The Consultative Council on Obstetric and Paediatric Mortality and Morbidity

# Victoria's Mothers, Babies and Children **2016**





Health and Human Services

# Victoria's Mothers, Babies and Children **2016**

To receive this publication in an accessible format phone (03) 9096 0380, using the National Relay Service 13 36 77 if required, or email <u>clinical.councils@dhhs.vic.gov.au</u>

Authorised and published by the Victorian Government, 1 Treasury Place, Melbourne.

 $\ensuremath{\mathbb{C}}$  State of Victoria, Department of Health and Human Services, November 2017.

Where the term 'Aboriginal' is used it refers to both Aboriginal and Torres Strait Islander people. Indigenous is retained when it is part of the title of a report, program or quotation.

ISBN 978-1-76069-054-0 (pdf/online)

Available at https://www2.health.vic.gov.au/hospitals-and-health-services/quality-safety-service/consultativecouncils/council-obstetric-paediatric-mortality/mothers-babies-children-report

# Message from the chair

The number of births in Victoria continues to rise, reflecting the 2.1 per cent increase in the population in 2016, the highest in Australia. With this increase comes the challenges of providing quality health care and thus it is reassuring that the mortality rates – perinatal, child and adolescent remain comparable with the other Australian jurisdictions and amongst the lowest in the developed world.

One of the most encouraging findings in this report is the continued reduction in perinatal mortality in pregnancies of Aboriginal women, with the rates in 2016 being comparable to non-Aboriginal mothers. The explanation for this fall appears to be multifactorial and is the subject of an ongoing in-depth analysis.

The Consultative Council on Obstetric and Paediatric Mortality and Morbidity (CCOPMM) has begun an in-depth review of severe morbidity with the commencement of the assessment of maternal admission to the adult intensive care unit. This will be followed by the review of surviving neonates with a diagnosis of hypoxic ischaemic encephalopathy. We anticipate that the detailed review of these major morbidities will add substantially to our understanding of the causation and potential preventability of some of these cases leading to improvements in clinical care.

The Report contains a series of recommendations that have arisen from the case reviews by the expert members of the four Sub-Committees of CCOPMM and these are commended to health policy makers, health services, health providers and consumers for their consideration.

In reflecting on CCOPMM's place in the improving quality of care and outcomes for Victoria's mothers and children and adolescents, I wish to pay tribute to the foresight of Professor Sir Lance Townsend and his colleagues who established CCOPMM in the late 1950s. The manner in which it was set up combining the birth and the mortality data and under specific legislative protection, sets it apart from most of the bodies with similar functions.

This 2016 report marks the return to annual reporting (the last 3 reports being biennial) and this is the result of extraordinary contributions by the Consultative Councils Unit team led by Ms Vickie Veitch that support CCOPMM and primarily draft the report, the work of the four sub-committees that review the maternal, still birth, neonatal and child and adolescent deaths and members of CCOPMM under whose auspices this report is prepared and released.

Jeremy J N Oats Chair CCOPMM

# **Acknowledgements**

This report was made possible by the generous assistance of many individuals.

Health services, encompassing obstetricians, midwives and health information officers, provide confidential medical reports on perinatal deaths and additional information on maternal, perinatal and paediatric deaths.

The autopsies undertaken by anatomical and forensic pathologists are indispensable in the comprehensive consideration of these deaths.

The State Coroner's Office and personnel from the Victorian Institute of Forensic Medicine provide information to CCOPMM on cases investigated by coroners in Victoria.

The Paediatric Infant Perinatal Emergency Retrieval (PIPER) provides additional information on infants and children transferred to and from tertiary neonatal and children's centres. The Intensive Care Unit of The Royal Children's Hospital provides data on paediatric emergency transfers. The Department of Health and Human Services (DHHS) contributes the information on childhood immunisation and vaccine-preventable diseases in Victoria. The printing and distribution costs of this publication are funded by the Safer Care Victoria, which funds the secretariat of CCOPMM and its running costs.

This report was developed by the (CCOPMM) with support from the following team members of the Consultative Councils Unit at Safer Care Victoria:

Ms. Vickie Veitch	Manager			
Dr. Shirin Anil	Acting Manager; Team Leader Research & Reporting			
Dr. Sophie Treleaven	Paediatric Epidemiologist			
Dr. Mary-Ann Davey	Perinatal Epidemiologist; Acting Team Leader Research & Reporting			
Ms. Gemma Wills	Senior Project Officer			
Ms. Diana Stubbs	Liaison Midwife			
Ms. Adelinda Botham	Project Officer			
Ms. Marina Forte	Administration Officer			
Ms. Deanne Needham	Project Officer			

Appreciation is also extended to Ms. Cathy Fraser and Ms. Suzana Talevska from Safer Care Victoria, who helped in the compilation of the report.

# Contents

Message from the chair	v
Acknowledgements	vi
Contents	vii
Figures	viii
Tables	ix
Executive summary	1
1. About this report	13
2. Priority Areas and Recommendations	14
2.1 Maternal mental health	14
2.2 Appropriate level of care	19
2.3 Consumer education	23
2.4 Ensuring the health and welfare of vulnerable newborns, children and adolescents	27
2.5 Sudden unexpected death in infancy / Sudden infant death syndrome	30
3. Aboriginal births and perinatal mortality in Victoria	34
4. Births in Victoria	43
4.1 Overview	43
4.2 Caesarean section	47
5. Maternal mortality and severe acute maternal morbidity	51
5.1 Overview	51
5.2 Maternal morbidity	57
6. Perinatal deaths	60
6.1 Overview and contributing factors	60
6.2 Diabetes	68
7. Child and adolescent deaths	72
7.1 Overview	72
7.2 The complexities of adolescent health	80
7.3 Minimising deaths from unintentional injuries	86
7.4 The dangers of suboptimal management of chronic disease	91
8. CCOPMM functions and audit methods	95
8.1 About the Consultative Council on Obstetrics and Paediatric Mortality and Morbidity	95
8.2 CCOPMM functions	95
8.3 Members of CCOPMM, 2015–2018	96
9. Collecting and reviewing information on births and deaths	99
9.1 Review of deaths	99
9.2 Review of births	99
9.3 Reporting and analysis	100
Appendix 1: Definitions and abbreviations	102
Appendix 2: Measures of obstetric and paediatric mortality and morbidity	108
Appendix 3: Flow diagram for births in Victoria, 2016	110
References	112

# **Figures**

Figure 1: Aboriginal women as a proportion of all women giving birth in Victoria, 2000–2016	36 26
Figure 2: Adjusted perinatal mortality by maternal Aboriginal status, Victoria, 2001–2016	30
Figure 3: Low birthweight for bables of Aboriginal and non-Aboriginal mothers, 2012–2016	27
(percentage of all births)	37
Figure 4: Low birthweight when baby and/or mother is an Aboriginal person and when neither	~ 7
mother nor baby is an Aboriginal person, 2012–2016 (percentage of all births)	37
Figure 5: Preterm birth (before 37 weeks) for babies of Aboriginal and non-Aboriginal mothers,	
2012–2016 (percentage of all births)	38
Figure 6: Preterm birth (before 37 weeks) when baby and/or mother is an Aboriginal person and	
when neither is an Aboriginal person, 2012–2016 (percentage of all births)	38
Figure 7: Small for gestational age (< 10th centile birthweight) for babies of Aboriginal and non-	
Aboriginal mothers, 2012–2016 (percentage of all births)	39
Figure 8: Small for gestational age (< 10th centile birthweight) when baby and/or mother is an	
Aboriginal person and when neither is an Aboriginal person, 2012–2016 (percentage of all births)	39
Figure 9: Trend in number of births, 1985–2016	45
Figure 10: Trend in management of labour and birth 2010 to 2016 (percentage)	45
Figure 11: Trends in method of birth, all confinements in Victoria, 1985–2016 (percentage)	48
Figure 12: Caesarean section rates by maternal age, Victoria, 2016	49
Figure 13: Caesarean section rates by maternal BMI category, Victoria, 2016	49
Figure 14: Caesarean section for Robson Groups 1 and 2 (modified) in Victoria in public and private	
hospitals, 2016 (percentage)	50
Figure 15: Maternal mortality ratios by triennia, Victoria and Australia, 1991–2016	52
Figure 16: Severe (third- or fourth-degree) perineal lacerations for women who gave birth vaginally,	
by parity and admission status, 2012–2016 (percentage)	58
Figure 17: Episiotomy for women giving birth vaginally, by parity and admission status, 2012–2016	
(percentage)	58
Figure 18: Perinatal mortality rates in Victoria, 2000–2016 (crude and adjusted)	63
Figure 19a: Causes of adjusted stillbirth (percentage), PSANZ PDC, Victoria 2016	64
Figure 19b: Causes of neonatal death (percentage), PSANZ PDC, Victoria 2016	64
Figure 20: Perinatal mortality rate (PMR) adjusted by Aboriginal and non-Aboriginal status, by	
rolling triennia. Victoria. 2001–2016	65
Figure 21: Perinatal deaths per 1 000 births to women with and without pre-destational diabetes	
(PGD), adjusted births in Victoria, 2016	70
Figure 22: Perinatal deaths per 1 000 births at 28 or more weeks' destation to women with and	
without destational diabetes mellitus (GDM), adjusted births in Victoria, 2016	70
Figure 23: Victoria's infant mortality and under five mortality rates 2000–2016	73
Figure 24: Pates of death by age group (excluding 28_364 days) Victoria 1985_2016	74
Figure 25: Pates of death by age group, (excluding 28–364 days) Victoria, 1985–2016	21
Figure 26: Pates of upintentional injury deaths in children and adolescents, by age group. Victoria	01
	01
Figure 27: Bates of intentional colf harm in adalassants 2005, 2016	01
Figure 27. Rates of unintentional injury deaths 28 days to 14 years Misteria 1085, 2010	0∠ 07
Figure 20. Rates of unintentional injury deaths, 26 days to 14 years, Victoria, 1985–2016	0/ 07
Figure 29. Rates of unintentional injury deaths by age group, victoria, 1985–2016	0/
rigure SU: CCOPININI'S relationships, accountabilities and role	101

# **Tables**

Table 1: Hospital of birth by capability level of public maternity service at various gestations	
(completed weeks), 2016	21
Table 2: Percentage of deaths aged 28 days to 17 years, by IRSD score, Victoria, 2016	28
Table 3: Causes of maternal deaths, Victoria, 2011–2016	54
Table 4: Assessment of contributing factors in maternal deaths, Victoria, 2011–2016	55
Table 5: Perinatal deaths and crude and adjusted perinatal mortality rates (PMR) in Victoria, 2001–	
2016	62
Table 6: Perinatal mortality rate (PMR) adjusted by maternal place of birth, Victoria, 2016	63
Table 7: PMR <sub>500</sub> in Victoria 2005–2016 (birthweight ≥ 500 g)	65
Table 8: Perinatal mortality, morbidity and care associated with pre-gestational diabetes (PGD),	
births in Victoria in 2016	69
Table 9: Percentage of deaths aged 28 days to 17 years, by IRSD score, Victoria, 2016	74



# **Executive summary**

*Victoria's Mothers, Babies and Children 2016* presents the key findings and recommendations arising from the review of births and deaths by the Consultative Council on Obstetric and Paediatric Mortality and Morbidity (CCOPMM). This report is designed to assist the process of service monitoring and delivery for all levels of the Victorian health system by providing the essential basic data and thus contribute to the improvement of health outcomes for mothers, babies, children and adolescents. Additionally, the report draws attention to areas of clinical risk to inform clinical practice, health policy and service planning.

This report continues with the format presented in *Victoria's Mothers, Babies and Children 2014 and 2015*, with a selection of high-level priority areas and recommendations focusing on system-level issues. In addition, it has continued with individual sections focusing on Aboriginal mothers and babies, births, perinatal mortality, child and adolescent and maternal mortality and morbidity, with messages for clinicians and consumers.

Although Victoria and Australia experience one of the lowest maternal and perinatal mortality rates internationally, identifying preventable or contributing factors and sharing lessons learnt is vital in improving the safety and quality of health services. Key to this is the dissemination and implementation of these recommendations by the health service providers in collaboration with Safer Care Victoria and the Clinical Networks. Building on the strong collaborative arrangements between the CCOPMM, Safer Care Victoria, the Coroners' Court of Victoria and the Victorian Managed Insurance Authority will also help to improve processes for quality improvement and management of risk.

# Priority Areas & Recommendations

Through the review of births and deaths for 2016, CCOPMM has highlighted a number of key priority areas that significantly impact on the health and wellbeing of Victorian women and children. These areas require attention not only from the Victorian health sector but also from the community more broadly.

# Maternal mental health

Psychosocial factors such as maternal mental health disorders and substance dependence continue to be a common contributing factor in maternal mortality in Victoria.

### **Recommendation 1**

#### Improving provision of maternal mental health services

CCOPMM recommends the following to improve provision of maternal mental health services:

- The recently updated *Effective mental health care in the perinatal period Australian clinical practice guideline* (2017) provides a comprehensive and evidence-based approach to caring for women with mental illness and their families. It is recommended that all clinicians are familiar with the guidelines and that they are made readily available.
- Health services should implement the recommendations from the National Perinatal Mental Health Guidelines namely to screen all pregnant women for anxiety and depression early in pregnancy, and repeated at least once during the pregnancy. Furthermore the Department of Health and Human Services should work with Maternal and Child Health and General Practitioners to ensure that all women are screened 6–12 weeks after birth and that this is repeated at least once in the first postnatal year.
- Mental health, primary care and obstetric services need to remain vigilant to the complex mental health needs that may arise in women in the perinatal period and ensure effective integration of care across services.
- When an Aboriginal family is not engaged with a public health/maternity service, consider involving appropriate Aboriginal organisations to facilitate the relationship between the treating hospital and client, or to provide postnatal care in consultation with the health service.
- As psychotropic medication does not necessarily become contraindicated once a woman becomes
  pregnant, the continued use or commencement of psychotropic medication should be carefully
  considered on a case by case basis, with each woman being informed of the risks and benefits of any
  proposed treatment.

# Appropriate level of care

Maternal and perinatal morbidity and mortality can be reduced by health services ensuring they are functioning at the appropriate level of care compatible with their staffing and facilities resources.

### **Recommendation 2**

#### Referral of women with complex needs

Women with complex medical and obstetric problems should be booked for confinement at an appropriate level hospital.

# Consumer education

Failure to provide clear, concise advice to pregnant women, to parents or caregivers of sick children and to adolescents about important aspects of their acute illness or underlying condition can contribute to worsening of illness or death.

# **Recommendation 3**

#### Heightened awareness of the importance of decreased fetal movements

Maternal perception of decreased fetal movements is common in late pregnancy. There is no objective definition of decreased fetal movements and, while the nature of movements may change as the pregnancy advances, there is no evidence that the number of movements actually changes. There is an association between decreased fetal movements and adverse perinatal outcomes including stillbirth, fetal growth restriction, low Apgar scores and acidosis.

During pregnancy clinicians should provide information to women regarding normal fetal movements and emphasise the importance of maternal awareness of fetal movements at every visit. Women are advised to contact their maternity care provider if they have concerns about decreased fetal movements and must not wait until the next day to report their concerns.

For women presenting before 28 weeks' gestation, auscultation of fetal heart and a clinical assessment of fetal growth is appropriate. After 28 weeks a cardiotocography should be performed with or without an ultrasound examination, depending on the presence of risk factors.

Induction of labour should be considered where there is a persistent maternal perception of decreased fetal movements or where there are suspected or actual concerns for fetal wellbeing. The decision to expedite the birth needs to be weighed against the risk to the mother and baby at that particular gestation.

Clinicians should be guided by the PSANZ SANDA *Clinical practice guideline for the care of women with decreased fetal movements* <<u>https://sanda.psanz.com.au/clinical-practice/clinical-guidelines/></u> and RCOG Green-top Guideline 57 Reduced Fetal Movements <<u>https://www.rcog.org.uk/en/guidelines</u>/research-services/guidelines/gtg57/>.

# **Recommendation 4**

# Consumer education on the importance of reporting Premature Rupture of the Membranes (PROM)

Health services and pregnancy care providers should provide education and information to women regarding the importance of reporting spontaneous rupture of the membranes, especially if preterm.

- Neonatal sepsis due to Group B Streptococcus (GBS) is a potentially preventable cause of neonatal death.
- Women should be advised to contact their pregnancy care provider promptly if they feel their membranes have ruptured so an assessment and appropriate management plan can be made to reduce the risk of this potentially serious condition.

# **Recommendation 5**

#### Consumer education on changing medication

When altering medications, doctors should ensure the patient and family has verbal and/or written instructions regarding the changes and should be confident that the patient and family understands these.

The family should understand what to expect from the change in medication and when to seek further medical attention. It is important that there is clear and documented communication between the discharging hospital, the patient and their general practitioner regarding the discharge plan and responsibility for follow-up of both the acute episode and the longer-term management.

# Ensuring the health and welfare of vulnerable newborns, children and adolescents

Vulnerable children are dying because their social risk factors are not being adequately addressed. All children should have the best opportunities possible to grow and develop to their full potential.

### **Recommendation 6**

#### Addressing social risk factors

CCOPMM recommends development of a new model of care in Victoria to provide family support to vulnerable children and young people with chronic health issues. This model needs skilled staff to ensure vulnerable children and young people with chronic health issues are identified and receive appropriate, potentially life-saving medical care, monitoring and prevention strategies.

The model proposed would improve active follow-up of high-risk children and families in their homes and communities. To achieve this, CCOPMM recommends the need for outreach child and adolescent health and support officers, with outreach workers who have both social and health skills. Given the system of service providers within Victoria, the model would include the following:

- Non-government community service organisations, community health centres and hospitals are supported to have outreach officers with skills in child and adolescent health, assessment, early child growth and development and social welfare. Such outreach child and family health support officers would have close links to hospitals, paediatricians, general practitioners and other specialist health professionals.
- Staff in non-government community service organisations and community health centres have improved access to consultation with health professionals, especially paediatricians and general practitioners. This requires more paediatricians who are based within community health centres and closer links between community service organisations and the health sector.

Currently the State Child Protection service responds to children at risk of significant physical harm or neglect – that is, children in need of protection. This new outreach model would address the health and welfare of vulnerable children and support to such families to reduce deaths from a wide range of childhood conditions. Such services would need the power to act in the best interests of the child and family, and to liaise with child protection services and other agencies.

# Sudden unexpected death in infancy / Sudden infant death syndrome

Sleeping a baby safely is one of the best ways to minimise the risk of sudden unexpected death in infancy (SUDI).

### **Recommendation 7**

#### Review of circumstances for SUDI

CCOPMM recommends that the circumstances of every sudden and unexpected infant death be thoroughly reviewed by a specialised team so that all the factors surrounding the death can be accurately detected to allow proper assessment of unexpected deaths.

### **Recommendation 8**

#### Safe sleeping recommendations for parents

Based on the case review of infant deaths and consideration of the wider literature, CCOPMM provides the following recommendations on safe sleeping for parents. These are a modified version of the Red Nose (formerly SIDS and Kids) Safe Sleeping Message:

- Sleep baby on their back: All babies should sleep on their back from birth, not on their front or side.
- Safe cot, safe mattress, safe bedding: Always sleep babies in a safe cot that meets the Australian Standard AS2172:2003, with a firm mattress that is the right size for the cot and is not tilted or elevated. The mattress should be covered with only a tightly-fitted sheet and, if required, a thin tightly-fitted mattress-protector under the fitted sheet. A baby should never be put down to sleep on a sofa, bean bag, sheepskin or pillow. There is no Australian standard for bassinettes.
- Keep baby's head and face uncovered: Babies should sleep in a light-weight sleeping bag of correct size that has a fitted neck, armholes or sleeves, and no hood.
- Safe bedding: There should be nothing else in the cot no blanket, doona, sheepskin, pillow, bumper or toys.
- Sleep baby in a safe cot in their parents' room: In the first 6–12 months, babies should sleep in their own cot in the same room as an adult caregiver. It is much safer for babies to sleep in their own cot than to sleep next to another person.
- Keep baby away from tobacco smoke before birth and after: The risk is increased even if a caregiver goes outside to smoke.
- Keep adults who are under the influence of alcohol or drugs or sedating medication away from babies.
- Breastfeed baby: Breastfeed your baby if you can.
- A dummy can be offered to a baby as a sleep aid for the first 6–12 months. Dummies must not be forced on the baby, or have a neck cord, or be covered in anything sweet.

### **Recommendation 9**

#### Provision of a portable infant sleep space to vulnerable babies

CCOPMM's recommendation regarding sleep sites remains that the safest place for babies to sleep is in their own cot, in the same room as an adult caregiver for the first 6–12 months of the infant's life.

However, the use of a portable infant sleep space such as a Pēpi-Pod or Wahakura (and commonly referred to as a 'Baby Box'), that can be used in shared sleep environments (for example, taken into the parental bed) is, **if used correctly as part of a safe sleep education program**, likely to protect vulnerable babies from asphyxia in a co-sleeping situation.

Consideration should be given to providing such a portable infant sleep space to every baby born to a vulnerable family in Victoria under a dedicated program. Such a program would need to be delivered prior to or at the time of birth, require extensive safe sleep education and be culturally appropriate for families. An impact and outcome evaluation would need to be part of the program. **The portable infant sleep space, its mattress and bedding must meet Australian standards.** CCOPMM recommends that babies sleep in a light-weight sleeping bag of correct size that has a fitted neck, armholes or sleeves, and no hood.

# Key findings

A selection of key findings from the analysis of the data received by CCOPMM in 2016 is provided below. These data provide insight into the needs of Victorian women, babies, children and adolescents, and should be used to inform clinical practice, health policy and service planning.

# Aboriginal births and perinatal mortality in Victoria

The proportion of women giving birth who are Aboriginal has increased from 0.6 per cent of all women giving birth in 2000 to 1.4 per cent in 2016.

Perinatal mortality for babies of Aboriginal women reduced from 13.6 per 1,000 births in 2013–2015 to 9.0 per 1,000 births for the 2014–2016 triennium. This is the lowest in 16 years. For the 2014–2016 triennium, the perinatal death rate for babies born to Aboriginal women was virtually the same as that for non-Aboriginal women (9.1 per 1,000 births).

Although babies of Aboriginal mothers having low birthweight (< 2,500 g) reduced from 11.5 per cent in 2015 to 9.8 per cent in 2016 (relative reduction of 14.7 per cent), it still remains higher than for the babies of non-Aboriginal women (6.8 per cent).

Smoking cessation rate, defined as a relative reduction of smoking in Aboriginal mothers in the second half of pregnancy as compared with the first half, increased from 21.1 per cent in 2015 to 25.2 per cent in 2016. The smoking cessation rate in Aboriginal mothers remains much less than that of non-Aboriginal mothers (40.2 per cent).

# Births in Victoria

In 2016, 79,319 women gave birth to 80,549 babies (excluding terminations of pregnancy for maternal psychosocial indications or congenital anomalies) – an increase of 2.0 per cent from 2015.

The crude birth rate fell slightly from 62.4 in 2015 to 61.4 per 1,000 women of reproductive age (15–44 years).

Of all women giving birth in Victoria in 2016, 1.5 per cent were younger than 20 years of age; the proportion aged 35 years or older remains steady at 25.3 per cent.

Of the women giving birth in 2016, 61.5 per cent were born in Australia. The most common countries of birth for women born in non-English-speaking countries were India and China.

The proportion of women who give birth by caesarean section has been increasing over the past three decades, from 15.3 per cent in 1985 to 34.0 per cent in 2016. Postpartum haemorrhage, admission to a high dependency unit or intensive care unit and surgical site infection rates are higher in women having a caesarean section compared with those having a vaginal birth.

# Maternal mortality and morbidity

In 2014–2016, the Maternal Mortality Ratio (MMR) was 8.9 per 100,000 women who gave birth.

For the years 2011–2016, the most common causes of maternal deaths (that is, during or within 42 days of the end of the pregnancy) were related to pre-existing cardiovascular disease, non-obstetric haemorrhage, including intracerebral haemorrhage, and intentional self-harm in women with pre-existing mental health disorders.

One-quarter of all women who gave birth in Victoria in 2016 experienced a postpartum haemorrhage (PPH) – blood loss of 500 mL or more in the first 24 hours following birth, while 2.0 per cent of all women experienced a severe PPH (at least 1,500 mL blood loss in the first 24 hours following birth).

Of women who gave birth vaginally in 2016, 3.0 per cent sustained a severe (third- or fourth-degree) perineal laceration, and 28.8 per cent had an episiotomy. This was more common for first births.

# Perinatal mortality

Victoria's Perinatal Mortality Rate (PMR) continues to fall and at 8.8 per 1,000 births (adjusted) is among the lowest in Australia and in other high-resources countries.

The leading cause of adjusted stillbirth is congenital anomalies. Unexplained fetal deaths, where a definitive cause could not be established, remained the second most common classification in 2016. Specific perinatal conditions (including twin-to-twin transfusion syndrome, fetomaternal haemorrhage, cord accidents and birth trauma), preterm birth and fetal growth restriction remain among the next most common causes.

For newborns up to the age of 28 days, congenital anomalies and spontaneous preterm birth were the two most common causes.

In 2014–2016, contributing factors for perinatal deaths were identified in 123 of the 1,086 stillbirths (11.3 per cent) and in 43 of the 415 neonatal deaths (10.4 per cent). Many of these contributing factors were not necessarily the direct cause of death, but their identification enables health services to improve their overall quality of care.

Women with diabetes before pregnancy (pre-gestational diabetes (PGD)) had a perinatal mortality rate of 12.0 per 1,000 births (9.0 stillbirths and 3.0 neonatal deaths) compared with 5.6 per 1,000 births (3.8 stillbirths and 1.8 neonatal deaths) for women without PGD.

Women giving birth at 28 or more weeks' gestation who had gestational diabetes mellitus (GDM) had a perinatal mortality rate of 2.0 per 1,000 births compared with 3.0 per 1,000 for those without GDM.

# Child and adolescent mortality

In 2016 Victoria's infant and under five-year mortality rates were 3.0 per 1,000 live births and 3.7 per 1,000 live births respectively, which are similar to the national rates (3.2 per 1,000 live births and 3.9 per 1,000 live births, respectively).

The main causes of the 75 deaths in post-neonatal infants (28–364 days of age) in 2016 were congenital anomaly (47 per cent), sudden infant death syndrome (19 per cent) and prematurity (9 per cent).

The main causes of the 40 deaths in children aged 1–4 years in 2016 were congenital anomalies (43 per cent), malignancy and undetermined cause of death (both 13 per cent) and drowning (10 per cent).

The main causes of the 42 deaths in adolescents aged 15–17 years in 2016 were intentional self-harm (including suicide) (38 per cent), motor vehicle accidents (21 per cent) and congenital anomaly and undetermined cause of death (both 12 per cent).

As children grow, they are less likely to die from conditions determined at birth (for example, congenital anomaly) and are more likely to die from acquired disease or injury (intentional or unintentional).

A number of adolescents who died in 2016 suffered from comorbidities including chronic disease, alcohol or illicit drug use or mental health issues.

CCOPMM's Child and Adolescent Mortality and Morbidity Subcommittee continues to review deaths of children with chronic disease who are not receiving optimal treatment. This includes a lack of understanding of the severity of the condition, a poor engagement with healthcare and other services leading to failure to adhere to the treatment plan or regular attendance for review.

# **1. About this report**

The review and reporting functions of the Consultative Council on Obstetric and Paediatric Mortality and Morbidity (CCOPMM) provides a vital service to the Victorian Government in monitoring the safety and quality of the Victorian healthcare system. This report provides an overview of the mortality and birth data received by CCOPMM for the 2016 calendar year. It is anticipated that the information provided in this report will be used to inform service monitoring, quality improvement initiatives, health policy and clinical practice guidelines. In addition, the report contains data to support important maternal and child health research.

The report provides:

- key findings and recommendations arising from CCOPMM's review of births and deaths in Victoria in 2016
- · detailed mortality and morbidity statistics
- summary information on the main causes of death, contributing factors and trends
- · de-identified clinical case studies to highlight recommendations and areas of particular concern
- · 'good practice points' arising from the review of cases during the reporting period
- key messages for consumers that arise from cases reviewed by CCOPMM.

The report highlights the priority areas identified by CCOPMM, key findings and the recommendations generated by CCOPMM. Supplementary tables for births, maternal mortality, perinatal mortality and child and adolescent mortality are available on the <u>CCOPMM website</u> at <<u>https://www2.health.vic.gov.au/hospitals-and-health-services/quality-safety-service/consultative-councils/council-obstetric-paediatric-mortality></u>.

For 2016, the report continues to provide high-level recommendations for health outcome improvement, with nine recommendations aimed at influencing system-level change. The remaining guidance from CCOPMM has been converted into 'Good practice points' for clinicians or 'Messages for consumers', with a further information section also included. Case studies along with the key messages have been included; these are based on clinical experience and reviews of cases – not on actual cases. As with the previous report, it is hoped that this new format will help facilitate increased transfer of information while ensuring the key findings, lessons and recommendations are easily accessible to both consumer and expert audiences.

The definitions and 'methods of analysis' should be used to fully interpret the key findings.

The statistical flowcharts (Appendix 3) outline the scope of the data collections, and the case inclusions and exclusions used for reporting. Data from outside of 2016 is included where it is available and where it provides contextual information. In the mortality sections (Sections 4, 6, 7 and 8), data may refer to deaths that occurred over a period of three or more years (for example, the triennium 2014–2016) to address low numbers of deaths.

CCOPMM values your feedback, which should be directed to <<u>ccopmm@dhhs.vic.gov.au</u>>.

Please share this report.

# 2. Priority Areas and Recommendations

Based on the available data sources and the cases reviewed by CCOPMM, a number of key priorities for the Victorian health system have been identified. These priority areas reflect factors and circumstances that impact significantly on women and children, in terms of:

- · the proportion of the population affected
- the severity of the impact
- the sustained disparities or slow improvement in outcomes.

# 2.1 Maternal mental health

Psychosocial factors such as maternal mental health disorders and substance dependence continue to be a common contributing factor in maternal mortality in Victoria.

In 2016 the leading cause of direct and indirect maternal deaths (including late maternal deaths) in Victoria was completed suicide or intentional self-harm (suspected suicide). Identification of maternal mental illness in the perinatal period continues to increase, with up to one in seven women who give birth in Australia being affected by postpartum depression (see <<u>https://www.beyondblue.org.au/the-facts/postnatal-depression</u>>). Maternal mental illness is often undiagnosed and hence remains untreated and underreported. The *National maternity clinical practice guidelines* and the *Effective mental health care in the perinatal period Australian clinical practice guidelines* recommend that all pregnant women be assessed for psychosocial factors including previous or current mental illness as early as practical in pregnancy and after giving birth. It is nonetheless apparent that not all women are accordingly assessed. Even for the women in whom mental illness is diagnosed, they may not have timely access to appropriate health services, appropriate treatment and ongoing psychosocial support. Cultural, socioeconomic and language barriers can also make mental health assessment and follow-up challenging. Psychosocial support is often not tailored to the context, impeding women and their families from engaging with the appropriate mental health service providers. This is particularly true for Aboriginal mothers demonstrating the need for culturally safe healthcare in the maternity setting.

Maternal deaths from psychosocial causes include deaths in which a psychiatric condition contributed to the cause of death and encompass wider issues such as family violence and substance dependence.

### Snapshot

Between 2011 and 2016:

 Maternal deaths from psychosocial causes was one of the leading causes of deaths (16/68 or 24 per cent), including late maternal death. Completed suicide was identified as the primary cause of death in eight of these cases and five deaths were intentional self-harm (suspected suicides).

In 2016:

- Victoria reported an unprecedented number of maternal deaths from psychosocial causes (8/17 or 47 per cent) including five deaths from completed suicide and three deaths from intentional self-harm (suspected suicides).
- The majority of these women (75 per cent) had pre-existing mental health disorders including bipolar disorder, depression and anxiety disorders, one had no documented mental health problems and one had a newly diagnosed mental health disorder related to pregnancy. Substance dependence was a known contributing factor in three maternal deaths. Social isolation was identified as a known contributing factor in one maternal death.
- Domestic violence was a known contributing factor in two maternal deaths.

#### Case studies

#### Case study 1

A 35-year-old multiparous woman (having had at least one previous birth) with a history of substance dependence was being managed separately by a drug rehabilitation service and a maternity service. She did not disclose to the maternity service her substance dependence history and they were therefore unaware of this until she suffered a fatal drug overdose in late pregnancy.

#### Case study 1 – key message

Communication between all caregivers is essential so that all available psychosocial support resources can be mobilised for vulnerable women and appropriate monitoring of both the mother and the fetus can be instituted.

#### Case study 2

A 30-year-old multiparous woman with a long history of depression and family violence ceased her antidepressant therapy during pregnancy. She declined assistance to access support services and took her life three weeks after the birth.

#### Case study 2 – key message

Careful consideration and counselling should be directed to the benefits (and risks) of taking antidepressant drug therapy during pregnancy and in the immediate puerperium in women at high risk of depressive illness.

#### Case study 3

A 37-year-old primiparous (first-time mother) woman from East Asia with no history of mental health issues had an Edinburgh Postnatal Depression Score of 19 (positive if 13 or more), which is indicative of postnatal depression. She was referred for supportive psychological management and began antidepressant therapy via her family practitioner. Access to specialist treatment was hampered because of social isolation. Although enquiry about suicidal ideation was sought on a number of occasions and was not identified, she took her own life four months after giving birth.

#### Case study 3 – key message

Women who come to Australia from other countries and are separated from their immediate family are particularly vulnerable to postnatal depressive illness.

### **Recommendation 1**

#### Improving provision of maternal mental health services

CCOPMM recommends the following to improve provision of maternal mental health services:

- The recently updated Effective mental health care in the perinatal period Australian clinical practice guideline (2017) provides a comprehensive and evidence-based approach to caring for women with mental illness and their families. It is recommended that all clinicians are familiar with the guidelines and that they are made readily available.
- Health services should implement the recommendations from the National Perinatal Mental Health Guidelines namely to screen all pregnant women for anxiety and depression early in pregnancy, and repeated at least once during the pregnancy. Furthermore the Department of Health and Human Services should work with Maternal and Child Health and General Practitioners to ensure that all women are screened 6-12 weeks after birth and that this is repeated at least once in the first postnatal year.
- Mental health, primary care and obstetric services need to remain vigilant to the complex mental health needs that may arise in women in the perinatal period and ensure effective integration of care across services.
- When an Aboriginal family is not engaged with a public health/maternity service, consider involving appropriate Aboriginal organisations to facilitate the relationship between the treating hospital and client, or to provide postnatal care in consultation with the health service.
- As psychotropic medication does not necessarily become contraindicated once a woman becomes pregnant, the continued use or commencement of psychotropic medication should be carefully considered on a case by case basis, with each woman being informed of the risks and benefits of any proposed treatment.

Safer Care Victoria and the Department of Health and Human Services continue to implement the key priorities of Victoria's 10-year mental health plan <<u>https://www2.health.vic.gov.au/about/publications/</u>policiesandguidelines/victorias-10-year-mental-health-plan> with the aim to reduce suicide rates and improve mental health outcomes in Victoria. These priorities include those set out in the whole-of-Victorian government suicide prevention framework, the Aboriginal social and wellbeing framework and the mental health workforce strategy.

# Messages for consumers

#### What is perinatal mental health?

Your emotional and psychological wellbeing during pregnancy or afterwards.

#### Key messages

- Pregnancy and becoming a new parent is a big change, and some women and their partners experience difficulties adapting during this period.
- Depression and anxiety is common during pregnancy and the postpartum period. If you have been feeling depressed, worried or anxious it's a good idea to talk to a health professional about how you are feeling.
- If you are having thoughts about suicide or having a personal crisis there is help immediately available. Call <u>Lifeline <<u>https://www.lifeline.org.au/</u>> on 13 11 14 or see your doctor. If life is in danger, call 000.
  </u>
- If English is not your first language, there is a free interpreting service for people who do not speak English available at 13 11 14.

#### For further information or where to get help

- Your doctor, obstetrician or midwife
- Maternal and child health nurse
- PANDA <http://www.panda.org.au/> (Perinatal Anxiety and Depression Australia) on 1300 726 306
- beyondblue <<u>https://www.beyondblue.org.au/</u>>on 1300 22 4636
- Lifeline <<u>https://www.lifeline.org.au/</u>> on 13 11 14
- Better Health Channel Perinatal mental health information pages <<u>https://www.betterhealth.vic.</u> gov.au/health/healthyliving/Pregnancy-and-your-mental-health>
- MumSpace <<u>https://www.mumspace.com.au/</u>>.

# Further information

Effective mental health care in the perinatal period Australian clinical practice guidelines 2017

Australian Health Ministers' Advisory Council 2017, *Pregnancy Care Guidelines*. Australian Government Department of Health, Canberra <<u>http://www.health.gov.au/antenatal</u>>

**Centre for Perinatal Excellence (COPE)**: COPE is dedicated to improving the emotional wellbeing of parents before and during pregnancy, and the year following the birth of a baby (Highet and Goddard, 2014).

Email: info@cope.org.au

Phone: (03) 9376 6321

Mobile: 0438 810 235

#### The Victorian suicide prevention framework

<a href="https://www2.health.vic.gov.au/about/publications/policiesandguidelines/victorian-suicide-prevention-framework-2016-2025">https://www2.health.vic.gov.au/about/publications/policiesandguidelines/victorian-suicide-prevention-framework-2016-2025</a>

#### The mental health workforce strategy

<https://www2.health.vic.gov.au/health-workforce/strategy-and-planning/workforce-strategy/mental-health-workforce-strategy>

# 2.2 Appropriate level of care

Maternal and perinatal morbidity and mortality can be reduced if managed by a health service that can provide the appropriate level of care.

Avoidable morbidity and mortality occurs when health services do not have the ability to cope with the level of acuity required for the patient. Perinatal mortality and other maternal and child health outcomes are poorer if the mother and children do not have timely access to appropriate level health services. In the review of contributing factors in maternal deaths, stillbirths, neonatal and child and adolescent deaths, a recurrent finding is a failure of, or delay in, referral for specialist care for women, babies and children with complex medical conditions. Associated with this is the reluctance or ultimate refusal of the pregnant woman or later parent to accept the need for specialist care.

### **Snapshot**

In Victoria the level of maternity health services is delineated according to the *Capability framework for Victorian maternity and newborn services*. These are:

- Primary maternity care is for women who experience an uncomplicated pregnancy and birth and do
  not require ongoing specialist supervision or intervention. The service providers in this level are usually
  general practitioners and midwives, although obstetricians may also participate in providing primary
  care in some locations. It is comprised of three levels of services:
  - Level 1 includes small, generally rural, services that provide comprehensive antenatal and postnatal care. Women travel to larger services to give birth but return to their local community after delivery. Level 1 services provide post-domiciliary care for babies born at 37 weeks' gestation or more without any complications.
  - Level 2 includes services that provide care including birthing services to low- or normal-risk pregnancies and births. These services provide postnatal inpatient and domiciliary management of newborns at 37 weeks' gestation or more without complications.
  - Level 3 services provide emergency caesarean sections. These services provide postnatal inpatient and domiciliary management of newborns at 37 weeks' gestation or more without complications.
- Secondary maternity care is for women who have or develop complications and require secondary level medical input during pregnancy or birth. Women are referred for medical care provided at the same hospital or through transfer to another hospital during pregnancy or labour. It comprises two levels of services:
  - Level 4 services provide care to women with medium-risk pregnancies and births with moderate complications. These services provide care for uncomplicated infants of 34 weeks' gestation or more, birthweight at least 2,000 grams, infants requiring incubator care for short-term transition problems or mild complications, including oxygen requirement of less than 40 per cent, apnoea monitoring, blood glucose monitoring, short-term intravenous therapy, phototherapy or gavage feeding.

- Level 5 are the regional health services. These services provide care for uncomplicated babies of 32 weeks' gestation or more, or birthweight at least 1,300 g, for those requiring incubator care, requiring oxygen less than 60 per cent, cardiorespiratory monitoring, short-term intra-arterial blood pressure monitoring, close observation such as for neonatal abstinence syndrome or for short-term ventilator care pending transfer (less than six hours). Depending on local facilities and personnel, level 5 services may have the option for nasal continuous positive airway pressure (CPAP) and exchange transfusion.
- Tertiary maternity care is for women and babies with complex and/or rare medical conditions who
  require multidisciplinary specialist care. Specialist obstetricians are particularly essential in providing
  tertiary-level care, with midwives still involved in providing continued clinical care antenatally, during
  labour and the postnatal period. Victoria has three hospitals that provide tertiary maternity services
  (the Royal Women's Hospital, Monash Medical Centre Clayton and Mercy Hospital for Women). When
  required, women may be referred or transferred to a tertiary hospital during pregnancy or labour.
  - Level 6 tertiary services are all located in the metropolitan area and provide care to women with complex pregnancies and births requiring neonatal intensive care. Depending on the statewide demand for complex specialist care, these tertiary services also provide lower complexity care for local women. These services provide comprehensive care for all neonates within a multidisciplinary management model. The full range of respiratory support is available for the babies. These may additionally provide level 2–5 services, may provide or have links to neonatal surgery and care for complex congenital and metabolic diseases of newborns. These services provide or have links to a broad range of subspeciality consultative and paramedical services.

The Department of Health and Human Services has assessed the capability levels for Victorian public hospitals. Assessment of capability levels for private hospitals is in progress.

In 2016, for Victorian public maternity and newborn services, 5.2 per cent of births occurred at level 2 services, 16.5 per cent at level 3, 29.9 per cent at level 4, 18.9 per cent at level 5 and 29.6 per cent at level 6 services (Table 1).

Gestation Capability level of maternity service							Total		
		Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Not stated	
20–27	n	0	8	40	50	58	295	0	451
	%	0.0	1.8	8.9	11.1	12.9	65.4	0.0	100
28–31	n	0	1	13	35	26	400	3	478
	%	0.0	0.2	2.7	7.3	5.4	83.7	0.6	100
32–36	n	0	78	533	1,199	817	1,519	1	4,147
	%	0.0	1.9	12.9	28.9	19.7	36.6	0.0	100
37–41	n	2	3,092	9,422	16,929	10,576	15,716	4	55,741
	%	0.0	5.5	16.9	30.4	19.0	28.2	0.0	100
42+	n	0	10	39	32	30	106	1	218
	%	0.0	4.6	17.9	14.7	13.8	48.6	0.5	100
Total	n	2	3,189	10,047	18,245	11,507	18,036	9	61,035
	%	0.0	5.2	16.5	29.9	18.9	29.6	0.0	100

Table 1: Hospital of birth by capability level of public maternity service at various gestations (completed weeks), 2016

# Case studies

### Case study 1

A 30-year-old woman with a body mass index (BMI)<sup>a</sup> of 42 kg/m<sup>2</sup> was diagnosed as having gestational diabetes during her second pregnancy. She attended a level 2 maternity service and was referred to the regional secondary level 5 service, but she declined attending. Her blood glucose control was suboptimal and she did not access specialist dietetic management. At 32 weeks she presented with a two-day history of absent fetal movements, and a fetal death in utero was diagnosed. Labour was induced the next day and she subsequently gave birth to a stillborn baby.

#### Case study 1 – key message

Mothers with significant obesity (BMI 35 or more) require management in an appropriate level of care that can provide the necessary clinical team care and physical support. Clinicians should refer and be guided by the Victorian and Newborn Clinical Network statewide clinical guideline on caring for obese pregnant women and weight management in pregnancy. Women with pre-gestational diabetes and gestational diabetes that does not respond to basic hypoglycaemic therapy should be managed by, or in close liaison with, a specialist diabetes in pregnancy team.

The responsible clinicians should ensure the woman and her family receive appropriate information, guidance and support to assist them in understanding and accepting the need for transfer.

a Body mass index (BMI) below 18.5 is considered underweight. A BMI of 18.5 to 24.9 is considered healthy. A BMI of 25 to 29.9 is considered overweight. A BMI of 30 or higher is considered obese.

#### Case study 2

A 39-year-old woman in her first pregnancy, with a history of intermittent chest and joint pain and palpitations, was booked at her local level 4 maternity service. The clinician did not ask about childhood illnesses and thereby missed that she had been hospitalised at age six with rheumatic fever. Further, a specific cardiovascular examination was not performed at her booking visit. During pregnancy she developed shortness of breath and fatigue on performing normal day-to-day activities, but this was not recorded at her routine antenatal visits. She presented in early labour to the hospital at 30 weeks. On admission she was noted to be severely short of breath, she had signs of congestive cardiac failure and her oxygen saturation was 85 per cent. Because of her condition she was transferred urgently to the tertiary-level hospital where, after initial stabilisation, she gave birth to a premature baby and then she herself required care in the intensive care unit. She was diagnosed to have rheumatic mitral stenotic heart disease and later required valvular replacement.

#### Case study 2 – key message

Clinicians should specifically ask whether the woman has a personal or family history of cardiac conditions at the booking visit and look for any signs of cardiac disease during the initial examination. If there is a relevant history including shortness of breath on exertion and/or there are abnormal examination findings she should be referred for specialist cardiovascular assessment. Women with cardiovascular disease should be cared for in a tertiary setting by a specialist team. In addition any cardiac symptoms, including increasing shortness of breath, need full specialist evaluation.

#### **Recommendation 2**

#### Referral of women with complex needs

Women with complex medical and obstetric problems should be booked for confinement at an appropriate level hospital.

### Further information

Capability framework for Victorian maternity and newborn services <<u>https://www2.health.vic.gov.au/</u> hospitals-and-health-services/patient-care/perinatal-reproductive/maternity-newborn-services/maternitynewborn-care>.

**Maternity and Newborn Clinical Network** – statewide *Care of the obese pregnant woman and weight management in pregnancy guideline* <<u>https://www2.health.vic.gov.au/about/publications/</u> policiesandguidelines/care-obese-pregnant-woman-mncn-guide>.

# 2.3 Consumer education

Failure to provide clear, concise advice to pregnant women, to parents or caregivers of sick children and to adolescents about important aspects of managing their acute illness or underlying condition can contribute to worsening of illness or death.

Maternal, perinatal and child and adolescent deaths have occurred when there has been a failure of effective communication between health service professionals and those seeking health care. These included a lack of clear communication about what symptoms or signs to trigger re-presentation to a health service, a failure to convey the expected course of an illness or injury, the emergency management of the condition and the risks around important changes to medication or not adhering to a recommended course of treatment.

### **Snapshot**

Between 2014 and 2016:

- A failure or delay in reporting decreased fetal movements was a contributing factor in 34 perinatal deaths (stillbirths and neonatal deaths).
- Family neglect or ignorance about the symptoms in the pregnant woman or her newborn infant was a contributing factor in 49 perinatal deaths.
- A lack of communication or adequate education to families contributed to the death of children with chronic medical conditions (for example, asthma, epilepsy, diabetes, anaphylaxis).

# Case studies

#### Case study 1

A 25-year-old woman, pregnant for the second time, had a normal course of pregnancy. At 38 weeks she presented to the health service with contractions and gave birth to a stillborn baby. Upon enquiry, she told the doctor that she had not felt any fetal movement for the past week.

#### Case study 1 - key messages

Maternity staff should specifically ask about fetal movements at each encounter, and women should be given explicit instructions about reporting any reduction in their perception of fetal movements. Further investigations including ultrasound growth, amniotic fluid measurement and Doppler blood flow measurements should be performed as a matter of urgency as set out in the PSANZ SANDA *Clinical practice guideline for the care of women with decreased fetal movements*.

# **Recommendation 3**

#### Heightened awareness of the importance of decreased fetal movements

Maternal perception of decreased fetal movements is common in late pregnancy. There is no objective definition of decreased fetal movements and, while the nature of movements may change as the pregnancy advances, there is no evidence that the number of movements actually changes. There is an association between decreased fetal movements and adverse perinatal outcomes including stillbirth, fetal growth restriction, low Apgar scores and acidosis.

During pregnancy clinicians should provide information to women regarding normal fetal movements and emphasise the importance of maternal awareness of fetal movements at every visit. Women are advised to contact their maternity care provider if they have concerns about decreased fetal movements and must not wait until the next day to report their concerns.

For women presenting before 26 weeks' gestation, auscultation of fetal heart and a clinical assessment of fetal growth is appropriate. After 26 weeks a cardiotocography should be performed with or without an ultrasound examination, depending on the presence of risk factors.

Induction of labour should be considered where there is a persistent maternal perception of decreased fetal movements or where there are suspected or actual concerns for fetal wellbeing. The decision to expedite the birth needs to be weighed against the risk to the mother and baby at that particular gestation.

Clinicians should be guided by the PSANZ SANDA *Clinical practice guideline for the care of women* with decreased fetal movements <a href="https://sanda.psanz.com.au/clinical-practice/clinical-guidelines/">https://sanda.psanz.com.au/clinical-practice/clinical-guidelines/</a> and RCOG Green-top Guideline 57 Reduced Fetal Movements <a href="https://www.rcog.org.uk/en/guidelines-research-services/guidelines/gtg57/">https://sanda.psanz.com.au/clinical-practice/clinical-guidelines/</a> and RCOG Green-top Guideline 57 Reduced Fetal Movements <a href="https://www.rcog.org.uk/en/guidelines-research-services/guidelines/">https://www.rcog.org.uk/en/guidelines/</a> research-services/guidelines/</a> 3.

# **Recommendation 4**

Consumer education on the importance of reporting Premature Rupture of the Membranes (PROM)

Health services and pregnancy care providers should provide education and information to women regarding the importance of reporting spontaneous rupture of the membranes, especially if preterm.

- Neonatal sepsis due to Group B Streptococcus (GBS) is a potentially preventable cause of neonatal death.
- Women should be advised to contact their pregnancy care provider promptly if they feel their membranes have ruptured so an assessment and appropriate management plan can be made to reduce the risk of this potentially serious condition.

#### Case study 2

A 13-year-old boy with an underlying chronic medical condition was being treated at a tertiary hospital with a complex medication regimen. He was discharged from hospital to be reviewed in outpatients. Due to improvements in his condition, an important medication was gradually able to be withdrawn. After ceasing the medication completely, he was told at discharge to have a monitoring blood test in three weeks and to return to outpatients with the results. During the period off medication the symptoms of his condition returned, and he became progressively more unwell. His family did not know to seek help when the symptoms of his condition returned prior to the planned appointment. He was found deceased in his bed the day he was to have his monitoring blood test. At the time of his death, the boy's general practitioner had not received any communication from the hospital as to the change in the boy's medication, or the planned follow-up.

#### Case study 2 – key message

**Changes in medication type or dose creates risk**. When prescribing a new medication, or when changing or ceasing a medication, clinicians should consider the best way of communicating to a patient and family what they should expect and when to seek further medical attention. Doctors tend to overestimate patient understanding of medications. Doctors should ensure the patient and family have verbal and/or written instructions regarding the changes and should be confident that the patient and family understand these instructions.

A systematic review (Glick et al. 2017) found that 70–94 per cent of parents did not recognise important signs and symptoms consistent with their child's diagnosis. Knowledge was higher when standardised verbal and written discharge instructions were used.

# **Recommendation 5**

#### Consumer education on changing medication

When altering medications, doctors should ensure the patient and family has verbal and/or written instructions regarding the changes and should be confident that the patient and family understands these.

The family should understand what to expect from the change in medication and when to seek further medical attention. It is important that there is clear and documented communication between the discharging hospital, the patient and their general practitioner regarding the discharge plan and responsibility for follow-up of both the acute episode and the longer-term management.

#### Case study 3

A nine-year-old boy with a history of asthma, eczema and a nut allergy complained to his parents of difficulty breathing and wheeze following a meal at home with friends. The visitors to the home had brought food to the home that was purchased from a café. The boy's family felt his symptoms were due to asthma and instituted his emergency asthma plan. His condition deteriorated rapidly and an ambulance was called. In the meantime they were advised to administer the adrenaline auto-injector, but due to a lack of confidence, the medication was not given. Despite resuscitation by paramedics and multiple doses of adrenaline and appropriate fluid and other management, he died.

#### Case study 3 – key messages

The following good practice points are vital in managing asthma and a history of food allergy or anaphylaxis.

- Children with food allergy/anaphylaxis need to have a regular review with their medical practitioner, and together with their families and regular carers, need to have ongoing education and reinforcement of the avoidance of triggers and the recognition and emergency management of food allergy/anaphylaxis.
- Families and carers should have the skills and confidence to administer the auto-injector at the first sign of anaphylaxis, even when there is resistance from the child. They should have practised how to give an adrenaline auto-injector to improve their confidence in a stressful emergency.
- In the event a carer is unable to determine whether a child is suffering from asthma or anaphylaxis, an adrenaline auto-injector should be administered in the first instance, followed by any medication listed within the emergency management plan for asthma or anaphylaxis.
- Carers of children with asthma who also have a history of food allergy or anaphylaxis need to be able to manage both their asthma and their food allergy/anaphylaxis confidently.
- A history of food allergy is not a contraindication to exercise. However, children who have had an acute allergic reaction or any signs of anaphylaxis to food should do *no* strenuous exercise for two to four hours to minimise the risk of worsening anaphylaxis.
- Health workers and parents need to appreciate the dangers of asthma and food allergy/anaphylaxis
  occurring at the same time. The treatment is adrenaline. Affected children and parents should
  be encouraged to carry an adrenaline auto-injector and to use it immediately when symptoms of
  anaphylaxis occur, or if symptoms of asthma do not respond to initial therapy.

# Further information

#### PSANZ SANDA Clinical practice guideline for the care of women with decreased fetal movements

<a href="https://www2.health.vic.gov.au/hospitals-and-health-services/safer-care-victoria/maternity-ehandbook/decreased-fetal-movements">https://www2.health.vic.gov.au/hospitals-and-health-services/safer-care-victoria/maternity-ehandbook/decreased-fetal-movements</a>.

Australasian Society of Clinical Immunology and Allergy <https://www.allergy.org.au>.

Asthma Australia <<u>https://www.asthmaaustralia.org.au/vic</u>>.

The National Asthma Council of Australia < https://www.nationalasthma.org.au/>.

Australian Asthma Handbook <http://www.asthmahandbook.org.au/>.
# 2.4 Ensuring the health and welfare of vulnerable newborns, children and adolescents

There is clear evidence internationally of a relationship between poor socioeconomic status and adverse health outcomes. In Victoria this translates into an increased number of deaths among the most socially and economically vulnerable children, including those with underlying chronic conditions. A new model of outreach services is needed.

The Child and Adolescent Mortality and Morbidity Subcommittee has identified a high number of deaths among vulnerable children with social risk factors. These risk factors include: having been previously reported to child protection; living in households where there is family violence or drug abuse, or where the environment is unsafe; or social marginalisation, including coming from immigrant, Aboriginal or refugee families. Among adolescents, additional social risk factors include disengagement from school, substance dependence and mental health problems. The causes of deaths reviewed by CCOPMM of such children and adolescents span the range of diagnoses: sudden unexpected death in infancy (SUDI), accidents, intentional self-harm (including suicide), epilepsy, asthma, infections, malignancy, congenital problems and other chronic health conditions.

Children with chronic health conditions who are socially marginalised, or have these risk factors, are more likely to have poor adherence to medications, poor engagement with healthcare and other services, to lack continuity of care and monitoring of their health condition, or have nutritional problems, educational failure and poor psychological health and wellbeing. Sometimes this leads to deaths that are preventable.

Mitigating the effect of these vulnerabilities and social risks on children's health is urgently needed. Children with chronic health conditions and social risk factors require close monitoring and follow-up, linking with skilled community doctors (general practitioners and paediatricians) and other health professionals (social work, maternal health, specialist medical and psychology services) as needed.

Currently some of the needs of vulnerable children are being addressed sporadically by not-for-profit non-government organisations or specific community and family support organisations (such as Aboriginal support services for some communities). However, such agencies have few staff with paediatric and adolescent health skills, and there are insufficient linkages with and between child welfare services, community health services and paediatric hospital services.

## **Snapshot**

In 2016 more children died in Victoria if they lived in areas of greater relative disadvantage, as measured by the Index of Relative Social Disadvantage (IRSD) score (Table 2).

The families of at least 57 of the 206 (28 per cent) post-neonatal infants, children and adolescents who died in Victoria in 2016 were known to child protection services, either prior to, at the time of or following the death.

The proportion of post-neonatal infants, children and adolescents who died in Victoria in 2016 whose deaths were referred to the coroner who were known to child protection services, either prior to, at the time of or following the death is at least 47 per cent.

	IRSD Quintile	%
Most Disadvantaged	1	25.2
	2	20.9
	3	19.4
	4	18.0
Least Disadvantaged	5	15.5

Table 2: Percentage of deaths aged 28 days to 17 years, by IRSD score, Victoria, 2016

IRSD = Index of Relative Social Disadvantage, from Socio-Economic Indexes for Areas (SEIFA) 2011

This data is based on the place of residence of the 204 deaths (missing=2) of Victorian residents aged 28 days to 17 years, occurring in Victoria in 2016. This data is based on the Australian SA1 Decile (IRSD 2011)

# Case studies

## Case study 1

A nine-year-old boy with a history of asthma with multiple admissions, including to an intensive care unit, was seen in outpatients. There it was noted that he had chronically undertreated asthma, with daily use of relieving medication, and poor adherence to his preventive therapy. His family was counselled about his asthma treatment regimen and emergency management of asthma. He did not have a regular general practitioner. His family was known to Child Protection services regarding concerns of family violence, drug and alcohol abuse and mental health concerns. The family moved house frequently. Subsequently he failed to attend his outpatient review on multiple occasions. He developed a sudden onset of severe asthma, arrested at home and later died from hypoxic ischaemic brain injury in an intensive care unit. It was noted at the time of his final admission that he had run out of both preventive and reliever asthma medication.

## Case study 2

A five-month-old girl lived with her 19-year-old mother and her mother's partner in rural Victoria. The infant slept in a pram or beside her mother. There had been a previous notification to child protection services for family violence. The baby was found deceased when the mother awoke at 9.00 am. An autopsy did not reveal the cause of death. Traces of methamphetamines were found in postmortem analysis of the baby's hair, but not in the blood.

## Case study 3

A 12-year-old boy with epilepsy and developmental problems died of sudden unexpected death in epilepsy. The family were refugees from East Africa, arriving four years before. They lived in rental accommodation in outer Melbourne, and the father was only occasionally in work. The boy's epilepsy had been less stable in recent months, with several brief seizures each day. He had missed a lot of school in the preceding year. He had previously been managed at a metropolitan paediatric outpatient department and once seen a neurologist, but the family missed their last two medical reviews, and there had been no medication review in over a year. His father was diligent in giving his medications and regularly checked on him overnight, worried that he would have a seizure. His father found him at 5.00 am pale and lifeless, commenced cardiopulmonary resuscitation and called an ambulance, but he could not be resuscitated and was later pronounced dead by an attending mobile intensive care paramedic.

## **Recommendation 6**

## Addressing social risk factors

CCOPMM recommends development of a new model of care in Victoria to provide family support to vulnerable children and young people with chronic health issues. This model needs skilled staff to ensure vulnerable children and young people with chronic health issues are identified and receive appropriate, potentially life-saving medical care, monitoring and prevention strategies.

The model proposed would improve active follow-up of high-risk children and families in their homes and communities. To achieve this, CCOPMM recommends the need for outreach child and adolescent health and support officers, with outreach workers who have both social and health skills. Given the system of service providers within Victoria, the model would include the following:

- Non-government community service organisations, community health centres and hospitals are supported to have outreach officers with skills in child and adolescent health, assessment, early child growth and development, and social welfare. Such outreach child and family health support officers would have close links to hospitals, paediatricians, general practitioners and other specialist health professionals.
- Staff in non-government community service organisations and community health centres have improved access to consultation with health professionals, especially paediatricians and general practitioners. This requires **more paediatricians who are based within community health centres** and closer links between community service organisations and the health sector.

Currently the State Child Protection service responds to children at risk of significant physical harm or neglect – that is, children in need of protection. This new outreach model would address the health and welfare of vulnerable children and support to such families to reduce deaths from a wide range of childhood conditions. Such services would need the power to act in the best interests of the child and family, and to liaise with child protection services and other agencies.

# 2.5 Sudden unexpected death in infancy / Sudden infant death syndrome

Sleeping a baby safely ('safe sleeping') is one of the best ways to minimise the risk of sudden unexpected death in infancy (SUDI).

The Child and Adolescent Mortality and Morbidity Committee has ongoing concerns about the number of infants dying suddenly and unexpectedly when they are asleep. In 2016 there were 23 infants who died in this manner. Unsafe sleeping, including co-sleeping (with a risk of overlay or being covered by bedding) and unsafe sleep sites continue to be major factors contributing to sudden death in infants, together with the effects of parental smoking, illicit drug use, alcohol use, mental health problems and child welfare concerns. Babies born preterm or with low birthweight have a higher risk of sudden and unexpected death.

## **Snapshot**

In 2016 there were 23 infant SUDI deaths. Of these:

- 10 infants (44 per cent) were co-sleeping in an adult bed or on a couch at the time of their death
- only five infants (22 per cent) were sleeping in a cot, which is the safest place for a baby to sleep
- nine (39 per cent) infants were exposed to maternal smoking in pregnancy and/or after birth
- nine (39 per cent) infants were partially or exclusively breastfed at the time of their death
- nine (39 per cent) infants were born preterm
- four (17 per cent) infants were born with a birthweight < 2,500 g.

## Case studies

## Case study 1

The parents of a two-month-old male infant spent their first evening out at a restaurant since the child's birth. Alcohol was consumed by both parents for the first time since the birth. The infant, who normally slept in a cot beside his parents' bed, was taken into the parental bed during the night for feeding and settling, and was found the next morning deceased between his parents.

## Case study 1 - key messages

**Sleep baby in a safe cot in their parents' room:** In the first 6–12 months, babies should sleep in their own cot in the same room as an adult caregiver. It is much safer for babies to sleep in their own cot than to sleep next to another person.

**Safe cot, safe mattress, safe bedding:** Always sleep babies in a safe cot that meets the Australian Standard AS2172:2013, with a firm mattress that is the right size for the cot, and is not tilted or elevated.

Keep adults who are under the influence of alcohol or drugs or sedating medication away from babies.

## Case study 2

A three-month-old male, born at 35 weeks' gestation, was placed to sleep in a borrowed bassinette. The mattress that was provided with the bassinette was dirty, so the family used a mattress from another bassinette. This mattress did not fit the borrowed bassinette, leaving a gap of approximately 8 cm on one side. The baby was placed on his back to sleep. When he was checked three hours later he was found deceased, lying on his stomach (prone), wedged into the gap between the mattress and the side of the bassinette. He was not able to be resuscitated.

## Case study 2 – key message

**Safe cot, safe mattress, safe bedding:** Always sleep babies in a safe cot that meets the Australian Standard AS2172:2013, with a firm mattress that is the right size for the cot, and is not tilted or elevated.

# **Recommendation 7**

## Review of circumstances for SUDI

CCOPMM recommends that the circumstances of every sudden and unexpected infant death be thoroughly reviewed by a specialised team so that all the factors surrounding the death can be accurately detected to allow proper assessment of unexpected deaths.

# **Recommendation 8**

## Safe sleeping recommendations for parents

Based on the case review of infant deaths and consideration of the wider literature, CCOPMM provides the following recommendations on safe sleeping for parents. These are a modified version of the Red Nose (formerly SIDS and Kids) Safe Sleeping Message:

- Sleep baby on their back: All babies should sleep on their back from birth, not on their front or side.
- Safe cot, safe mattress, safe bedding: Always sleep babies in a safe cot that meets the Australian Standard AS2172:2003, with a firm mattress that is the right size for the cot and is not tilted or elevated. The mattress should be covered with only a tightly-fitted sheet and, if required, a thin tightly-fitted mattress-protector under the fitted sheet. A baby should never be put down to sleep on a sofa, bean bag, sheepskin or pillow. There is no Australian standard for bassinettes.
- Keep baby's head and face uncovered: Babies should sleep in a light-weight sleeping bag of correct size that has a fitted neck, armholes or sleeves, and no hood.
- **Safe bedding:** There should be nothing else in the cot no blanket, doona, sheepskin, pillow, bumper or toys.
- Sleep baby in a safe cot in their parents' room: In the first 6–12 months, babies should sleep in their own cot in the same room as an adult caregiver. It is much safer for babies to sleep in their own cot than to sleep next to another person.
- Keep baby away from tobacco smoke before birth and after: The risk is increased even if a caregiver goes outside to smoke.
- Keep adults who are under the influence of alcohol or drugs or sedating medication away from babies.
- Breastfeed baby: Breastfeed your baby if you can.
- A dummy can be offered to a baby as a sleep aid for the first 6–12 months. Dummies must not be forced on the baby, or have a neck cord, or be covered in anything sweet.

# **Recommendation 9**

## Provision of a portable infant sleep space to vulnerable babies

CCOPMM's recommendation regarding sleep sites remains that the safest place for babies to sleep is in their own cot, in the same room as an adult caregiver for the first 6–12 months of the infant's life.

However, the use of a portable infant sleep space such as a Pēpi-Pod or Wahakura (and commonly referred to as a 'Baby Box'), that can be used in shared sleep environments (for example, taken into the parental bed) is, **if used correctly as part of a safe sleep education program**, likely to protect vulnerable babies from asphyxia in a co-sleeping situation.

Consideration should be given to providing such a portable infant sleep space to every baby born to a vulnerable family in Victoria under a dedicated program. Such a program would need to be delivered prior to or at the time of birth, require extensive safe sleep education and be culturally appropriate for families. An impact and outcome evaluation would need to be part of the program. **The portable infant sleep space, its mattress and bedding must meet Australian standards.** CCOPMM recommends that babies sleep in a light-weight sleeping bag of correct size that has a fitted neck, armholes or sleeves, and no hood.

In 2013 a trial of the Pēpi-Pod Program began in Queensland for Aboriginal families (University of the Sunshine Coast 2017). The Pēpi-Pod is similar to the Coolamon, a traditional shallow, wooden vessel that many Aboriginal families used to sleep newborns next to their parents. Early results from the program suggest benefits relating to safety, convenience and portability. The health services involved in the program found it feasible, flexible and sustainable and built local workforce capacity with integration into current service models, suggesting that the Pēpi-Pod Program is sustainable in the long term.

Recently, similar programs (provision of a portable safe infant space as part of a wider safe-sleeping education campaign) have commenced in Scotland, New Zealand and selected states of the USA to selected or all pregnant women.

# Further information

Red Nose – general information <<u>https://rednose.com.au/</u>>.

Red Nose - safe sleeping < https://rednose.com.au/section/safe-sleeping>.

### Find out more:

Keeping baby safe – a guide to infant and nursery products <a href="https://www.productsafety.gov.au/system/files/Keeping%20baby%20Safe\_0.pdf">https://www.productsafety.gov.au/system/files/Keeping%20baby%20Safe\_0.pdf</a>>.

#### Mandatory safety standards for babies

<a href="https://www.productsafety.gov.au/product-safety-laws/safety-standards-bans/mandatory-standards">https://www.productsafety.gov.au/product-safety-laws/safety-standards-bans/mandatory-standards></a>

Red Nose advises that baby boxes distributed without education by known service provider are not associated with reduced infant mortality <<u>https://rednose.com.au/news/baby-boxes-distributed-without-education-by-known-service-provider</u>>.

# **3. Aboriginal births and perinatal mortality in Victoria**

For the first time, perinatal mortality for babies born to Aboriginal women is no higher than for those born to non-Aboriginal women.

The gap in a number of other perinatal outcomes between Aboriginal and non-Aboriginal women persists.

Up until the triennium 2014–2016, the perinatal mortality rate for babies born to Aboriginal women was substantially higher than for those born to non-Aboriginal women. As there is a small number of Aboriginal perinatal deaths in any single year, these results are pooled for three years and reported for rolling triennia.

Aboriginal women who gave birth in Victoria in 2016 were more likely than others to live in disadvantaged circumstances and to suffer the adverse health effects and pregnancy outcomes that accompany poverty.

## Snapshot

- In 2016, 1,107 Aboriginal women gave birth to 1,117 babies (1.4 per cent of all mothers and 1.4 per cent of all babies born in Victoria). This is an increase from 0.6 per cent of women giving birth in Victoria in 2000 (Figure 1).
- In 2016, 1,702 babies were born for whom their own and/or their mother's Aboriginal status was reported as Aboriginal. This is based on asking women whether they themselves identify as an Aboriginal person and also whether their baby will be identified as an Aboriginal person. This would be expected to include cases where the father is an Aboriginal person and the mother is a non-Aboriginal person.
- For the 2014–2016 triennium, the perinatal death rate for babies born to Aboriginal women was virtually the same as that for non-Aboriginal women (9.0 and 9.1 per thousand births respectively) (Figure 2).

In 2016, Aboriginal women were more likely than non-Aboriginal women to:

- have a baby with low birthweight (< 2,500 g) (9.8 per cent and 6.8 per cent respectively). Over the
  past two years there has been a reduction in rates of low birthweight for babies of Aboriginal mothers
  (Figure 3).</li>
- have a baby born before 37 weeks' gestation (13.2 per cent and 8.2 per cent respectively). The preterm birth rate for babies of Aboriginal women is 60 per cent higher than for those of non-Aboriginal women and this difference has not changed over recent years (Figure 5).
- have a baby who is born small for gestational age (birthweight below the 10th centile for gestation, sex and plurality) (10.6 per cent and 8.5 per cent respectively). This difference has reduced slightly over recent years (Figure 7).
- be aged younger than 20 years when they gave birth (11.0 per cent and 1.3 per cent respectively). In 2016, 3.7 per cent of Aboriginal women who gave birth were younger than 18 years.
- have diabetes before pregnancy than non-Aboriginal women (1.3 per cent and 0.8 per cent respectively). This is associated with less favourable perinatal outcomes (see section 6.2 on diabetes). Contrary to the experience in other Australian states and territories, the rates of gestational diabetes was similar (11.7 per cent of Aboriginal women and 12.2 per cent of non-Aboriginal women).
- live in a rural area (52.7 per cent and 23.1 per cent respectively)

- be classified in the most disadvantaged socioeconomic quintile (Index of Relative Social Disadvantage (IRSD)) (42.9 per cent and 19.7 per cent respectively)
- smoke in the first half of pregnancy (36.9 per cent compared with 8.2 per cent respectively). This shows a slight decrease in the rate of smoking from 2015 (37.9 per cent and 8.8 per cent respectively). Of those who smoked in the first half of pregnancy, 13.0 per cent of Aboriginal women and 27.0 per cent of non-Aboriginal women were reported as not smoking after 20 weeks' gestation (12.8 per cent and 27.8 per cent respectively in 2015). It is possible that the number of women who stopped smoking by 20 weeks is higher than this because smoking after 20 weeks was not reported in 2016 for over 15 per cent of Aboriginal and non-Aboriginal women. Smoking cessation is reported elsewhere as a relative overall reduction, which is calculated as the number of women smoking before 20 weeks. It increased from 21.1 per cent in 2015 to 25.2 per cent in 2016 but remains lower than the non-Aboriginal women in 2016 (40.2 per cent).

Aboriginal women were less likely to initiate breastfeeding than non-Aboriginal women (87.0 per cent and 94.6 per cent, respectively). However, for those babies born at 37 or more weeks' gestation whose mother initiated breastfeeding, Aboriginal babies were not more likely than others to be given formula in hospital and were no less likely to be fully breastfeeding at the time of discharge from hospital.

When the perinatal outcomes for those where either the mother and/or the baby was reported as an Aboriginal person (here referred to as Aboriginal babies) are compared with those where neither the mother nor the baby was reported as an Aboriginal person (non-Aboriginal babies), Aboriginal babies were more likely than non-Aboriginal babies to:

- be born with low birthweight (< 2,500 g) (8.6 per cent and 6.5 per cent respectively) over the last three years there has been a reduction in low birthweight for Aboriginal babies (Figure 4)
- be born prematurely (before 37 weeks' gestation) (11.5 per cent and 7.9 per cent respectively) (Figure 6)
   this is 45 per cent higher than for non-Aboriginal babies
- be small for gestational age (birthweight below the 10th centile for gestation, sex and plurality) (9.8 per cent and 8.5 per cent respectively) – this disparity has reduced in recent years (Figure 8).

Refer to supplementary tables and figures for more details.



Figure 1: Aboriginal women as a proportion of all women giving birth in Victoria, 2000–2016







Figure 3: Low birthweight for babies of Aboriginal and non-Aboriginal mothers, 2012–2016 (percentage of all births)















Figure 7: Small for gestational age (< 10th centile birthweight) for babies of Aboriginal and non-Aboriginal mothers, 2012–2016 (percentage of all births)





## **Case study**

A 27-year-old multiparous Aboriginal woman with a BMI of 34 presented for her first visit at approximately 20 weeks' gestation. Her previous pregnancy six months prior had ended in a stillbirth at 37 weeks of a baby that weighed 4,200 g. Unfortunately she had declined any investigations and was lost to followup. A morphology scan revealed a female infant, estimated gestational age 21 weeks with a large spinal menigomyelocele. Her screening investigations included an HbA1C of 65 mmol/mol (8.1 per cent) and a random blood glucose of 11.5 mmol/l indicative of pre-existing undiagnosed diabetes mellitus. She was commenced on insulin therapy and after counselling decided to terminate the pregnancy. Postpartum her diabetes was stabilised with metformin therapy and in conjunction with a Koori Maternity Service (KMS) she was encouraged to take folic acid 5 mg when she was planning to conceive and to maintain close contact with her maternity diabetes service.

## Case study – key messages

This case highlights a number of important issues:

- the need for careful supportive counselling after a perinatal loss to maximise the appropriate investigations for the cause of the perinatal loss, so that, where one is found, preventative measures can be put in place
- close liaison with a KMS to assist in pre-pregnancy assessment in women with risk factors
- screening high-risk women for undiagnosed diabetes before conception or when this has not occurred as early as feasible in pregnancy
- prophylactic pre-conception folic acid 0.5 mg daily for all women and with a higher dose (1–5 mg) for those at high risk of neural tube anomalies.

# Good practice points

- Supporting women to quit smoking during pregnancy is an important component of antenatal care.
- Encouraging Aboriginal women to initiate breastfeeding would improve health outcomes for their babies.
- Screen all Aboriginal women for diabetes pre-pregnancy, and if this has not happened, as early as possible during pregnancy.
- All women with pre-gestational diabetes should be cared for in a maternity service that can adequately monitor and manage their diabetes.

To continue to improve the outcomes for Aboriginal women and babies, their care must reflect the social and clinical vulnerability more commonly experienced by this community. To achieve this, public and private maternity providers are expected to:

- actively maintain their partnerships with KMS
- align their maternity and pregnancy care model with the principles of care outlined in the KMS guidelines
- ensure the processes for the transfer of pregnancy care of an Aboriginal woman to a higher capability service is well coordinated and supported by Aboriginal Liaison Officers, local Aboriginal Community Controlled Health Organisations and KMS
- develop reciprocal training, skills development and coaching programs with their local KMS (including cultural competency)

Further, public and private maternity providers and KMS are encouraged to:

- ensure their smoking cessation interventions for Aboriginal women are multicomponent and delivered early in pregnancy
- have comprehensive and evidence-based approaches to assessing fetal growth and wellbeing.
- align their breastfeeding information and advice to the resources developed for Aboriginal women and families including the Boorai Bundle Breastfeeding booklet <<u>http://www.vaccho.org.</u> au/resources/maternity-early-years/bb/>>.

# Messages for consumers

- Seeing your midwife and/or your doctor regularly during pregnancy is important for a healthy pregnancy and safe birth. Talk to your KMS or your hospital's Aboriginal Liaison Officer if you need help to get to your pregnancy care appointments.
- Smoking in pregnancy is dangerous for your growing boorai and can mean they are born too early. Quitting smoking at any time during your pregnancy helps keep your boorai safe, but we know that quitting early in pregnancy is the best way to give your boorai a good start.
- Looking after diabetes during pregnancy is really important for a healthy boorai and safe birth. Have a yarn about diabetes with your doctor or KMS. Ask them about monitoring your blood sugar levels during your pregnancy and any extra tests you will need through your pregnancy to make sure your levels are in a safe range.
- Women should start antenatal care as soon as they suspect they are pregnant.
- Breastfeeding is best for the health of babies and mothers. Aboriginal women who initiated breastfeeding were no more likely than other women to have problems establishing breastfeeding.

# Further information

### Koori Maternity Services and program guidelines

<a href="https://www2.health.vic.gov.au/hospitals-and-health-services/patient-care/perinatal-reproductive/maternity-newborn-services/aboriginal-maternity-services">https://www2.health.vic.gov.au/hospitals-and-health-services/patient-care/perinatal-reproductive/maternity-newborn-services/aboriginal-maternity-services</a>

Quitline <https://www.quit.org.au/articles/how-can-quitline-help/>.

#### Breastfeeding information from the Victorian Aboriginal Community Controlled Health Organisation

<http://www.vaccho.org.au/assets/01-RESOURCES/TOPIC-AREA/KMS/BOORAI-BUNDLE/BOORAI-NUTRITION-BREASTFEEDING.pdf>.

#### Royal Women's Hospital:

Aboriginal newborn identification project <a href="http://haveyoursay.thewomens.org.au/aboriginal-newborn-identification-project">http://haveyoursay.thewomens.org.au/aboriginal-newborn-identification-project</a>>.

Women's Alcohol and Drug Service <a href="https://www.thewomens.org.au/health-professionals/maternity/womens-alcohol-and-drug-service/">https://www.thewomens.org.au/health-professionals/maternity/womens-alcohol-and-drug-service/</a>>.

#### Maternity Services Education Program (cultural safety training)

<a href="https://www.thewomens.org.au/health-professionals/clinical-education-training/the-womens-maternity-services-education-program-msep/koori-maternity-services-kms-program/>">https://www.thewomens.org.au/health-professionals/clinical-education-training/the-womens-maternity-services-education-program-msep/koori-maternity-services-kms-program/>">https://www.thewomens.org.au/health-professionals/clinical-education-training/the-womens-maternity-services-education-program-msep/koori-maternity-services-kms-program/>">https://www.thewomens-maternity-services-kms-program/>">https://www.thewomens-maternity-services-kms-program/>">https://www.thewomens-maternity-services-kms-program/>">https://www.thewomens-maternity-services-kms-program/>">https://www.thewomens-maternity-services-kms-program/>">https://www.thewomens-maternity-services-kms-program/>">https://www.thewomens-maternity-services-kms-program/<//>">https://www.thewomens-maternity-services-kms-program/>">https://www.thewomens-maternity-services-kms-program/</https://www.thewomens-maternity-services-kms-program/">https://www.thewomens-maternity-services-kms-program/</https://www.thewomens-maternity-services-kms-program/</https://www.thewomens-maternity-services-kms-program/">https://www.thewomens-maternity-services-kms-program/</https://www.thewomens-maternity-services-kms-program/</https://www.thewomens-maternity-services-kms-program/">https://www.thewomens-maternity-services-kms-program/</https://www.thewomens-maternity-services-kms-program/</https://www.thewomens-maternity-services-kms-program/</https://www.thewomens-maternity-services-kms-program/</https://www.thewomens-maternity-services-kms-program/</https://www.thewomens-maternity-services-kms-program/</https://www.thewomens-maternity-services-kms-program/</https://www.thewomens-maternity-services-kms-program/</https://www.thewomens-maternity-services-kms-program/</https://www.thewomens-maternity-services-kms-program/</https://www.thewomens-maternity-services-kms-program/</https://www.thewomens-kms-pr

# 4. Births in Victoria

# 4.1 Overview

Information about maternal characteristics, maternal medical conditions, complications of pregnancy, details of labour and birth and the postnatal stay in hospitals, and details about the baby, are reported to CCOPMM via the Victorian Perinatal Data Collection (VPDC) for every birth in Victoria. This includes babies born in public and private hospitals and at home under the care of a midwife.

This information is used to monitor and report on the quality of maternity and newborn care, for research related to birth, and for policy and planning decisions.

The accuracy of this information is checked from time to time – most recently on data for births in 2011 (Flood et al. 2017).

Victoria continues to be a very safe place to give birth. However, disparities in health outcomes exist between different groups of women, and these need to be highlighted and addressed.

## Snapshot

Births included in this section of the report and supplementary tables exclude all terminations of pregnancy for congenital anomaly or maternal psychosocial indications.

- In 2016, 79,319 women gave birth to 80,549 babies an increase of 2.0 per cent from 2015 (Figure 9).
- The crude birth rate fell slightly from 62.4 to 61.4 per 1,000 women of reproductive age (15-44 years).
- The proportion of women giving birth by caesarean section continues to increase from 23.4 per cent in 2000 to 33.4 per cent in 2015 and 34.0 per cent in 2016 (Figure 10). More women admitted as private patients gave birth by caesarean section – 43.3 per cent compared with 30.6 per cent of those admitted as public patients.
- An increasing proportion of women had labour induced (30.8 per cent of all women who gave birth in 2016 compared with 28.8 per cent in 2015) (Figure 10). Induction rates were similar for women admitted as public and private patients (31.4 per cent and 29.0 per cent, respectively).
- More women giving birth in 2016 used epidural analgesia to relieve pain in labour 47.6 per cent of women having their first baby who experienced labour (compared with 44.9 per cent in 2015) and 21.1 per cent of those having subsequent births (compared with 19.3 per cent in 2015), or 33.8 per cent of all women who experienced labour in 2016 (Figure 10).
- Women having their first birth were around four times as likely to experience a severe perineal laceration (third or fourth degree) or an episiotomy as those having a subsequent birth. Perineal outcomes are described in detail in section 5.2.
- One-quarter (24.3 per cent) of all women giving birth in 2016 experienced a postpartum haemorrhage of 500 mL or more, including 2.0 per cent who experienced a severe postpartum haemorrhage of 1,500 mL or more. A total of 1,349 women required a blood transfusion. Postpartum haemorrhage is discussed in more detail in section 5.2.

- A slightly smaller proportion of women giving birth in 2016 (1.5 per cent) were aged younger than 20 years than in 2015 (1.6 per cent); the proportion aged 35 years or older remains steady at 25.3 per cent.
- 61.5 per cent of women giving birth in 2016 were born in Australia. The most common countries of birth for women born in non-English-speaking countries were India and China.
- Women giving birth at older ages are more likely to be in more favourable socioeconomic circumstances than younger mothers, with 6.2 per cent of women aged younger than 20 years in the least disadvantaged socioeconomic quintile compared with 26.9 per cent of those aged 35–39 years. Women younger than 20 years were more likely to be admitted as public patients (97.6 per cent) compared with women aged 35–39 years (62.0 per cent).
- Rural residents giving birth were more likely than metropolitan residents to belong to the most disadvantaged socioeconomic quintile (26.7 per cent and 17.9 per cent, respectively).
- 95 per cent of women who gave birth to term liveborn babies initiated breastfeeding. Of these babies,
   25 per cent in public hospitals and 38 per cent in private hospitals were given infant formula in hospital, and 77 per cent of term breastfed babies had the last feed before they went home directly and entirely from the breast. Most women leave public hospitals within two days of the birth, so longer term breastfeeding outcomes are not reported to the VPDC.
- 8.3 per cent of babies were born preterm (before 37 weeks' gestation), most of them at 35 (1.5 per cent) or 36 (3.4 per cent) weeks.
- 6.8 per cent of babies were born with a birthweight under 2,500 g; 1.3 per cent below 1,500 g. The proportion of babies born with a birthweight of at least 4,500 g has reduced from 1.9 per cent in 2010 to 1.3 per cent in 2016.
- 2.9 per cent of babies born were multiple births, the vast majority being twins. Multiple births were more likely than singletons to be born preterm and by caesarean section.
- The proportion of babies born to Aboriginal women more than doubled from 0.6 per cent in 2000 to 1.3 per cent in 2011 and has remained relatively stable since then (1.4 per cent in 2016). This may be the result of better ascertainment of Aboriginal status as well as an increase in the number of Aboriginal women of childbearing age. Details of Aboriginal births are described in section 3.

Refer to supplementary tables and figures for more details.



Figure 9: Trend in number of births, 1985–2016

Figure 10: Trend in management of labour and birth 2010 to 2016 (percentage)<sup>a</sup>



a Includes all women who gave birth for inductions and caesareans and all women who experienced labour for epidurals.

# Good practice points

Giving infant formula in the first 48 hours of life to breastfed babies has been shown to reduce the duration of breastfeeding (Parry et al. 2013). The very high proportion of babies given formula in hospital suggests there are opportunities to reduce this risk factor for early weaning.

## Messages for consumers

Information about pregnancy care choices in Victoria <a href="https://www.betterhealth.vic.gov.au/health/servicesandsupport/having-a-baby-in-Victoria">https://www.betterhealth.vic.gov.au/health/servicesandsupport/having-a-baby-in-Victoria</a>.

# Further information

Information on caesarean section, induction of labour and other aspects of care at individual health services can be found in the *Perinatal services performance indicators report 2015–16* <<u>https://www2.health.vic.gov.au/about/publications/researchandreports/perinatal-services-performance-indicators-2015-16</u>>.

The Australian Institute of Health and Welfare provides information on births in all states and territories <<u>https://www.aihw.gov.au/reports/mothers-babies/australias-mothers-babies-2014-in-brief/contents/table-of-contents</u>>.

# 4.2 Caesarean section

One in three women who gave birth in 2016 did so by caesarean section.

The proportion of women who give birth by caesarean section has been increasing over the past three decades, from 15.3 per cent in 1985 to 34.0 per cent in 2016 (Figure 11).

Caesarean section is a life-saving procedure for mothers and babies in some circumstances. There is concern, however, that the high rate indicates that many caesareans are carried out for less compelling reasons. Despite improvements in surgical and anaesthetic techniques, the use of prophylactic antibiotics and ready access to blood banks, there remain increased maternal and neonatal risks. The short-term risks include surgical complications (bladder, ureteric and bowel damage), anaesthetic complications, increased blood loss with the need for blood transfusion, pulmonary embolus and infection.

Postoperatively the caesarean section can result in restriction in daily living, increased postnatal depression and increased difficulties establishing breastfeeding. For the baby, it can mean increased nursery admission rates, with consequent separation from the mother, iatrogenic prematurity and increased neonatal respiratory problems. There are also reports of increased risk of developing diabetes and asthma in the babies.

Longer term for the mother, problems are associated with abnormal placentation including placenta praevia/ accreta in subsequent pregnancies with consequent hysterectomy, ectopic pregnancy, uterine scar rupture, implantation endometriosis and adenomyosis (Lavender et al. 2012). A large Canadian study reported that, compared with vaginal birth, low-risk planned caesarean carried a three-fold increased risk of severe maternal morbidities (haemorrhage requiring hysterectomy or transfusion, uterine rupture, anaesthetic complications, shock, cardiac arrest, acute renal failure, assisted ventilation, venous thromboembolism, major infection, wound disruption) (Liu et al. 2007).

## **Snapshot**

- In 2016, among women having caesarean section in Victoria, 36.3 per cent had a postpartum haemorrhage (blood loss ≥ 500 mL) and 1.5 per cent had a severe postpartum haemorrhage (blood loss ≥ 1,500 mL), in comparison with 18.1 per cent and 2.2 per cent respectively among women having a vaginal birth. Admission to a high dependency unit or intensive care unit was reported in 2.0 per cent of the mothers undergoing caesarean section compared with 1.1 per cent of those having vaginal birth. Wound infection was reported in 0.3 per cent of women undergoing caesarean section in 2016, which is likely to be an under estimate, because wound infection may not have been apparent until after discharge from the hospital.
- There are a number of reasons for the increased rate of caesarean sections including women having babies at an older age, increasing maternal obesity, medico-legal concerns and perceived convenience. Mothers aged 35 years or older were 41 per cent more likely to have a caesarean section in 2016 (RR 1.41, 95% CI 1.38–1.45) compared with those younger than 35 years (Figure 12). In 2016, the risk of caesarean section in overweight women (BMI 25–29.9 kg/m<sup>2</sup>) was 26.3 per cent higher than those in the healthy BMI range (RR 1.26, 95% CI 1.23–1.29), which increased to 58.1 per cent (RR 1.58, 95% CI

1.51–1.65) in obese women (BMI 30–34.9 kg/m<sup>2</sup>), and to 63.5 per cent (RR 1.63, 95% CI 1.57–1.69) in women with a BMI of at least 35 kg/m<sup>2</sup> compared with women with a normal BMI (Figure 13).

• The way care is provided in labour also influences the likelihood of caesarean – for example, one-toone care by a midwife during labour reduces the rate of caesarean section.

The Ten Group Classification System (also known as the Robson Groups) was developed to monitor and compare outcomes, particularly caesarean sections, for women who have a similar risk profile (Robson et al. 2015). The 10 groups are defined to enable all women giving birth to be classified to one group only, according to whether it is their first birth, the gestation, the part of the baby that is presenting, whether a singleton or multiple pregnancy and whether the woman has had a caesarean for a previous birth. These groups have been further modified by Zhang (Zhang et al, 2015).

Figure 14 shows the proportion of women in Group 1 and Group 2<sup>a</sup> in public and private hospitals who gave birth by caesarean section. Women in Group 1 had their first baby at 37 or more weeks' gestation, with a singleton baby in the head-first position and had begun labour spontaneously. Those in Group 2 were the same as those in Group 1, but labour had been induced. Those who were induced were more likely to have had a caesarean than those who began labour spontaneously, and those in each group in private hospitals were more likely to have a caesarean than those in public hospitals (Figure 14).





a The modified version of Group 2 is used here, excluding women who have a pre-labour caesarean section (Zhang et al. 2015).



#### Figure 12: Caesarean section rates by maternal age, Victoria, 2016

Age group



Figure 13: Caesarean section rates by maternal BMI category, Victoria, 2016

Body mass index



# Figure 14: Caesarean section for Robson Groups 1 and 2 (modified) in Victoria in public and private hospitals, 2016 (percentage)

## Messages for consumers

Before having a caesarean section, talk to your doctor or obstetrician about:

- pre-existing health issues or general health concerns, as they may affect decisions for anaesthesia and surgery
- risks related to having a caesarean section
- have you had a past history of bleeding problems or easy bruising
- medication history or any allergies
- investigations that are required, including blood tests to check your haemoglobin level and blood type, as blood transfusion may be required in case of excessive blood loss during the surgery.

More information on caesarean section is available from the Better Health Channel at <a href="https://www.betterhealth.vic.gov.au/health/healthyliving/caesarean-section">https://www.betterhealth.vic.gov.au/health/healthyliving/caesarean-section</a>>.

## Further information

ACOG/SMFM Consensus: Safe prevention of the primary caesarean delivery <a href="http://dx.doi.org/10.1016/j.ajog.2014.01.026">http://dx.doi.org/10.1016/j.ajog.2014.01.026</a>>.

# 5. Maternal mortality and severe acute maternal morbidity

# 5.1 Overview

Maternal deaths are an important indicator of maternal health and the performance of the health system. As maternal death continues to be an uncommon event in Australia, the monitoring of severe acute maternal morbidity (SAMM) becomes an important adjunct measure to monitor the quality and safety of health care provided to pregnant women.

The increasing complexity of health and social problems in the pregnant population poses significant challenges to healthcare providers and the health system. There is an increasing number of women over the age of 35 years having their first baby (currently 25 per cent up from six per cent in 1985), women with preexisting co-morbidities such as obesity (one in five or 19 per cent), type 2 diabetes, essential hypertension and cardiovascular disease. The number of women who have a combination of psychosocial risk factors and complex medical problems is also increasing, often with compounding problems of substance dependence, family violence or social isolation. All of these factors contribute to a more complex, high-risk population with an increasing need for specialist care, sometimes intensive care and most importantly a multidisciplinary model of care.

Maternal deaths are classified as 'direct' (relating to the pregnancy or birth), 'indirect' (pre-existing medical condition or newly diagnosed condition), 'incidental' (unrelated to the pregnancy or birth) and 'late' (those occurring more than 42 days from the end of the pregnancy and less than one year after cessation of pregnancy).

SAMM is defined as 'a woman who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy' (Say et al. 2009).

Monitoring health outcomes and reviewing the circumstances around maternal deaths and SAMM cases assists the health system to respond better to the needs of the pregnant population and to implement prevention or health promotion strategies. As the underlying sequelae of events are similar for maternal deaths and SAMM, the same lessons about the quality and safety of maternity care can be derived by examining the circumstances of women with SAMM as those learnt from the review of a maternal death.

## **Snapshot**

- In 2016 there were 17 maternal deaths: seven direct, four indirect, five late (direct and indirect causes) and one incidental.
- Because the number of deaths in any one year is small, this report has combined the deaths over threeyear periods, with the most recent triennium being 2014 to 2016 inclusive.
- The Maternal Mortality Ratio (MMR) from 2014 to 2016 was 8.9 per 100,000 women who gave birth (Figure 15).
- The latest available Australian data is for the three-year period 2012 to 2014, when the MMR was 6.9 per 100,000 women giving birth. Comparison with other jurisdictions should be undertaken with caution because the numbers are small and therefore subject to volatility.

- For the years 2011–2016, the most common causes of the early deaths (that is, during or within 42 days of the end of the pregnancy) were related to pre-existing cardiovascular disease or non-obstetric haemorrhage, including intracerebral haemorrhage, and psychosocial issues that is, women with pre-existing mental health disorders. These accounted for 21 of the 26 indirect deaths (81 per cent) (Table 3).
- In a number of cases it was not possible to determine if the deaths related to drug overdoses were
  accidental or intentional, and consequently the number of deaths due to intentional self-harm (including
  suicide) may be underestimated. In the six-year interval, intentional self-harm (including suicide) was
  identified as the primary cause of death in eight cases and five deaths were intentional self-harm
  (suspected suicides). In one case, family violence was identified as being a principal cause, but family
  violence as a cause of maternal death may be an underestimate due to inadequate ascertainment.
- Of the 19 direct deaths, obstetric haemorrhage and thromboembolism were the most common causes (five each), followed by amniotic fluid embolism and complications related to anaesthesia (two each).
- Infection is an important cause of maternal deaths (three early and one late).
- In three deaths, despite comprehensive investigations including autopsy, it was not possible to definitively determine the cause of the death and these remain 'undetermined or unascertained'.



#### Figure 15: Maternal mortality ratios by triennia, Victoria and Australia, 1991–2016

a The years 2013 and 2015 are included twice and the year 2014 is included three times, as rolling triennia were used for the two most recent triennia so that the 2014, 2015 and 2016 data could be represented.

b At the time of publication the latest provisional Australian data for 2012–2014 indicated the rate was between 6.4 and 6.7.

## **Case study**

A 36-year-old grand multiparous woman (successfully delivered five or more babies) reported decreased fetal movements at term, so labour was induced. Labour was incoordinate and oxytocin augmentation was started. She progressed slowly to a normal vaginal birth 12 hours later, but this was followed by a severe postpartum haemorrhage and she was transferred to the operating theatre. Blood transfusion was commenced together with prostaglandin injections and continuing oxytocin infusion. The uterus remained atonic despite the insertion of a Bakri balloon (a device that provides direct pressure to the placental bed to stop bleeding), and she suffered a cardiac arrest. Despite resuscitative efforts, circulation could not be restored.

## Case study – key messages

Clinicians are reminded of the increased risks associated with induction of labour in grand multiparous women including postpartum haemorrhage, uterine rupture and the need to have senior obstetric and anaesthetic staff readily available during the labour and at the birth. Maternity staff should be aware of the need for early identification of coagulation disorders including point-of-care testing of the implementation of the massive blood transfusion protocol, the use of uterine balloon tamponade and emergency response training.

# Contributing factors in maternal deaths

The review of maternal death cases occurring in the six-year period between 2011 and 2016 revealed a range of contributing factors including maternal factors such as substance dependence and mental illness and suboptimal standards of professional practice (Table 4). One or more contributing factors were identified in 32 of all 68 maternal deaths (47 per cent). Removing the 12 incidental deaths increases the proportion in whom contributing factors were found to 55 per cent (32/56).

It is important to note that the contributing factors identified may not have directly caused the death or had an influence on the outcome, although this assessment is made on each case.

Where these factors were related to sub-optimal clinical care, feedback to health services was given so that they can be addressed and reduce subsequent morbidity and mortality.

Cause of death		Maternal deaths included in	Late maternal deaths <sup>a</sup>	
Direct		19	2	
(due to a complication	Obstetric haemorrhage	5		
	Thromboembolism	5	1	
	Anaesthetic related death	2		
	Amniotic fluid embolus	2		
	Early pregnancy death – ectopic pregnancy	1		
of the pregnancy)	Sepsis <sup>b</sup>	1		
	Eclampsia	1		
	Psychosocial <sup>c</sup>	1	1	
	Post partum sepsis – Streptococcus Group A	1		
Indirect		26	9	
	Cardiac disease	8		
	Non-obstetric haemorrhage (includes intracerebral bleeding)	8		
	Psychosocial <sup>c</sup>	6	4	
(related to a	Sepsis – acute pyelonephritis	1		
pre-existing or newly diagnosed	Complications of heart transplant for the treatment of peripartum cardiomyopathy		1	
condition	Carcinoma of the cervix		1	
exacerbated by pregnancy)	Bronchopneumonia with associated substance dependence and domestic violence		1	
	Primary pulmonary hypertension		1	
	Multiple sclerosis		1	
	Undetermined	3		
Incidental		0	12	
(where the pregnancy is unlikely to have contributed significantly to the death)	Bronchopneumonia		1	
	Metastatic melanoma		1	
	Subarachnoid haemorrhage secondary to endocarditis		1	
	Prolonged QT syndrome		1	
	Pulmonary embolus		1	
	Complications post tubal ligation		1	
	Psychosocial <sup>c</sup>		4	
	Accidental injury		2	
Total		45	23	

### Table 3: Causes of maternal deaths, Victoria, 2011–2016

a Late maternal deaths (after 42 days but within one year of the birth) and all incidental deaths are not included in the maternal mortality ratio.

b. This death did not occur in Victoria.

c Psychosocial causes include deaths in which a psychiatric condition contributed to the cause of death and encompass wider issues such as family violence and substance misuse. In 2012 the National Maternal Mortality Advisory Committee advised that maternal deaths from intentional self-harm (including suicide) where the onset of mental health disorder is first recognised in pregnancy should be classified as "direct" deaths, all other maternal intentional self-harm (including suicide) deaths and psychosocial deaths should be classified as "indirect". Previously many psychosocial deaths unrelated to the pregnancy were classified as "incidental" deaths.

## Table 4: Assessment of contributing factors in maternal deaths, Victoria, 2011–2016

Contributing factor	Number				
Factors relating to access to care	3				
Delay in transfer	1				
Delay in access to specialist assistance	1				
Lack of access to specialist care and services					
Factors relating to professional practice	33				
Anaesthetic issues					
Delay in diagnosis and transfer					
Failure to review diagnosis in light of diagnostic evidence	1				
Failure to maintain an adequate airway and ventilation	1				
Over reliance on test result despite clinical evidence of placenta accreta	1				
Inadequate communication / communication breakdown	2				
Inadequate management of obstetric haemorrhage (monitoring, diagnosis, resuscitation)	3				
Inadequate investigation and management of sepsis					
Suboptimal resuscitation	3				
Suboptimal diabetes management	1				
Inappropriate discharge	1				
Poor organisational management	1				
Poor documentation					
Poor crisis management	1				
Inadequate involvement with Koori Maternity Services	1				
Failure to recognise eclampsia	1				
Lack of recognition of complexity or seriousness of condition by care giver	2				
Delayed involvement of senior experienced staff/Failure to escalate care	3				
Failure to follow recommended best practice:					
<ul> <li>cessation of anti-depressant medication</li> </ul>	1				
<ul> <li>delayed assessment of coagulation status</li> </ul>	1				
Factors relating to the pregnant woman, her family and social situation	22				
Declining or not following medical advice	2				
Delay in seeking medical advice/help	3				
Family violence	3				
Maternal mental illness	6				
Lack of recognition by the woman or family of the seriousness of the condition	1				
Social isolation	1				
Substance dependence	6				
Total	58				

Note: Some cases have multiple contributing factors.

# Good practice points

• Management of postpartum haemorrhage:

- Maternity services should provide ready access to guidelines for managing massive haemorrhage. These guidelines should cover early recognition, escalation and treatment.
- Point of care, or ready access to, coagulation profile assessment should be available in all major maternity services and utilised early for patients suffering a major postpartum haemorrhage.
- A convulsion in pregnancy even when there is a history of epilepsy should first be treated as an eclamptic seizure, especially if there are signs of hypertension and/or proteinuria.
- Pregnant women presenting to emergency departments wherever possible should be assessed by an obstetrically trained medical practitioner.
- When an Aboriginal family becomes disengaged from a maternity service, appropriate Aboriginal organisations should be contacted to facilitate the relationship between the treating health service and the family or to provide postnatal care in consultation with the health service.
- Practitioners should give careful consideration when prescribing antidepressant therapy to pregnant women that considers the benefit–risk ratio.

# Further information

Royal College of Obstetricians and Gynaecologists, Green-top Guideline No.52: *Postpartum haemorrhage, prevention and management* <<u>https://www.rcog.org.uk/en/guidelines-research-services/guidelines/gtg52/></u>.

Effective mental health care in the perinatal period: Australian clinical practice guideline 2017.

# 5.2 Maternal morbidity

Primary postpartum haemorrhage (PPH) is a relatively common complication of childbirth that requires careful and timely management. In the most severe cases it can result in maternal death.

PPH and severe perineal lacerations are complications of childbirth that affect recovery from the birth, breastfeeding and the long-term health of women.

## **Snapshot**

One-quarter of all women who gave birth in Victoria in 2016 experienced a PPH – blood loss of 500 mL or more in the first 24 hours following birth, while 2.0 per cent of all women experienced a severe PPH (at least 1,500 mL blood loss in the first 24 hours following birth).

PPH was more common in:

- first births than subsequent births (28.4 per cent and 21.0 per cent, respectively)
- caesarean and instrumental vaginal births than unassisted vaginal births (36.3 per cent, 30.3 per cent and 14.4 per cent, respectively)
- twin than singleton births (47.4 per cent and 24.0 per cent, respectively).

Severe PPH was more common in:

- first births than subsequent births (2.3 per cent and 1.7 per cent, respectively)
- instrumental vaginal births than caesarean and unassisted vaginal births (3.6 per cent, 1.5 per cent and 1.8 per cent, respectively)
- twin than singleton births (4.1 per cent and 2.0 per cent, respectively).

The mean blood loss following caesarean birth was 477 mL (95% CI 473 to 481), 474 mL following instrumental vaginal birth (95% CI 467 to 481) and 338 mL following unassisted vaginal birth (95% CI 335 to 341). Median blood loss was 400 mL, 350 mL and 250 mL respectively.

- Prophylactic oxytocics were given to 98.8 per cent of women giving birth to reduce the risk of PPH.
- 1.7 per cent of all women giving birth required a blood transfusion, almost always because of PPH. This increased to 41.2 per cent of women who had a severe PPH.
- Of women who gave birth vaginally in 2016, 3.0 per cent sustained a severe (third- or fourth degree) perineal laceration. This was more common for first births and in women admitted to public hospitals (Figure 16).
- Of women who gave birth vaginally in 2016, 28.8 per cent had an episiotomy, which is higher than in 2015 (26.6 per cent). Women having their first baby and those admitted as private patients were more likely than others to have an episiotomy (Figure 17).



Figure 16: Severe (third- or fourth-degree) perineal lacerations for women who gave birth vaginally, by parity and admission status, 2012–2016 (percentage)





# Good practice points

Multidisciplinary training in preventing severe perineal trauma and management of PPH are recommended at all health services.

## Messages for consumers

For PPH:

• If you experienced a PPH, you and/or your partner may wish to speak to a health professional to debrief or seek formal debriefing with a qualified counsellor.

For perineal outcomes:

- For birth, discuss with your midwife or doctor about ways to protect your perineum during labour and any wishes/preferences you have for the birth.
- Following birth, tell your midwife, general practitioner or maternal and child health nurse if you
  are experiencing any problems/issues following a tear or episiotomy such as pain, urine or faecal
  incontinence. (The Better Health Channel is a good reference for definitions and consumer-based
  material). <<u>https://www.betterhealth.vic.gov.au</u>>

# 6. Perinatal deaths

Perinatal mortality includes fetal deaths (stillbirths) and deaths of live-born babies within the first 28 days after birth (neonatal deaths). The information in this section refers to the 'adjusted ' perinatal mortality, where terminations of pregnancy for psychosocial indications are excluded. This adjustment provides a better measure for assessing avoidable mortality and for comparisons with other jurisdictions both nationally and internationally. Statistics for the unadjusted perinatal mortality can be found in the appendices of this report.

# 6.1 Overview and contributing factors

Victoria's perinatal mortality rate continues to fall and at 8.8 per 1,000 births is among the lowest in Australia and in other high-resources countries. Noteworthy for the first time, the perinatal mortality rate for Aboriginal and mothers was similar to non-Aboriginal and mothers, although due to small numbers in the former group, this should be interpreted with caution.

Although the perinatal mortality rate is at its lowest in sixteen years, efforts should be made to reduce it further.

Autopsy rates, particularly for stillborn infants, continue to fall (from 56.6 per cent in 2000 to 35.1 per cent in 2016). It is anticipated that the introduction of the coordinated Victorian Perinatal Autopsy Service will assist in arresting this decline so that families can access maximum information in a timely fashion that will determine the cause of their perinatal loss and consequently help reduce subsequent perinatal mortalities for themselves and others.

Contributing factors to the cause of the perinatal deaths were identified in 123 of the 501 stillbirths (24.6 per cent) and in 43 of the 213 neonatal deaths (20.2 per cent). However, in many cases the contributing factors indicated a suboptimal factor that did not contribute to that particular death. The identification of contributing factors enables health services to improve their overall quality of care.

# **Snapshot**

- Victoria's adjusted perinatal mortality rate in 2016 was 8.8 per 1,000 births (Table 5). This is the lowest reported for Victoria in 16 years (Figure 18). For international comparison, the perinatal mortality limited to infants with a birthweight of at least 500 gm, is 6.0 per 1,000 births (Table 7).
- The adjusted stillbirth rate for babies born after 20 weeks' gestation in 2016 was 6.2 per 1,000 births.
- The adjusted neonatal death rate (up to 28 days of age) was 2.7 per 1,000 live births in 2016.
- The adjusted perinatal mortality rate for twin pregnancies for 2016 was 42.2 per 1,000 births, and for triplet pregnancies was 64.9 per 1,000 births, compared with 7.8 per 1,000 births for singletons.
- The perinatal mortality rates continued to be higher for women from north Africa and the Middle East, southern and central Asia, the Americas, Sub-Saharan Africa and southern and eastern Europe compared with women born in Australia (Table 6).
- The leading cause of adjusted stillbirth was congenital anomalies. Unexplained fetal deaths, where a
  definitive cause could not be established, remained the second most common classification in 2016.
  Specific perinatal conditions (including twin-to-twin transfusion syndrome, fetomaternal haemorrhage,
  cord accidents and birth trauma), preterm birth and fetal growth restriction remain among the next most
  common causes.
- The fall in the perinatal mortality rates for women of Aboriginal status continued in 2016 (down from 23.6 per 1,000 births in 2008–10 to 13.6 per 1,000 births in 2013–15) and for the first time is similar to non-Aboriginal women (9.0 versus 9.1 per 1,000 births in 2014–2016, respectively) (Figure 20). This reduction is primarily due to the decline in stillbirths (4.8 per 1,000 births in Aboriginal women compared with 6.5 per 1,000 births in non-Aboriginal women). The neonatal mortality rate in Aboriginal women remains higher than for non-Aboriginal women. The gap in neonatal mortality rate had remained relatively unchanged until the period 2014–16, when the neonatal mortality rate dropped slightly (4.2 per 1,000 live births in Aboriginal women compared with 2.6 per 1,000 live births in non-Aboriginal women). As the numbers involved are small and associated with a high degree of variability from year to year, further analysis and trend data is required to confirm these results, and therefore these should be interpreted with caution.
- For newborns up to the age of 28 days, congenital anomalies and spontaneous preterm birth were the two most common causes.

	2001	2003	2005	2007	2009	2011	2013	2015	2016
Number									
Livebirths <sup>a</sup>	61,705	63,028	66,041	71,780	72,474	73,389	77,609	78,637	80,233
Stillbirths	444	521	599	672	767	705	712	633	626
Neonatal deaths	204	237	247	241	226	223	241	189	213
Perinatal deaths	648	758	846	913	993	928	953	822	839
PMR <sub>Crude</sub> (per 1,000 births <sup>b,c</sup> )									
Stillbirth	7.1	8.2	9.0	9.3	10.5	9.5	9.1	8.0	7.7
Neonatal	3.3	3.8	3.7	3.4	3.1	3.0	3.1	2.4	2.7
Perinatal	10.4	11.9	12.7	12.6	13.6	12.5	12.2	10.4	10.4
Number adjusted <sup>d</sup>									
Live births	61,705	63,028	66,039	71,780	72,474	73,389	77,609	78,637	80,233
Stillbirths	399	418	421	508	553	522	533	526	501
Neonatal deaths	204	237	245	241	226	223	241	189	213
Perinatal deaths	603	655	666	749	779	745	774	715	714
PMR <sub>Adjusted</sub> (per 1,000 births <sup>b,c</sup> )									
Stillbirth	6.4	6.6	6.3	7.0	7.6	7.1	6.8	6.6	6.2
Neonatal	3.3	3.8	3.7	3.4	3.1	3.0	3.1	2.4	2.7
Perinatal	9.7	10.3	10.0	10.4	10.7	10.1	9.9	9.0	8.8

### Table 5: Perinatal deaths and crude and adjusted perinatal mortality rates (PMR) in Victoria, 2001–2016

a Live births include babies born alive who died soon after, following induction of labour for congenital anomalies and other fetal conditions.

b Stillbirth and perinatal death rates were calculated using total births (live births and stillbirths) as the denominator.

c Neonatal death rates were calculated using live births as the denominator.

d Births and deaths excluding those arising from termination of pregnancy for maternal psychosocial indications (MPI)


### Figure 18: Perinatal mortality rates in Victoria, 2000–2016 (crude and adjusted)

Table 6: Perinatal m	ortality rate (PN	MR) adjusted <sup>a</sup> by	v maternal plac	e of birth.	Victoria, 2016
rabie of i cililatai ili	ion cancy rate (i ii	my adjaoted by	, maternar prac		, ietoila, <b>E</b> ele

	Adjusted total births	Live births <sup>b</sup>	Adjusted stillbirths	Neonatal deaths	Adjusted perinatal deaths	Per cent of all Perinatal deaths	PMR <sub>Adjusted</sub> by maternal place of birth
North-East Asia	4,591	4,571	20	5	25	3.5	5.4
North-West Europe	2,374	2,365	9	5	14	2.0	5.9
Oceania and Antarctica (excluding Australia)	2,249	2,238	11	7	18	2.5	8.0
South-East Asia	5,162	5,138	24	18	42	5.9	8.1
Australia	49,772	49,457	315	119	434	60.8	8.7
North Africa and The Middle East	2,878	2,861	17	10	27	3.8	9.4
Southern and Central Asia	8,793	8,729	64	21	85	11.9	9.7
Americas	1,089	1,081	8	5	13	1.8	11.9
Sub-Saharan Africa	1,830	1,816	14	8	22	3.1	12.0
Southern and Eastern Europe	1,473	1,463	10	10	20	2.8	13.6
Missing	523	514	9	5	14	2.0	26.8
Total	80,734	80,233	501	213	714	100.0	8.8

a The figures and calculations in this table exclude 125 stillbirths from terminations of pregnancy (TOP) for maternal psychosocial indications (MPI).

b Live births include all livebirths, including those who later die as neonatal deaths.

This table is ranked by PMR (excluding missing data).



#### Figure 19a: Causes of adjusted stillbirth (percentage), PSANZ PDC, Victoria 2016

Note: TOP refers to terminations of pregnancy for congenital abnormality or maternal psychosocial indications.

#### Figure 19b: Causes of neonatal death (percentage), PSANZ PDC, Victoria 2016



Percentage TOP Percentage non-TOP

Note: TOP refers to terminations of pregnancy for congenital abnormality or maternal psychosocial indications.



Figure 20: Perinatal mortality rate (PMR) adjusted by Aboriginal and non-Aboriginal status, by rolling triennia, Victoria, 2001–2016

### Table 7: $PMR_{500}$ in Victoria 2005–2016 (birthweight $\ge$ 500 g)<sup>a</sup>

	2005	2010	2015	2016
Number				
Total births (birth weight $\ge$ 500 g)	66,226	74,000	78,867	80,501
Live births	65,948	73,641	78,515	80,158
Stillbirths	278	359	352	343
Neonatal deaths	159	152	129	144
Perinatal deaths	437	511	481	487
Rate per 1,000 births				
Stillbirths <sup>b</sup>	4.2	4.9	4.5	4.3
Neonatal <sup>c</sup>	2.4	2.1	1.6	1.8
Perinatal <sup>b</sup>	6.6	6.9	6.1	6.0

a PMR500 – perinatal mortality rate per 1,000 births where birth weight  $\geq$  500 g or, if birth weight unknown, gestation  $\geq$  22 weeks

b Stillbirth and perinatal death rates were calculated using total births (live births and stillbirths) as the denominator.

c Neonatal death rates were calculated using live births as the denominator.

### Contributing factors

Key to improving the quality of care and consequent perinatal outcomes is the careful review of all perinatal deaths to determine if there were contributing factors. This review is preferably initially conducted by a multidisciplinary perinatal mortality and morbidity review committee at the health service where the perinatal death occurred. The introduction of regional perinatal mortality and morbidity meetings is providing support to smaller services to aid their case review. Finally, cases identified as having potential contributing factors are reviewed by the two CCOPMM expert subcommittees – the Stillbirth and Neonatal Mortality and Morbidity Subcommittees. Where identified, the contributing factors are graded as:

- unlikely to have contributed to the outcome (insignificant)
- might have contributed to the outcome (possible)
- likely to have contributed to the outcome (significant).

Even significant factors may not necessarily be preventable or imply unacceptable standards of care.

### In 2016:

- 84 perinatal deaths (gestation age greater than or equal to 20 weeks or birthweight more than 400 g if gestation is unknown) had contributing factors in babies
- Suboptimal factor(s) identified but unlikely to have contributed to the outcome (insignificant) were found in six (7.0 per cent), factors that might have contributed to the outcome (possible) were found in 46 (55.0 per cent) and significant factors likely to have contributed to perinatal mortality were found in 32 (38.0 per cent) cases.
- Contributory factors were related to a mother/family/social situation in 61 (73.0 per cent) cases, access to care in five (6.0 per cent) and professional care in 27 (32.0 per cent) cases.

### Between 2014 and 2016:

- There were 1,501 perinatal deaths of babies with a birthweight of 500 g or more. Review by the Stillbirth and Neonatal Mortality and Morbidity Subcommittees identified 166 cases (11.1 per cent) in which there were one or more contributing factors.
- The most common contributing factors were:
  - factors related to the woman's pregnancy, family or social situation 34.6 per cent
  - inadequate antenatal care 22.2 per cent
  - inadequate intrapartum care 16.3 per cent
  - inadequate management of antenatal conditions and complications 7.2 per cent
  - inadequate antenatal monitoring 6.2 per cent
  - paediatric delay in recognition/treatment in neonatal deaths 5.9 per cent
  - inadequate paediatric management in neonatal deaths 3.3 per cent
  - inadequate intrapartum management 2.9 per cent.

Factors related to the pregnant woman and her social situation remain major issues for health services. Family neglect or ignorance and delays in reporting decreased fetal movements highlight areas that require effective consumer education and engagement, especially for women in challenging social situations.

There has been a further reduction in the numbers of deaths in which inadequate intrapartum monitoring was considered to be a causative factor reflecting the effectiveness of training in the interpretation and appropriate management of abnormal cardiotocography patterns.

There have also been reductions in the contributing factors associated with managing mothers with diabetes and intrauterine growth restriction.

Failure to expedite delivery of the compromised fetus remains an area that needs attention.

### Good practice points

- When fetomaternal haemorrhage is suspected, obstetricians must convey this clearly to the attending paediatrician so that, if required, appropriate volume expansion can begin as early as possible.
- Maternity services should implement a Neonatal Resuscitation Program, for example, Paediatric Infant Perinatal Emergency Retrieval (PIPER's) neoResus program, which is based on the Australian and New Zealand Committee on Resuscitation guidelines.
- Collection of blood from the femoral artery is not recommended in neonates because this can cause thrombosis of the vessel and disseminated intravascular coagulopathy in the presence of hypoxia.
- In newborns, paracetamol should not be used to treat irritability that may be due to pain without a thorough assessment of the possible cause of this behaviour.
- Birth trauma resulting in death should be reported to the Coroner. Advice is available 24 hours a day seven days a week on 1300 309 519 and is also available on the Coroners' Court of Victoria website.
- Testing for proteinuria is essential for women with hypertension and with risk factors for pre-eclampsia.
- Pregnant women in the second half of pregnancy attending emergency departments should be assessed by a member of the obstetric service.

### Further information

National clinical practice guidelines – maternity care <a href="http://www.health.gov.au/internet/main/publishing.nsf/Content/phd-antenatal-care-index">http://www.health.gov.au/internet/main/publishing.nsf/Content/phd-antenatal-care-index</a>.

PSANZ SANDA – Clinical practice guideline for the care of women with decreased fetal movements 2007 <a href="https://sanda.psanz.com.au/clinical-practice/clinical-guidelines">https://sanda.psanz.com.au/clinical-practice/clinical-guidelines</a>>.

PIPER neoResus program <<u>https://www.rch.org.au/piper/education/Neonatal\_Education/></u>.

Information for health professionals about requirements for reporting deaths to the Coroner <<u>http://www.coronerscourt.vic.gov.au/resources/af021994-c0cc-4b39-95a0-49dcf08f812b/info\_health\_pros+4pp+a4+2013+lr.pdf</u>>.

# 6.2 Diabetes

Women who have diabetes mellitus before they become pregnant (pre-gestational diabetes) are at increased risk of adverse perinatal outcomes.

Both pre-gestational diabetes (PGD) and gestational diabetes mellitus (GDM) rates are rising, placing an increasing burden on pregnant women and the health services providing their care. The major challenge is to ensure that women with, or at risk of having, abnormal glucose tolerance (for example, a history of GDM) are seen before they become pregnant so their blood glucose control can be maximised before conception and early fetal development.

### Snapshot

- Women giving birth at older ages are significantly more likely to have diabetes before they become pregnant, and also to develop GDM.
- PGD was present in 0.5 per cent of women aged 20–24 years who gave birth to singleton babies in 2016, increasing to 1.9 per cent of those aged 40–44 years and 2.8 per cent of those aged 45 or older.
- GDM was present in 7.6 per cent of those aged 20–24 years, 19.1 per cent of those aged 40–44 years and 27.7 per cent of those aged 45 or older.
- In total, 665 women who gave birth to singleton babies in 2016 had PGD and 9,696 had GDM.
- Given the substantial number of affected women, the risk of perinatal death associated with PGD and GDM for births in 2016 was investigated. Births before 28 weeks' gestation are excluded from the GDM comparison because it is not usually known whether or not a pregnancy is affected by GDM until around 28 weeks.
- Women with PGD had a perinatal mortality rate of 12.0 per 1,000 births (9.0 stillbirths and 3.0 neonatal deaths) compared with 5.6 per 1,000 births (3.8 stillbirths and 1.8 neonatal deaths) for women without PGD (Figure 21).
- Women giving birth at 28 or more weeks' gestation who had GDM had a perinatal mortality rate of 2.0 per 1,000 births compared with 3.0 per thousand for those without GDM (Figure 22).
- Place of birth:
  - Nearly half of all women with type 1 diabetes gave birth at services with level 6 neonatal capability, followed by 18.6 per cent at level 4 services, 11.5 per cent at private hospitals with at least 2,000 births per year, 9.6 per cent at smaller private hospitals, 7.5 per cent at level 5 services and small numbers at level 3 and 2 services (Table 8).
  - One-quarter of women with type 2 diabetes gave birth at each of level 6 and level 5 services, 20 per cent at level 4, 13 per cent at large private hospitals, 10 per cent at smaller private hospitals and 5 per cent at level 2 or 3 services (Table 8).

- 71 per cent of women with type 1 diabetes gave birth by caesarean compared with 57 per cent of those with type 2 diabetes and 34 per cent of those without PGD.
- Babies of mothers with type 1 diabetes were more likely to:
  - be born before 37 weeks' gestation (33.6 per cent compared with 21.8 per cent of those with type 2 diabetes and 8.1 per cent of those without PGD)
  - have a birthweight above the 95th centile for sex, plurality and gestation (33.6 per cent compared with 14.6 per cent of those with type 2 and 4.8 per cent of those without PGD)
  - have neonatal hypoglycaemia (24.4 per cent compared with 12.3 per cent of those with type 2 and 3.2 per cent of those without PGD)
  - be admitted to neonatal intensive care (9.6 per cent compared with 6.2 per cent of those with type 2 and 1.8 per cent of those without PGD) or a special care nursery (55.9 per cent compared with 36.7 per cent of those with type 2 and 14.6 per cent of those without PGD) (Table 8).

Table 8: Perinatal mortality, morbidity and care associated with pre-gestational diabetes (PGD), births in Victoria in 2016

	No PGD		Type 1 PGD		Type 2 PGD	
	n	per cent	n	per cent	n	per cent
Baby						
Perinatal death (per 1000 births)	521	7.0	4	12.0	4	13.0
Neonatal hypoglycaemia	2,588	3.2	79	24.4	38	12.3
Baby admitted to Special Care Nursery	11,645	14.6	181	55.9	113	36.7
Baby admitted to Neonatal Intensive Care	1,475	1.8	31	9.6	19	6.2
Baby born before 37 weeks' gestation	6,483	8.1	109	33.6	67	21.8
Birthweight >95th centile	3,863	4.8	109	33.6	45	14.6
Mother						
Neonatal capability level of birth hospital						
6	17,359	22.1	152	47.2	81	26.8
5	11,274	14.3	24	7.5	74	24.5
4	17,961	22.8	60	18.6	61	20.2
3	9,951	12.6	15	4.7	14	4.6
2	3,162	4.0	3	0.9	1	0.3
Private hospital with 2000+ births/year	10,956	13.9	37	11.5	40	13.2
Private hospital with <2000 births/year	7,816	9.9	31	9.6	31	10.3
Birth by caesarean section	26,538	33.7	228	70.8	172	57.0





Note: Caution should be used interpreting this figure due to the small number of deaths of babies born to women with PDG



Figure 22: Perinatal deaths per 1,000 births at 28 or more weeks' gestation to women with and without gestational diabetes mellitus (GDM), adjusted births in Victoria, 2016

Note: Caution should be used interpreting this figure due to the small number of deaths of babies born to women with GDM.

### **Case study**

A 34-year-old woman in her third pregnancy presented to her family doctor at 12 weeks' gestation. Her doctor noted she had a strong family history of diabetes – her mother and older sister both had type 2 diabetes – and arranged for an immediate random blood glucose and HbA1C test. The random glucose was 11.5 mmol/l and the HbA1C was 65 mmol/mol (8.1 per cent), which is indicative of pre-existing type 2 diabetes. She was immediately referred to the diabetes service at the nearest level 6 maternity hospital where she was commenced on insulin therapy and given dietetic advice. Achieving normoglycaemia remained challenging, the last HbA1C before spontaneous rupturing of her membranes and giving birth at 37 weeks' was 48 mmol/ mol (6.6 per cent). The baby's birthweight was 4,000 g (> 97th centile) and his early neonatal course was complicated by neonatal hypoglycaemia and jaundice, eventually leaving the neonatal unit on the seventh day of life.

### Case study – key message

Women at risk of diabetes should be screened before pregnancy and if found to have diabetes be encouraged to achieve normoglycaemia before conceiving. If this has not occurred they should be tested as soon as they present in pregnancy.

### Good practice points

Women with diabetes need specialist care. Primary care of women with diabetes between pregnancies is important to future pregnancies.

Women with diabetes should have multidisciplinary specialist care that includes a clear documented plan for monitoring and early induction, particularly when poor glycaemic control and/or clinical or ultrasound evidence of macrosomia is present.

### Messages for consumers

Gestational diabetes is a common complication of pregnancy. With careful management there is no increased risk of perinatal loss. Diabetes that occurs before pregnancy is associated with higher risk and needs specialist care and careful management.

Women who are at increased risk of diabetes – including a history of GDM, family history of diabetes, BMI  $\ge$  35, previous baby whose birthweight was  $\ge$  4,500 g, polycystic ovarian syndrome, age 40 years or older, ethnicity with higher rates of diabetes – should be tested for diabetes before becoming pregnant.

### Further information

Australasian Diabetes in Pregnancy Society – Consensus guidelines for the management of patients with type 1 and type 2 diabetes in relation to pregnancy <a href="http://adips.org/downloads/adips\_pregdm\_guidelines.pdf">http://adips.org/downloads/adips\_pregdm\_guidelines.pdf</a>>.

# 7. Child and adolescent deaths

# 7.1 Overview

Child and adolescent mortality rates are relatively low in Victoria, and have been for some time. However, a number of young people continue to die from preventable causes, and this chapter highlights opportunities for Victoria to reduce these rates even further.

The main causes of death in infants and children up to 14 years are congenital anomalies and malignancies. However, for Victorian adolescents (15–17 years) the main causes of death are intentional self-harm (including suicide) and motor vehicle accidents.

### **Snapshot**

- Overall, mortality rates continue to decline, with slight year-on-year variation. In 2016 there were slightly fewer deaths (*n* = 131) than in 2015 (*n* = 155) for children and adolescents aged between one and 17 years, a similar number to that in 2014 (133) (Figures 23, 24).
- In 2016 mortality rates per 1,000 live births in Victoria for infants and those aged under five years are similar to the national rates (3.0 compared with 3.2; 3.7 compared with 3.9, respectively). However, Australia's rates were ranked 17th and 19th respectively in 2016 for the 34 OECD countries.
- The main causes of the 75 deaths in post-neonatal infants (28–364 days of age) in 2016 were:
  - congenital anomaly (47 per cent)
  - sudden infant death syndrome (19 per cent)
  - prematurity (9 per cent).
- Victoria's infant mortality rate was 3.0 per 1,000 live births in 2016 (Figure 23).
- The main causes of the 40 deaths in children aged 1–4 years in 2016 were:
  - congenital anomaly (43 per cent)
  - malignancy and undetermined cause of death (both 13 per cent)
  - drowning (10 per cent).
- Victoria's mortality rate for those aged under five years was 3.7 per 1,000 live births in 2016 (Figure 23).
- The main causes of the 28 deaths in children aged 5–9 years in 2016 were:
  - malignancy (43 per cent)
  - congenital anomaly (25 per cent)
  - other unintentional injury and undetermined cause of death (both 7 per cent).
- The main causes of the 21 deaths in children aged 10–14 years in 2016 were:
  - malignancy (33 per cent)
  - other acquired disease (14 per cent)
  - congenital anomaly, other conditions determined at birth, other unintentional injury and intentional self-harm (including suicide) (each 10 per cent).

- The main causes of the 42 deaths in adolescents aged 15–17 years in 2016 were:
  - intentional self-harm (including suicide) (38 per cent)
  - motor vehicle accidents (21 per cent)
  - congenital anomaly and undetermined cause of death (both 12 per cent).



Figure 23: Victoria's infant mortality and under five mortality rates, 2000–2016



Victorian rates of death for children 1–17 years of age between 1985 and 2016 are shown in Figure 24. Figure 24: Rates of death by age group, (excluding 28–364 days) Victoria, 1985–2016

Table 9 shows the proportion of deaths among Victorian children aged 28 days to 17 years in 2016 by the Index of Relative Social Disadvantage.

#### Table 9: Percentage of deaths aged 28 days to 17 years, by IRSD score, Victoria, 2016

	IRSD Quintile	%
Most Disadvantaged	1	25.2
	2	20.9
	3	19.4
	4	18.0
Least Disadvantaged	5	15.5

IRSD = Index of Relative Social Disadvantage, from Socio-Economic Indexes for Areas (SEIFA) 2011

This data is based on the place of residence of the 204 deaths (missing=2) of Victorian residents aged 28 days to 17 years, occurring in Victoria in 2016. This data is based on the Australian SA1 Decile (IRSD 2011)

### Good practice points

### 1. Serious bacterial infections due to gram-positive bacteria

Group A streptococcal and staphylococcal infections (including community-acquired methicillinresistant *Staphylococcus aureus*) are increasingly common in the Victorian community and particularly so among high-risk populations including Aboriginal, Pacific Islander and Indian children. They also occur in many children with no clear vulnerability. Serious cases of pneumonia from *Streptococcus pneumoniae* still occur, even in vaccinated children.

Children with likely serious bacterial infection or toxin-mediated disease from gram-positive organisms should be treated promptly with antibiotics and referred. The signs are non-specific but include fever, erythematous sunburn-like rash, limb pain or limitation of movement, poor feeding, abdominal pain, diarrhoea, lethargy, throat infection, pleural effusion and oliguria. It is the persistence of these signs, the presence of multiple signs, or their extreme nature (for example, a temperature of 40°C in a child who refuses to walk or child who has been given the diagnosis of bronchiolitis but has a pleural effusion), that signals likely serious bacterial infection rather than a common viral syndrome. A full assessment of the severity of illness is indicated, including blood pressure to assess for postural hypotension. A blood culture and full blood examination should be done, and if the child has several signs of serious infection, initial antibiotics should include a third-generation cephalosporin, flucloxacillin and clindamycin.

Unrecognised shock is often seen in toxin-mediated disease due to *Staphylococcus* or *Streptococcus*. Early resuscitation with oxygen and fluid is critical. Seek urgent advice in any child with suspected severe sepsis and any one of the following:

- venous blood lactate above 3 mmol/L
- neutropenia (neutrophil count < 1,000 / mm3), unexpected (not related to cancer chemotherapy)
- large pleural effusion (for example, near white-out of hemi-thorax)
- coagulopathy (INR > 1.6, APTT > 60, Fib < 1)</li>
- Signs of shock<sup>a</sup> persisting despite a total of 40 mL per kg fluid

Despite substantial reductions in childhood infections due to *Streptococcus pneumoniae* because of vaccination, severe pneumococcal pneumonia still occurs, sometimes from non-vaccine strains and sometimes because of waning or inadequate immunity in vaccine-strains. An empyema or pleural effusion, even in a child with a known viral infection, may be due to pneumonia from *Streptococcus pneumoniae*, *Staphylococcus aureus* or group A streptococcal infection. Children have died in Victoria from failure to drain pleural effusions.

Serious bacterial infection often occurs after an initial viral syndrome (often in association with a similar viral illness in siblings). The fact the child had features commonly seen in viral infections – coryza, sore throat and so on – or that other members of the family also have an obvious viral infection, does not mean that a serious bacterial infection can be ruled out in an unwell child. Failure to recover quickly, especially where more serious features as above appear, should trigger alerts and review.

In such children giving antipyretics (ibuprofen or paracetamol) can mask signs of bacterial sepsis, delay presentation and make the infection worse.

a Signs of shock include capillary refill longer than 3 seconds, low-volume pulses, hypotension, tachypnoea, lethargic and poor conscious state.

### 2. Infant jaundice awareness among health professionals

Although jaundice in newborn infants occurs in approximately 60 per cent and is usually self-limiting, it is important to recognise pathological jaundice early and to treat it to prevent serious sequelae.

Jaundice should be investigated if it occurs:

- within the first 24 hours of life
- if the serum bilirubin concentration exceeds 200–250 mmol/L between 24 hours and 10 days of life
- if it continues past 10 days of life, and especially after two weeks of age.

Breastfeeding jaundice after 10 days of life should only be considered if other conditions have been excluded.

Conjugated hyperbilirubinaemia is abnormal and needs to be investigated.

#### 3. Brain injury – ABC and treat signs of raised intracranial pressure

After a traumatic or hypoxic-ischaemic brain injury, if the child does not have a purposeful response to pain (or GCS < 8), early endotracheal intubation is required to control respiration (providing skilled staff are available) – even if the child has a patent airway. This is particularly important if there is bradycardia or hypertension (using values appropriate for the age of the child), as these findings suggest there may be raised intracranial pressure. Aim for mild hyperventilation (pCO<sub>2</sub> 35–40 mmHg), but avoid severe hyperventilation (pCO<sub>2</sub> < 35 mmHg) because this may cause cerebral ischaemia. After a severe brain injury, the child should remain intubated for several days – the tube should not be removed just because there is spontaneous respiration (Fletcher et al. 1987). Such a child should be urgently referred to a tertiary paediatric centre through PIPER.

### 4. Brain injury – recovery despite fixed dilated pupils

Prediction of outcome in brain injury is complex and requires an integration of information on aetiology, clinical signs and symptoms of brain dysfunction, biochemical markers, neuroimaging and sometimes electrical studies. No one sign predicts outcome precisely. In the first 48 hours after traumatic or hypoxic-ischaemic brain injury, fixed dilated pupils do not rule out the possibility of a good recovery, especially if large doses of atropine, dopamine or adrenaline have been given (Yung and Herrema 2000, Ong and Bruning, 1981). Neurological recovery has been reported in patients with unresponsive pupils up to 48–72 hours after acute brain injury (Bertini et al. 1989). Such a child should be urgently referred to a tertiary paediatric centre through PIPER.

### 5. Intussusception also occurs in older children

Although intussusception is more likely to occur in the two-month to two-year age group, with a peak incidence at five to nine months, it may occur at any age, and 15 per cent of cases occur in children aged over three years. Intussusception must be considered as a differential diagnosis in children of all ages with persistent vomiting, particularly if associated with intermittent severe abdominal pain (Justice et al. 2005).

### 6. Understand the total fluid intake and type of intravenous fluid in children

Among hospitalised children intravenous fluids are one of the most commonly prescribed components of treatment. Internationally many deaths have occurred in children from iatrogenic hyponatraemia and cerebral oedema in sick children. Excessive amounts of fluid in children who have high antidiuretic hormone levels because of illness is a potent factor, and it is not always possible to identify the children at most risk. Even when prescribed standard amounts of maintenance intravenous fluid, children may end up receiving much larger volumes as their total fluid intake. The combination of hypotonic intravenous fluid at maintenance rates, plus oral and nasogastric fluid, can cause severe hyponatraemia and cerebral oedema. Pay attention to the child's total fluid intake, including other sources of fluid such as enteral fluids, drug flushes and dilutions. In unwell children these additional sources of fluid can add 50 per cent to the prescribed maintenance fluid. Use maintenance fluid with some glucose and a similar sodium concentration to plasma for the most unwell children who need intravenous fluids: Plasma-Lyte, Hartmann's solution or 0.9 per cent NaCl. If children with severe pneumonia, bronchiolitis or meningitis need to be on intravenous fluid, unless they have signs of dehydration, start with 50 per cent of standard maintenance fluid rates.

### 7. Children with headache – beware of red flags

Headache is a common symptom in childhood, and while intracranial lesions and other pathology are uncommon, the 'red flags' in the history and examination need to be carefully looked for and excluded. Red flag symptoms and signs include: acute and severe headache; progressive chronic headaches; focal neurology; age under three years; headache/vomiting on waking; consistent localisation of recurrent headaches; presence of ventriculoperitoneal shunt; hypertension; and papilloedema.

Any child with a headache and one or more red flags should be consulted with the local paediatric team to arrange urgent imaging (CT or MRI).

For further information see:<http://www.rch.org.au/clinicalguide/guideline\_index/Headache/>.

### 8. The criteria for reporting deaths to the coroner - when in doubt seek advice

The reporting of a death to the Coroner is necessary when: a person dies unexpectedly; a person dies as a result of accident or injury; a person dies in a violent or unnatural way; or death occurred during or following a medical procedure where death was not expected.

Reporting is necessary when a medical certificate as to the cause of death is not signed or is unlikely to be signed. There are special provisions applicable to deceased persons who have been in custody or care and for those who have been subject to the *Mental Health Act 2014*.

Clinicians considering certifying the cause of a child's death need to be vigilant about assigning a cause of death based on their knowledge of the child's condition – for example, asthma and epilepsy. There is evidence that even the most experienced clinicians may be unduly influenced by prior knowledge and fail to consider other possible causes of death. Even with a known cause of death (for example, asthma or epilepsy), if the death was unexpected, the Coroners' Office should be consulted. Doctors should always consider seeking the advice of a more senior medical practitioner, or even a colleague, when deciding whether or not to report to the Coroner.

Advice from the Coroners' Office is available 24 hours a day seven days a week on 1300 309 519. The Coroners' Court of Victoria also provides <u>clear advice</u> on its easily accessible website at <<u>http://www.coronerscourt.vic.gov.au</u>>. The Royal Children's Hospital, Melbourne, provides an excellent practical summary of reporting children's deaths. Go to its <u>website</u> at <<u>http://www.rch.org.au</u>> and choose 'General Medicine Clinical Practice Guidelines'.

The best rule is: When in doubt, report or at least seek advice from the Coroners' Office <<u>http://www.coronerscourt.vic.gov.au/></u>.

### 9. Pertussis – need for urgent exchange transfusion

Pertussis (whooping cough) should be suspected in any infant with an acute illness and a total white cell count over 30,000/mm<sup>3</sup>. A whoop is rare in infants, and there may be no fever. Infants may present with respiratory distress, apnoea or encephalopathy. If the white cell count is over 50,000/mm<sup>3</sup> and there is respiratory or cardiac failure, especially with evidence of pulmonary hypertension on echocardiography, exchange transfusion should be performed urgently to reduce the white cell count below 50,000/mm<sup>3</sup> (Chantreuil et al. 2015; Rowlands et al. 2010). Such a child should be urgently referred to a tertiary paediatric centre through PIPER.

#### 10. Importance of cardiac review of any child who collapses and requires resuscitation

Transient loss of consciousness in children and young people is a fairly common presentation to health practitioners and emergency departments. Most events are benign in aetiology, with the majority being due to vasovagal syncope (fainting). A small, but not insignificant, proportion are due to a more important cause such as a seizure disorder, a dysrhythmia or another structural (for example, aortic stenosis) or functional (for example, cardiomyopathy) cardiac disorder. Seizure disorders are important but not usually life-threatening and will usually be suspected based on physical features such as convulsive movements. Cardiac disorders, in particular dysrhythmias, are important not to miss because subsequent episodes may be fatal. Following an episode of collapse in a child that requires resuscitation, or where an underlying cardiac anomaly cannot be immediately excluded, the child should be referred to a paediatric cardiologist or a paediatrician and admitted as an inpatient.

Red flags that may suggest the need for more extensive investigation/referral include:

- exertional onset
- chest pain
- dyspnoea
- palpitations
- family history of dysrhythmia or sudden unexpected death aged under 45 years
- · need for cardiopulmonary resuscitation during an event
- severe headache
- focal neurologic deficits
- diplopia
- ataxia
- dysarthria
- any relevant abnormality on physical examination or in the standard electrocardiogram (ECG).

All patients presenting for medical care following a transient loss of consciousness should have a standard 12-lead ECG to look for a dysrhythmia or prodysrhythmic abnormality (such as Wolff-Parkinson-White, prolonged QT and Brugada syndromes). Paediatric ECGs have significant differences from adult ECGs. Sometimes ECGs need to be performed in emergency department settings after hours or in other circumstances where there may not be expertise in reading paediatric ECGs. When this is the case it is important that mechanisms are in place to ensure the ECG is reviewed by someone experienced in paediatric ECG reading (paediatric cardiologist or paediatrician) and followup organised when abnormalities are found.

### 11. Pholcodine – remove from sale in Australia

Sales of pholodine should be banned. It is freely available over the counter as a cough suppressant, but there is no scientific evidence it is effective and it increases the risk of severe anaphylaxis to the muscle relaxants suxamethonium and rocuronium (McAleer et al. 2017). When pholodine was withdrawn in Scandinavia, the number of cases of severe anaphylaxis during anaesthesia fell from 37 per year to zero in Sweden (Johansen et al. 2009) and from 28 per year to seven per year in Norway (Florvaag et al. 2011).

### 12. Prolonged use of antibiotics – adhere to antibiotic guidelines

Prolonged use of antibiotics leads to multi-resistant bacterial infection. Victoria has hospital-acquired infections in children and neonates due to extended spectrum beta-lactamase producing gramnegative bacteria. There have been child deaths reported from carbapenem-resistant gram-negative bacteria associated with prolonged antibiotic exposure in the past few years. Victoria has increasing community-acquired methicillin-resistant *Staphylococcus aureus*. There is a need for adherence to antibiotic guidelines, antibiotic stewardship programs, restriction of prescribing of broad-spectrum antibiotics through a drug usage committee process, criteria for ceasing or scaling back antibiotics, and audit.

### Further information

Royal Children's Hospital – Clinical practice guideline on *Syncope* contains additional advice on investigation and management <<u>https://www.rch.org.au/clinicalguide/guideline\_index/Syncope/</u>>.

Royal Children's Hospital – Headache < https://www.rch.org.au/clinicalguide/guideline\_index/Headache/>.

Royal Children's Hospital – Antibiotic guidelines for community-acquired suspected bacterial infections in children <a href="https://www.rch.org.au/clinicalguide/guideline\_index/Antibiotics/">https://www.rch.org.au/clinicalguide/guideline\_index/Antibiotics/</a>.

Better Health Channel – infant jaundice <<u>https://www2.health.vic.gov.au/hospitals-and-health-services/</u>patient-care/perinatal-reproductive/neonatal-ehandbook/conditions/jaundice>.

# 7.2 The complexities of adolescent health

Adolescents need support during this important time in their development. Although the adolescent focus on individuation is well recognised, adolescents continue to closely observe the relationships they witness their parents, guardians and caregivers have with others as role models. Listening to and modelling good behaviours and approaches to stress and conflict will assist adolescents in their own responses to difficulty. Listening to and relating openly to adolescents in an open and non-judgemental manner will help adults to understand the perspective of the adolescent.

Adolescence is a time of great stress for many young people. Rapid physical, emotional and social development, leading to increased autonomy and independence together with increased risk-taking behaviour and mental health issues can lead to morbidity and mortality. Young people with chronic illness are at greater risk, especially if they do not adhere to treatment regimens or miss follow-up appointments.

### Snapshot

- As children grow, they are less likely to die from conditions determined at birth (for example, congenital anomaly), and more likely to die from acquired disease or injury (intentional or unintentional) (Figures 25–27).
- In 2016, 63 children and teenagers died between the ages of 10 and 17 years in Victoria.
- 18/63 (29 per cent) died from intentional self-harm (including suicide).
- 16/63 (25 per cent) died from unintentional injury, including those arising from risk-taking behaviours.
- A number of adolescents who died in 2016 suffered from comorbidities including chronic disease, alcohol or illicit drug use or mental health issues.
- Non-adherence to treatment regimens, irregular attendance at follow-up and failure by caregivers
  or clinicians to appreciate the importance of new symptoms or signs, were identified as contributing
  factors in the deaths of some adolescents who died from causes other than intentional and
  unintentional injury in Victoria in 2016.



#### Figure 25: Rates of death by age group (excluding 28–364 days), Victoria, 1985–2016







Figure 27: Rates of intentional self-harm in adolescents, 2005–2016

### Case studies

### Case study 1

A 15-year-old girl was found dead by her parents, with evidence of drug overdose. She had been having difficulties with friendships at school and had missed about 25 per cent of school in 2016. She became increasingly withdrawn and subsequently engaged in risk-taking behaviours, which created conflict with her parents and led to her frequently not returning home in the evenings. Her family disapproved of her boyfriend, an older male. Her general practitioner diagnosed her with anxiety and depression. Her family and general practitioner tried to engage her with a psychologist; however, she did not continue to attend the appointments. She left school. Illicit drug and alcohol use escalated. She stole from family members to support her drug addiction. Her family sought to admit her to a rehabilitation centre; however, she refused to be admitted. Conflict with her parents grew, and she was absent from the home for many days at a time. Her death was unexpected, but a downward spiral was evident to family and health service providers.

### Case study 1 – key message

It is important to provide services for adolescents with the dual problems of substance dependence (for example, alcohol or other drugs) and mental health problems.

### Case study 2

A 16-year-old male with a history of attention deficit hyperactivity disorder (ADHD), depression and a chronic pain syndrome complained of a new onset abdominal pain. This pain was initially intermittent in nature and occurred over a number of months and was described as causing abdominal swelling and pain. No investigations were undertaken despite him presenting to two general practitioners and two health services in a single day. He presented six hours later with severe abdominal pain, distension and bilious vomiting, and was diagnosed with shock associated with malrotation and volvulus. Despite surgery he did not survive.

### Case study 2 – key message

An acute severe illness in children and adolescents with concurrent behavioural, mental health or other chronic disease issues can be missed if an objective consideration of the new presenting symptoms and signs (especially vital signs) is not undertaken. Recognition of true intercurrent severe illness by the regular clinician or referring to a different clinician to independently assess new symptoms or signs can prevent misdiagnosis of a new illness.

### Good practice points

### 1. Appendicitis in adolescents

Appendicitis is a common diagnosis in the child and adolescent population, with the incidence of appendicitis increasing with age, peaking in the teenage years. The symptoms of appendicitis in older adolescents are similar to that of younger children. However, the diagnosis of appendicitis in older adolescents may be delayed or missed due to a teenager's apparent stoicism or delay in seeking medical attention. Delay in the diagnosis of appendicitis may result in perforation, sepsis or even death.

Key points:

- Clinicians should be cognisant of the possibility of appendicitis in adolescents presenting with sudden or recent onset abdominal pain.
- Clinicians should take into account that an adolescent with appendicitis may minimise their symptoms.
- Parents should be advised to seek medical examination of adolescents if their abdominal pain is:
   severe
  - localising to the right lower quadrant
  - not resolving in 24 hours
  - accompanied by other symptoms such as fever, vomiting for more than 24 hours, pallor, sweatiness.

The Better Health channel has more information about <u>abdominal pain in children</u> at <https://www.betterhealth.vic.gov.au/health/conditionsandtreatments/abdominal-pain-in-children>.

### 2. Recognition of new acute severe illness in children and adolescents with comorbidities

A new acute severe illness in children and adolescents with concurrent behavioural, mental health or other chronic disease issues can be missed if an objective consideration of the new presenting symptoms and signs (especially vital signs) is not undertaken. Recognition of true intercurrent severe illness by the regular clinician or referring to a different clinician to independently assess new symptoms or signs can prevent misdiagnosis of a new illness.

### 3. Children and adolescents with chronic health conditions

Children and adolescents with chronic health conditions are a vulnerable group who are at added risk when they miss medication, miss appointments and have conditions that require the input of multiple services. Clinicians need to be aware of the risks for this group of children and adolescents and to ensure follow-up appointments are made and consider comprehensive care planning. Children and adolescents with potentially life-threatening conditions who frequently miss appointments or are noncompliant with medication, or whose caregivers are not able to meet the needs of the child, require additional involvement.

### 4. Services for the dual problem of substance dependence and mental health issues

It is important to provide services for adolescents with the dual problems of substance dependence (for example, alcohol or other drugs) and mental health problems.

### 5. Eating disorders

Eating disorders are mental health conditions that affect both females and males. Eating disorders often cause serious physical morbidity or even life-threatening complications. Anorexia nervosa has the highest lifetime mortality rate of any psychiatric disorder (Athey 2003, Fichter and Quadflieg 2016) (estimates up to 25 per cent lifetime risk of premature death). The risk of premature death is usually related to medical complications (Athey 2003, Fichter and Quadflieg 2016), However, intentional self-harm (including suicide) has also been identified as a major cause of death (Preti et al 2011).

Optimal treatment of eating disorders involves a multidisciplinary approach. While general practitioners and paediatricians are well placed to monitor the physical condition of patients with eating disorders, effective therapeutic psychological interventions, such as family-based treatment, are best delivered through a mental health practitioner experienced in treating eating disorders.

Specialist eating disorder services for children exist within the child and adolescent mental health services (CAMHS) across Victoria.

Weight restoration early in treatment suggests better long-term prognosis.

Children/adolescents with any of the following symptoms or signs are likely to need admission to a hospital ward for medical stabilisation and should be discussed with a paediatrician with experience in stabilising such patients:

- significant weight loss (> 30 per cent of pre-morbid weight, even if current weight is not low: about one in six patients with anorexia nervosa who are medically unstable due to weight loss are overweight at the time)
- bradycardia (resting heart rate < 50 bpm)</li>
- postural hypotension (fall in systolic blood pressure lying to standing >20 mmHg)
- dehydration
- hypothermia (temperature <35°C oral)
- electrolyte abnormalities (for example, hypokalaemia, hypernatraemia).

### 6. Impact of poor school attendance / disengagement from school on mental health

Children with poor school attendance or disengagement from mainstream school are at higher risk than their peers of mental health issues such as anxiety and depression.

The reasons for poor school attendance or disengagement from school are complex and often multifactorial. Contributing factors can include: chronic illness or disability; behavioural issues (including ADHD), which led to suspension from school; learning difficulties leading to anxiety regarding school performance; primary mental health issues such as anxiety or depression; peer issues; and parental illness, capacity or beliefs.

While many children with a number of these contributing factors come into regular and frequent contact with health professionals, conversely, these children may be over-represented in those who fail to engage with health professionals.

Health professionals managing children with conditions that may impact on school attendance should routinely assess a child's / young person's attendance. If school attendance is affected, the health professional should formally screen the child's / young person's mental health or arrange for this to be done.

Health professionals are in a unique position to advocate for additional support for children / young people who are struggling to attend school, and to refer to appropriate mental health services if needed.

### 7. Overdose of unknown synthetic recreational drugs: the need for toxidromic approaches

The range and availability of synthetic recreational drugs has rapidly increased over recent years. Health professionals working in emergency departments and intensive care units are increasingly faced with patients presenting with overdose, intoxication and/or the behavioural or mental health effects resulting from the ingestion of substances (often multiple), the composition of which is unknown at the time of presentation.

As such, clinicians need to become familiar with 'toxidromic' approaches (rather than drug-specific) to manage such ingestions.

Early consultation with on-call toxicologists is essential in managing such patients. In general, adult services have more expertise in managing such patients, but paediatric services need to ensure they are able to respond as needed to younger adolescents presenting in this way.

The Poisons Information Centre can provide support on 13 11 26.

### Further Information

raisingchildren.net.au – Social and emotional changes in adolescence <<u>http://raisingchildren.net.au/articles/</u>social\_and\_emotional\_development\_teenagers.html/context/1153>.

# 7.3 Minimising deaths from unintentional injuries

Despite declines in child and adolescent deaths over the past 30 years from unintentional injuries, children die unnecessarily in Victoria each year from avoidable injuries (Figures 28, 29).

Children continue to die from a lack of supervision around water and from a lack of protection from other hazards such as roadways, swimming pools and dams, foreign objects and medications that can be swallowed, guns that are incorrectly stored or where children and adolescents can access the keys to gun safes, motorised vehicles or locked medicine cabinets.

It is illegal to have a child not properly restrained in a car.

Legislation and regulation of safety measures (for example, seatbelts, child car restraints, pool fencing, blood alcohol testing and product design standards) together with parental education have reduced the number of unintentional injuries; however, not all hazards can be removed with these methods. **Parental supervision and awareness of potential hazards are essential to minimise the deaths from unintentional injury.** 

### Snapshot

- 31 children and adolescents died from unintentional injury in 2016.
- Of the 31 children and adolescents who died, eight (26 per cent) were aged 1–4 years and 12 (39 per cent) were aged 15–17 years.
- 13 (42 per cent) died from motor vehicle accident (three as pedestrians).
- Seven (23 per cent) drowned (three in the bath or shower).
- Four (13 per cent) died from unintentional drug overdose.









### Case study

A four-year-old previously well girl was briefly left unattended in the bath while her parents were elsewhere in the home. She had a history of two convulsions related to fever at the age of two years. She had been mildly unwell with a cold but was not noted to be febrile. She was left unattended for approximately five minutes, at which time she was found face down in the bath. She was unable to be resuscitated.

### Case study – key messages

A child under five years of age should never be left alone in the bath, nor should they be left in the care of an older child, even for a short period of time.

Children older than five years of age may still need constant active supervision in the bath if they have a developmental delay or a history of seizures. If they have epilepsy or uncontrolled seizures they should be supervised regardless of age.

### Good practice points

### 1. Supervising children in the bath

The Royal Life Saving Society – Australia recommends that a child under five years of age should never be left alone in the bath, nor should they be left in the care of an older child, even for a short period of time.

If a child is old enough to want to bathe alone, they should shower, and keep the bathroom door unlocked and open.

Children older than five years of age may still need constant active supervision in the bath if they have a developmental delay or a history of seizures. If they have epilepsy or uncontrolled seizures they should be supervised regardless of age.

Children who have epilepsy are at increased risk of drowning, and deaths in these circumstances have been seen in Victoria. Children living with epilepsy should never be left unattended in the bath or shower, or go swimming without an adult within reach, observing them at all times.

The Royal Life Saving Society – Australia provides more information about <u>bath time supervision</u> at <a href="https://www.royallifesaving.com.au/programs/keep-watch-toddler-drowning-prevention-program/keep-watch-@-bath-time">https://www.royallifesaving.com.au/programs/keep-watch-toddler-drowning-prevention-program/keep-watch-@-bath-time</a>>.

### 2. Button batteries and rapid erosion

Button batteries that are lodged in the oesophagus, or inserted into the nose, can rapidly cause severe erosive injury and must be urgently removed. It is a time-critical event, and children have died when the battery was not removed within hours. There may not be a clear history of ingestion of a foreign body and a high index of suspicion is needed. Symptoms may include difficulty swallowing, drooling, refusing to eat, persistent vomiting or gagging, pain in the chest, unexplained fever or listlessness. Obtain a plain lower neck, chest and abdominal anteroposterior (AP) x-ray (one film) to determine the position of the foreign body. Beware that button batteries can be mistaken for coins or other objects. Button batteries may have a 'halo sign' (double rim) on the AP film, or a 'step-off' sign seen on the lateral x-ray; however, do not rely on these signs (or their absence). If there is suspicion for a button battery in the oesophagus then it needs to be removed urgently. Batteries in the nose are more readily visible and must be urgently removed.

### For further information see:

<a href="https://www.rch.org.au/clinicalguide/guideline\_index/Foreign\_body\_ingestion/">https://www.rch.org.au/clinicalguide/guideline\_index/Foreign\_body\_ingestion/</a>>.

### 3. Dangers of ingesting opiate replacement therapy (ORT) for children and adolescents

The prescription of 'take-away' doses of ORT (in particular methadone) for home consumption creates a risk of death from accidental or deliberate ingestion by children and adolescents living in the home.

A Checklist for assessing the appropriateness of take-away doses of ORT (see <<u>https://www2.health.</u> vic.gov.au/public-health/drugs-and-poisons/pharmacotherapy/policy-resources-pharmacotherapy>) was developed in 2016. It includes absolute contraindications to prescribing take-away ORT:

- overdose to any substance reported
- · reported diversion of doses to others, sharing or trading doses
- no safe and secure storage facility available
- concerns about risk of harm to self or others.

The checklist does not contain any specific prompt for prescribers to discuss or consider the risk to children or adolescents or any other at risk group (for example, children or adults with a disability) who may accidentally or intentionally access the take-away ORT dose. Nor is it compulsory for a prescriber to complete this checklist when commencing a patient on ORT or changing to take-away doses.

CCOPMM recognises that take-away doses of ORT often allow adults living with children to better function and to care for children living with them. It is therefore important to strike a balance between allowing adults access to take-away doses of ORT where appropriate, and introducing measures around safe storage of ORT, which may have the unintentional consequence of creating barriers to treatment for drug-dependent adults.

CCOPMM recommends that:

- 1. The *Checklist for assessing the appropriateness of take-away doses* include prompts that specifically address the issues of safe storage of the take-away ORT doses in households where children, adolescents or those with disability may have access to ORT.
- 2. Prescribers of take-away ORT be regularly oriented to the checklist and go through the list each time they prescribe take-away ORT.
- 3. Pharmacists who dispense take-away doses of ORT be clearly oriented to the checklist and go through the list with clients each time they dispense ORT.
- 4. The state government consults with drug and alcohol peak bodies regarding the feasibility of legislation relating to the safe storage of take-away doses of ORT, similar to legislation relating to the safe storage of firearms.

### Messages for consumers

#### **Car restraints**

Properly fitted and fastened infant and child car restraints save lives and must be used at all times the child is in the car. It is illegal and dangerous for children to be unrestrained in a moving car.

### Storage of firearms

There are specific storage requirements that must be met to possess a firearm licence in Victoria. These are set out in Schedule 4 of the *Firearms Act 1996* and include the requirement that the firearm and the ammunition are stored in separate locked containers.

To ensure safe storage, it is essential that non-licensed people (including children) do not have the means of access to these containers, and the keys or codes to access the containers are kept secure.

#### Supervising children in the bath

The Royal Life Saving Society – Australia recommends that a child under five years of age should never be left alone in the bath, nor should they be left in the care of an older child, even for a short period of time. Proper preparation prior to filling a bath should include being prepared by having towels, clothes and other bathing items ready, and ignoring potential distractions such as telephones and doorbells.

If a child is old enough to want to bathe alone, they should shower, and keep the bathroom door unlocked and open. Children older than five years of age may still need constant active supervision in the bath if they have a developmental delay or a history of seizures. If they have epilepsy or uncontrolled seizures they should be supervised regardless of age.

The Royal Life Saving Society – Australia provides more information about <u>bath time supervision</u> at <<u>https://www.royallifesaving.com.au/programs/keep-watch-toddler-drowning-prevention-program/keep-watch-@-bath-time></u>.

#### The dangers of button batteries

Button batteries and items containing button batteries must be stored appropriately to avoid young children from accessing them. If there is any possibility that a button battery has been swallowed, urgent medical help should be sought.

#### Keep opiate replacement therapy (ORT) take-away doses away from children and adolescents

Take-away doses of ORT must be safely and securely stored in the home to prevent children and adolescents from accidentally accessing and ingesting them.

### Further information

KidSafe - Child Accident Prevention Society of Australia < http://www.kidsafe.com.au/>.

#### The Royal Life Saving Society – Australia

The Royal Children's Hospital fact sheets <<u>http://www.rch.org.au/kidsinfo/#tab-F</u>>.

Kids Health Info App <<u>http://www.rch.org.au/kidsinfo/#tab-F</u>>.

Better Health Channel <<u>https://www.betterhealth.vic.gov.au/</u>>.

Raising Children Network <<u>http://raisingchildren.net.au/</u>>.

# 7.4 The dangers of suboptimal management of chronic disease

Children with chronic disease are at higher risk of death due not only to the nature of their disease but also due to suboptimal management and treatment of their disease or associated comorbidities, including the development of mental health issues.

The Child and Adolescent Mortality and Morbidity Subcommittee continues to review deaths of children with chronic disease who are not receiving optimal treatment. This includes a lack of understanding of the severity of the condition and poor engagement with healthcare and other services leading to failure to adhere to the treatment plan or regular attendance for review. Many of these children have nutritional problems, educational failure and poor psychological health and wellbeing. Some children develop mental health problems in association with their chronic disease. In addition, many of these children live in homes where there is social marginalisation, poverty or parental mental health or drug and alcohol issues.

### Case studies

### Case study 1

A 12-year-old boy with chronic asthma presented to the emergency department of a regional hospital with acute severe asthma and was unable to be resuscitated. His history included poor compliance with medication, frequent non-attendance at medical review, multiple hospital admissions for asthma (including to the intensive care unit) and daily use of reliever medications. His family circumstances were complicated by frequent changes of address (leading to poor school attendance and a lack of a regular general practitioner) and parental mental health and substance dependence concerns.

### Case study 1 – key messages

Patients whose asthma is poorly controlled despite preventive treatment should be referred for specialist review by a paediatrician. Children with underlying chronic disease should be closely monitored. Persistent non-attendance at appointments or noncompliance with medication or treatment plans may become a welfare issue and even, in the event of risk to child safety, a child protection issue. Every child has the right to optimal treatment.

### Case study 2

A 15-year-old boy with epilepsy was found dead in his bed. His previous attendance at medical review was intermittent, and he frequently ran out of his antiepileptic medication. His seizures increased in frequency and he attended outpatient review. A new medication was commenced with a gradual increase in dose, with withdrawal of his old medication. He failed to attend an outpatient review and ran out of medication. He had not taken his medication for at least a week prior to death.

#### Case study 2 - key messages

Children and adolescents with refractory or difficult-to-control epilepsy should have an individualised care plan, be treated by a paediatrician with expertise in epilepsy, and have regular review of the adequacy of seizure control. Non-attendance at appointments or non-adherence with medications needs to be followed up to minimise the risk of sudden unexpected death in epilepsy (SUDEP). Families should be advised of increased risk of SUDEP if medication is ceased or if there is poor compliance.

### Good practice points

#### 1. Comprehensive care planning in children and adolescents with chronic health conditions

Children and adolescents with chronic health conditions are a vulnerable group who are at added risk when they miss medication, miss appointments and have conditions that require the input of multiple services. Clinicians need to be aware of the risks for this group of children and adolescents and to ensure follow-up appointments are made and consider *comprehensive care planning*. Children and adolescents with potentially life-threatening conditions who frequently miss appointments or are noncompliant with medication, or whose caregivers are not able to meet the needs of the child, require additional involvement.

### 2. Children and adolescents with epilepsy

Children and adolescents with refractory or difficult to control epilepsy should have an individualised care plan, be treated by a paediatrician with expertise in epilepsy, and have regular review of the adequacy of seizure control. Non-attendance at appointments or non-adherence with medications needs to be followed up to minimise the risk of SUDEP. Families should be advised of increased risk of SUDEP if medication is ceased or if there is poor compliance.

Children who have epilepsy are at increased risk of drowning, and deaths in these circumstances have been seen in Victoria. Children living with epilepsy should never be left unattended in the bath or shower or go swimming without an adult within reach, observing them at all times.

#### 3. Recognition of new acute severe illness in children and adolescents with comorbidities

A new acute severe illness in children and adolescents with concurrent behavioural, mental health or other chronic disease issues can be missed if an objective consideration of the new presenting symptoms and signs (especially vital signs) is not undertaken. Recognition of true intercurrent severe illness by the regular clinician or referring to a different clinician to independently assess new symptoms or signs can prevent misdiagnosis of a new illness.

### 4. Asthma

Best practice in asthma treatment requires treatment of acute exacerbations plus review of preventive treatment. Preventive treatment needs to be considered, or reviewed, if either:

- wheezing episodes occur less than six weeks apart
- · exacerbations are becoming more frequent and severe, or
- there are increasing interval symptoms.

Patients whose asthma is poorly controlled despite preventive treatment should be referred for specialist review by a paediatrician.

It is important that there is clear and documented communication between the discharging hospital, the patient and their general practitioner regarding the discharge plan and responsibility for follow-up of both the acute episode and the longer term management.

The Royal Children's Hospital provides a <u>template to follow</u> at <<u>http://www.rch.org.au/clinicalguide/</u> guideline\_index/Asthma\_Discharge\_Pack/>.

The *Australian asthma handbook* (version 1.2, 2016) by the National Asthma Council Australia provides new national asthma guidelines to assist all health professionals. See <<u>http://www.asthmahandbook.org.au/></u>.

### 5. Co-existent asthma and anaphylaxis

Prompt and repeated administration of adrenaline in patients with known potential for anaphylaxis who present with apparent acute severe asthma could prevent death in the event of diagnostic difficulty.

The Victorian statewide clinical practice guideline on managing anaphylaxis has recently been revised to emphasise this.

The good practice points from the CCOPMM 2012–2015 reports remain relevant. They are repeated here, with updated information.

Children and adolescent asthma plans should be reviewed regularly and encompass asthma control, medication review, education and understanding of emergency care.

Clinicians are required to create asthma plans that can be easily followed by adolescents and, in the case of children, their families and carers.

Children with food allergy or anaphylaxis need to have regular review with their medical practitioner to:

- have ongoing education and reinforcement of the avoidance of triggers, and the recognition and
   emergency management of anaphylaxis
- receive prescriptions to ensure their adrenaline auto-injectors are up to date
- ensure the correct dose for weight is prescribed
- review symptoms so the management plan can be changed if needed
- ensure competence in recognition and emergency management of anaphylaxis is maintained.

The early administration of adrenaline is essential in managing anaphylaxis.

Children with severe anaphylaxis will need repeated doses of adrenaline. After the second dose if there is **no resolution of symptoms within five minutes**, a continuous intravenous infusion of adrenaline should be commenced if practitioners have the skills and equipment available.

Children who have suffered anaphylaxis should be admitted for observation to an emergency department or short-stay unit for four to six hours.

A history of food allergy is not a contraindication to exercise. However, children who have had an acute allergic reaction or any signs of anaphylaxis to food should do no strenuous exercise for two to four hours to minimise the risk of worsening anaphylaxis.

Health workers and parents need to appreciate the dangers of asthma and anaphylaxis together. The treatment is adrenaline. Affected children and parents should be encouraged to carry an adrenaline auto-injector and to use it immediately symptoms of anaphylaxis occur, or if symptoms of asthma do not respond to initial therapy.

### Messages for consumers

### Asthma and anaphylaxis

- Adolescents with increasing autonomy and independence need to be able to manage their asthma and be aware of symptoms suggesting deterioration. They need assistance from their parents, carers and health professionals to ensure they have a full understanding of regular and emergency care of their asthma.
- Carers of children with asthma who also have a history of food allergy or anaphylaxis need to be able to manage both their asthma and their food allergy or anaphylaxis confidently.
- Children with food allergy or anaphylaxis need to have a regular review with their medical
  practitioner, and together with their families and regular carers, need to have ongoing education
  and reinforcement of the avoidance of triggers, and the recognition and emergency management
  of their food allergy or anaphylaxis.
- Families and carers should have the skills and confidence to administer the auto-injector at the first sign of anaphylaxis, even when there is resistance from the child. They should have practised how to give an adrenaline auto-injector to improve their confidence in a stressful emergency.
- In the event a carer is unable to determine whether a child is suffering from asthma or anaphylaxis, an adrenaline auto-injector should be administered in the first instance, followed by any medication listed within the emergency management plan for asthma or anaphylaxis.
- A history of food allergy is not a contraindication to exercise. However, children who have had an acute allergic reaction or any signs of anaphylaxis to food should do no strenuous exercise for two to four hours to minimise the risk of developing anaphylaxis.
- Health workers and parents need to appreciate the dangers of asthma and food allergy or anaphylaxis occurring at the same time. The treatment is adrenaline. Affected children and parents should be encouraged to carry an adrenaline auto-injector and to use it immediately when symptoms of anaphylaxis occur, or if symptoms of asthma do not respond to initial therapy.

# 8. CCOPMM functions and audit methods

# 8.1 About the Consultative Council on Obstetrics and Paediatric Mortality and Morbidity

CCOPMM was established in 1962 under the *Health Act* 1958 and now functions under 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 of Health. Four substantive subcommittees also report to CCOPMM:

- Maternal Mortality and Morbidity Subcommittee
- Stillbirth Subcommittee
- Neonatal Mortality and Morbidity Subcommittee
- Child and Adolescent Mortality and Morbidity Subcommittee.

CCOPMM works closely with the Department of Health and Human Services and Safer Care Victoria in its role to advise on strategies to reduce avoidable mortality and morbidity. The Consultative Councils Unit, within the Stewardship and Support Division of Safer Care Victoria, manages and supports the work programs of CCOPMM and two other consultative councils.

# 8.2 CCOPMM functions

Under the Act, CCOPMM's functions are to:

- a. Conduct study, research and analysis into the incidence and causes in Victoria of maternal deaths, stillbirths and the deaths of children;
- b. Conduct study, research and analysis into the incidence and causes of obstetric and paediatric morbidity;
- c. Conduct a perinatal data collection unit for the purpose of
  - i. Collecting, studying, researching and interpreting information on and in relation to births in Victoria;
  - ii. Identifying and monitoring trends in respect of perinatal health including birth defects and disabilities;
  - iii. Providing information to the Secretary on the requirements for and the planning of neonatal care units;
  - iv. Providing information for research into the epidemiology of perinatal health including birth defects and disabilities;
  - v. Establishing and maintaining a register of birth defects and disabilities;
- d. Provide to health service providers
  - i. Information on obstetrics and paediatrics;
  - ii. Strategies to improve obstetric and paediatric care;
- e. 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;
- f. Liaise with any other Consultative Council (whether or not prescribed) on any matter relevant to the functions of CCOPMM;
- g. Publish an annual report on the research and activities of CCOPMM;
- h. Perform any other prescribed function;
- i. Collect information for the purpose of performing its functions as outlined in the Act.

## 8.3 Members of CCOPMM, 2015-2018

### Consultative Council on Obstetric and Paediatric Mortality and Morbidity

Professor Jeremy Oats (Chair) Professor Susan McDonald (Deputy Chair) Dr Mary Belfrage Ms Lisa Dunlop Dr David Fuller Ms Anne Jorgensen Dr Mark Lubliner Professor Peter McDougall Professor Peter McDougall Professor Paul Monagle Ms Nicola Reinders (until March 2017) Ms Karen Sawyer Dr Alexis Shub Mr Nicolas Thomas Professor Euan Wallace (until March 2017)

#### Maternal Mortality and Morbidity Sub-committee

Professor Jeremy Oats (Chair) Dr Malcolm Barnett Dr Virginia Billson Dr Dennis Handrinos Dr Matthew Lynch Professor Susan McDonald Ms Abby Monaghan (from August 2016) Professor Michael Permezel Dr Wendy Pollock Associate Professor Scott Simmons Professor Mark Umstad Dr Craig Walker Professor Euan Wallace (until March 2017)

### **Stillbirth Sub-committee**

Professor Euan Wallace (Chair, until March 2017) Professor Susan Mc Donald (Chair from March 2017) Dr Lisa Begg Dr Jodie Benson Dr Virginia Billson Associate Professor Lisa Hui Professor Jeremy Oats Associate Professor Joanne Said (from April 2017) Dr David Simon Associate Professor Glyn Teale (until April 2017) Dr Christine Tippett Professor Mark Umstad Dr Bernadette White Ms Colleen White

#### **Neonatal Mortality and Morbidity Sub-committee**

Professor Peter McDougall (Chair) Ms Jane Bailey Dr Charles Barfield Dr Lisa Begg (from February 2017) Dr Virginia Billson Dr Rosemarie Boland Dr Simon Fraser Dr Jim Holberton Dr Paul Howat Dr Carl Kuschel Ms Abby Monaghan (from June 2016) Professor Jeremy Oats Dr Sarah Parsons Dr Alexis Shub Dr Michael Stewart Dr Mark Tarrant Dr Sophie Treleaven Associate Professor Glyn Teale (from May 2017) Professor Susan Walker

### Child and Adolescent Mortality and Morbidity Sub-committee

- Professor Paul Monagle (Chair)
- Professor Jeremy Oats (Chair CCOPMM)
- Ms Tracy Beaton
- Dr Mick Creati
- Professor Richard Doherty
- Professor Trevor Duke
- Dr Karen Dunn
- Dr David Fuller
- Associate Professor Duncan MacGregor (until March 2017)
- Dr Annie Moulden
- Dr Sarah Parsons (from March 2017)
- Dr Jenny Proimos
- Dr Cathie Rose
- Dr Rob Roseby
- Dr Greg Rowles
- Professor Frank Shann
- Professor Mike South (until June 2017)
- Dr Sophie Treleaven

Dr Peter Wearne

Professor Katrina Williams

98
# 9. Collecting and reviewing information on births and deaths

## 9.1 Review of deaths

CCOPMM's primary role is to review all maternal, perinatal and paediatric deaths in Victoria, determine factors that may have contributed to these deaths and provide advice and recommendations on effective strategies to address preventable harm and improve clinical outcomes. All perinatal deaths from 20 weeks' gestation (or 400 g birthweight if gestation is not known) and all child deaths under the age of 18 years that occur in Victoria are reviewed.

Information is sought from multiple sources, including the VPDC, hospital case records, individual doctors and midwives, pathology services, the State Coroner and PIPER. CCOPMM considers the clinical features of each case and classifies each death according to the Perinatal Society of Australia and New Zealand's Perinatal Mortality Classification System for perinatal deaths and the *International Statistical Classification of Diseases and Health Related Problems, 10th revision, Australian Modification* (6th edition) for all postneonatal infant, child and adolescent deaths.

In many cases, CCOPMM has multiple sources of information available regarding children (including health, welfare and education records) and may not limit the cause of death classification to the cause of death recorded in post-mortem reports or death certificates alone. In some cases, new information may become available at a later time 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 for improving clinical practice and systems based on the findings from each review and the best available evidence. Avoidable factors cannot always be identified from the information available during case review; therefore, the actual number of cases that may have preventable factors could be higher.

## 9.2 Review of births

It is a requirement of the Public Health and Wellbeing Act that births that occur in Victoria are reported to CCOPMM within a prescribed time period. CCOPMM has statutory responsibility for the VPDC and the Victorian Congenital Anomalies Register (VCAR). The data collections are managed by the Department of Health and Human Services and Safer Care Victoria on CCOPMM's behalf.

The collections enable information to be analysed in relation to the health of mothers, babies and children in order to contribute to improvements in their health. Information is collected on obstetric conditions, procedures and outcomes, as well as 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 g birthweight.

## Victorian Perinatal Data Collection (VPDC)

The VPDC was established in 1982 under the Health Act and consists of sociodemographic characteristics and clinical outcome data on all births occurring in Victoria. Data are collected from public and private hospitals, birth centres and homebirth practitioners from their clinical and patient administrative system, via secure data exchange.

Further information on the VPDC can be found at <a href="https://www2.health.vic.gov.au/hospitals-and-health-services/guality-safety-service/consultative-councils/council-obstetric-paediatric-mortality/perinatal-data-collection">https://www2.health.vic.gov.au/hospitals-and-health-services/guality-safety-service/consultative-councils/council-obstetric-paediatric-mortality/perinatal-data-collection</a>.

## Victorian Congenital Anomalies Register (VCAR)

As per the Public Health and Wellbeing Act, CCOPMM has a legislative responsibility to maintain a register of congenital anomalies and disabilities. The data collected in this register provide the necessary information for surveillance, research and planning of clinical improvement initiatives. The VCAR 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 VCAR via CCOPMM's website.

Further information about VCAR can be found at <<u>https://www2.health.vic.gov.au/hospitals-and-health-services/quality-safety-service/consultative-councils/council-obstetric-paediatric-mortality/congenital-anomalies-register></u>.

## 9.3 Reporting and analysis

The VPDC contributes to the National Perinatal Data Collection (NPDC) managed by the University of New South Wales National Perinatal Epidemiology and Statistics Unit (NPESU). The NPESU produces the annual report *Australia's mothers and babies* on behalf of the Australian Institute of Welfare using the NPDC and other data. The VPDC contains additional items to enable more detailed analysis on the health of mothers and babies in Victoria.

CCOPMM supports research that is strategic and targeted at priority areas requiring further evidence to inform clinical outcome improvements. Regulation 10 of the Public Health and Wellbeing Regulations 2009 sets out the circumstances in which CCOPMM is authorised to release data for research purposes. All research requests involving CCOPMM-held data must be submitted to CCOPMM for approval. Research proposals must conform to the National Health and Medical Research Council's *National statement on ethical conduct in human research* (2007) and a properly constituted Victorian Human Research Ethics Committee must give approval prior to CCOPMM considering the request.

In the public interest, CCOPMM is also authorised to provide information to authorities and interested parties specified under s. 41 of the Public Health and Wellbeing Act.

Further information regarding data and research requests can be found at <<u>https://www2.health.vic.gov.</u> au/hospitals-and-health-services/quality-safety-service/consultative-councils/council-obstetric-paediatricmortality/access-to-ccopmm-data>.

#### Figure 30: CCOPMM's relationships, accountabilities and role



# Appendix 1: Definitions and abbreviations

## 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 coloration; a score of 10 represents the best possible condition.

## Child death

Child death refers to the death of a child occurring after and including the first birthday and up to, but not including, the 18th birthday (1–17 years).

## Confinements

Confinements refer to the number of women who gave birth to one or more live births and/or stillbirths (regardless of plurality) with a pregnancy of 20 weeks' gestation or more.

## Congenital anomaly (formerly 'birth anomaly')

A congenital anomaly is any anomaly of prenatal origin, arising from conception or occurring before the end of pregnancy. This includes structural, functional, genetic, chromosomal and biochemical anomalies.

PSANZ coding uses the wording 'congenital abnormality', and where PSANZ codes are used in this report 'congenital abnormality' is used.

CCOPMM uses the wording 'congenital anomaly' in all other areas of this report.

## Crude birth rate

The crude birth rate is measured by the number of live births (see definition above) 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

The estimated resident population (ERP) is an Australian Bureau of Statistics measure of the population based on the concept of residence and refers to all people, regardless of nationality or citizenship, who usually live i n Australia, with the exception of foreign diplomatic personnel and their families. The CCOPMM report uses e stimated female resident population (EFRP), aged 15-44 years, in its tables.

## Infant death

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

## Late maternal death

Late maternal death refers to the death of a woman after 42 days but within a year of the birth or end of the pregnancy. The death may be due to direct, indirect or incidental causes. These late deaths are not included in the maternal mortality ratio.

## Live birth

A live birth is the birth of a child who, after delivery, breathes or shows any evidence of life such as a heartbeat.

## Maternal death

#### For classification of cause of death

For classification purposes, maternal death refers to the death of a woman while pregnant or within 42 days of the end of the pregnancy, irrespective of the cause of death. This definition allows for classification of maternal deaths based on direct, indirect or incidental causes, as follows:

- **direct** the death is considered to be due to a complication of the pregnancy (for example, haemorrhage from placenta praevia)
- **indirect** the death is considered to be 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 consequent on psychiatric disease are usually categorised as indirect, except for puerperal psychosis, which is classified as direct
- incidental the death is considered unrelated to pregnancy (for example, passenger in motor vehicle accident)
- late maternal death when the death occurs after 42 days but within a year of the birth or end of
  pregnancy.

#### For calculating the maternal mortality ratio

The World Health Organization (WHO) defines maternal death as 'the death of a woman during pregnancy, childbirth or in the 42 days of the puerperium, irrespective of the duration and site of the pregnancy, from any cause related to, or aggravated by, the pregnancy or its management'. This WHO definition allows for identification of maternal deaths as either direct or indirect only. It includes deaths from abortion and ectopic pregnancy, however, excludes incidental deaths from causes unrelated to pregnancy, such as deaths from injury or malignancy. CCOPMM uses the WHO definition to calculate the maternal mortality ratio.

## Perinatal death

Perinatal deaths refer to stillbirths and live births with only brief survival and are grouped on the assumption that similar factors are associated with these losses. CCOPMM defines perinatal death to include stillbirth and neonatal deaths within 28 days of birth of infants of gestation  $\ge$  20 weeks or, if gestation is unknown, of birthweight  $\ge$  400 g.

For national statistics, CCOPMM also reports on perinatal deaths of infants with a birthweight of  $\geq$  500 g 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 live births of < 500 g and also the majority of cases where the pregnancy was terminated for fetal or maternal indications.

For international comparison and as recommended by WHO, only fetuses and infants of at least 1,000 g birthweight, or where birthweight is unavailable, the corresponding gestational age (28 weeks) or body length (35 cm crown–heel), are included in the perinatal mortality ratio.

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

These deaths are classified under the following categories:

- determined at birth
- SUDI, including sudden infant death syndrome
- unintentional injury
- acquired disease
- intentional injury
- undetermined.

## Standardised mortality ratio

This is a risk ratio where the observed mortality pattern in a group is compared with what would have been expected if the variable–specific mortality rates had been the same as the specified reference population. Indirect standardisation adjusts for differences in the distribution of the variable of interest (for example, age) between the study and reference population.

### Stillbirth

A stillbirth is defined as the birth of an infant of at least 20 weeks' gestation or, if gestation is unknown, weighing at least 400 g, who shows no signs of life at birth.

## Sudden unexpected deaths in infancy (SUDI)

This group of deaths includes all infants (under one year of age) who die suddenly and unexpectedly after they are placed for sleeping. SUDI can be classified into explained SUDI and unexplained SUDI and can include deaths related to:

• unexplained:

- sudden infant death syndrome (SIDS) 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 (USID), with or without autopsy
- undetermined

- 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 elsewhere in the report. SUDI deaths where a cause of death is identified (usually at autopsy) are included in the 'explained' category 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 Krous definition (Krous et al. 2004). See below:

#### **General Definition of SIDS**

SIDS is defined as the sudden unexpected death of an infant <1 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 SIDS

Category IA includes deaths that meet the requirements of the general definition and also all of the following requirements.

Clinical:

- >21 days and <9 months of age</li>
- normal clinical history including term pregnancy (gestational age ≥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 pathologic 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 g and/or moderate/ severe cortical lymphocyte depletion). Occasional 'starry sky' macrophages or minor cortical depletion is acceptable
- negative results of toxicologic, microbiologic, radiologic, vitreous chemistry and metabolic screening studies.

#### Category IB SIDS

Category IB includes infant deaths that meet the requirements of the general definition and also meet all of the criteria for category IA except that investigation of the various scenes where incidents leading to death might have occurred was not performed or  $\geq 1$  of the following analyses were not performed: toxicologic, microbiologic, radiologic, vitreous, chemistry or metabolic screening studies.

#### Category II SIDS

Category II includes infants that meet category I except for  $\geq 1$  of the following.

Clinical:

- age range outside that of category IA or IB (that is 0-21 days or 270 days [9 months] through to first birthday)
- similar deaths among siblings, close relatives or infants in the custody of the same caregiver that are not recognised 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.

#### Unclassified sudden infant death

Includes deaths that do not meet the criteria for category I or II SIDS, but for which alternative diagnoses of natural or unnatural conditions are equivocal, including cases where autopsies were not preformed.

#### Post-resuscitation cases

Infants found in extremis who are not resuscitated and later die ('temporarily interrupted SIDS') may be included in the aforementioned categories, depending on the fulfilment of relevant criteria.

### Twin-to-twin transfusion syndrome

A disease that affects identical twins who share a common placenta. Blood vessels that connect the two umbilical cords on the surface of the placenta allow blood from one twin (the donor) to flow into the other twin (the recipient). This transfusion of blood occurs when there is an imbalance of blood flow from the donor twin to the recipient twin, which causes twin-to-twin transfusion syndrome.

## Acronyms and abbreviations

BMI	body mass index	
CI	confidence interval	
ССОРММ	Consultative Council on Obstetric and Paediatric Morbidity and Mortality	
COPE	Centre for Perinatal Excellence	
CPAP	continuous positive airway pressure	
DHHS	Department of Health and Human Services	
ECG	electrocardiogram	
EFRP	estimated female resident population	
ERP	estimated resident population	
GBS	Group B Streptococcus	
GCS	Glasgow Coma Scale	
GDM	gestational diabetes mellitus	
IMR	infant mortality rate	
IRSD	Index of Relative Social Disadvantage	
KMS	Koori Maternity Services	
MMR	maternal mortality ratio	
NPDC	National Perinatal Data Collection	
NMR	neonatal mortality rate	
NPESU	National Perinatal Epidemiology and Statistics Unit	
ORT	opiate replacement therapy	
PGD	pre-gestational diabetes	
PIPER	Paediatric Infant Perinatal Emergency Retrieval	
PMR	perinatal mortality rate	
PPH	postpartum haemorrhage	
PSANZ	Perinatal Society of Australia and New Zealand	
RR	relative risk	
SEIFA	Socio-Economic Indexes for Areas	
SIDS	Sudden Infant Death Syndrome	
SUDEP	sudden unexplained death in epilepsy	
SUDI	sudden unexpected death in infancy	
TOP	termination of pregnancy	
VCAR	Victorian Congenital Anomalies Register	
VPDC	Victorian Perinatal Data Collection	
VICTOR	Victorian Children's Tool for Observation and Response	
WHO	World Health Organization	

# Appendix 2: Measures of obstetric and paediatric mortality and morbidity

## Maternal mortality ratio (MMR)

The MMR is defined as follows:

Maternal mortality ratio =

number of direct and indirect maternal deaths total number of confinements

×100,000

The MMR excludes late maternal deaths.

Confinements is the number of pregnancies of 20 weeks' gestation or more resulting in live birth 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 because the available data on the number of these pregnancies are unreliable.

## Perinatal mortality rate (PMR)

The PMR is calculated as stillbirths and neonatal deaths per 1,000 total births (stillbirths and live births). For CCOPMM statistics, the rate refers to all births of at least 20 weeks' gestation or, if gestation is unknown, of birthweight of at least 400 g. However, for purposes of continuity, PMR of infants of  $\geq$  500 g or, where the birthweight is unknown, of at least 22 weeks' gestation, is also presented (PMR<sub>500</sub>). For international comparisons, the rate refers to all births of at least 1,000 g 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).

 $Perinatal mortality rate = \frac{(number of stillbirths + neonatal deaths)}{total (stillbirths + live births)} \times 1,000$ 

## Neonatal mortality rate (NMR)

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

 Neonatal mortality rate =
 number of neonatal deaths
  $\times$  1,000

 Stillbirth rate =
 number of stillbirths
  $\times$  1,000

 Stillbirth rate =
 number of stillbirths
  $\times$  1,000

## Infant mortality rate (IMR)

The IMR is calculated as the number of infant deaths divided by the number of total (Victorian-born) live births for the index year (reported as the rate per 1,000 live births). The live births are limited to those infants  $\geq$  20 weeks' gestation or, if the gestation is unknown, of birthweight  $\geq$  400 g.

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.

Infant mortality rate =

number of infant deaths

×1,000

total live births

# Appendix 3: Flow diagram for births in Victoria, 2016

### Abbreviations used in this flow diagram

BW	birthweight
----	-------------

- CA congenital anomaly
- EFRP estimated female resident population (see supplementary tables detailing births in Victoria)
- IMR infant mortality rate.
- MPI maternal pyschosocial indications
- NND neonatal death death of a liveborn infant less than 28 days of age
- PMR perinatal mortality rate
- SB stillbirth
- TOP termination of pregnancy
- VPDC Victorian Perinatal Data Collection

## Formulae

	E	— ×1,000
Crude birth rate =	EFRP	
PMR=	(G+U(i))	×1,000
	(G+C)	
IMR=		×1,000
	Ľ	

## Notes for flow diagram

- a Includes only births occurring in Victoria and their outcomes
- b Neonatal death exclusions (J) comprise:
  - J(i). Those live born <20 weeks' gestation (n=15)
- J(ii). Those live born at unknown gestation with a birthweight <400 gm (n=0)  $\,$
- c Stillbirth exclusions (N) comprise:
  - N(i). Stillbirths where death and birth known to have occurred <20 weeks' gestation (n=1)
  - N(ii). Stillbirths where death and birth occurred at unknown gestation, with a birthweight <400 gm (n=0)
  - N(iii). Stillbirths where death known to have occurred <20 weeks' gestation but born  $\geq$ 20 weeks' gestation, with unknown BW (n=1)
- N(iv). Stillbirths where death occurred at unknown gestation, birth occurred  $\geq$  20 weeks' gestation, but where BW <150 gm (n=42) d One of these deaths did not occur in Victoria
- e Deaths reported to CCOPMM as at July 31 2017. Final figures will be given in the 2017 Annual Report



# References

Athey J. Medical complications of anorexia nervosa. Primary Care Update for Ob/Gyns, 2003;10(3): 110–115.

Australian Bureau of Statistics, 2014. IRSD. Available at <<u>http://www.abs.gov.au/ausstats/abs@.nsf/</u> Lookup/2033.0.55.001main+features100052011>. Accessed September 20, 2017.

Australian Bureau of Statistics, 2014. FAQs – SEIFA 2011 Available at <<u>http://www.abs.gov.au/ausstats/</u> abs@.nsf/Lookup/by%20Subject/2033.0.55.001~2011~Main%20Features~FAQs%20-%20SEIFA%202011~9>. Accessed September 20, 2017.

Bertini G, Margheri M, Giglioli C, Cricelli F, Simone LD, Taddei T, Marchionni N, Zini G, Gensini GF. Prognostic significance of early clinical manifestations in postanoxic coma: A retrospective study of 58 patients resuscitated after prehospital cardiac arrest. Crit Care Med. 1989; 17:627–33.

Chantreuil J, Fakhri N, Labarth F, Saliba E, Favrais G. Coqueluche maligne et exsanguino-transfusion. Arch Pediatrie. 2015; 22(1):84–7.

Dobbins T, Sullivan E, Roberts C, Simpson J. Australian national birthweight percentiles by sex and gestational age, 1998–2007. MJA. 2012; 197:291-294 doi: 10.5694/mja11.11331.

Fichter MM and Quadflieg N. Mortality rates in eating disorders – results of a large prospective clinical longitudinal study. International Journal of Eating Disorders, 2016;49(4): 391–491.

Fletcher J, Shann F, Duncan A. The dangers of premature extubation after severe birth asphyxia. J Paediatr Child Health. 1987; 23:27–29.

Flood MM, McDonald SJ, Pollock WE, Davey M-A. Data accuracy in the Victorian Perinatal Data Collection. Health Inf Manag 2017; 46(3):113–26.

Florvaag E, Johansson SG, Irgens Å, de Pater GH.IgE-sensitization to the cough suppressant pholodine and the effects of its withdrawal from the Norwegian market. Allergy. 2011 Jul;66(7):955–60.

Glick AF, Farkas JS, Nicholson J, Dreyer BP, Fears M, Bandera C, et al. Parental management of discharge instructions: a systematic review. Pediatrics. 2017; 140(2):e20164165.

Highet, NJ and Goddard, AK . Aboriginal and Torres Strait Islander Perinatal Mental Health Mapping Project: A scoping of current practice surrounding the screening, assessment and management of perinatal mental health across Australia's New Directions: Mothers and Baby Service program. Centre for Perinatal Excellence (COPE). June 2014.

Johansson SG, Oman H, Nopp A, Florvaag E. Pholcodine caused anaphylaxis in Sweden 30 years ago. Allergy. 2009; 64(5): 820–1.

Justice F, Carlin J, Bines J. Changing epidemiology of intussusception in Australia. J Paediatr Child Health. 2005; 41(9-10):475-8.

Krous HF, Beckwith JB, Byard RW, Rognum TO, Bajanowski T, Corey T, Cutz E, Hanzlick R, Keens TG, Mitchell EA. Sudden Infant Death Syndrome and Unclassified Sudden Infant Deaths: A definitional and Diagnostic Approach' Pediatrics. 2004; 114(1):234–238.

Lavender T, Hofmeyr GJ, Neilson JP, Kingdom Cm, Gyte GML. Caesarean section for non-medical reasons at term (Review). Cochrane Database Syst Rev. 2012 Issue 3. Art. No.:CF004660 DOI:10.1002/14651858. CD004660.pub3.

Liu S, Liston RM, Joseph KS, Harman M, Sauve R, Kramer MS. Maternal mortality and severe morbidity associated with low-risk planned caesarean delivery at term versus planned vaginal delivery at term: maternal

health study group of the Canadian perinatal surveillance system. CMAJ. 2007; 176:455–60.

Mavrides E, Allard S, Chandraharan E, Collins P, Green L, Hunt BJ, Riris S, Thomson AJ on behalf of the Royal College of Physicians. Prevention and management of postpartum haemorrhage. BJOG 2016; doi:10.1111/1471-0528.14178.

McAleer PT, McNicol L, Rose MA. Perioperative anaphylaxis: progress, prevention and pholodine policy. Anaes Int Care. 2017; 45(2):147–150.

Ong GL, Bruning HA. Dilated fixed pupils due to administration of high doses of dopamine hydrochloride. Crit Care Med. 1981; 9(9):658–9.

Parry JE, Ip DK, Chau PY, Wu KM, Tarrant M. Predictors and consequences of in-hospital formula supplementation for healthy breastfeeding newborns. J Hum Lact. 2013; 29(4): 527–536.

Preti A, Rocchi MBL, Sisti D, Camboni MV and Miotto P. A comprehensive meta-analysis of the risk of suicide in eating disorders. Acta Psychiatr Scandinavia, 2011;124: 6–17.

Red Nose National Scientific Advisory Group (NSAG). 2017. Information Statement: Baby Safe Sleeping Products. Melbourne, Red Nose. August 2017. Available at <<u>https://rednose.com.au/news/baby-boxes-distributed-without-education-by-known-service-provider</u>>. Accessed 20 September 2017

Robson M, Murphy M, Byrne F. Quality assurance: the 10-group classification system (Robson classification), induction of labour, and caesarean delivery. IJGO. 2015; 131:S23-S27.

Rowlands HE, Goldman AP, Harrington K, Karimova A, Brierley J, Cross N, Skellett S, Peters MJ. Impact of rapid leukodepletion on the outcome of severe clinical pertussis in young infants. Pediatrics. 2010; 126(4):e816–27.

Say L, Souza JP, Pattinson RC. Maternal near miss – towards a standard tool for monitoring quality of maternal health care. Best Pract Res Clin Obstet Gynaecol. 2009; 23:287–96. doi: 10.1016/j. bpobgyn.2009.01.007 pmid: 19303368.

Skupski DW, et al. Improvement in outcomes of major obstetric haemorrhage through systematic change. Obstet Gynecol. 2017; 130:770–7.

University of the Sunshine Coast. The Pēpi-Pod Program. Available from: <<u>https://www.usc.edu.au/research-and-innovation/medical-and-health-science/nurture/research-projects/the-pepi-pod-program</u>>. Accessed 20 September 2017.

Yung M, Herrema I. Persistent mydriasis following intravenous atropine in a neonate. Paed Anaesth. 2000; 10(4):438–40.

Zhang J, Geerts C, Hukkelhoven C, Offerhaus P, Zwart J, de Jonge A. Caesarean section rates in subgroups of women and perinatal outcomes. BJOG. 2015 doi: 10.1111/1471-0528.13520.