 ICU admissions during pregnancy



The remainder of women were admitted during the postpartum period.

Of the 44 women admitted to ICU with COVID-19

**95.5%** (42)  
were unvaccinated

The remaining two women had partial (<2) COVID-19 vaccinations at the time of ICU admission.

**13.6%**  
had a pre-term birth  
(<37 weeks' gestation)

**Table 3: CCOPMM criteria and definitions for severe maternal morbidity**

Code	Category	Definition
1	Major obstetric haemorrhage	Estimated blood loss $\geq$ 2,500 mL, or transfusion $\geq$ 5 units blood or received treatment for coagulopathy (fresh frozen plasma, cryoprecipitate, platelets)  Includes ectopic pregnancy
2	Uterine rupture	Complete separation of wall of pregnant uterus +/- expulsion of fetus, involving rupture of membranes at the site of the uterine rupture or extension into uterine muscle separate from any previous scar, and endangering the life of the mother or fetus  Excluded: any asymptomatic palpable or visualised defect (e.g. dehiscence noted incidentally at caesarean delivery)
3	Peripartum hysterectomy	Peripartum hysterectomy
4	Eclampsia	Seizure associated with antepartum, intrapartum or postpartum symptoms and signs of pre-eclampsia
5	Renal or liver dysfunction	Acute onset of biochemical disturbance, urea $>$ 15 mmol/L, creatinine $>$ 400 mml/L, AST/ALT $>$ 200 U/L
6	Pulmonary oedema	Clinically diagnoses pulmonary oedema associated with acute shortness of breath and oxygen saturation $<$ 95%, requiring oxygen, diuretics or ventilation
7	Acute respiratory dysfunction	Requiring intubation or ventilation for $>$ 60 minutes (not including duration of general anaesthetic)
8	Pulmonary embolism	Increased respiratory rate ( $>$ 20/min), tachycardia, hypotension  Diagnosed as 'high' probability on ventilation-perfusion scan or positive spiral chest CT scan  Treated by heparin, thrombolysis or embolectomy
9	Cardiac arrest	No detectable major pulse
10	Coma	Includes diabetic coma  Unconscious for $>$ 12 hours
11	Cerebrovascular event	Stroke, cerebral/cerebellar haemorrhage or infarction, subarachnoid haemorrhage, dural venous sinus thrombosis
12	Status epilepticus	Constant or near constant state of having seizures that last $\geq$ 30 minutes
13	Septicaemic shock	Shock (systolic blood pressure $<$ 80) in association with infection  No other cause for decreased blood pressure  Pulse $\geq$ 120 bpm
14	Anaesthetic problem	Aspiration, failed intubation, high spinal or epidural anaesthetic
15	Anaphylactic shock	An allergic reaction resulting in collapse with severe hypotension, difficulty breathing and swelling/rash
16	Other severe morbidity	Other severe morbidity (e.g. amniotic fluid embolism)
17	Interventional radiology	Receive planned (a) or unplanned (b) interventional radiology

# Perinatal mortality

*Perinatal mortality includes fetal deaths (stillbirths) and deaths of live-born babies within the first 28 days after birth (neonatal deaths).*

This section uses 'adjusted' perinatal mortality and stillbirths, where terminations of pregnancy for psychosocial indications are excluded. This provides a more accurate measure for assessing avoidable mortality and for comparisons with other jurisdictions both nationally and internationally.

Statistics for unadjusted perinatal mortality can be found in the online supplementary tables for this report.

**785**  
perinatal deaths 2021

→ Slight decrease  
from 816 in 2020



**696**  
adjusted perinatal  
deaths 2021

→ Slight increase  
from 687 in 2020

**8.5**  
per 1,000 births  
adjusted perinatal  
mortality rate 2021

→ Slight decrease  
from 8.9 in 2020

**31.5%** of adjusted  
perinatal deaths in 2021  
underwent a full autopsy

↘ Down from 34.9% in 2020

**34.9%**  
of adjusted stillbirths  
underwent a full autopsy

↘ Down from 38.0% in 2020

**22.7%**  
of neonatal deaths  
underwent a full autopsy

↘ Down from 27.2% in 2020

**6.1** per 1,000 births  
adjusted stillbirth rate 2021  
for babies born after 20 weeks' gestation

→ Compared with  
6.4 per 1,000 in 2020



**10.4** per 1,000 births  
adjusted perinatal mortality  
rate 2021 in women who  
**smoked at any time**  
while pregnant

**2.4** per 1,000 live births  
neonatal mortality rate 2021

→ Compared with 2.5 per  
1,000 live births in 2020



**8.4** per 1,000 births  
adjusted perinatal mortality  
rate 2021 in women who  
**did not smoke**  
while pregnant

## SNAPSHOT

- There were 696 adjusted<sup>3</sup> perinatal deaths in 2021 compared with 687 in 2020.
- These included 498 adjusted stillbirths and 198 adjusted neonatal deaths.
- While there were more births in 2021 compared with 2020, the adjusted perinatal mortality rate (PMR) was 8.5 per 1,000 births in 2021, compared with 8.9 per 1,000 births in 2020.
- The adjusted PMR in women smoking at any time during pregnancy was 10.4 per 1,000 births compared with 8.4 per 1,000 births in those who did not smoke while pregnant.
- In 2021, 31.5 per cent of adjusted perinatal deaths underwent a full perinatal autopsy (34.9 per cent of stillbirths and 22.7 per cent of neonatal deaths).
- The adjusted stillbirth rate for babies born after 20 weeks' gestation was 6.1 per 1,000 births, a slight decrease from 6.4 per 1,000 births in 2020.
- The adjusted neonatal mortality rate was 2.4 per 1,000 livebirths in 2020 compared with 2.5 per 1,000 livebirths in 2020.
- There were 132 stillbirths after 28 weeks in 2021 compared with 129 in 2020 (excluding perinatal deaths from congenital anomaly and termination of pregnancy for maternal psychosocial indications).

### Perinatal mortality rates

The 2021 adjusted PMR was:

- 7.7 per 1,000 births for singletons
- 35.3 per 1,000 births for twin pregnancies
- 130.4 per 1,000 for other multiple pregnancies

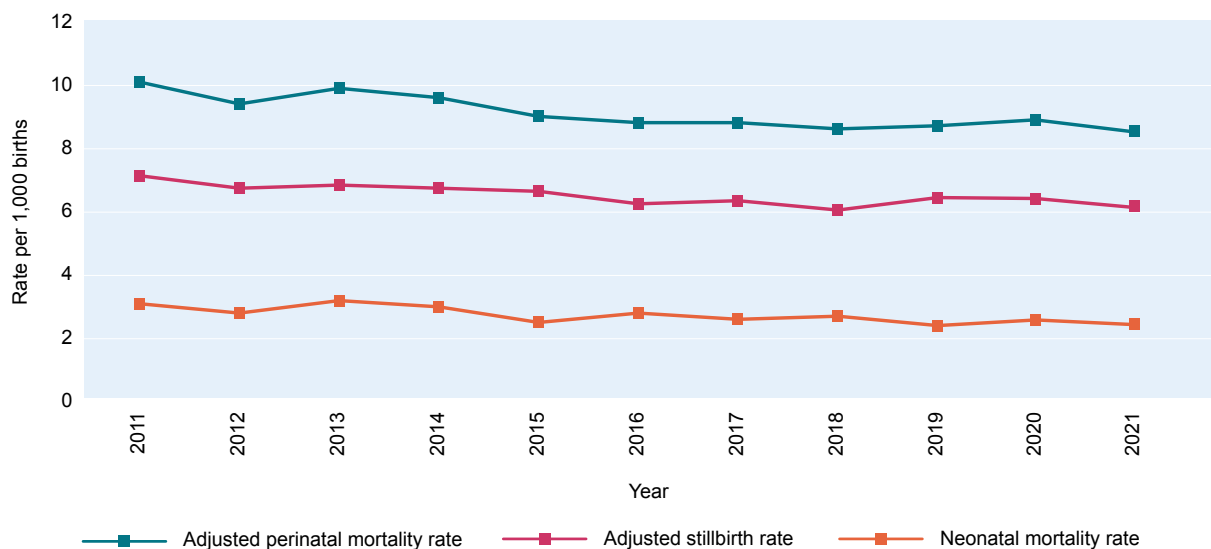
Safer Care Victoria coordinated the **Safer Baby Collaborative** to reduce stillbirth rates during the third trimester and improve outcomes for mothers and their babies. This collaborative ended in 2021 and saw a 21.0 per cent decrease in stillbirth rates across participating health services.

There is currently national work that aims to reduce the number of stillbirths after 28 weeks, excluding perinatal deaths from congenital anomaly and terminations of pregnancy for maternal psychosocial indications. **The Safer Baby Bundle** uses five evidence-based elements to address key areas where improved practice can reduce the number of stillborn babies. The five elements of the Safer Baby Bundle are:

1. **Quit smoking** – Smoking is one of the main causes of stillbirth. Quitting at any time during your pregnancy reduces the risk of harm to the baby.
2. **Growing matters** – If a baby is growing slower than expected, additional monitoring may be required.
3. **Movements matter** – If a baby's movements stop or slow down, contact your maternity healthcare professional immediately
4. **Side sleeping from 28 weeks** – Going to sleep on your side from 28 weeks of pregnancy can reduce the risk of stillbirth. Both left and right sleeping are safe.
5. **Let's talk timing of birth** – Your maternity healthcare professional will work with you to determine the safest timing of birth for you and your baby to reduce the risk of stillbirth.

<sup>3</sup> 'Adjusted' perinatal deaths (including stillbirths and neonatal deaths) exclude terminations of pregnancy for maternal psychosocial indications.

**Figure 3: Trend in adjusted PMR, SB and NN mortality rate, 2011-2021**



**Table 4: Adjusted PMR by maternal place of birth, Victoria 2021<sup>4,5</sup>**

	Adjusted total births		Livebirths <sup>6</sup>		Adjusted stillbirths	Neonatal deaths	Adjusted perinatal deaths	% of all perinatal deaths	Adjusted PMR by maternal place of birth
	N	%	N	%	N	N	N	%	
<b>North-West Europe</b>	2,248	3	2,239	2.8	9	1	10	1.4	4.4
<b>Americas</b>	1,273	2	1,268	1.6	5	2	7	1.0	5.5
<b>North-East Asia</b>	3,235	4	3,223	4.0	12	7	19	2.7	5.9
<b>South-East Asia</b>	4,886	6	4,860	6.0	26	11	37	5.3	7.6
<b>North Africa and the Middle East</b>	2,584	3	2,567	3.2	17	3	20	2.9	7.7
<b>Australia</b>	51,133	63	50,823	62.6	310	115	425	61.1	8.3
<b>Oceania and Antarctica (excl. Australia)</b>	2,094	3	2,083	2.6	11	7	18	2.6	8.6
<b>Southern and Eastern Europe</b>	1,337	2	1,326	1.6	11	2	13	1.9	9.7
<b>Southern and Central Asia</b>	10,843	13	10,766	13.3	77	37	114	16.4	10.5
<b>Sub-Saharan Africa</b>	1,708	2	1,692	2.1	16	9	25	3.6	14.6
<b>Unknown</b>	310	0	306	0.4	4	4	8	1.1	25.8
<b>Total</b>	81,651	100	81,153	100	498	198	696	100	8.5

<sup>4</sup> The figures and calculations in this table exclude 89 stillbirths from terminations of pregnancy for maternal psychosocial indications.

<sup>5</sup> This table is ranked by PMR (excluding missing data).

<sup>6</sup> Livebirths include all livebirths, including those who later die as neonatal deaths.

## SMOKING AND PERINATAL MORTALITY

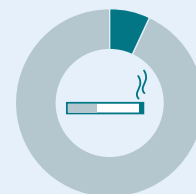
### In 2021:

- 5,841 babies were born to women who reported smoking at any time during pregnancy (7.2 per cent of all adjusted births).
- There were 38 adjusted stillbirths and 23 neonatal deaths in women who smoked at any time during pregnancy
- There were 443 adjusted stillbirths and 166 neonatal deaths in women who did not smoke at any time.

The adjusted PMR in women smoking at any time during pregnancy was 10.4 per 1,000 births compared with 8.4 per 1,000 births in those who did not smoke while pregnant<sup>7</sup>.

Strategies to improve smoking cessation rates are likely to lead to a reduction in stillbirth rates and are a key part of many stillbirth reduction initiatives. Women from socially disadvantaged backgrounds have lower smoking cessation rates reported. Programs that support women to stop smoking should be prioritised in any initiative aiming to reduce stillbirths.

**5,841** babies born to women who smoked at any time during their pregnancy in 2021. (7.2% of all adjusted births)



**10.4** adjusted PMR per 1,000 births



**38** stillbirths

**23** neonatal deaths

in women who smoked at any time during their pregnancy in 2021.

**8.4** adjusted PMR per 1,000 births



**443** stillbirths

**166** neonatal deaths

in women who did not smoke at any time during their pregnancy in 2021.

<sup>7</sup> The data in this section refer to babies affected by smoking in pregnancy (i.e. twins would be counted separately), whereas the smoking data on page 45 refers to women who smoked in pregnancy regardless of whether they had a singleton or multiple pregnancy.

## MOST COMMON CAUSES OF PERINATAL MORTALITY

Congenital anomaly (including termination of pregnancy for congenital anomaly) is the most common cause of death for adjusted stillbirths and neonatal deaths. In 2021 congenital anomaly accounted for:

- 208 adjusted stillbirths (41.8 per cent of all adjusted stillbirths)
- 61 neonatal deaths (30.8 per cent of all neonatal deaths)
- 269 adjusted perinatal deaths (38.6 per cent of all adjusted perinatal deaths).

After congenital anomalies, the most common causes of perinatal death in 2021, according to the Perinatal Society of Australia and New Zealand (PSANZ) perinatal death classification, were:

- spontaneous preterm labour or rupture of membranes (< 37 weeks' gestation) (123 deaths, 17.7 per cent)
- unexplained antepartum fetal death (91 deaths, 13.1 per cent)
- placental dysfunction or causative placental pathology (64 deaths, 9.2 per cent).

The most common causes of neonatal death in 2021, according to the PSANZ perinatal death classification, were:

- spontaneous preterm labour or rupture of membranes (< 37 weeks' gestation) (79 deaths, 39.9 per cent)
- congenital anomaly (61 deaths, 30.8 per cent)
- antepartum haemorrhage (13 deaths, 6.6 per cent).

After congenital anomalies, the most common causes of stillbirth in 2021, according to the PSANZ perinatal death classification, were:

- unexplained antepartum fetal death (91 deaths, 18.3 per cent)
- placental dysfunction or causative placental pathology (61 deaths, 12.2 per cent)
- spontaneous preterm labour or rupture of membranes (< 37 weeks) (44 deaths, 8.8 per cent).

## FACTORS CONTRIBUTING TO PERINATAL DEATH

CCOPMM reviews all perinatal deaths to examine whether there were factors contributing to the death that could have been prevented. Identifying these contributing factors is key to improving the care and experiences of women and improving perinatal outcomes. Perinatal deaths identified as having contributing factors are reviewed by the Stillbirth or the Neonatal Subcommittee of CCOPMM. Contributing factors identified are categorised using the PSANZ classification as:

- unlikely to have contributed to the outcome (insignificant)
- might have contributed to the outcome (possible)
- likely to have contributed to the outcome (significant)
- insufficient information available (undetermined)
- unknown.

It is important to recognise that not all contributing factors may be preventable or indicative of unacceptable standards of care. CCOPMM is continuing to refine its case review processes to further strengthen the reporting of contributing factors and ensure that lessons learnt can be shared with services, clinicians and consumers.

Contributing factors may be systemic, for example:

- resources such as staffing
- access to appropriate services
- ability to communicate or share information.

Or relate to personnel, for example:

- availability of appropriately skilled staff
- adequate staff numbers
- level and availability of training and education.

Or be attributable to other factors, for example:

- no or low attendance for clinical care
- poor compliance with advice.

In 2021, contributing factors were identified in 181 of 479 perinatal deaths (37.8 per cent of cases), excluding termination of pregnancy for maternal psychosocial indication or congenital anomaly (Table 5).



**Table 5: Factors identified in adjusted perinatal deaths, Victoria 2021**

Significance of identified factors in...	Factors relating to organisational and/or management identified	Factors relating to personnel identified	Barriers to accessing/engaging with care identified	Total
<b>Stillbirths</b>				
Insignificant: Sub-optimal factors identified but unlikely to have contributed to outcome	1	1	4	6
Possible: Sub-optimal factors identified might have contributed to outcome	8	22	92	122
Significant: Sub-optimal factors identified were likely to have contributed to outcome	8	18	36	62
Undetermined: insufficient information available to determine whether sub-optimal factors identified contributed to outcome	0	0	1	1
<b>Total number of factors</b>	<b>17</b>	<b>41</b>	<b>133</b>	<b>191</b>
<b>Total number of cases</b>	<b>7</b>	<b>17</b>	<b>93</b>	<b>117</b>
<b>Neonatal deaths</b>				
Insignificant: Sub-optimal factors identified but unlikely to have contributed to outcome	7	6	10	23
Possible: Sub-optimal factors identified might have contributed to outcome	10	17	13	40
Significant: Sub-optimal factors identified were likely to have contributed to outcome	12	22	7	41
Undetermined: insufficient information available to determine whether sub-optimal factors identified contributed to outcome	1	1	0	2
<b>Total number of factors</b>	<b>30</b>	<b>46</b>	<b>30</b>	<b>106</b>
<b>Total number of cases</b>	<b>19</b>	<b>25</b>	<b>20</b>	<b>64</b>

Note: Cases can have more than one factor identified, so the total number of cases does not equal the sum of individual cases identified by factor  
n=479 total perinatal deaths of infants born in Victoria not from termination of pregnancy for maternal psychosocial indication or congenital anomaly (311 stillbirths and 168 neonatal deaths)

# Aboriginal births, mortality and morbidity

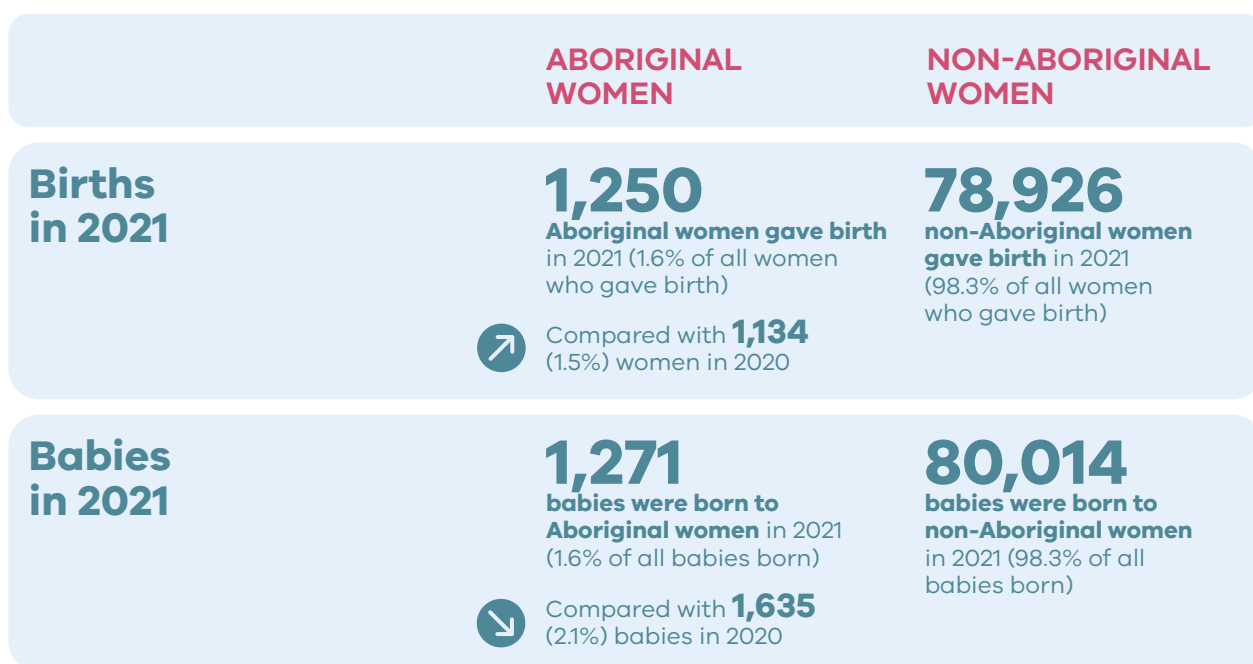
*This chapter focuses only on births to Aboriginal women, mortality and morbidity. Births to Aboriginal fathers and non-Aboriginal women are not included.*

Perinatal outcomes are improving for Victoria's Aboriginal mothers and babies, however we can do more to continue closing the gap. In recent times, the PMR for babies born to Aboriginal women is improving and approaching the PMR for babies born to non-Aboriginal women (11.2 to 8.6 per 1,000 births this triennium).

We have also seen a decrease in smoking rates during pregnancy. Work continues to support smoking cessation amongst pregnant Aboriginal women.

## SNAPSHOT

- In 2021, 1,250 Aboriginal women gave birth to 1,271 babies (1.6 per cent of all women who gave birth and 1.6 per cent of all babies born in Victoria).
- 12.2 per cent of babies born to Aboriginal women were born before 37 weeks' gestation compared with 7.6 per cent of those born to non-Aboriginal women.
- 11.8 per cent of babies born to Aboriginal women had a birthweight below the 10th centile compared with 8.7 per cent of those born to non-Aboriginal women.



Percentage does not add to 100% as Maternal Aboriginal status was not reported for 146 women and 149 babies.

- While some babies with a birthweight below the 10th centile are growing as well as expected and are simply smaller, others have problems that restrict their growth. Babies in this second category, have an increased risk of stillbirth as well as short- and long-term illness and developmental problems.
- The adjusted PMR for babies born to Aboriginal women for the 2019–2021 triennium was 11.2 per 1,000 births and 8.6 per 1,000 births for non-Aboriginal women. This compares with 11.3 and 8.7 per 1,000 births respectively for the 2018–2020 triennium. The PMR for babies born to Aboriginal women has improved this triennium.
- The adjusted stillbirth rate for babies born to Aboriginal women for the 2019–2021 triennium was 7.9 per 1,000 births and 6.3 per 1,000 births for non-Aboriginal women. This compares with 7.8 and 6.3 per 1,000 births for the 2018–2020 triennium for Aboriginal and non-Aboriginal women, respectively.
- The neonatal mortality rate for babies born to Aboriginal women for the 2019–2021 triennium was 3.4 per 1,000 livebirths and 2.4 per 1,000 livebirths for non-Aboriginal women. This compares with 3.5 and 2.5 per 1,000 livebirths for the 2018–2020 triennium for Aboriginal and non-Aboriginal women, respectively. The neonatal mortality rate for babies born to Aboriginal women has improved compared with the previous triennium.

The gap between Aboriginal and non-Aboriginal PMR for the 2019–2021 triennium has remained steady from the 2018–2020 triennium.

## Closing the gap

To address the continuing gap in outcomes between Aboriginal and non-Aboriginal women, CCOPMM will continue to support research and quality improvement initiatives, informed by Aboriginal health partners and with the Aboriginal community to improve health outcomes for all Victorian Aboriginal women, babies and children.

The Victorian Government has committed to setting up more Early Parenting Centres through its 2023–24 State Budget investment. New centres will be established in Shepparton and Northcote, and an Aboriginal-dedicated Early Parenting Centre in Frankston will provide culturally safe early parenting supports. In addition, the Aboriginal Maternal & Child Health (MCH) services and early years health co-design project is underway and due for completion early 2024. Safer Care Victoria have also successfully appointed two Aboriginal MCH consumer partners.

The Victorian Government also funds 14 Koori Maternity Services across Victoria. Koori Maternity Services provide flexible, holistic and culturally safe pregnancy and postnatal care for Aboriginal women and non-Aboriginal women having Aboriginal babies and their families.



**Improving**



**Steady**



**Needs improvement**

Care is to be taken when interpreting the results of the **traffic light** system. While green may show improvements or increases in trend data, they may still remain unacceptable in relation to existing gaps between Aboriginal and non-Aboriginal families.

Furthermore, while the gap may have reduced between Aboriginal and non-Aboriginal people, when combined, there may be an overall decline or deterioration across both population groups.

**ABORIGINAL WOMEN**

**NON-ABORIGINAL WOMEN**

**Adjusted Perinatal Mortality Rate**

**11.2**

deaths per 1,000 births for 2019-2021



Compared with **11.3** in 2018-2020

**8.6**

deaths per 1,000 births for 2019-2021



Compared with **8.7** in 2018-2020

**Adjusted Stillbirth Mortality Rate**

**7.9**

deaths per 1,000 births for 2019-2021



Compared with **7.8** in 2018-2020

**6.3**

deaths per 1,000 births for 2019-2021



Compared with **6.3** in 2018-2020

**Neonatal Mortality Rate**

**3.4**

deaths per 1,000 live births for 2019-2021



Compared with **3.5** in 2018-2020

**2.4**

deaths per 1,000 live births for 2019-2021

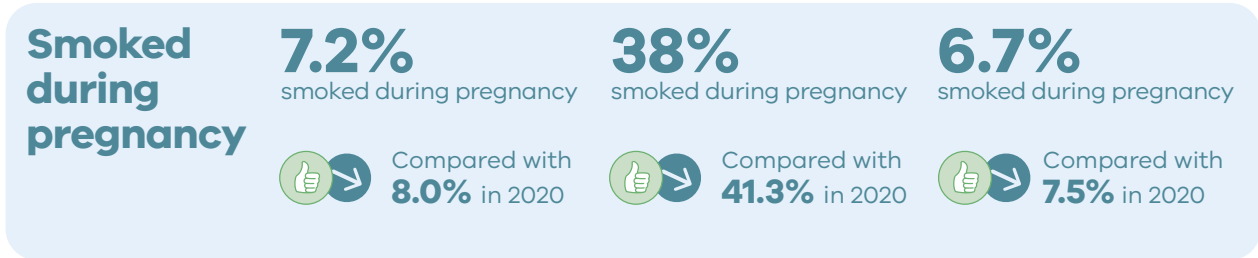





Compared with **2.5** in 2018-2020



**The gap has remained steady** between Aboriginal and non-Aboriginal PMR for the 2019-2021 triennium from the 2018-2020 triennium.

	ALL WOMEN	ABORIGINAL WOMEN	NON-ABORIGINAL WOMEN
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   **The gap has decreased** between Aboriginal and non-Aboriginal smoking rates during pregnancy since the 2020 report.

Work is underway to support and increase quit attempts among pregnant Aboriginal women.

- The Victorian Aboriginal Community Controlled Health Organisation (VACCHO) is working with the Koori Maternity Services workforce to support women and families with smoking cessation during pregnancy.
- The VACCHO is offering iSISTAQUIT training at Koori Maternity Services sites and are planning a new engagement tool to support conversations between the Koori Maternity Services workforce and families about smoking cessation.
- Tackling Indigenous Smoking Teams across Victoria will also be working closely with Koori Maternity Services and their nominated Aboriginal Community Controlled Health Organisations to tailor support around smoking cessation.

### SMOKING AND ABORIGINAL BIRTHS, MORTALITY AND MORBIDITY




- 38.0 per cent of Aboriginal women smoked during pregnancy (down from 41.3 per cent in 2020) compared with 6.7 per cent of non-Aboriginal women<sup>8</sup>.
- 12.4 per cent of Aboriginal women gave birth preterm (before 37 weeks) compared with 7.7 per cent of non-Aboriginal women.
- 10.9 per cent of babies born to Aboriginal women had a low birthweight (under 2,500 grams) compared with 6.2 per cent of babies born to non-Aboriginal women.

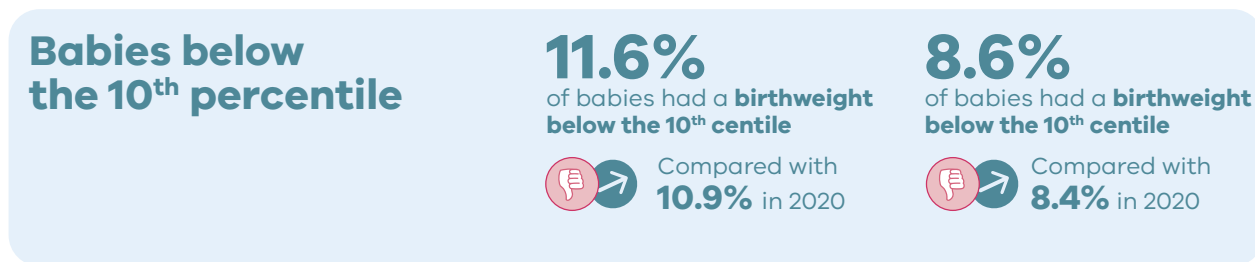
<sup>8</sup> The data in this section refers to the smoking status of all mothers, whereas the section on page 38, 'Smoking and perinatal mortality', refers only to the smoking status of the mothers whose babies were included in the adjusted number of births (which excludes terminations of pregnancy for psychosocial indications).



## MATERNAL FINDINGS

- 2.9 per cent of Aboriginal women were underweight (with a BMI under 18.5) compared with 2.0 per cent of non-Aboriginal women.
- Aboriginal women were also more likely to be obese (with a BMI of 30 or over) than non-Aboriginal women (36.0 per cent and 21.9 per cent, respectively).



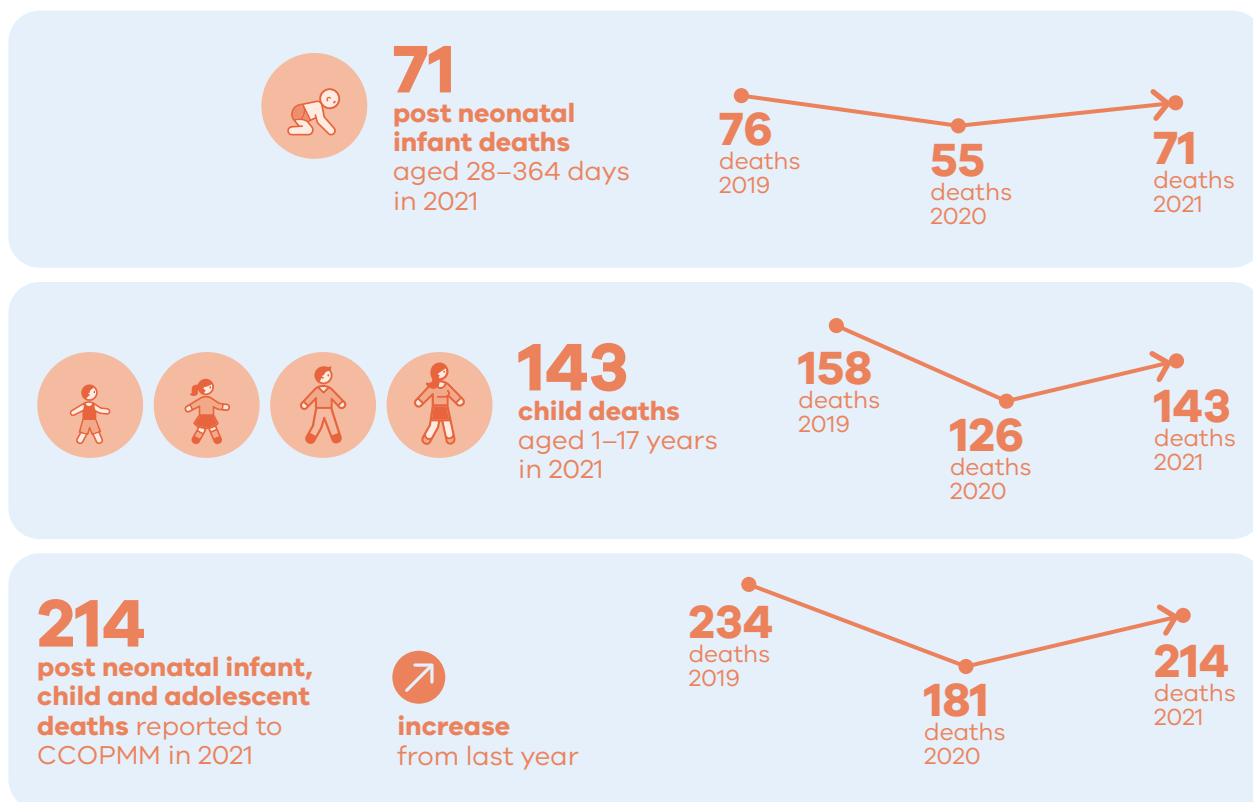
  
**The gap has decreased** between Aboriginal and non-Aboriginal babies born before 37 weeks' gestation since the 2020 report.



  
**The gap has increased** between Aboriginal and non-Aboriginal babies born below the 10<sup>th</sup> percentile since the 2020 report.

# Child and adolescent mortality

*Child and adolescent mortality includes post-neonatal infant, child and adolescent deaths between the ages of 28 days and 17 years and 364 days.*



In Victoria, child and adolescent mortality rates are low, but there are some deaths that may have been prevented. From the review of these deaths there are important findings that inform improvements that need to be made by both our health services and our community to prevent further deaths.

The important role of maternal and child health nurses, general practitioners, other primary care practitioners and general paediatricians in assessing infant and child growth, development and wellbeing (and not just acute or chronic illness) cannot be underestimated.

## MALNUTRITION AND NEGLECT

Between September 2020 and January 2022, five Victorian children (two between the ages of 0–27 days and three between the ages of 28 days–4 years) died from the complications of malnutrition and neglect. Malnutrition as a cause of death in Victoria was exceedingly rare before 2020, with the complications of malnutrition as the primary cause of death occurring only twice between 2000 and 2019 in children aged between 28 days and 17 years. This steep rise in deaths from malnutrition is extremely concerning to CCOPMM.

Contributing factors in the deaths of these infants and children included:

- a lack of antenatal and/or postnatal care in neonates
- a lack of recognition of the seriousness of the condition by parents or caregivers
- a delay in care seeking for infants and older children
- a lack of recognition by the treating practitioner(s) to recognise the severity of the issue and investigate the failure to thrive
- difficulty accessing in-person medical or maternal and child health services (due to COVID-19 restrictions, staffing capacity and conversion to telehealth)
- parental and family factors of intellectual disability, pervasive developmental disorders, mental health issues, substance abuse, family violence and poverty
- inability to access medical care due to poverty and social issues
- lack of access to Medicare-funded services.

Some of these families were involved with Child Protection, including antenatal reports of concern from maternity care providers.

CCOPMM has made a recommendation about malnutrition in the 'Recommendations' section of this report.

The effect of COVID-19 on healthcare staffing levels and subsequent restrictions in Victoria during some of this period contributed to a delay in or a lack of face-to-face reviews of infants and children, meaning they could not be observed fully, nor be weighed and measured.

These deaths demonstrate the importance of parental or caregiver connection to and involvement with competent extended family members, maternal and child health nurses, general practitioners, other primary care services, early childhood educators and others who can assist parents with limited capacity or resources to give their infants and children the best start in life.

Safer Care Victoria issued a clinical alert in 2022 on the importance of weighing children, monitoring growth and escalating concerns if the infant is not progressing on growth centiles or is not gaining weight. The alert emphasised the need for healthcare professionals to consider neglect and malnutrition in infants and children, and to be aware of the risk factors above.



## LISTENING TO CAREGIVERS WHEN THEY EXPRESS CONCERNS

The importance of listening to families when they escalate concerns is critical to timely assessment and care. Too often parents have voiced concerns that their child is not recovering as they should, or is deteriorating, but these concerns have not been listened to or not responded to appropriately, often with tragic consequences. This has been a concern repeatedly raised by CCOPMM over the past 10 years.

The Minister for Health has committed to implementing a number of initiatives, many previously recommended by CCOPMM, including:

- a central, parent-led escalation system
- a virtual paediatric consultation system
- mandating the use of standardised and age-specific charts whenever a child's vital signs are recorded.

## RECOMMENDATIONS AND GOOD PRACTICE POINTS

Following the review of deaths occurring in 2021, CCOPMM's Child and Adolescent Mortality Subcommittee made several recommendations and good practice points (GPPs).

The recommendations are:

- To strengthen systems to detect, monitor and treat malnutrition
- To consider admission to hospital of an infant, child or adolescent who has presented (unplanned) three times to a hospital during the same acute illness
- The Victorian Government to fund whole exome sequence testing for families of children who have died from undiagnosed conditions

GPPs are targeted at all healthcare professionals providing care. The GPPs address themes including:

- managing children with developmental challenges or difficulty communicating
- the risks of telehealth for neonates and infants in cases of failure to thrive
- the importance of safe sleeping in unfamiliar environments
- managing illness on school camps

## infant mortality rate

age 0 – 364 days



**2.9** deaths  
per 1,000 live births  
for infants in Victoria  
in 2021

**3.2** deaths  
per 1,000 live births  
for infants in Australia  
in 2021

## under-5 mortality rate



**3.4** deaths  
per 1,000 live births  
for under-5 in Victoria  
in 2021

**3.7** deaths  
per 1,000 live births  
for under-5 in Australia  
in 2021

## SNAPSHOT

This report includes all post-neonatal (28–364 days) and child and adolescent (1–17 years) deaths of children normally living in Victoria who died in Victoria during 2021.

- There were 214 post-neonatal infant, child and adolescent deaths reported in 2021 – more than the 181 deaths reported in 2020 but fewer than the 234 deaths in 2019.
- There were 143 deaths in children aged one to 17 years compared with 126 in 2020 and 158 in 2019.
- There were 71 post-neonatal infant deaths (28–364 days) compared with 55 in 2020 and 76 in 2019.
- The highest rate of death was in the 28–364 days age group.
- The infant mortality rate in Victoria in 2021 was 2.9 per 1,000 livebirths for infants (0–364 days) compared with the Australian infant mortality rate of 3.2 per 1,000 livebirths in 2021.<sup>9</sup>
- The under-five mortality rate in Victoria in 2021 was 3.4 per 1,000 livebirths compared with the Australian rate of 3.7 per 1,000 livebirths in 2021.<sup>10</sup>

<sup>9</sup> Refer to The World Bank website <<https://databank.worldbank.org/reports.aspx?source=2&series=SP.DYN.IMRT.IN&country=#>>.

<sup>10</sup> Refer to The World Bank website <<https://data.worldbank.org/indicator/SH.DYN.MORT>>.

## LEADING CAUSES OF DEATH BY AGE GROUP, 2021

### Post-neonatal infants (28–364 days)

- The leading cause of post-neonatal infant deaths was congenital anomalies (39.4 per cent of 71 deaths).
- Prematurity (16.9 per cent) and sudden infant death syndrome (15.5 per cent) were the next most common causes of post-neonatal infant deaths.

### Children aged one to four years

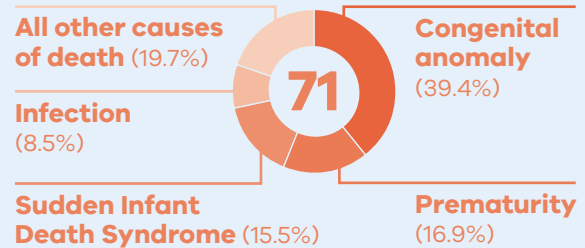
- The leading causes of death of children aged one to four years were congenital anomalies and malignancy (each 19.4 per cent of 36 deaths).
- Drowning and undetermined cause of death were the next most common (each accounting for 13.9 per cent of deaths).

### Children aged five to nine years

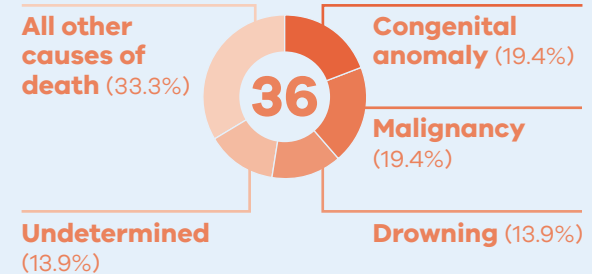
- The leading causes of death of children aged five to nine years were congenital anomalies and malignancy (each accounting for 21.9 per cent of the 32 deaths).
- Deaths from fire (12.5 per cent) and motor vehicle accidents (9.4 per cent) were the next most common causes of death.

### Post-neonatal infant deaths

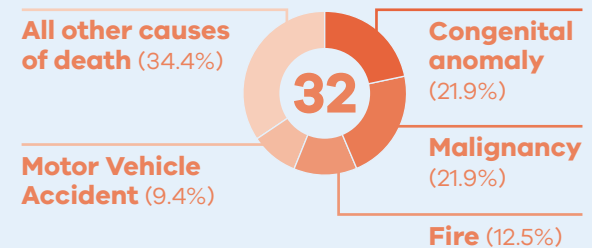
(28–364 days old)



### Children aged 1–4yrs deaths



### Children aged 5–9yrs deaths



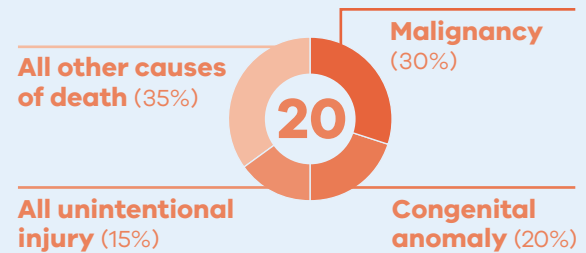
### Children and adolescents aged 10–14 years

- The leading causes of death of children and adolescents aged 10 to 14 years were malignancy (30.0 per cent of 20 deaths) and congenital anomalies (20.0 per cent).
- Deaths from all unintentional injury was the next most common cause of death (15.0 per cent).

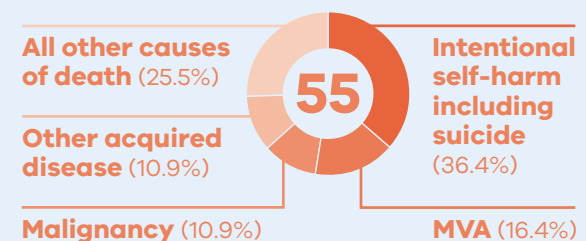
### Adolescents aged 15–17 years

- The leading cause of death of adolescents aged 15 to 17 years was intentional self-harm (including suicide) (36.4 per cent of 55 deaths).
- Motor vehicle accidents (16.4 per cent) and malignancy and other acquired disease (each 10.9 per cent) were the next most common causes of death.

### Adolescents aged 10–14yrs deaths



### Adolescents aged 15–17yrs deaths



# Research and quality improvement

*CCOPMM is legislated to conduct research into the incidence and causes of mortality and morbidity in women, babies, children and adolescents. Undertaking and supporting research is a critical function of CCOPMM to ensure continuous improvements in quality of care. **The Public Health and Wellbeing Regulations** allow CCOPMM to make perinatal data available to researchers.*

## RESEARCH AND REPORTING SUBCOMMITTEE

Established in 2020, CCOPMM's Research and Reporting Subcommittee is a multidisciplinary group combining specialist clinical and research knowledge to drive CCOPMM's research function.

The group was formed to:

- facilitate research and report to CCOPMM on research and quality improvement. The subcommittee also supports research from Safer Care Victoria fellowship programs
- provide advice and assistance to CCOPMM on research priorities and recommendations as relevant to maternal, perinatal, infant and child and adolescent mortality and morbidity
- assist with CCOPMM's reporting activities including the annual *Victoria's mothers, babies and children* report, the periodic *Congenital anomalies in Victoria* report and relevant benchmarking activities including providing the advice and support on data used in the *Perinatal Services Performance Indicators* report
- provide advice and guidance on data governance issues in relation to CCOPMM data and support national reporting requirements
- review and approve annual changes to the Victorian Perinatal Data Collection
- approve the process for data requests as per regulation 10 of the *Public Health and Wellbeing Regulations 2009*
- monitor and support data requests through the Victorian Agency for Health Information Data Request Hub
- review and approve research publications using CCOPMM data (including presentations).

## UNDERSTANDING THE IMPACTS OF THE COVID-19 PANDEMIC

In May 2021 CCOPMM published the **COVID-19 Communique**, which examined the results of 10 key maternity indicators during 2020 and compared them with similar time points in 2018 and 2019. This communique noted the need for more research into women's experiences of care during the pandemic and the impacts of the pandemic response on children and adolescents.

Safer Care Victoria, in partnership with the University of Melbourne, has published a follow-up report *COVID-19 communique: a report on maternal and newborn outcomes during the COVID-19 pandemic*. This report used CCOPMM data and compared the pre-pandemic period (January 2018 to March 2020) with the pandemic period (April 2020 to June 2022). Significant changes noted in this report include reduced rates of:

- preterm birth
- newborn admissions to a Special Care Nursery or Neonatal Intensive Care Unit
- severe fetal growth restriction
- low Apgar score in term infants
- lengths of hospital stay greater or equal to 3 days for mothers and babies, and
- maternal readmission due to post-partum infections

Increased rates of:

- large for gestational age infants
- births outside hospital,
- gestational diabetes mellitus
- maternal overweight or obesity at first antenatal visit
- unplanned newborn readmissions due to feeding problems and infectious diseases, and
- maternal readmissions due to hypertensive disorders

The report also highlighted some priority areas for research including:

- understanding the causes and contributors to the reduction in iatrogenic and spontaneous preterm births
- determining the relationship between reduced length of stay and unplanned newborn readmissions
- examining the health outcomes and consumer experience of out-of-hospital births
- evaluating the adequacy of domiciliary and community care for new mothers and babies, with particular focus on breastfeeding rates and prevention of unplanned readmissions
- analysing trends in maternal and infant weight and gestational diabetes to inform future health policy and health service planning, and identifying opportunities for intervention and prevention
- studying the immediate and long-term consequences of prolonged pandemic restrictions to maternal and child health outcomes.

## ACCESSING CCOPMM DATA

Each year CCOPMM receives requests for data from external researchers. In 2021, there were 82 requests for CCOPMM data, many of which required data from the Victorian Perinatal Data Collection.

Requests for data are submitted through the Victorian Agency for Health Information [Data Request Hub](#). Approved research involving data linkage is facilitated by the [Centre for Victorian Data Linkage](#). All requests for data are reviewed in keeping with CCOPMM's legislative requirements.

The use of CCOPMM data in recent peer-reviewed journals can be found in Appendix 3.

The subcommittee is working towards publishing all approved projects and data requests using CCOPMM data so this information can be accessible to researchers and duplication of effort is minimised among the research community. Publishing current research requests may also facilitate partnerships for researchers with similar interests.

CCOPMM is making improvements to accessibility and equity of CCOPMM-supported student research projects by partnering with Victorian universities and medical research institutes in 2022.

## CCOPMM DATABASES

CCOPMM is responsible for the following databases:

- **Victorian Perinatal Data Collection** – a register recording more than 100 data items for all births in Victoria of at least 20 weeks' gestation or (if gestation is unknown) 400 grams birthweight
- **Victorian Congenital Anomalies Register** – information on congenital anomalies reported for livebirths, stillbirths and terminations of pregnancy diagnosed before birth to six years of age (reporting to the register is voluntary)
- **CCOPMM Mortality Database** – information on all cases of maternal, perinatal and paediatric mortality in Victoria
- **Severe Acute Maternal Morbidity (SAMM) Dataset** – information on maternal admissions to intensive care during pregnancy and up to 42 days after birth or end of pregnancy.

## RESEARCH AREAS OF FOCUS IN 2021

CCOPMM undertakes internal research projects on key priority areas. CCOPMM data is used in a diverse set of projects to understand whether events in the perinatal period are associated with longer term childhood impacts.

### Fetal growth restriction and long-term outcomes

CCOPMM has been supporting Dr Roshan Selvaratnam in undertaking research in key priority areas. One priority area is exploring long-term childhood outcomes after perinatal events such as fetal growth restriction.

Previous CCOPMM-supported work has explored the childhood school outcomes for infants suspected of fetal growth restriction<sup>11</sup>. This work has shown that detection and early delivery of babies affected by severe fetal growth restriction, while beneficial in reducing their rate of stillbirth, is associated with poorer developmental outcomes at school entry and poorer educational outcomes across primary school and early high school. Research has also shown that detection and planned delivery of pregnancies affected by fetal growth restriction may be associated with increased neonatal morbidity related to iatrogenic prematurity<sup>12</sup>.

Further research conducted into this area has shown that Apgar scores at five minutes after birth are independently predictive of childhood school outcomes<sup>13</sup>. Apgar scores of 7, 8 and 9 were shown to be associated with poorer school outcomes when compared with Apgar scores of 10. More research projects are underway to explore the effect of gestation on school outcomes as well as birthweight centile.

### Translational research project – Optimising Outcomes for the Most Premature Babies

The management of births at 22–25 weeks' gestation involves complex ethical and clinical challenges. There is wide variation in approach to managing these infants in Victoria, nationally and internationally, leading to wide variation in infant outcomes<sup>14</sup>. In 2019, Safer Care Victoria appointed an expert working group to develop a clinical guideline for managing extremely preterm births at 22–25 weeks. The guideline was published in December 2020 and is available from the [Safer Care Victoria website](#).

Associate Professor Rose Boland has been using CCOPMM data for a translational research project focusing on optimising outcomes for the most premature babies born at 22–25 weeks' gestation.

The first part of the translational research project aimed to:

- report current outcomes of all infants born in Victoria at 22–25 weeks over a nine-year period (2009–2017)<sup>15</sup>
- determine if clinicians caring for women and babies born at 22–25 weeks had accurate perceptions of infant outcomes<sup>16</sup>
- develop a digital tool – [NIC-PREDICT](#) to improve parent counselling and decision making
- determine if clinicians could more accurately predict outcome using NIC-PREDICT.

<sup>11</sup> Selvaratnam RJ, Wallace EM, Wolfe R, Anderson PJ, Davey MA. Association between iatrogenic delivery for suspected fetal growth restriction and childhood school outcomes. *JAMA*. 2021 Jul 13;326(2):145–53.

<sup>12</sup> Selvaratnam RJ, Wallace EM, Treleaven S, Hooper SB, Davis PG, Davey MA. Does detection of fetal growth restriction improve neonatal outcomes? *Journal of Paediatrics and Child Health*. 2021;57(5):677–83.

<sup>13</sup> Selvaratnam RJ, Wallace EM, Davis PG, Rolnik DL, Fahey M, Davey M-A. The five minute Apgar score and childhood school outcomes. *Acta Paediatrica* 2022. doi: 10.1111/apa.16443

<sup>14</sup> Boland RA, Cheong JL, Doyle LW. Changes in long-term survival and neurodevelopmental disability in infants born extremely preterm in the post-surfactant era. *Seminars in Perinatology*. 2021;151479.

<sup>15</sup> Boland RA, Cheong JLY, Stewart MJ, Doyle LW. Temporal changes in rates of active management and infant survival following live birth at 22–24 weeks' gestation in Victoria. *Australian and New Zealand Journal of Obstetrics and Gynaecology*. 2021;61(4):528–35.

<sup>16</sup> Boland RA, Cheong JLY, Stewart MJ, Kane SC, Doyle LW. Disparities between perceived and true outcomes of infants born at 23–25 weeks' gestation. *The Australian & New Zealand journal of obstetrics & gynaecology*. 2022;62(2):255–62.

The final stage of the translational research aims to report on changes, pre and post publication of the guideline. The research will focus on:

- rates of in-utero transfer to a tertiary centre at 22–25 weeks
- livebirths at 22–25 weeks
- rates of active management at 22–25 weeks
- survival to Neonatal Intensive Care Unit admission
- survival to Neonatal Intensive Care Unit discharge
- survival to one year.

## IMPROVEMENT PROJECTS

### POSTPARTUM HAEMORRHAGE COLLABORATIVE

Postpartum haemorrhage (PPH) caused 37 per cent of all severe acute maternal morbidity reported in Victoria in 2019. Starting in April 2022, Safer Care Victoria partnered with the Institute for Healthcare Improvement, consumers with lived experience of PPH and 33 Victorian maternity services to reduce the rate of PPH and its associated long-term physiological and psychological trauma.

A bundle of evidence-based interventions were introduced to reduce the rates of severe PPH, improve measurement of quantitative blood loss, increase risk assessment uptake, and improve time to medication administration. All of these measures aimed to reduce delayed recognition and treatment of PPH. Health services participating in the PPH collaborative made a commitment to enhance the consumer experience with a focus on partnering with consumers before, during and after birth.

All health services that participated in the collaborative have implemented a system for accurate quantitative blood loss measurement for all births, and preliminary results indicate improved recognition of PPH.

Health services continue to prioritise and make gains in ensuring women/birthing parents and their partners receive education and support regarding PPH before, during and after birth.

Find out more about the Postpartum Haemorrhage Collaborative on the [Safer Care Victoria website](#).



# Appendix 1: Measures

## MATERNAL MORTALITY RATIO (MMR)

**MMR = number of direct and indirect maternal deaths / total number of birthing episodes × 100,000**

The MMR includes all direct and indirect maternal deaths during pregnancy or within 42 days of the end of the pregnancy. It excludes coincidental and late maternal deaths.

'Total number of birthing episodes' is the number of pregnancies of 20 weeks' gestation or more (or if gestation is unknown, with birthweight of at least 400 grams) resulting in livebirth or stillbirth (regardless of plurality).

Maternal deaths in early pregnancy from direct or indirect causes are included in the numerator for the MMR even though the denominator does not include pregnancies that end before 20 weeks' gestation. This is because the available data on the number of these pregnancies are unreliable.

## PERINATAL MORTALITY RATE (PMR)

**PMR = (number of stillbirths + neonatal deaths) / total (stillbirths + livebirths) × 1,000**

The PMR is calculated as the rate of stillbirths and neonatal deaths per 1,000 total births (including all stillbirths and livebirths).

For CCOPMM statistics, the rate refers to all births of at least 20 weeks' gestation (or a birthweight of at least 400 grams if gestation is unknown), and at least 150 grams birthweight unless known to have been alive at 20 or more weeks' gestation. However, for purposes of continuity, PMR of infants of ≥ 500 grams or, where the birthweight is unknown, of at least 22 weeks' gestation, is also presented (PMR500).

For international comparisons, the rate refers to all births of at least 1,000 grams birthweight or, when the birthweight is unknown, of at least 28 weeks' gestation and neonatal deaths occurring within seven days of birth (recommended by the World Health Organization).

## NEONATAL MORTALITY RATE (NMR)

**NMR = number of neonatal deaths / total livebirths × 1,000**

The NMR is calculated per 1,000 livebirths of at least 20 weeks' gestation or, if gestation is unknown, of birthweight at least 400 grams.

## STILLBIRTH RATE

**Stillbirth rate = (number of stillbirths / total (stillbirths + livebirths)) × 1,000**

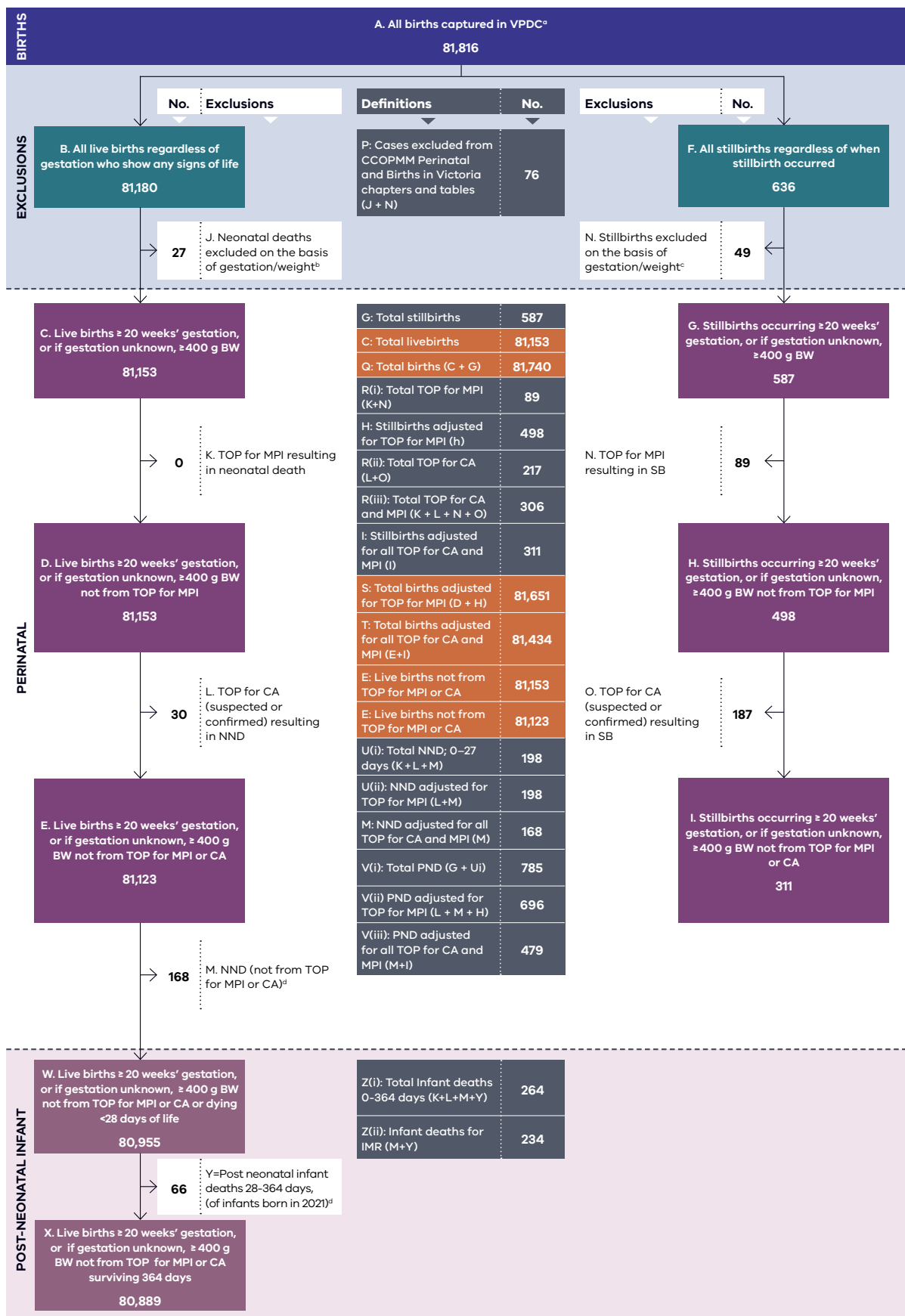
## INFANT MORTALITY RATE (IMR)

**IMR = (number of infant deaths / total livebirths) × 1,000**

The IMR is calculated as the number of infant deaths divided by the number of total (Victorian-born) livebirths for the index year (reported as the rate per 1,000 livebirths). The livebirths are limited to those infants ≥ 20 weeks' gestation (or a birthweight of at least 400 grams if gestation is unknown), and at least 150 grams birthweight unless known to have been alive at 20 or more weeks' gestation.

Deaths during the neonatal period of infants born as the result of termination of pregnancy for congenital anomaly or maternal psychosocial indications are excluded from the IMR calculation.

# Appendix 2: Flow diagram for births in Victoria, 2021



## ABBREVIATIONS USED IN THIS FLOW DIAGRAM

**BW** – birthweight

**CA** – congenital anomaly (suspected or confirmed)

**EFRP** – estimated female resident population

**IMR** – infant mortality rate

**MPI** – maternal psychosocial indications

**NND** – neonatal death

**PMR** – perinatal mortality rate

**SB** – stillbirth

**TOP** – termination of pregnancy

**VPDC** – Victorian Perinatal Data Collection

## FORMULAE

Crude birth rate =  $E / EFRP \times 1,000$

$PMR = (G + U(i)) / (G + C) \times 1,000$

$IMR = Z(ii)/E \times 1,000$

## NOTES

- a. The diagram includes only births occurring in Victoria and their outcomes.

Numbers of births in the various categories can differ slightly between the 'Mothers and babies' section, the 'Perinatal mortality' section and this flow diagram. Births in Victoria uses *gestation at birth*, regardless of when the fetal death occurred, whereas this flow diagram and the 'Perinatal mortality' section use *gestation at the diagnosis of death*, regardless of the gestation at which the birth occurred.

For example, where a fetal death is diagnosed at 19 weeks but not born until 21 weeks, and the birthweight was  $\geq 150$  grams: this baby would be:

- included as a birth in the sections of this report dealing with births (as born  $> 20$  weeks' gestation)
- excluded from the flow diagram and the 'Perinatal mortality' section (as known to have died  $< 20$  weeks' gestation).

- b. Neonatal death exclusions (J) comprise:

J(i). Those live born  $< 20$  weeks' gestation (n = 27)

J(ii). Those live born at unknown gestation with a birthweight  $< 400$  grams (n = 0)

- c. Stillbirth exclusions (N) comprise:

N(i). Stillbirths where death is known to have occurred  $< 20$  weeks' gestation but birth  $\geq 20$  weeks' gestation with birthweight  $< 400$  grams (n = 6)

N(ii). Stillbirths where death and birth occurred at unknown gestation, with a birthweight  $< 400$  grams (n = 0)

N(iii). Stillbirths where death is known to have occurred  $< 20$  weeks' gestation but born  $\geq 20$  weeks' gestation, with unknown birthweight (n = 2)

N(iv). Stillbirths where death occurred at unknown gestation, birth occurred  $\geq 20$  weeks' gestation, but where birthweight  $< 150$  grams (n = 41)

N(v) stillbirths where death and birth are known to have occurred  $< 20$  weeks' gestation (n = 0)

- d. Post-neonatal infant deaths includes all those born in 2021 with deaths occurring up until 30 December 2022.

# Appendix 3: 2021 publications using CCOPMM data

Boland RA, Cheong JLY, Doyle LW. Changes in long-term survival and neurodevelopmental disability in infants born extremely preterm in the post-surfactant era. *Seminars in Perinatology*. 2021;45(8):151479.

Boland RA, Cheong JLY, Stewart MJ, Doyle LW. Temporal changes in rates of active management and infant survival following live birth at 22–24 weeks' gestation in Victoria. *Australian and New Zealand Journal of Obstetrics and Gynaecology*. 2021;61(4):528–535.

Boland RA, Cheong JLY, Stewart MJ, Kane SC, Doyle LW. Disparities between perceived and true outcomes of infants born at 23–25 weeks' gestation. *Australian and New Zealand Journal of Obstetrics and Gynaecology*. 2022;62(2):255–262.

Burger RJ, Temmink JD, Wertaschnigg D, Ganzevoort W, Reddy M, Davey MA, et al. Trends in singleton preterm birth in Victoria, 2007 to 2017: a consecutive cross-sectional study. *Acta Obstetrica et Gynecologica Scandinavica*. 2021;100(7):1230–1238.

Burger RJ, Temmink S, Wertaschnigg D, Ganzevoort W, Reddy M, Davey MA, et al. Trends in preterm birth in twin pregnancies in Victoria, Australia, 2007–2017. *Australian and New Zealand Journal of Obstetrics and Gynaecology*. 2021;61(1):55–62.

Doyle LW, Spittle AJ, Olsen JE, Kwong A, Boland RA, Lee KJ, et al. Translating antenatal magnesium sulphate neuroprotection for infants born < 28 weeks' gestation into practice: a geographical cohort study. *Australian and New Zealand Journal of Obstetrics and Gynaecology*. 2021;61(4):513–518.

Edvardsson K, Davey MA, Powell R, Axmon A. Sex ratios at birth in Australia according to mother's country of birth: a national study of all 5,614,847 reported live births 1997–2016. *PLoS ONE*. 2021;16(6):e0251588.

Giles ML, Davey MA, Wallace EM. Associations between maternal immunisation and reduced rates of preterm birth and stillbirth: a population based retrospective cohort study. *Frontiers in Immunology*. 2021;12:704254.

Hassen TA, Chojenta C, Egan N, Loxton D. The association between birth weight and proxy-reported health-related quality of life among children aged 5–10 years old: a linked data analysis. *BMC Pediatrics*. 2021;21(1):408.

Hassen TA, Chojenta C, Egan N, Loxton D. The Association between the five-minute Apgar score and neurodevelopmental outcomes among children aged 8–66 months in Australia. *International Journal of Environmental Research and Public Health*. 2021;18(12).

Hassen TA, Chojenta C, Egan N, Loxton D. Determinants of neonatal near miss in Australia: A multilevel analysis. *Early Human Development*. 2021;156:105343.

Lindquist AC, Hastie RM, Hiscock RJ, Pritchard NL, Walker SP, Tong S. Risk of major labour-related complications for pregnancies progressing to 42 weeks or beyond. *BMC Medicine*. 2021;19(1):126.

Moss KM, Doust J, Homer H, Rowlands IJ, Hockey R, Mishra GD. Delayed diagnosis of endometriosis disadvantages women in ART: a retrospective population linked data study. *Human Reproduction*. 2021;36(12):3074–3082.

Namachivayam SP, Butt W, Brizard C, Millar J, Thompson J, Walker SP, et al. Potential benefits of prenatal diagnosis of TGA in Australia may be outweighed by the adverse effects of earlier delivery: likely causation and potential solutions. *Archives of Disease in Childhood*. 2023.

Selvaratnam RJ, Davey MA, Hudson RM, Farrell T, Wallace EM. Improving maternity care in Victoria: an accidental learning healthcare system. *Australian and New Zealand Journal of Obstetrics and Gynaecology*. 2021;61(2):165–168.

Selvaratnam RJ, Rolnik DL, Davey MA, Wallace EM. Stillbirth: are we making more progress than we think? A retrospective cohort study. *BJOG: An International Journal of Obstetrics & Gynaecology*. 2021;128(8):1304–1312.

Selvaratnam RJ, Wallace EM, Hunt RW, Davey MA. Preventing harm: A balance measure for improving the detection of fetal growth restriction. *Australian and New Zealand Journal of Obstetrics and Gynaecology*. 2021;61(5):715–721.

Selvaratnam RJ, Wallace EM, Treleaven S, Hooper SB, Davis PG, Davey MA. Does detection of fetal growth restriction improve neonatal outcomes? *Journal of Paediatrics and Child Health*. 2021;57(5):677–683.

Selvaratnam RJ, Wallace EM, Wolfe R, Anderson PJ, Davey MA. Association between iatrogenic delivery for suspected fetal growth restriction and childhood school outcomes. *JAMA*. 2021;326(2):145–153.

# Appendix 4:

## Acknowledgements

The creation of this report each year is not possible without the generous assistance of many people. Midwives across Victoria notify CCOPMM of all births via the Victorian Perinatal Data Collection. Vital information about maternal, perinatal and child deaths is received from:

- health services
- the Registry of Births, Death and Marriages Victoria
- anatomical and forensic pathologists
- the Coroners Court of Victoria
- the Victorian Institute of Forensic Medicine
- the Paediatric Infant Perinatal Emergency Retrieval (PIPER) service
- individual treating practitioners
- palliative care services
- maternal and child health nurses
- Ambulance Victoria
- child protection services.

This report would not be possible without their assistance, and that of many others, and we thank them for their continued support and diligence in providing us with information that makes our work possible.

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- Dr Lisa Begg
- Dr Peter McDougall
- Dr Erin Mills
- Dr Sophie Treleaven
- Dr Julia Unterscheider
- Dr Carmel Walsh.

# Appendix 5: CCOPMM Member lists

## CCOPMM SUBCOMMITTEES

There are five subcommittees that report to CCOPMM:

1. Maternal Subcommittee
2. Stillbirth Subcommittee
3. Neonatal Subcommittee
4. Child and Adolescent Subcommittee
5. Research and Reporting Subcommittee.

## CCOPMM MEMBERS, 2021

Adj. Prof. Tanya Farrell (Chair)

Ms Ann Jorgensen (Deputy Chair)

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Dr Alison Green

Prof. Caroline Homer

Prof. Rod Hunt

Dr Niroshini Kennedy

Adj. Prof. Alan Lilly

Ms Siobhan Mansfield

Prof. Susan McDonald

Ms Jacquelyn Mead

Ms Andrea Rindt

Adj. Clin. Assoc. Prof. Robert Roseby

Assoc. Prof. Glyn Teale

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Dr Stephen Cole

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Mrs Andrea Rindt  
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Assoc. Prof. Rebecca Giallo

Assoc. Prof. Lisa Hui

Prof. Rod Hunt

Assoc. Prof. Alexis Shub

Prof. Joshua Vogel

# Glossary

## **Adjusted perinatal death**

Terminations of pregnancy for psychosocial indications are excluded in adjusted perinatal deaths. This provides a more accurate measure for assessing avoidable mortality and for comparisons with other jurisdictions both nationally and internationally.

## **Adjusted stillbirth**

Terminations of pregnancy for psychosocial indications are excluded when calculating adjusted stillbirths. This provides a more accurate measure for assessing avoidable mortality and for comparisons with other jurisdictions both nationally and internationally.

## **Apgar score**

A measure of the physical condition of a newborn infant. It is obtained by adding points (2, 1 or 0) for heart rate, respiratory effort, muscle tone, response to stimulation and skin colouration. A score of 10 represents the best possible condition.

## **Birth episodes (previously confinements)**

The number of women who gave birth (regardless of whether the pregnancy resulted in one or more babies, and regardless of whether the baby/babies were liveborn or stillborn) with a gestation of 20 weeks or more.

## **Child death**

The death of a child occurring after and including their first birthday and up to but not including their 18<sup>th</sup> birthday (one to 17 years).

## **Congenital anomaly (formerly 'birth anomaly')**

Any abnormality of prenatal origin arising from conception or occurring before the end of pregnancy. This includes structural, functional, genetic, chromosomal and biochemical anomalies. Perinatal Society of Australia and New Zealand coding uses the wording 'congenital abnormality.' CCOPMM uses the wording 'congenital anomaly', and the terms 'congenital abnormality' and 'congenital anomaly' are considered to be synonymous.

## **Crude birth rate**

Measured by the number of livebirths (see definition below) per 1,000 estimated female resident population aged 15–44 years for a given calendar year.

## **Episiotomy**

A surgical cut made at the opening of the vagina during childbirth to aid a difficult delivery and prevent rupture of tissues.

### Estimated resident population

An Australian Bureau of Statistics measure of the population based on residence. It refers to all people, regardless of nationality or citizenship, who usually live in Australia, except for foreign diplomatic personnel and their families. The CCOPMM report uses estimated female resident population, aged 15–44 years, in its tables.

### Fetal growth restriction

Fetal growth restriction is a condition in which an unborn baby (fetus) is smaller than expected for the number of weeks of pregnancy (gestational age).

### Infant death

The death of a liveborn infant occurring within one year of birth. Infant death can be divided into 'neonatal death' referring to the death of a liveborn infant less than 28 days after birth, of at least 20 weeks' gestation or, if gestation is unknown, weighing at least 400 grams, and 'post-neonatal infant death', referring to the death of an infant between 28 days and 364 days.

### Livebirth

The birth of a child who, after delivery, breathes or shows any evidence of life such as a heartbeat.

### Maternal death

Maternal death refers to the death of a woman while pregnant or within 12 months of the end of the pregnancy, irrespective of the cause of death. This definition allows for classification of maternal deaths as follows:

- **Direct** – the death is due to a complication of the pregnancy or its management (for example, haemorrhage from placenta praevia).
- **Indirect** – the death is due to a pre-existing or newly diagnosed condition aggravated by the physiological or pathological changes of pregnancy (for example, deterioration in pre-existing heart disease or diabetes); deaths resulting from a known mental health disorder are usually categorised as indirect. If there is no history of mental health disorder, the classification is direct.
- **Coincidental** – the death is considered unrelated to pregnancy (for example, a passenger in a motor vehicle accident). Coincidental deaths are not included in the maternal mortality ratio.
- **Early maternal death** – when the death occurs during pregnancy or within 42 days of birth or end of pregnancy. The death may be due to direct, indirect or coincidental causes.
- **Late maternal death** – when the death occurs after 42 days but within a year of the birth or end of pregnancy. The death may be due to direct, indirect or coincidental causes. Late deaths are not included in the maternal mortality ratio.

## Median

The middle point of a set of numbers.

The median is chosen rather than the mean (average) when describing the age of women giving birth because it is less skewed by ages that sit at extreme ends of the range.

## Neonatal death

Death of a liveborn infant less than 28 days after birth. All neonatal deaths must be reported to CCOPMM. However, those included in the report are those of at least 20 weeks' gestation, or if gestation is unknown, weighing at least 400 grams.

## Perinatal death

CCOPMM defines perinatal death to include stillbirth and neonatal deaths within 28 days of birth of infants of  $\geq 20$  weeks' gestation or, if gestation is unknown, of birthweight  $\geq 400$  grams. Stillbirths and livebirths with only brief survival are grouped into 'perinatal deaths' on the assumption that similar factors are associated with these losses.

CCOPMM also reports nationally on perinatal deaths of infants with a birthweight of  $\geq 500$  grams or, if the birthweight is unknown, infants of  $\geq 22$  weeks' gestation. This definition has certain advantages because it excludes from the calculation those mostly pre-viable livebirths weighing  $< 500$  grams and most cases where the pregnancy was terminated for fetal or maternal indications.

## Post-neonatal infant, child and adolescent deaths classification

These deaths are classified under the following categories:

- determined at birth
- sudden unexpected deaths in infancy, including sudden infant death syndrome
- unintentional injury
- acquired disease
- intentional injury
- undetermined.

## Postpartum haemorrhage

Maternal blood loss of 500 mL or more in the 24 hours following birth.

## Pre-eclampsia

A complication of pregnancy characterised by high blood pressure and damage to another organ/system.

## Sepsis/septic shock

A life-threatening complication of an infection. Septic shock is also a life-threatening condition caused by severe localised or system-wide infection that requires immediate medical management.

## Stillbirth

The birth of an infant of at least 20 weeks' gestation or, if gestation is unknown, weighing at least 400 grams, who shows no signs of life at birth.

## Sudden unexpected deaths in infancy

This group of deaths includes all infants (under one year of age) who die suddenly and unexpectedly after they are placed for sleeping. Sudden unexpected deaths in infancy (SUDI) can be classified as **unexplained**:

- sudden infant death syndrome – the sudden unexpected death of an infant under one year of age, with onset of the fatal episode apparently occurring during sleep
- unclassified sudden infant death, with or without autopsy
- undetermined

or **explained**:

- suffocation while sleeping (including asphyxiation by bedclothes and overlaying)
- infection, metabolic disorders, congenital anomalies, genetic conditions
- other, for example, non-accidental injury.

Some international definitions of SUDI include unexpected events such as unintentional injury (for example, motor vehicle accidents). CCOPMM does not include unintentional injuries in its SUDI definitions, but details of unintentional injury in infants are listed in the report.

SUDI deaths are included in the 'explained' category where a cause of death is identified (usually at autopsy) and are also included within other appropriate categories (for example, congenital anomalies or genetic conditions, infection) elsewhere in the report.

'Unexplained' SUDI deaths are classified according to the following definitions:

**General definition:** The sudden unexpected death of an infant under 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.

**Category IA:** Includes deaths that meet the requirements of the general definition and all the following requirements.

- Clinical:
  - older than 21 days and younger than nine months of age
  - normal clinical history including term pregnancy (gestational age  $\geq$  37 weeks)
  - normal growth and development
  - no similar deaths among siblings, close genetic relatives (uncles, aunts or first-degree cousins) or other infants in the custody of the same caregiver.
- Circumstances of death:
  - investigation of the various scenes where incidents leading to death might have occurred and determination that they do not provide an explanation for the death
  - found in a safe sleeping environment, with no evidence of accidental death.
- Autopsy:
  - absence of potentially fatal pathological findings; minor respiratory system inflammatory infiltrates are acceptable; intrathoracic petechial haemorrhage is a supportive but not obligatory or diagnostic finding
  - no evidence of unexplained trauma, abuse, neglect or unintentional injury
  - no evidence of substantial thymic stress effect (thymic weight of  $<$  15 grams and/or moderate/severe cortical lymphocyte depletion); occasional 'starry sky' macrophages or minor cortical depletion is acceptable
  - negative results of toxicological, microbiological, radiological, vitreous chemistry and metabolic screening studies.

**Category IB:** Includes infant deaths that meet the requirements of the general definition and the criteria for category IA, except that investigation of the various scenes where incidents leading to death might have occurred was not performed or  $\geq$  one of the following analyses were not performed:

- toxicological
- microbiological
- radiological
- vitreous
- chemistry
- metabolic screening studies.

**Category II:** Includes infants that meet category I except for  $\geq$  one of the following.

- Clinical:
  - age range outside that of category IA or IB (that is, 0–21 days or 270 days (nine months to first birthday)
  - similar deaths among siblings, close relatives or infants in the custody of the same caregiver that are not suspect for infanticide or recognised genetic disorders
  - neonatal or perinatal conditions (for example, those resulting from preterm birth) that have resolved by the time of death.
- Circumstances of death:
  - mechanical asphyxia or suffocation caused by overlaying not determined with certainty.
- Autopsy:
  - abnormal growth or development not thought to have contributed to death
  - marked inflammatory changes or abnormalities not sufficient to be unequivocal causes of death.

### **Trimester gestation values**

- First trimester: gestation  $\leq$  13 completed weeks
- Second trimester: gestation 14–28 completed weeks
- Third trimester: gestation  $\geq$  29 completed weeks

**Unclassified sudden infant death:** Includes deaths that do not meet the criteria for category I or II but for which alternative diagnoses of natural or unnatural conditions are equivocal, including cases where autopsies were not performed.

**Post-resuscitation cases:** Infants found in extremis who are not resuscitated and later die ('temporarily interrupted SUDI') may be included in the previous categories, depending on the fulfilment of relevant criteria.

