

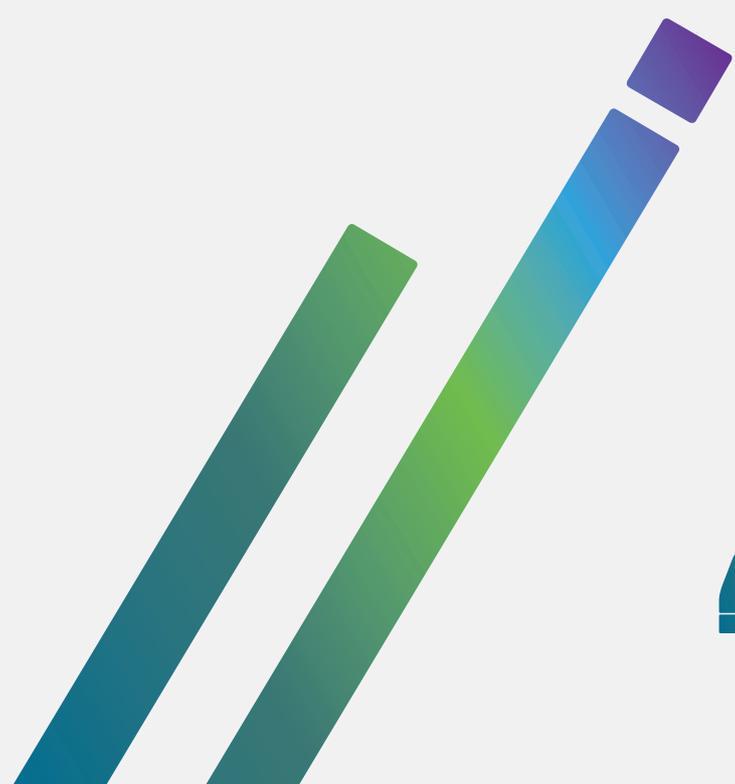


**Australian Government**  
**Australian Institute of  
Health and Welfare**



# Maternal deaths in Australia

## 2012–2014



**AIHW**





**Australian Government**

**Australian Institute of  
Health and Welfare**

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**2012–2014**

Australian Institute of Health and Welfare  
Canberra

Cat. no. PER 92

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The authors would like to acknowledge the families and loved ones whose losses are documented in this report and express their sincere condolences to them. Every maternal death is a tragedy and the aim of investigating and reporting maternal deaths is to assist in finding answers for those who experience such loss personally and for the health-care professionals involved.

# Abbreviations

ABS	Australian Bureau of Statistics
ACSQHCC	Australian Commission on Safety and Quality in Health Care
ACT	Australian Capital Territory
AMOSS	Australasian Maternity Outcomes Surveillance System
AHMC	Australian Health Ministers' Conference
AIHW	Australian Institute of Health and Welfare
BMI	body mass index
ICD-10	World Health Organisation International Statistical Classification of Diseases and Related Health Problems, 10th revision
MDGs	United Nations Millennium Development Goals
MMEIG	Maternal Mortality Estimation Inter-Agency Group
MMR	Maternal mortality ratio
MRSA	Methicillin-resistant <i>Staphylococcus aureus</i>
NMDDP	National Maternity Data Development Project
NMMAC	National Maternal Mortality Advisory Committee
NMMDC	National Maternal Mortality Data Collection
NMPMAG	National Maternal and Perinatal Mortality Advisory Group
NPESU	National Perinatal Epidemiology and Statistics Unit
NSW	New South Wales
NT	Northern Territory
PMMRC	Perinatal and Maternal Mortality Review Committee, New Zealand
Qld	Queensland
QMPQC	Queensland Maternal and Perinatal Quality Council
RA	Remoteness Areas index

RANZCP	Royal Australian and New Zealand College of Psychiatrists
SA	South Australia
SEIFA	Socio-Economic Indexes for Areas
STMMCs	State and Territory Maternal Mortality Committees
Tas	Tasmania
UI	Uncertainty interval
UKOSS	United Kingdom Obstetric Surveillance System
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
UNPD	United Nations Population Division
Vic	Victoria
WA	Western Australia
WHO	World Health Organization

## Symbols

—	nil or rounded to zero
..	not applicable
n.a.	not available
n.p.	not publishable because of small numbers, confidentiality or other concerns about the quality of the data

# Summary

Global estimates from the World Health Organization (WHO) show that the maternal mortality ratio (MMR) fell from 385 per 100,000 women giving birth in 1990 to 216 per 100,000 women giving birth in 2015. This equates to around 300,000 women estimated to have died world-wide in association with pregnancy in 2015. In 2015 the MMR for developed countries, which includes Australia, New Zealand, the United Kingdom and the United States of America, was 12 per 100,000 women giving birth, which is lower than in regions such as Oceania (MMR estimate 187 per 100,000 women giving birth), South-East Asia (110 per 100,000 women giving birth) and Sub-Saharan Africa (546 per 100,000 women giving birth).

In the triennium 2012 to 2014, 920,095 women gave birth in Australia. The deaths of 73 women during pregnancy or within 42 days of the end of pregnancy are reviewed in this report.

Following review by the various State and Territory Maternal Mortality Committees, 61 deaths were classified as directly or indirectly related to pregnancy and 2 were considered related to the pregnancy or its management, but could not be further classified as direct or indirect. This led to a maternal mortality ratio of 6.8 deaths per 100,000 women giving birth. The remaining 10 deaths were classified as incidental to the pregnancy.

The most common causes of the Australian maternal deaths from 2012–2014 were non-obstetric haemorrhage, cardiovascular conditions and thromboembolism. Maternal suicide was less prominent in this period than in the 2006–2010 and 2008–2012 reports (AIHW: Johnson et al. 2014b; AIHW: Humphrey et al. 2015).

There continues to be a higher incidence of maternal death in Aboriginal and Torres Strait Islander women: the Aboriginal and Torres Strait Islander MMR is 3 times that for other Australian women.

Women aged under 35 years in their second to fourth pregnancies who had an unassisted vaginal birth were the least likely to die in association with pregnancy and childbirth.

Some data provided to the AIHW about maternal deaths were incomplete, mostly due to restrictions on data availability by state or territory health privacy legislation, as well as incomplete reporting to and by some jurisdictional health departments. The AIHW is working with jurisdictions to improve the quality and timeliness of maternal deaths data in the future.

# 1 Introduction

## 1.1 Background

Maternal death is a rare event in Australia. However, healthy women do still die from pregnancy-related causes.

Exploration of contributory factors to these deaths suggests that up to one-third may be avoidable. Maternal deaths are included in an Australian sentinel events list (ACSQHC 2002) monitored by the Australian Commission on Safety and Quality in Health Care (ACSQHC). Consequently, all maternal deaths require structured scrutiny to examine questions of possible substandard care and ineffective health-care administration.

Confidential enquiries are conducted into maternal deaths in all Australian states and territories, as they are in New Zealand and the United Kingdom, and a number of other European countries.

This is the 17th report published on maternal deaths in Australia and the fifth in the AIHW maternal deaths series. The report aims to identify trends in maternal mortality and to develop an evidence base for maternal deaths that can be used to inform maternity services policy and practice. Reporting maternal mortality data in Australia began with the triennium 1964–1966, when a direct maternal mortality rate of 30.3 per 100,000 confinements was reported. Using the same definitions as those used in this report, the maternal mortality ratio has decreased from 12.7 per 100,000 women giving birth in 1973–1975 to 6.8 per 100,000 women giving birth in 2012–2014.

### The Australian Maternity Context

In 1994, 261,335 babies born to 257,657 mothers were notified to perinatal data collections in the eight states and territories of Australia (Day et al, 1997), increasing to 312,548 babies born to 307,844 mothers in 2014. Maternity services in Australia are provided by 8 state and territory health departments and a number of private providers. Each state and territory has differing care provision systems and care available to pregnant women and their babies.

In 2008, a national review of maternity services was carried out in Australia. The findings were presented in 2009 in *Improving maternity services in Australia: the report of the Maternity Services Review* (DoH 2009). The report aimed to identify key gaps in maternity care and to inform development of the first National Maternity Services Plan (AHMC 2011).

The National Maternity Services Plan (the Plan) was implemented in February 2011 and set out a 5-year vision for maternity care that provides a strategic national framework to guide policy and program development across Australia (AHMC 2011).

The Plan's purpose is to maintain Australia's high standard of maternity care while improving access to services and choice in care, by increasing and supporting the maternity workforce, strengthening infrastructure and building the evidence base of what measures work well in Australia. Key actions recommended by the Plan were that 'A national maternal mortality and morbidity review process is established' and that 'National maternal and perinatal mortality and morbidity reports are produced'. This report responds to these actions.

### The international context

The World Health Organization (WHO) estimates that worldwide 300,000 women die each year from complications of pregnancy and childbirth (WHO 2015). Australia was a signatory

to the United Nations Millennium Development Goals (MDGs), which formed an international blueprint aimed at reducing poverty, hunger and disease by 2015. The fifth MDG was 'Improve maternal health', and was stated as 'Reduce by three-quarters, between 1990 and 2015, the maternal mortality ratio' (UN 2010). The global maternal mortality ratio has dropped by almost 44% between 1990 and 2015, from 385 to 216 deaths per 100,000 live births (WHO 2015), although many low to middle resource countries did not meet the target.

United Nations Sustainable Development Goal 3, adopted by world leaders in September 2015, is to reduce the global maternal mortality ratio to less than 70 per 100,000 births, with no country having a rate more than twice the global average.

This work has been supported by various governance committees described in Appendix B.

## **Purpose of this report**

The National Maternity Services Plan Priority Action 2.1 recommended that a national maternal mortality review process be established and that national maternal mortality reports be produced (AHMC 2011). This report reviews 3 years of maternal deaths, from 2012 to 2014, and reinstates the triennial reporting practised before 2006.

Detailed examination and reporting of maternal deaths provides the basis for improving performance in all sectors of maternity care by defining risks and profiling good practice.

Internationally, measuring maternal mortality enables comparisons of maternal health outcomes across countries and may be seen as an indicator of society's health-care services. Where possible, comparisons are made with data in the most recent maternal mortality reports from New Zealand (PMMRC 2016) and the United Kingdom (Knight et al. 2015). Relevant studies by the Australasian Maternity Outcomes Surveillance System (AMOSS) and the UK Obstetric Surveillance System (UKOSS), where published, are also referenced.

The specific aims of the report are to:

- provide an overview of maternal mortality from collated information on maternal deaths in Australia that occurred between 1 January 2012 and 31 December 2014
- provide an evidence base to inform policy development
- provide to practitioners information on maternal deaths that might be used to prevent avoidable deaths and reduce the maternal mortality ratio
- provide information to women who may be at higher than normal risk of death or severe morbidity and are considering pregnancy
- inform national processes for classification of maternal deaths, providing a basis for consensus in the review of maternal deaths by State and Territory Maternal Mortality Committees (STMMCs).

## **1.2 Definitions and classifications**

The WHO *International statistical classification of diseases and related health problems, 10th revision* (ICD-10) defines maternal death as 'the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes' (WHO 1992). These WHO definitions are applied in this report.

Maternal deaths as defined above are subdivided into 2 categories: direct deaths and indirect deaths (Table 1.1). Direct maternal deaths are those that result directly from complications of pregnancy or its management. Indirect maternal deaths are those that are due to pre-existing or inter-current disease but where disease progression was influenced by pregnancy.

For the purposes of examining the context of deaths of women in relation to pregnancy and birth, deaths considered to be causally unrelated to pregnancy are classified as 'incidental'.

Where pregnancy was considered to have contributed to the death but the relevant state or territory maternal mortality committee found that the death could not be classified as a direct or indirect maternal death, the death is categorised as 'Maternal death, not further classified'. Deaths that have not been classified by the relevant state or territory maternal mortality committee and where insufficient information is available to assess cause of death are considered 'Unclassified' deaths.

**Table 1.1: Definitions of maternal death categories**

Type of death	Definition
Direct maternal deaths <sup>(a)</sup>	Those resulting from obstetric complications of the pregnant state (pregnancy, labour and puerperium) from interventions, omissions, incorrect treatment or from a chain of events resulting from any of the above
Indirect maternal deaths <sup>(a)</sup>	Those resulting from previous existing diseases or diseases that developed during pregnancy, and which were not due to a direct obstetric cause, but were aggravated by the physiologic effects of pregnancy
Maternal death, not further classified	Deaths considered to be related to the pregnancy or its management, but could not be further classified as either 'direct' or 'indirect'. These deaths are included in the maternal deaths total
Incidental maternal deaths	Deaths from unrelated causes that happen to occur in pregnancy or the puerperium
Unclassified death	Maternal death from unspecified or undetermined cause occurring during pregnancy, labour and delivery, or the puerperium

(a) Definitions are from the International statistical classification of diseases and related health problems, 10th revision, volume 2, section 5.8.1.

Though there is increasing interest in the examination of 'Late maternal deaths' in a number of jurisdictions (Knight et al. 2015; QMPQC 2013), they are not examined in this report. Late maternal deaths are deaths that occur between 43 and 365 days after pregnancy ends and result from obstetric complications of the pregnancy or previous existing diseases or diseases that developed during pregnancy. It is not currently possible to review and report late maternal deaths on a national basis as these deaths are not yet examined by all state and territory maternal mortality committees. As a trend towards review of these deaths across all such committees continues, their inclusion in future *Maternal deaths in Australia* reports will be possible.

In this report, the cause of death is that determined by the jurisdictional maternal mortality committee after consideration of all available information. Autopsy, coronial and other information is frequently available after the health-care facility admission and discharge coding process is completed, and hence the cause of death allocated by the jurisdictional maternal mortality committee used in this report may not be the same as the initial ICD-10 coding.

## Measuring maternal mortality

The incidence of maternal death, as defined above, is expressed as the maternal mortality ratio (MMR), which is calculated using direct and indirect deaths combined, and excludes incidental deaths.

The WHO definition specifies that the number of live births or the total number of births (live births plus fetal deaths) can be used as the denominator, and where both denominators are available, both calculations are made (WHO 2011). Although the most appropriate denominator for estimating maternal mortality would be the number of women at risk (the number of pregnant or recently pregnant women), this number is not available in Australia because the number of pregnancies ending before 20 weeks' gestation is unknown. In Australia, accurate population data are available for the number of women who gave birth to at least 1 baby (either a live birth or a stillbirth) of 20 weeks' completed gestation or more or birthweight of 400 grams or more and are held in the AIHW's National Perinatal Data Collection; this is the denominator number used when calculating the MMR in this report.

### Calculation of maternal mortality ratio (MMR)

$$\text{MMR} = \frac{\text{Number of direct and indirect maternal deaths}^{(a)}}{\text{Number of women who gave birth}^{(a)}} \times 100,000$$

(a) For a defined place and time.

## Data sources and availability

Data on maternal deaths are sourced from state and territory health departments and other jurisdictional bodies responsible for primary data collection and review regarding maternal deaths in Australia. Initial notification to these bodies includes significant input from the relevant registrars of births, deaths and marriages, and Coroners. Data from these jurisdictions are subsequently provided to the AIHW for collation into a National Maternal Mortality Data Collection (NMMDC).

The NMMDC is an ongoing data set collected for use in *Maternal deaths in Australia* triennial reports. Only summary data on maternal deaths in Western Australia and the Northern Territory were made available for review due to their health and privacy legislation (WA 1911; NT 2003). General population data for this publication have also been sourced from the AIHW's National Perinatal Data Collection.

## State and territory maternal mortality committees

A confidential enquiry into each of the maternal deaths that occurred in 2012–2014 was undertaken by 7 separate State and Territory Maternal Mortality Committees (STMMCs). The Northern Territory did not convene a committee during this time period.

The committees operate under legal privilege and are provided with clinical information and the results of autopsy investigations where available. The confidential enquiry process seeks to identify and understand the individual circumstances surrounding each death.

Subsequently, the STMMC agrees on the causes of each death and assigns the death to a maternal death category. The organisational and governance arrangements for STMMCs vary between jurisdictions (details of each jurisdiction's maternal death data collection process is outlined in Appendix C).

## **Reporting maternal deaths in 2012–2014**

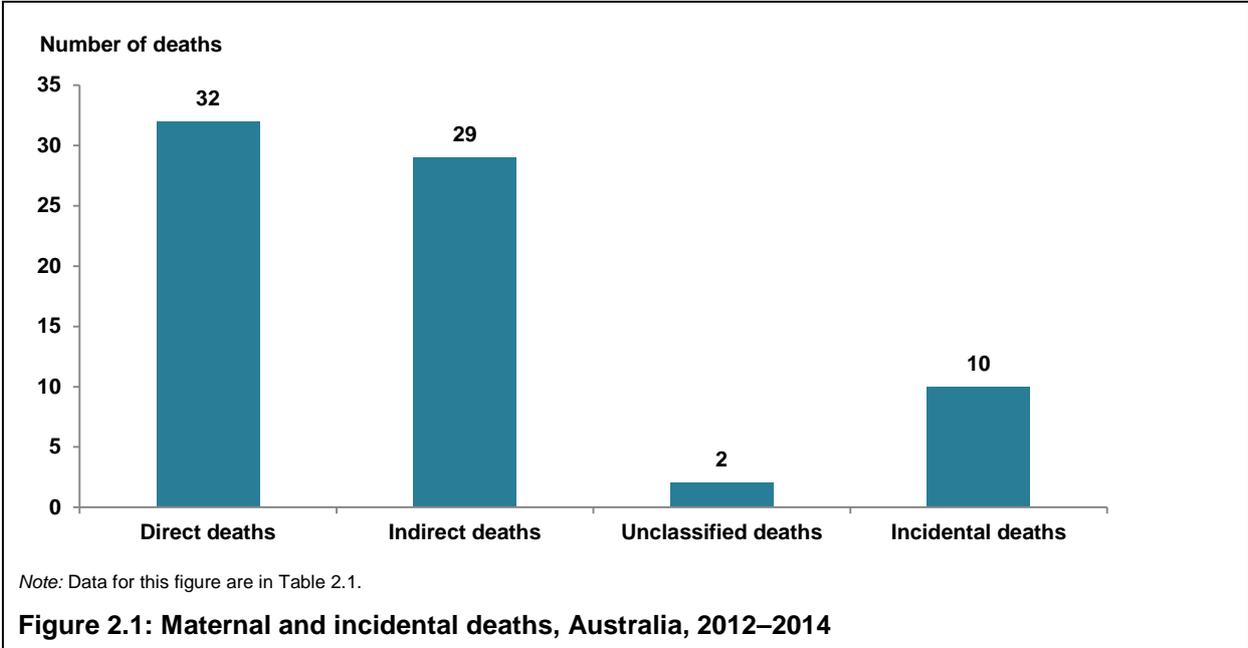
The methodology used for this report is similar to that used in previous reports in the *Maternal deaths in Australia* series (see Appendix A). It includes epidemiological data on maternal deaths, the use of illustrative vignettes known as ‘case summaries’, clinical commentary and references to published guidelines for further education on specific clinical management where available and relevant. Illustrative vignettes are developed from de-identified case information and sometimes combined to protect anonymity.

# 2 Overview of maternal deaths

In the 2012 to 2014 triennium, 73 deaths were reviewed and reported by the various state and territory maternal mortality committees. Following review, 63 (86%) of these deaths were classified as maternal deaths; 61 of the deaths were considered to be directly or indirectly related to pregnancy and 2 were considered to be related to the pregnancy or its management, but could not be further classified as either direct or indirect. Ten of the deaths were classified as incidental to the pregnancy.

As shown in Figure 2.1, over half (32 or 51%) of the 63 deaths between 2012 and 2014 that met the definition of a maternal death were directly related to obstetric complications of the pregnancy and occurred while the woman was pregnant or within 42 days of the end of the pregnancy. Twenty-nine deaths (46%) were classified as indirect maternal deaths and were considered to be due to non-pregnancy related conditions that were aggravated by the pregnancy or its management. Two maternal deaths were considered to be related to the pregnancy or its management, but could not be further classified as either direct or indirect.

The 10 incidental deaths are not included in maternal mortality calculations.



## 2.1 Maternal mortality ratio

The maternal mortality ratio (MMR) for 2012–2014 was 6.8 per 100,000 women giving birth (Table 2.1).

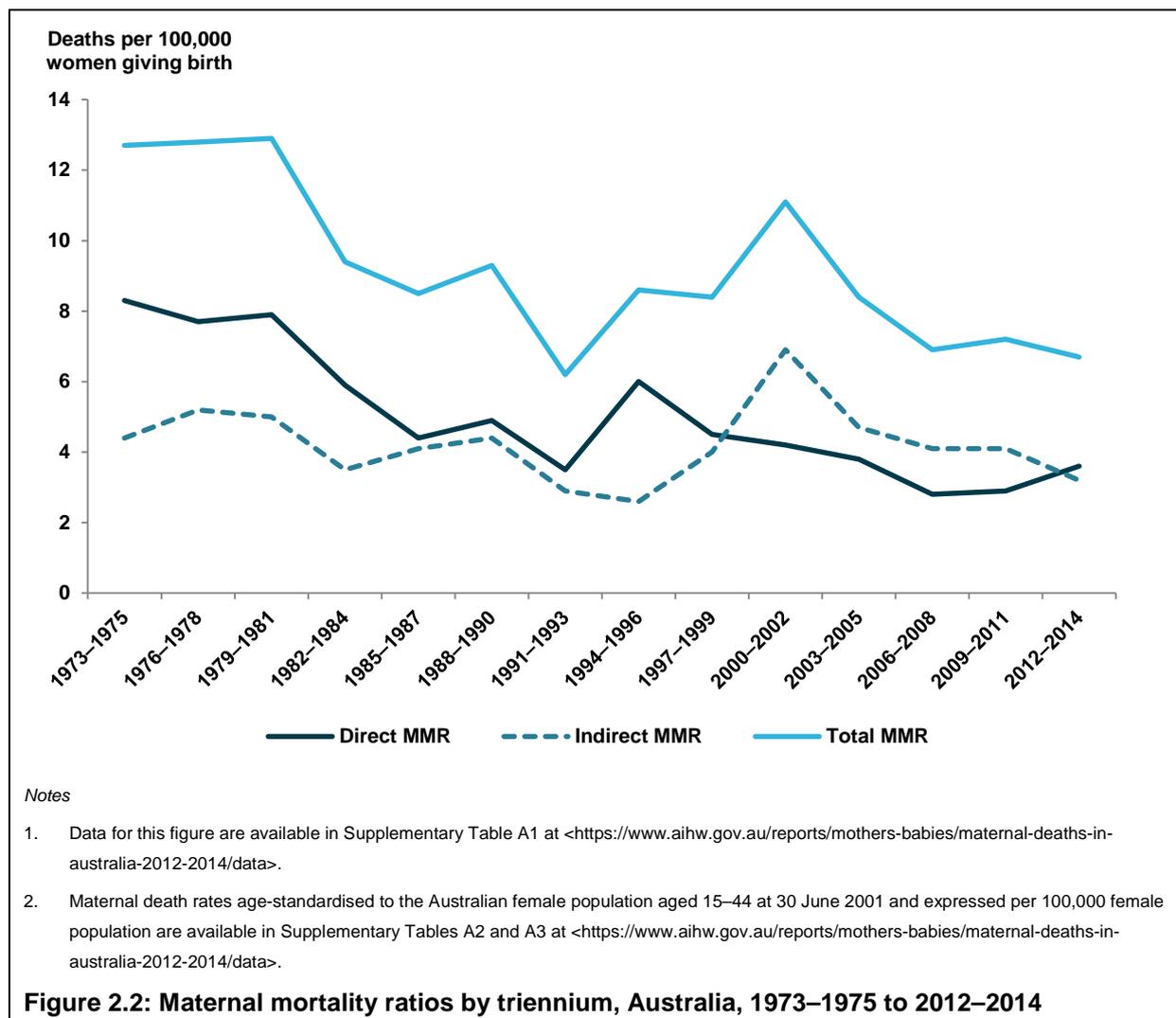
**Table 2.1: Maternal mortality ratio, Australia, 2012–2014**

Year	Direct deaths	Indirect deaths	Maternal death not further classified	Total maternal deaths	Number of women who gave birth	Maternal mortality ratio <sup>(a)</sup>	Incidental deaths
2012	16	10	1	27	307,474	8.8	4
2013	7	9	0	16	304,777	5.2	3
2014	9	10	1	20	307,844	6.5	3
<b>Total</b>	<b>32</b>	<b>29</b>	<b>2</b>	<b>63</b>	<b>920,095</b>	<b>6.8</b>	<b>10</b>

(a) Per 100,000 women who gave birth. Includes direct deaths, indirect deaths and deaths not further classified.

(b) Incidental deaths are not included in the MMR calculations.

As illustrated in Figure 2.2, the MMR for 2012–2014 is similar to that for the periods 2006–2008 (6.9 per 100,000 women who gave birth) and 2009–2011 (7.2 per 100,000 women who gave birth). There has been a significant decline in the direct MMR between 1973–1975 and 2012–2014, reducing from 8.3 per 100,000 women who gave birth to 3.5 per 100,000 women who gave birth (odds ratio 0.4; 95% confidence limits 0.3, 0.7). There has not been any clear change in the indirect MMR over this period; the fluctuations reflect the variability in the reporting of rare events such as maternal deaths.



Australia was a signatory to the Millennium Development Goals and the fifth goal is to 'Reduce by three-quarters, between 1990 and 2015, the maternal mortality ratio' (UN 2010). The MMRs reported between 1988-1990 and 2012-2014 show a reduction of 28% over the 27-year period since 1990 (9.3 per 100,000 women who gave birth and 6.8 per 100,000 women who gave birth, respectively).

## 2.2 International comparisons

The Maternal Mortality Estimation Inter-Agency Group (MMEIG), which includes representation from the World Health Organization, the United Nations Children's Fund (UNICEF), the United Nations Population Fund (UNFPA), the World Bank Group and the United Nations Population Division (UNPD), regularly provides estimates of international maternal mortality incidence (WHO 2015).

Globally, the MMEIG estimates that the MMR decreased from 385 (80% uncertainty interval (UI) 359-427) per 100,000 women giving birth in 1990 to 216 (80% UI 207-249) per 100,000 women giving birth in 2015 (Table 2.2). These estimates represent a decrease from 532,000 (80% UI 496,000-590,000) women dying in association with pregnancy and childbirth in 1990 to 303,000 (80% UI 291,000-349,000) in 2015. There are considerable variations in the

MMR within and between countries, and many experience significant difficulties with obtaining accurate data collections and instituting effective enquiry processes.

In 2015 the MMR for developed regions, which includes Australia, New Zealand, the United Kingdom and the United States of America, was estimated as 12 (80% UI 11–14) per 100,000 women giving birth. The MMR was 11 (80% UI 9–14) per 100,000 women giving birth in New Zealand, 9 (80% UI 8–11) per 100,000 women giving birth in the United Kingdom, and 14 (80% UI 12–16) per 100,000 women giving birth in the United States of America.

The MMR for Australia's northern neighbours was 215 (80% UI 98–457) per 100,000 women giving birth in Papua New Guinea, 215 (80% UI 150–300) per 100,000 women giving birth in Timor-Leste, and 114 (80% UI 75–175) per 100,000 women giving birth in the Solomon Islands.

Sub-Saharan Africa has a maternal mortality rate more than 45 times that of Australia, with the MMR estimate for 2015 being 546 (80% UI 511–652) per 100,000 women giving birth.

**Table 2.2: Comparison of maternal mortality ratio (MMR, maternal deaths per 100,000 live births) and number of maternal deaths, by United Nations Millennium Development Goal region, 1990 and 2015.**

United Nations Millennium Development Goal region	1990		2015		Percentage change between 1990 and 2015 <sup>(c)</sup>
	MMR <sup>(a)</sup>	Maternal deaths <sup>(b)</sup>	MMR <sup>(a)</sup>	Maternal deaths <sup>(b)</sup>	
World	385	532,000	216	303,000	44
Developed regions <sup>(d)</sup>	23	3,500	12	1,700	48
Developing regions	430	529,000	239	302,000	44
• Northern Africa <sup>(e)</sup>	171	6,400	70	3,100	59
• Sub-Saharan Africa <sup>(f)</sup>	987	223,000	546	201,000	45
• Eastern Asia <sup>(g)</sup>	95	26,000	27	4,800	72
• Southern Asia <sup>(h)</sup>	538	210,000	176	66,000	67
• South-eastern Asia <sup>(i)</sup>	320	39,000	110	13,000	66
• Western Asia <sup>(j)</sup>	160	6,700	91	4,700	43
• Caucasus and Central Asia <sup>(k)</sup>	69	1,300	33	610	52
• Latin America and Caribbean <sup>(l)</sup>	135	16,000	67	7,300	50
• Oceania <sup>(m)</sup>	391	780	187	500	52

(a) MMR estimates have been rounded according to the following scheme: <100 rounded to nearest 1; 100–999 rounded to nearest 1; and ≥1,000 rounded to nearest 10.

(b) Numbers of maternal deaths have been rounded according to the following scheme: <100 rounded to nearest 1; 100–999 rounded to nearest 10; 1,000–9,999 rounded to nearest 100; and ≥10 000 rounded to nearest 1,000.

(c) Overall change.

(d) Albania, Australia, Austria, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Canada, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Latvia, Lithuania, Luxembourg, Malta, Montenegro, Netherlands, New Zealand, Norway, Poland, Portugal, Republic of Moldova, Romania, Russian Federation, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, The former Yugoslav Republic of Macedonia, Ukraine, United Kingdom, United States of America.

(e) Algeria, Egypt, Libya, Morocco, Tunisia.

(f) Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cabo Verde, Central African Republic, Chad, Comoros, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Somalia, South Africa, South Sudan, Sudan, Swaziland, Togo, Uganda, United Republic of Tanzania, Zambia, Zimbabwe.

(g) China, Democratic People's Republic of Korea, Mongolia, Republic of Korea.

(h) Afghanistan, Bangladesh, Bhutan, India, Iran (Islamic Republic of), Maldives, Nepal, Pakistan, Sri Lanka.

(i) Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand, Timor-Leste, Viet Nam.

(j) Bahrain, Iraq, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, Turkey, United Arab Emirates, West Bank and Gaza Strip territory (UNICEF, UNPFA, World Bank Group and UNPD refer to this territory as the State of Palestine), Yemen.

(k) Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan.

(l) Argentina, Belize, Bolivia (Plurinational State of), Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Suriname, Uruguay, Venezuela (Bolivarian Republic of); Bahamas, Barbados, Cuba, Dominican Republic, Grenada, Haiti, Jamaica, Puerto Rico, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago.

(m) Fiji, Kiribati, Micronesia (Federated States of), Papua New Guinea, Samoa, Solomon Islands, Tonga, Vanuatu.

Source: Trends in Maternal Mortality 1990 to 2015: Estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division (WHO 2015).

## 2.3 State and territory of death

The Australian MMR varied by state and territory of death (Table 2.3). These data are analysed by the state or territory in which the maternal death occurred. As this report includes a review of contributing factors to deaths where contributing factor assessment was undertaken, analysis by state or territory of death is a more relevant than state or territory of normal residence. The small number of deaths indicates that caution should be used when interpreting the state and territory MMRs.

**Table 2.3: Maternal deaths by type of death and state or territory of death, 2012–2014**

State or territory	Number of women who gave birth	Number of maternal deaths	Maternal mortality ratio <sup>(a)</sup>
NSW <sup>(b)</sup>	289,596	12	4.1
Vic	232,213	23	9.9
Qld	187,617	11	5.9
WA	102,007	7	6.9
SA <sup>(b)</sup>	60,711	6	9.9
Tas	17,617	2	11.4
ACT	18,409	0	0
NT	11,925	2	16.8
<b>Total</b>	<b>920,095</b>	<b>63</b>	<b>6.8</b>

(a) Per 100,000 women who gave birth.

(b) Two of the deaths that occurred in 2012 were reported by two state committees, as death occurred in a state other than that of usual residence; these deaths are recorded in this table as per the state in which the death occurred.

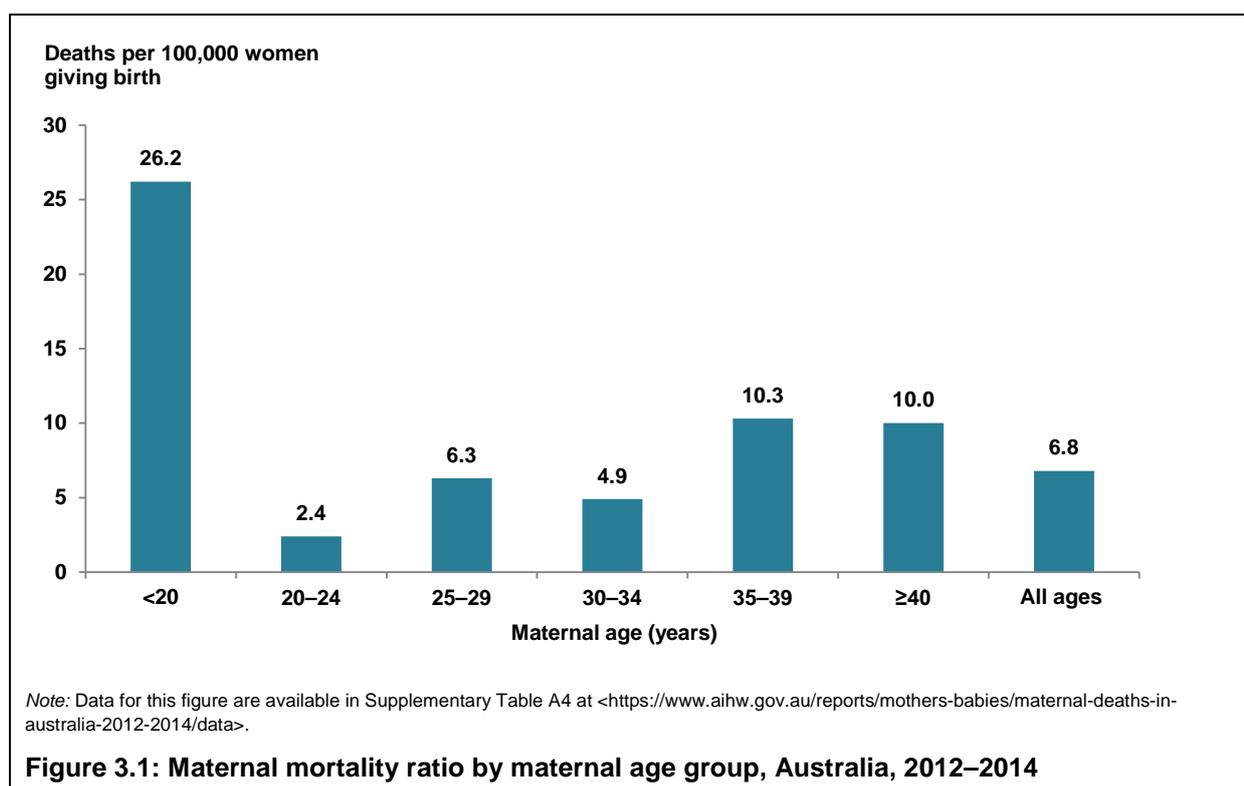
*Note:* Variations in MMR between states and territories should be interpreted with caution due to the small numbers of deaths.

### 3 Demographic characteristics

Understanding the age, parity and residential location of women who die assists in explaining the maternal mortality rate and this information may be used for appropriate planning of services. Due to the sources and nature of data being contributed to the National Maternal Mortality Data Collection, some demographic characteristics were not available for all women who died.

#### 3.1 Maternal age

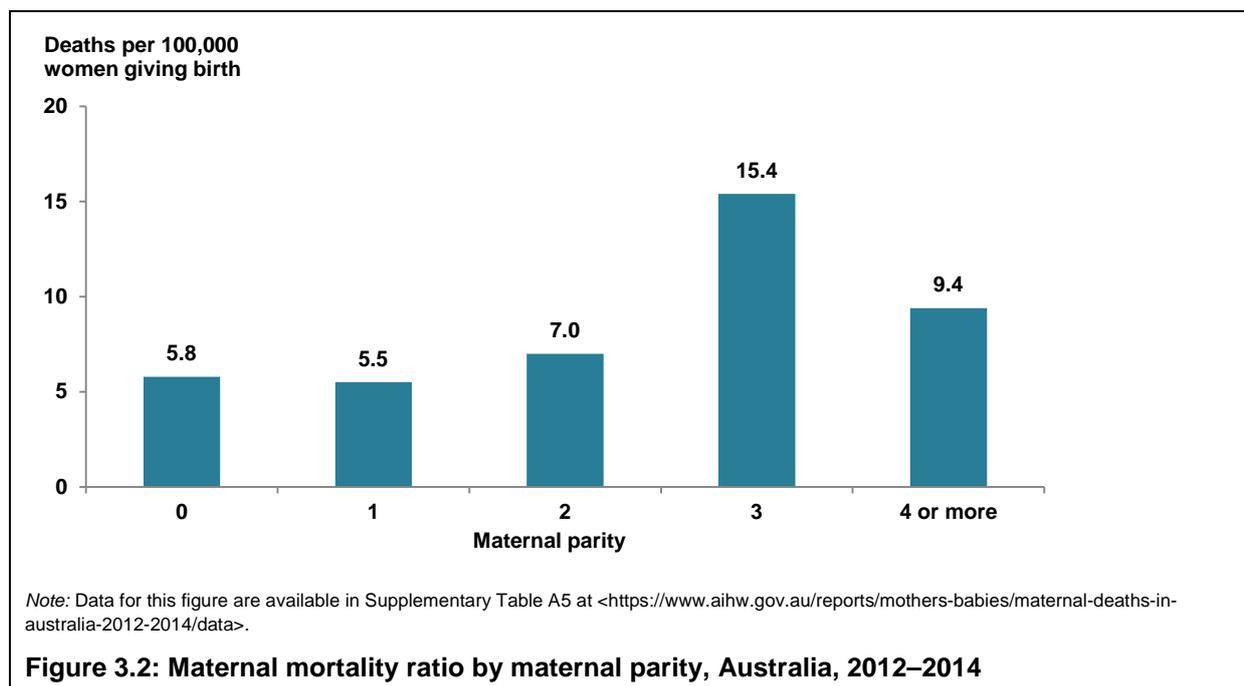
Between 2012 and 2014 the incidence of maternal death was higher for younger and older mothers (Figure 3.1), with the lowest incidence of maternal death occurring between the ages of 20 and 34 (MMR 5.0 per 100,000 women who gave birth). One in 3 maternal deaths (33.3%) occurred in women who were aged 35 or over (MMR 10.3 per 100,000 women who gave birth). The incidence of maternal death in women aged under 20 years was higher than it has been in previous years: 12.7% of the maternal deaths occurred in these young women (MMR 26.2 per 100,000 women who gave birth). However, these data should be viewed with caution due to the small number of women aged under 20 giving birth.



#### 3.2 Maternal parity

Parity refers to a woman's number of previous pregnancies carried to a viable gestational age (usually 20 weeks), resulting in live births or stillbirths and excluding the current pregnancy. Women with a parity of 3 or more were twice as likely to die as women of parity 0 to 2 (MMR 12.9 per 100,000 women who gave birth and 5.9 per 100,000 women who gave

birth, respectively; odds ratio of 2.2, 95% confidence limits 1.1, 4.4) (Figure 3.2). There was no clear pattern discernible in the distribution of the causes of death in relation to parity.



### 3.3 Maternal Body Mass Index

Of the 33 women whose Body Mass Index (BMI) was identified, 9 (27%) were overweight, with a BMI between 25 and 29.9, and 14 (42%) were obese, with a BMI of 30.0 or more. When compared to the overall incidence of BMI among child-bearing women, maternal deaths were more common in women with a high BMI (of 30.0 or more) than in women with a lower BMI (in those maternal deaths where the woman’s BMI was identified, 42% had a high BMI, compared with only 20% of all women who gave birth) (Table 3.1). As the number of maternal deaths with a recorded BMI is limited, caution should be taken when interpreting these data, as the odds ratio confidence limits are broad.

**Table 3.1: Incidence of maternal death by maternal BMI, Australia, 2012–2014**

Maternal BMI <sup>(a)</sup> at first antenatal visit	Total maternal deaths <sup>(b)</sup>	Percentage of maternal deaths	Percentage of women giving birth <sup>(c)</sup>
Less than 18.5	1	3.0	3.9
18.5–24.9	9	27.3	49.6
25–29.9	9	27.3	26.2
30–39.9	8	24.2	17.4
40 or more	6	18.2	3.0
<b>All women with BMI reported</b>	<b>33</b>	<b>100.0</b>	<b>100.0</b>
<i>BMI not reported</i>	30		
<b>Total</b>	<b>63</b>		

(a) BMI = body mass index (kg/m<sup>2</sup>).

(b) BMI data for maternal deaths were not available from WA and NT.

(c) BMI data for all women giving birth were not available from NSW and NT.

### 3.4 Smoking during pregnancy

Smoking status of the women who died was available for 34 (54%) of the 63 maternal deaths in 2012–2014. Sixteen of the 34 women for whom smoking status was available were reported to have smoked during the first 20 weeks of pregnancy (Table 3.2). Maternal death was more common in those who smoked in the first 20 weeks of pregnancy than in those who did not smoke (15.5 per 100,000 women who gave birth and 2.2 per 100,000 women who gave birth, respectively; odds ratio 7.0, 95% confidence limits 3.5, 13.5). As the number of maternal deaths with a recorded smoking status is limited, caution should be taken when interpreting these data.

**Table 3.2: Incidence of maternal death by maternal smoking during the first 20 weeks of pregnancy, Australia, 2012–2014**

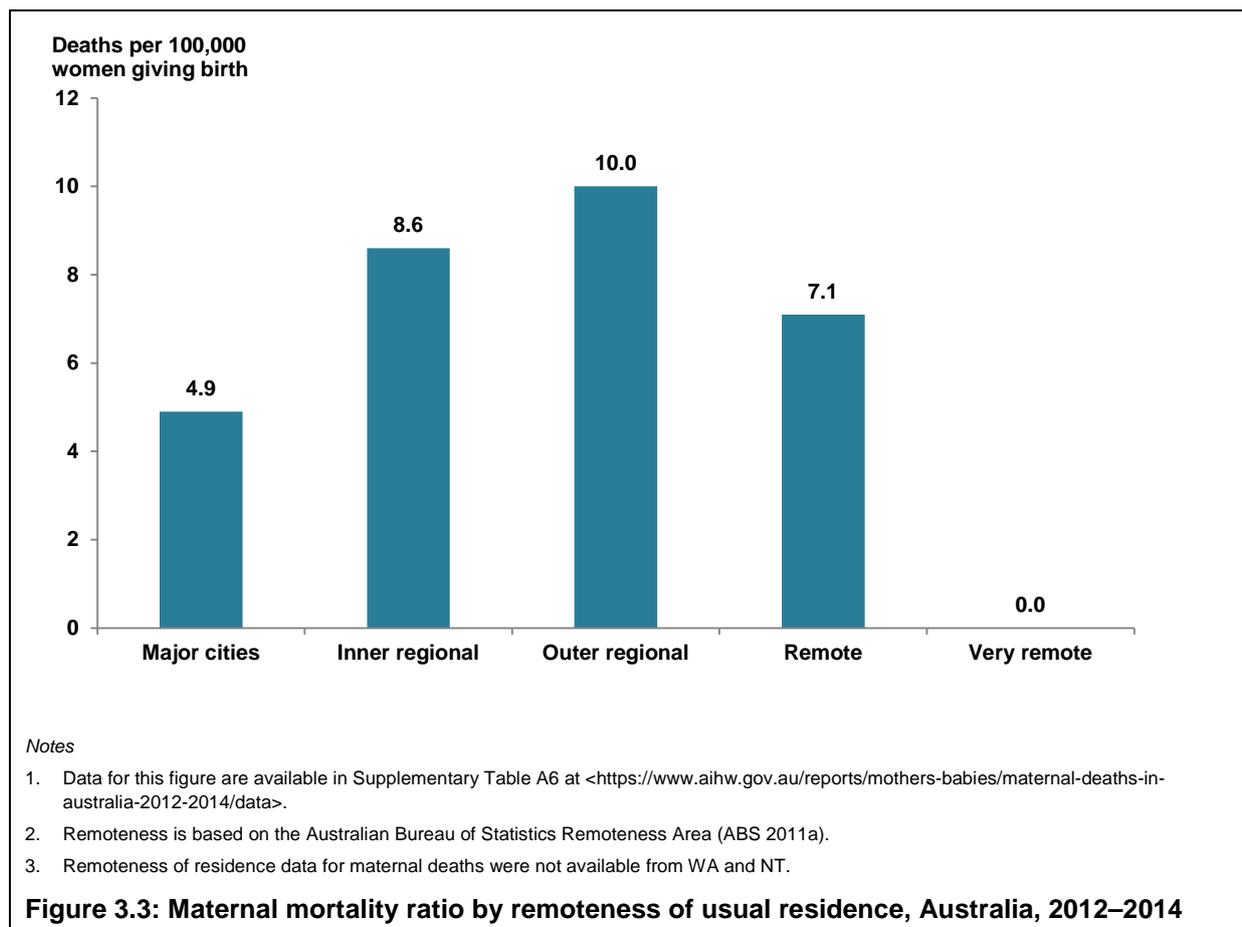
Smoking status	Maternal deaths <sup>(a)</sup>	Percentage of maternal deaths	Percentage of women giving birth
Smoked during first 20 weeks of pregnancy	16	47.1	11.3
Did not smoke during first 20 weeks of pregnancy	18	52.9	88.7
<b>All women with smoking during first 20 weeks of pregnancy reported</b>	<b>34</b>	<b>100.0</b>	<b>100.0</b>
<i>Smoking during first 20 weeks of pregnancy not reported</i>	29		
<b>Total</b>	<b>63</b>		

(a) Smoking data for maternal deaths were not available from NT.

### 3.5 Remoteness of usual residence

Figure 3.3 provides information regarding the remoteness area of the usual place of residence for the women who died, as defined by the Remoteness Areas (RA) 2011 index (ABS 2011a). The RA geographical classification is calculated from the postcode of the woman's usual residence in relation to the physical distance from the nearest urban centre. Usual residence information was not available for women from Western Australia and the Northern Territory.

The majority of the women who died where usual residence was identified (59%) lived in *Major cities* of Australia and had the lowest MMR (4.9 per 100,000 women giving birth) (Figure 3.3). Women who lived in *Inner regional* Australia had an MMR of 8.6 and those who lived in *Outer regional, Remote or Very remote* locations had a combined MMR of 17.1 per 100,000 women giving birth. The incidence of maternal death in areas other than major cities of Australia should be treated with caution due to the small numbers.



## 3.6 Country of birth

Almost three-quarters of the women who died (71%) were born in Australia (Table 3.3). The MMR for women born in Australia was 7.2 per 100,000 women giving birth, and for those identified as being born in another country the MMR was 3.1 per 100,000 women giving birth.

**Table 3.3: Maternal deaths by country of birth, Australia, 2012–2014**

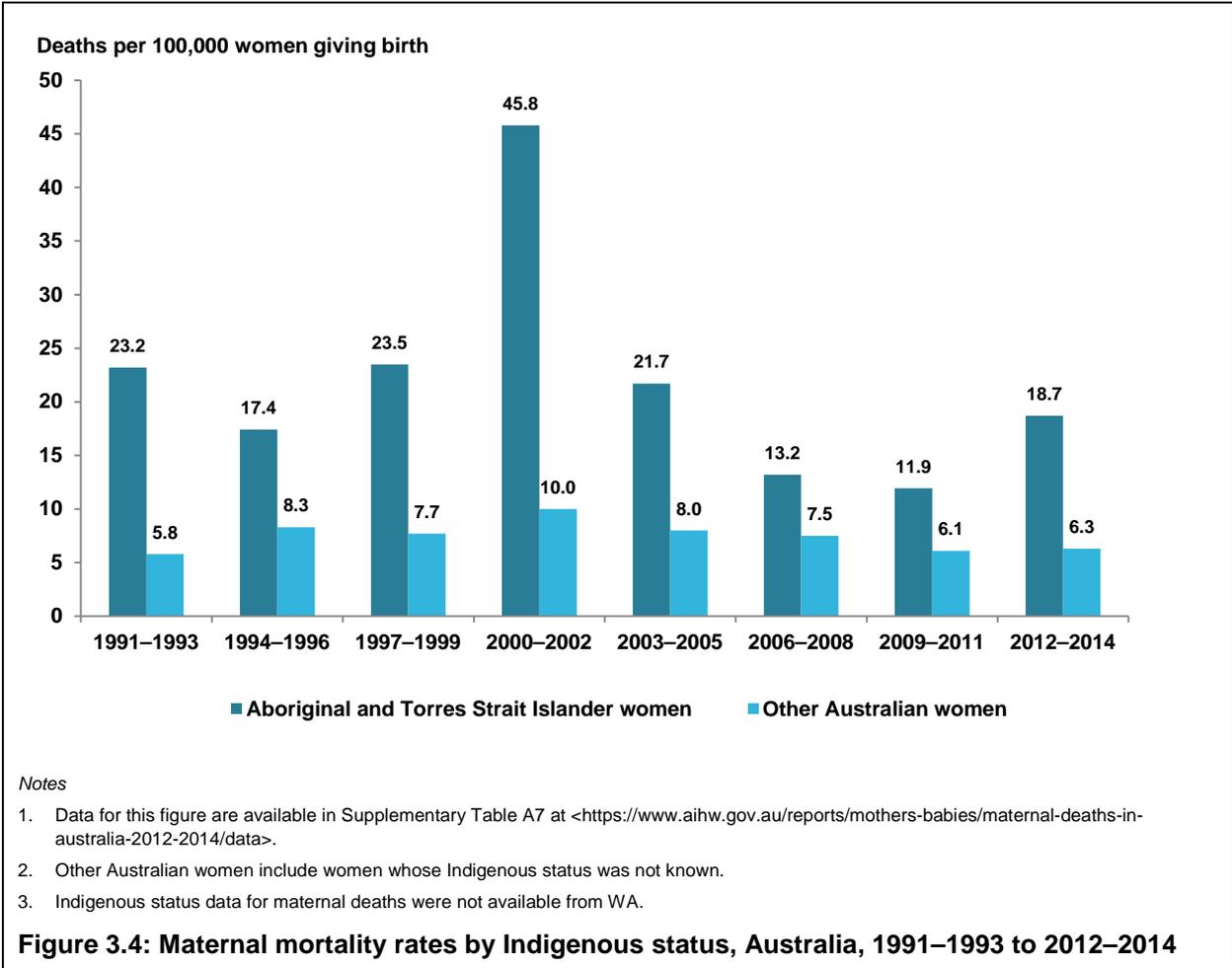
Country of birth	Number of maternal deaths <sup>(a)</sup>	Percentage of maternal deaths
Australia	45	71.4
New Zealand & Oceania	2	3.2
Europe	0	0
Africa & Middle East	2	3.2
Northern Americas	0	0
Central & Southern Americas	0	0
North-East Asia (China, Japan, Korea)	1	1.6
South-East Asia	3	4.8
Southern & Central Asia	1	1.6
Unknown/not stated	9	14.3
<b>Total</b>	<b>63</b>	<b>100.0</b>

(a) Country of birth data for maternal deaths were not available from NT.

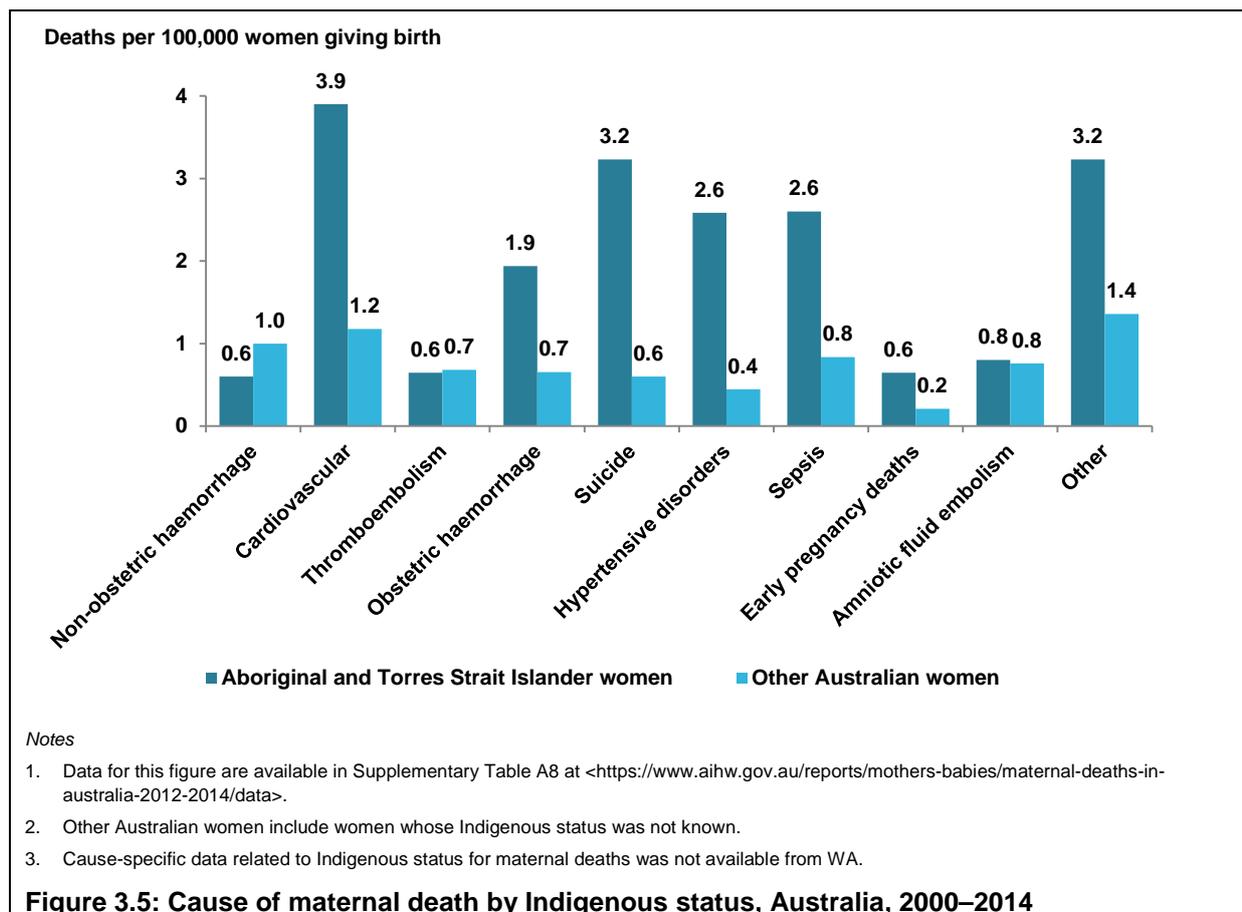
### 3.7 Aboriginal and Torres Strait Islander women

Indigenous status has been collected for women categorised as direct maternal deaths since 1970, and for indirect maternal deaths and incidental deaths since 1991.

Between 2012 and 2014, the MMR for Aboriginal and Torres Strait Islander women was 18.7 per 100,000 women who gave birth, compared with 11.9 in 2009–2011 and 13.2 in 2006–2008 (Figure 3.4). The corresponding figures for other Australian women were 6.3 per 100,000 in 2012–2014, 6.1 in 2009–2011 and 7.5 in 2006–2008.



Cause-specific MMRs are shown in Figure 3.5. Since 2000, Aboriginal and Torres Strait Islander women have been significantly more likely than other Australian women to die in relation to pregnancy from cardiovascular causes, suicide, hypertensive disorders, obstetric haemorrhage, sepsis and in early pregnancy.

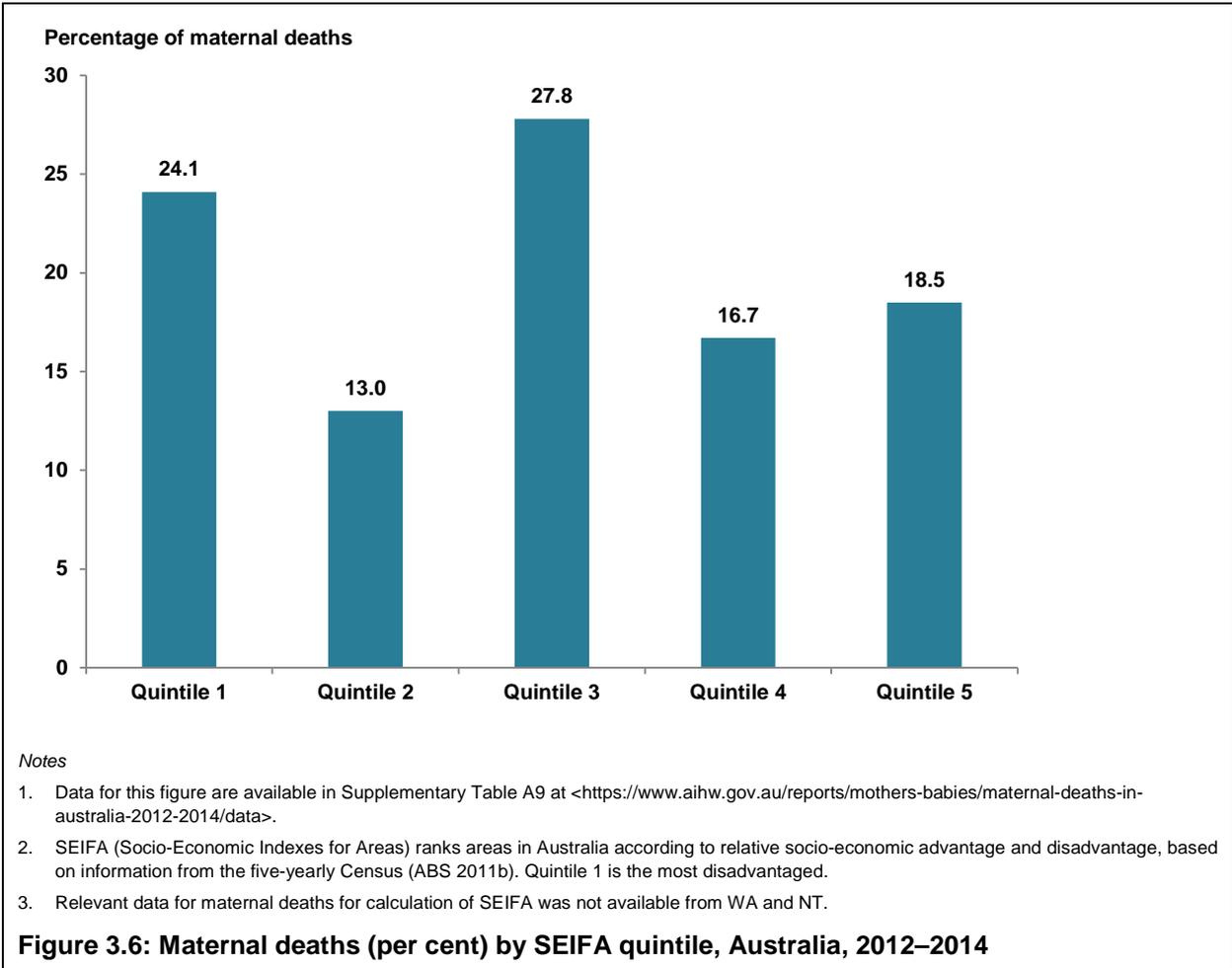


### 3.8 Socioeconomic status

Figure 3.6 provides information regarding the relative socioeconomic status of women who died, as defined by the Index of Relative Socio-Economic Advantage and Disadvantage, one of four indexes that comprise the Socio-Economic Indexes for Areas (SEIFA). The SEIFA, compiled by the ABS, is a summary measure of a number of variables that represent different aspects of relative socio-economic disadvantage and/or advantage in a geographic area (ABS 2011b). For this report, SEIFA was calculated on the basis of the mother’s usual area of residence.

For the purposes of this report the SEIFA Index of Relative Socio-economic Advantage and Disadvantage is divided into 5 percentage-based groups (quintiles), producing a continuum of advantage (high values—quintiles 5 and 4) to disadvantage (low values—quintiles 1 and 2). The data shown in Figure 3.6 are divided by percentage of all maternal deaths as the distribution of all women giving birth in 2012–2014 is not known.

There was no discernible pattern regarding the distribution of maternal deaths across the Index of Relative Socio-Economic Advantage and Disadvantage categories.



## 4 Clinical characteristics

### 4.1 Antenatal care

Data regarding the number of antenatal visits undertaken by women who died before 20 weeks of pregnancy was not available or not relevant as death occurred in early pregnancy. In 2012–2014, 59 women whose pregnancy extended more than 20 weeks' gestation died. Of the women who died, 11 attended fewer than 5 antenatal visits during their pregnancy and 28 women attended 5 or more antenatal visits (Table 4.1).

**Table 4.1: Incidence of maternal death by antenatal care, Australia, 2012–2014**

Antenatal care	Direct maternal deaths	Indirect maternal deaths	Classification not stated	Total maternal deaths
0–4 antenatal visits	5	6	0	11
5 or more antenatal visits	15	13	0	28
Not stated	9	9	2	20
Death before antenatal care appropriate (less than 20 weeks gestation)	3	1	0	4
<b>Total</b>	<b>32</b>	<b>29</b>	<b>2</b>	<b>63</b>

### 4.2 Mode of giving birth

Of the 63 women who died, 45 gave birth. The remaining 18 died before giving birth or classification was not stated. Nineteen (42%) of those births were vaginal births and 26 (58%) births were by caesarean section (Table 4.2). One-quarter of the caesarean sections (27%) were perimortem caesarean sections performed in women who were close to death to assist with attempted maternal resuscitation and/or to facilitate emergency birth for the purpose of saving the life of the baby. The baby was unborn at the time of the woman's death in 10 (16%) maternal deaths and the mode of birth was not stated for 1 woman.

**Table 4.2: Maternal deaths by type of death and mode of birth, Australia, 2012–2014**

Mode of birth	Type of maternal death			Total
	Direct	Indirect	Classification not stated <sup>(b)</sup>	
Unassisted vaginal birth	7	7	2	16
Assisted vaginal birth <sup>(a)</sup>	2	0	1	3
Caesarean section birth	12	5	2	19
Perimortem caesarean section birth	3	3	1	7
No birth–Baby remained in-utero at maternal death	2	8	0	10
No birth–Pregnancy ended before 20 weeks	3	4	0	7
Not stated	0	0	1	1
<b>Total</b>	<b>29</b>	<b>27</b>	<b>7</b>	<b>63</b>

(a) Forceps or vacuum extraction-assisted vaginal births.

(b) Classification not stated includes maternal deaths from WA; data were not available by Mode of birth and Type of maternal death.

Information was available regarding the urgency with which 19 of the 26 caesarean sections were performed (Table 4.3). Five (26%) of these caesarean sections were performed in response to an immediate threat to life of the mother or baby and 9 (47%) were performed with no immediate threat to the life or health of the mother or baby. Five (26%) caesarean sections were perimortem operations; 4 of the 6 resulting babies were live born. There was limited information available regarding the urgency for a number of these caesarean sections.

**Table 4.3: Maternal deaths by type of death and urgency of caesarean section, Australia, 2012–2014**

Urgency of caesarean section	Number
Immediate threat to life of mother or baby	5
Maternal or fetal compromise with no immediate threat to life	4
No maternal or fetal compromise but needs early delivery	2
Delivery timed to suit woman or staff	3
Peri- or post-mortem	5
Not stated	7
<b>Total</b>	<b>26</b>

Note: Caesarean section urgency data were not available for maternal deaths from WA and NT.

### 4.3 Location of death

Forty-three of the 63 women who died were hospital inpatients at the time of their death and 12 women died at home (Table 4.4). Where the site of hospital death is known, 20 (54%) of the women died in an intensive care unit and a further 9 (24%) died in an operating theatre (Table 4.5).

**Table 4.4: Maternal deaths by setting<sup>(a)</sup> and type of death, Australia, 2012–2014**

Setting of death	Direct	Indirect	Classification not stated	Total
Home	3	9	0	12
Hospital	28	14	1	43
Birth centre	0	0	0	0
Other	0	2	1	3
Not stated	1	4	0	5
<b>Total</b>	<b>32</b>	<b>29</b>	<b>2</b>	<b>63</b>

(a) Setting of death indicates where a death occurred. It does not imply that birth occurred in that setting (for example, a birth may occur in hospital and death may subsequently occur at home).

Note: Setting of death data were not available for maternal deaths from NT.

**Table 4.5: In-hospital maternal deaths by location and setting of death<sup>(a)</sup> in hospital and type of death, Australia, 2012–2014**

<b>Location and setting of death</b>	<b>Direct</b>	<b>Indirect</b>	<b>Maternal death not further classified</b>	<b>Total</b>
All deaths in hospital	28	14	1	43
<i>Intensive care unit</i>	13	7	0	20
<i>Operating theatre</i>	7	2	0	9
<i>Emergency department</i>	2	4	0	6
<i>Maternity setting</i>	1	1	0	2
<i>Location in hospital not stated</i>	5	0	1	6
Deaths that did not occur in hospital	3	11	1	15
Location of death not stated	1	4	0	5
<b>Total</b>	<b>32</b>	<b>29</b>	<b>2</b>	<b>63</b>

(a) Setting of death indicates where a death occurred. It does not imply that birth occurred in that setting (for example, a birth may occur in hospital and death may subsequently occur at home).

Note: Setting of death data were not available for maternal deaths from NT; data from WA did not include location of death within hospitals.

## 4.4 Baby outcomes among maternal deaths

Babies were born to 42 women who died, including three sets of twins, and most of those 45 babies were live born (38, 91%); 4 babies (10%) were stillborn (Table 4.6). There was no birth in 17 pregnancies and information was not available regarding the baby outcome in 4 pregnancies.

**Table 4.6: Maternal deaths by baby outcome, Australia, 2012–2014**

<b>Baby outcome</b>	<b>Type of maternal death</b>			<b>Total</b>
	<b>Direct</b>	<b>Indirect</b>	<b>Maternal death not further classified</b>	
Live birth	24	13	1	38
Stillbirth	2	2	0	4
No birth <sup>(a)</sup>	5	12	0	17
Not stated	1	2	1	4
<b>Total</b>	<b>32</b>	<b>29</b>	<b>2</b>	<b>63</b>

(a) Pregnancy ended before 20 weeks or baby remained in utero at maternal death.

Note: Baby outcome data were not available for maternal deaths from NT.

## 4.5 Incidence of autopsy

Diagnosis of cause of death was confirmed in the majority (49, 79%) of maternal deaths (Table 4.7). Autopsy was not performed after 13 deaths, and 7 of those deaths occurred in an intensive care unit. In at least 1 case where autopsy was not performed the cause of death was not clear.

**Table 4.7: Maternal deaths by performance of autopsy, Australia, 2012–2014**

	Type of death			Total
	Direct	Indirect	Maternal death not further classified	
Autopsy performed	27	21	1	49
Autopsy not performed	5	8	0	13
Not stated	0	0	1	1
<b>Total</b>	<b>32</b>	<b>29</b>	<b>2</b>	<b>63</b>

### ***Good practice guidance***

While accepting that there are a number of reasons that autopsy may be declined, the National Maternal and Perinatal Mortality Advisory Group strongly supports the premise that autopsy should be advocated to establish the cause of death for all maternal deaths where the cause of death is not clearly known or is unusual. Presumptive diagnoses of cause of death may not always be correct (for example, amniotic fluid embolism versus pulmonary thromboembolism).

## 4.6 Contributing factors in maternal deaths

Some State and Territory Maternal Mortality Committees assess the presence or absence of contributing factors in relation to maternal deaths. Contributing factors are factors related to the woman's care that the STMMC considered may have contributed to her death. It is important to note, however, that the contributing factor(s) identified may not have directly caused the death or had an influence on the outcome.

A maternal mortality committee finding of the presence of contributing factors does not imply negligence. As a form of health-care audit, a contributing factor review seeks lessons that can be learned, with the aim of improving future outcomes through potential upgrades to healthcare processes, and identifies areas where changes to health policy and changes to health care may improve outcomes.

Assessments were undertaken for 43 of the 63 maternal deaths in 2012–2014 and of these contributing care factors were assessed as present in 26 of the deaths (Table 4.8).

Some of the case vignettes in Section 5 illustrate the presence of contributing factors.

**Table 4.8: Assessment of possible contributing factors in maternal deaths, Australia, 2012–2014**

Contributing factor assessment	Total
Contributing care factor(s) identified <i>likely</i> to have contributed to outcome (significant)	9
Contributing care factor(s) identified <i>might</i> have contributed to outcome (possible)	12
Contributing care factor(s) identified but unlikely to have contributed to outcome (insignificant)	5
No contributing care factors identified	17
Contributing factor assessment not undertaken	20
<b>Total</b>	<b>63</b>

The presence of contributing care factors was thought to have been *likely* to have contributed to outcome in 9 deaths and *might* have contributed to outcome in a further 12 deaths.

Thirty-two contributing factors were identified in relation to 26 deaths; in 6 cases 2 factors were identified. The majority of the contributing care factors were related to professional care of the women (Table 4.9).

**Table 4.9: Type of contributing care factor identified in maternal deaths, Australia, 2012–2014**

Contributing care factor(s) identified by state or territory maternal mortality committee <sup>(a)</sup>	Total
Contributing care factor(s) related to professional care	23
Contributing care factor(s) related to access to care	1
Contributing care factor(s) related to the woman/her family/social situation	4
Other contributing factors identified	4
<b>Total</b>	<b>32</b>

(a) Contributing factors were found in 26 cases; in 6 cases 2 factors were identified.

# 5 Causes of maternal deaths

## 5.1 Primary cause

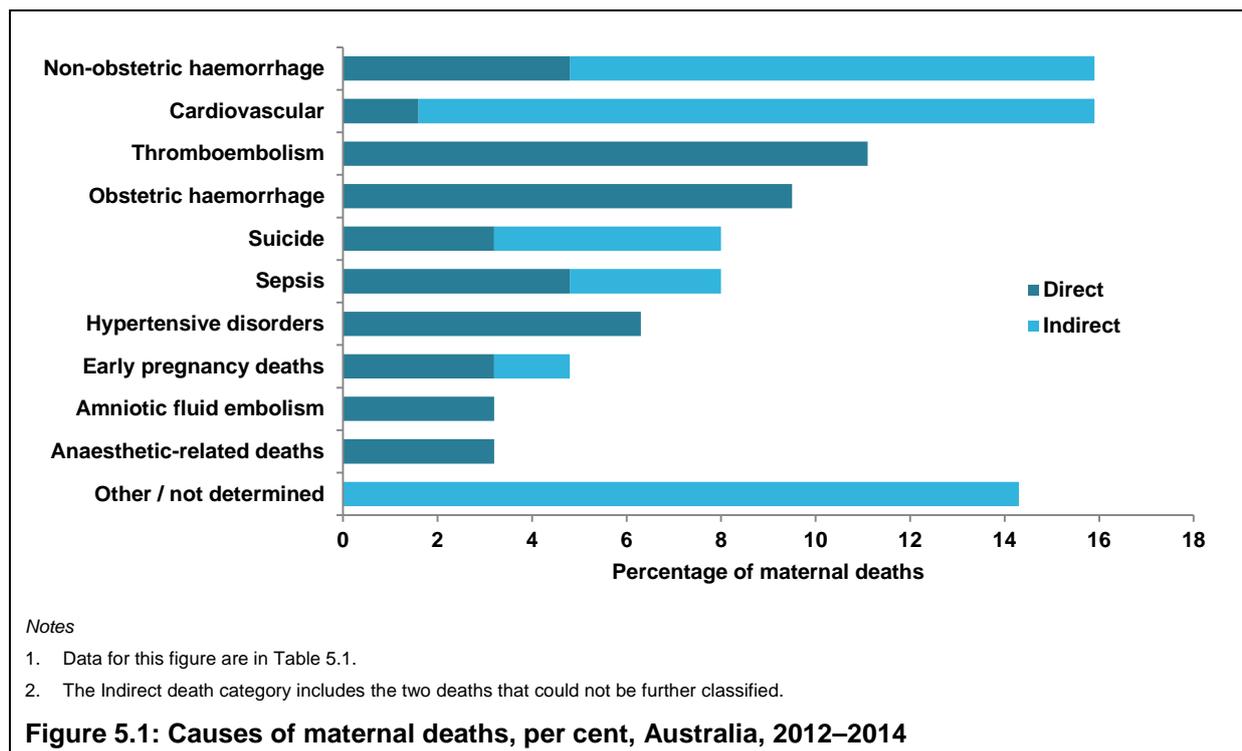
For the purposes of this report, the deaths have been categorised according to their primary cause, as assessed by the state or territory maternal mortality committee (Box 5.1).

### Box 5.1: Primary causes of maternal deaths

- **Amniotic fluid embolism:** deaths related to the effects of significant amounts of amniotic fluid entering the maternal circulation.
- **Cardiovascular:** deaths due to a disease process (usually pre-existing) affecting the heart and/or major blood vessels.
- **Early pregnancy deaths:** this category includes deaths related to miscarriage, termination of pregnancy, ectopic pregnancy and gestational trophoblastic disease.
- **Hypertensive disorders:** deaths related to the effects of pre-eclampsia and eclampsia and other disorders of high blood pressure in pregnancy.
- **Obstetric haemorrhage:** deaths related to haemorrhage from the uterus, and usually being from the placenta.
- **Non-obstetric haemorrhage:** deaths related to haemorrhage elsewhere in the woman's body.
- **Anaesthetic-related:** deaths where the cause was related to anaesthesia and/or a surgical procedure.
- **Sepsis:** deaths originating in infection.
- **Suicide:** deaths caused by maternal suicide.
- **Thromboembolism:** deaths due to obstruction of a blood vessel (most frequently the pulmonary blood vessels) by a blood clot that has become dislodged from another site in the circulation.
- **Other:** deaths that do not fall into one of the above categories.
- **Unclassified:** deaths that the state or territory maternal mortality committee has been unable to classify due to insufficient information being available regarding causation.

The most common causes of maternal death in 2012–2014 were non-obstetric haemorrhage (haemorrhage from sites other than the genital tract), cardiovascular conditions, thromboembolism and obstetric haemorrhage (Figure 5.1 and Table 5.1).

Note: This section includes case vignettes; care has been taken to remove or change information that could potentially identify any individual.



**Table 5.1: Causes of maternal deaths, Australia, 2012–2014**

Cause of death	Classification of maternal deaths			Total maternal deaths	Percentage of maternal deaths	Maternal mortality ratio <sup>(a)</sup>
	Direct	Indirect	Not further classified			
Non-obstetric haemorrhage	3	7	0	10	15.9	1.1
Cardiovascular	1	9	0	10	15.9	1.1
Thromboembolism	7	0	0	7	11.1	0.8
Obstetric haemorrhage	6	0	0	6	9.5	0.7
Suicide	2	3	0	5	7.9	0.5
Sepsis	3	2	0	5	7.9	0.5
Hypertensive disorders	4	0	0	4	6.3	0.4
Early pregnancy deaths	2	1	0	3	4.8	0.3
Amniotic fluid embolism	2	0	0	2	3.2	0.2
Anaesthetic-related deaths	2	0	0	2	3.2	0.2
Other	0	7	2	9	14.3	1.0
<b>Total</b>	<b>32</b>	<b>29</b>	<b>2</b>	<b>63</b>	<b>100.0</b>	<b>6.8</b>

(a) Per 100,000 women who gave birth.

## Direct maternal deaths

Direct maternal deaths were most frequently due to pulmonary thromboembolism (blood clots blocking blood flow in major arteries in the lungs), obstetric haemorrhage (blood loss from the uterus) and hypertensive disorders (high blood pressure due to pre-eclampsia) (Table 5.2). More than two-thirds of direct maternal deaths (21 deaths, 65.6%) occurred after the woman had given birth (postpartum). The majority of women whose parity was stated had given birth previously (19, 67.9%). Contributing causes were noted in relation to most of the direct maternal deaths.

**Table 5.2: Cause of direct maternal deaths, Australia, 2012–2014**

Maternal death group	Cause of death	No. of deaths
Non-obstetric haemorrhage	Intracerebral haemorrhage	1
	Intra-abdominal haemorrhage	1
	Cause of death not stated	1
Cardiovascular disease	Cardiopulmonary collapse of uncertain cause–possible conduction disorder	1
Thromboembolism	Pulmonary thromboembolism	7
Obstetric haemorrhage	Postpartum haemorrhage	3
	Placenta accreta	1
	Uterine rupture	1
	Excessive blood loss post-miscarriage	1
Suicide	Overdose	1
	Suicide unspecified	1
Hypertensive disorders	Intracerebral haemorrhage	3
	Hypoxaemic ischaemic encephalopathy	1
Sepsis	Group A Streptococcal sepsis	1
	MRSA Staphylococcal sepsis	2
Early pregnancy death	Ectopic pregnancy	2
Amniotic fluid embolism	Amniotic fluid embolism	2
Anaesthetic-related death	Unable to ventilate post seizure	1
	Ischaemic brain injury	1

## Indirect maternal deaths

Non-obstetric haemorrhage (bleeding from sites other than the uterus) and cardiovascular disease (diseases of the heart and major arteries) were the most common groups of indirect maternal death causes (Table 5.3). Slightly more than half of the deaths (13, 54% when timing of death was stated) occurred after the woman had given birth (postpartum) or in association with birth (peripartum). Where the woman's parity was stated, 10 women (38%) were in their first pregnancy and 14 (54%) had given birth previously. Contributing causes were noted in relation to many of the indirect maternal deaths.

**Table 5.3: Cause of indirect maternal deaths, Australia, 2012–2014**

<b>Maternal death group</b>	<b>Cause of death</b>	<b>No. of deaths</b>
Non-obstetric haemorrhage	Intracerebral haemorrhage	4
	Haemothorax	1
	Mediastinal haemorrhage and haemothorax	1
	Haemorrhagic shock	1
Cardiovascular disease	Myocardial infarction	2
	Ischaemic heart disease	1
	Lymphocytic myocarditis	1
	Dissecting aortic aneurysm	1
	Arrhythmic cardiac event	2
	Pulmonary haemorrhage and pneumothorax	1
	Cause of death not stated	1
Suicide	Hanging asphyxia	2
	Suicide, mode unspecified	1
Sepsis	Acute pyelonephritis	1
	Cause of death not stated	1
Early pregnancy death	Intracerebral haemorrhage	1
Other	Substance abuse	1
	Epilepsy	1
	Metabolic complications of diabetes mellitus	1
	Asthma	1
	Cause of death undetermined	2
	Cause of death not stated	1

## Non-obstetric haemorrhage

Deaths categorised to non-obstetric haemorrhage have their primary origin in bleeding arising from maternal blood vessels that are not within the genital tract.

There were 10 maternal deaths due to non-obstetric haemorrhage, 3 direct and 7 indirect, making deaths due to non-obstetric haemorrhage the most common cause of maternal death for 2012–2014 (tables 5.1–5.3). The maternal mortality ratio for non-obstetric haemorrhage deaths for 2012–2014 was 1.1 per 100,000 women who gave birth, compared with 1.2 per 100,000 women who gave birth in 2006–2008 and 1.0 per 100,000 women who gave birth in 2009–2011, further detail is available in Supplementary Table A10 at <<https://www.aihw.gov.au/reports/mothers-babies/maternal-deaths-in-australia-2012-2014/data>>.

## Intracerebral haemorrhage

Intracerebral haemorrhage occurs when a blood vessel within the brain bursts, allowing blood to leak into the substance of the brain. When a blood vessel in the skull bursts the sudden increase in pressure within the brain damages the brain cells surrounding the blood vessel, potentially leading to unconsciousness or death.

The most common cause of intracerebral haemorrhage is high blood pressure. If the high blood pressure is related to a pregnancy complication such as pre-eclampsia the death may be classified within the hypertensive disorders group of deaths. Less common causes of intracerebral haemorrhage include trauma, infections, tumours, blood clotting deficiencies, and abnormalities in blood vessels (such as arteriovenous malformations).

## Rupture of splenic artery

The causation of splenic artery aneurysm, and the strong association of aneurysmal rupture with pregnancy, is unclear. Hormonal influences in pregnancy and the increased cardiac output in pregnancy have been postulated as responsible for increasing the chances of aneurysm formation and/or rupture during pregnancy, by respectively weakening the arterial wall and increasing the blood pressure (Sadat et al. 2008).

Rupture of a splenic artery aneurysm in pregnant women is unusual and typically presents as sudden, unexpected death. Epigastric and/or left hypochondrial area pain associated with left shoulder tip pain associated with nausea, vomiting, abdominal tenderness and shock may precede sudden collapse. Early recognition allowing prompt planned resection of the aneurysm has been reported where the prodromal symptoms were recognised.

From 2006 to 2014 there have been instances when the STMMC has concluded that a maternal death associated with rupture of a splenic artery aneurysm was a direct result of the pregnancy (a direct maternal death), and in other instances such a death was thought to be due to a previous existing disease aggravated by the physiologic effects of pregnancy (an indirect maternal death).

### **Case vignette: Non-obstetric haemorrhage due to intracerebral haemorrhage**

A woman who had given birth previously was in the late second trimester of her pregnancy and suddenly developed chest pain and collapsed. Cardiopulmonary resuscitation was immediately commenced and she was intubated prior to transfer to a tertiary hospital. She could not be resuscitated. At autopsy a ruptured cerebral arteriovenous malformation causing massive intracerebral haemorrhage was found.

### **Case vignette: Non-obstetric haemorrhage due to ruptured splenic artery aneurysm**

An overweight woman in the third trimester of her second pregnancy collapsed in the antenatal clinic after complaining of abdominal pain. A perimortem caesarean section, performed to assist with cardiopulmonary resuscitation and to try to ensure fetal survival, revealed a large amount of blood in the peritoneal cavity. All maternal resuscitation measures were unsuccessful. A live baby was born but died after 7 hours of life. Autopsy revealed a ruptured splenic artery aneurysm as the source of the haemoperitoneum.

### **Good practice guidance**

Carefully consider ruptured splenic artery aneurysm in any pregnant woman presenting with severe abdominal pain, especially when associated with sudden collapse and/or shoulder tip pain or when requiring narcotic analgesia for pain relief. In these circumstances, prompt consultation with senior specialist obstetricians and surgeons is recommended.

*Sources:* Coroner South Australia 0597/2012; Coroner Victoria 109310; Sadat et al. 2008.

## **Cardiovascular**

Deaths categorised to cardiovascular have their primary origin in new or existing disease processes in the heart or major blood vessels. As examples, new illnesses include cardiomyopathy of pregnancy and existing illnesses include congenital heart malformations and rheumatic heart valve lesions.

Cardiovascular disease is generally the most common cause of death during pregnancy in industrialised countries. Pregnancy may unmask previously undiagnosed cardiovascular disease, due to the physiological changes that occur, including increased cardiac output related to increased blood volume and increased heart rate, and peripheral vasodilation with decreased systemic vascular resistance.

Older mothers, especially when obesity, smoking, diabetes and hyperlipidaemia (high blood lipid levels) co-exist with advanced maternal age, are at increased risk of heart disease. The incidence of maternal death from ischaemic heart disease has been shown to be rising in the United Kingdom and the changing age structure of the population of pregnant women may be responsible for this change (RCOG 2011).

There were 10 maternal deaths from cardiovascular causes from 2012 to 2014, and cardiovascular disease was the most common cause of indirect maternal death for this period (tables 5.1–5.3). The maternal mortality ratio for cardiovascular deaths for 2012–2014 was 1.1 per 100,000 women who gave birth compared with 0.8 per 100,000 women who gave birth in 2006–2008 and 1.2 per 100,000 women who gave birth in 2009–2011, further detail is available in Supplementary Table A10 at <<https://www.aihw.gov.au/reports/mothers-babies/maternal-deaths-in-australia-2012-2014/data>>.

Three deaths were related to ischaemic heart disease, 3 to apparent arrhythmic events and one each to a ruptured ascending aortic aneurysm and complications of infective endocarditis; the cause of death was not stated in one instance.

## Ischaemic heart disease

There were 2 maternal deaths in the postpartum period and 1 in early pregnancy (that is, during the first trimester) due to myocardial infarction and ischaemic heart disease. Both the women who died postpartum had risk factors for ischaemic heart disease, were classified as obese, and had reported smoking during pregnancy.

## Cardiac arrhythmia

Three women were thought to have died as a result of disorders of their heart rhythm, one being a direct death in association with severe haemorrhage and two being indirect deaths.

## Inflammatory cardiac lesions

One woman died postpartum as a result of multiple infective emboli (infective particles carried in the bloodstream) entering her lungs from heart valve infections that were presumed to be related to intravenous substance abuse, and one woman late in pregnancy died as a result of a viral infection of her heart muscle (lymphocytic myocarditis).

## Aortic dissection

One maternal death was caused by aortic dissection leading to a ruptured aortic aneurysm. Despite early warning signs, radiological studies were not undertaken, which meant that a diagnosis was not made prior to the woman's collapse and death.

### **Case vignette: Ruptured ascending aortic aneurysm**

A woman in her 30s with no significant past medical history had an uneventful antenatal course until the mid-third trimester when she developed severe chest pain. Investigations for myocardial infarction and pulmonary embolism were negative, though a chest X-ray was not performed. Labour was induced 2 weeks later for signs suggestive of pre-eclampsia, and she was treated with magnesium sulphate as there was a suspicion of HELLP syndrome (a severe complication of pre-eclampsia; see Glossary). An unassisted vaginal birth occurred. Two days postpartum the woman collapsed with chest pain while breast-feeding and could not be resuscitated. Autopsy revealed a ruptured ascending aortic aneurysm and haemopericardium. The jurisdictional maternal mortality committee case review found that failure to fully investigate chest pain antepartum may have been a significant contribution to the death.

### **Good practice guidance**

Pregnancy is not a contraindication to investigative radiology that would usually be used in the investigation of major symptoms and signs in a non-pregnant woman, with the application of appropriate screening safeguards.

*Source: ACOG 2016.*

## Thromboembolism

Deaths categorised to thromboembolism have their primary origin in the effects of blood clots travelling from a point of origin in the circulation to obstruct major blood vessels. The most common example is pulmonary thromboembolism with obstruction of the major pulmonary arteries.

There were 7 maternal deaths due to thromboembolism between 2012 and 2014 (tables 5.1–5.3); the MMR was 0.8 per 100,000 women who gave birth. The MMR for thromboembolism was 0.5 per 100,000 women who gave birth in 2006–2008 and 1.0 per 100,000 women who gave birth in 2009–2011, further detail is available in Supplementary Table A10 at <<https://www.aihw.gov.au/reports/mothers-babies/maternal-deaths-in-australia-2012-2014/data>>.

All of the women died from pulmonary thromboembolism and their deaths were all classified as direct deaths. Known identifiable risk factors for thromboembolic disease, such as obesity, older age, smoking and operative delivery were infrequent in these women. Information was not available regarding the use of preventive measures such as thromboprophylaxis and/or thrombolysis in most cases.

### **Good practice guidance**

Clear evidence is available regarding the importance of minimisation of immobilisation of pregnant and postpartum women, and the use of pharmacological and non-pharmacological prophylaxis regarding thromboembolism in pregnant women at risk of venous thrombosis and its complications.

*Source:* NHMRC 2009.

## **Obstetric haemorrhage**

Deaths categorised to obstetric haemorrhage have their primary origin in bleeding from the area of the uterine wall to which the placenta was attached, whether from the placental site during pregnancy (antepartum haemorrhage), from the placental bed after a birth (postpartum haemorrhage) or from damage to the uterus, cervix and vagina.

Six women died due to obstetric haemorrhage in 2012–2014 (tables 5.1–5.3); the MMR was 0.7 per 100,000 women who gave birth. The MMR for obstetric haemorrhage was 0.4 per 100,000 women who gave birth in 2006–2008 and 0.8 per 100,000 women who gave birth in 2009–2011, further detail is available in Supplementary Table A10 at <<https://www.aihw.gov.au/reports/mothers-babies/maternal-deaths-in-australia-2012-2014/data>>.

Historically, postpartum haemorrhage was a major cause of maternal death, though the advent of oxytocic drugs has significantly reduced this pregnancy complication. In 1964–1966 17.8% of Australian maternal deaths were due to obstetric haemorrhage (NHMRC 1966) whereas in 2012–2014 8.2% were due to postpartum haemorrhage.

In more recent years the focus has shifted to haemorrhage associated with morbidly adherent placentation when part of the placenta, or the entire placenta, grows into and is inseparable from the uterine wall (placenta accreta). The incidence of placenta accreta has increased and this increase seems to parallel the increasing caesarean section rate. Women at greatest risk of placenta accreta are those who have scarred uterine muscle (myometrium) caused by a previous caesarean section and a placenta praevia overlying that uterine scar (RANZCOG 2015).

### **Case vignette: Obstetric haemorrhage due to placenta praevia accreta**

A woman with a history of two previous caesarean sections had her antenatal care in an inner regional setting. A third trimester ultrasound suggested that the placenta was low-lying, but was reported as providing no evidence of placenta praevia accreta. A small antepartum haemorrhage occurred at 37 weeks' gestation. Planned caesarean section occurred in a regional hospital at 38 weeks' gestation without further imaging. There was difficulty separating the placenta that was seen to encroach significantly on the lower uterine segment. In response to ongoing heavy bleeding with the development of disseminated intravascular coagulopathy treatment included massive transfusion, insertion of a Bakri balloon, and hysterectomy. Assistance was sought from a vascular surgeon but was not immediately available. Death occurred in the operating suite.

### **Good practice guidance**

Except in dire emergency circumstances, caesarean section for placenta praevia/accreta should be undertaken in a facility with access to 24-hour blood and blood product transfusion.

Where morbidly adherent placentation in a placenta praevia in a woman with a history of caesarean section or other uterine surgery is possible, specialist obstetric ultrasound review of the placenta is important.

Because of the very high risk of major haemorrhage, women known or suspected to have placenta accreta should be managed only by teams very experienced and knowledgeable about the condition.

*Source:* RANZCOG 2015.

## **Refusal of blood transfusion**

During their antenatal care, 2 women who died as a result of obstetric haemorrhage had indicated to the health-care providers responsible for their care that they would not agree to receive a blood transfusion or other blood products under any circumstances. In neither case was there a clear plan of management for massive haemorrhage without resort to blood transfusion which made the catastrophic blood loss challenging.

Best practice should involve the most senior medical practitioners available in discussion and recording of specific issues of consent early in the pregnancy, optimisation of the woman's cardiovascular status early in the pregnancy, planning of pregnancy care to minimise risks associated with unexpected need for intervention, and prompt attendance in the event of required surgical intervention or unexpected serious blood loss. These women should be cared for in high-level obstetric facilities with access to specialist obstetric practitioners experienced in all forms of management of obstetric haemorrhage, and the ability to access other practitioners such as vascular surgeons where necessary. The women should be encouraged to provide a specific Advanced Health Directive.

All maternity facilities that undertake care for this group of women should have a clear clinical protocol in place for management of obstetric haemorrhage where blood transfusion is not a treatment option. The National Blood Authority's *Patient Blood Management Guideline: Module 1 Critical Bleeding/Massive Transfusion* (NBA 2011) and *Module 5 Obstetrics and Maternity* (NBA 2015) are useful resources.

### **Case vignette: Refusal of blood transfusion**

A woman with a known major placenta praevia had recurrent antepartum haemorrhages. She had made it very clear to all staff that she did not consent to the use of blood transfusion under any circumstances. Early in the third trimester of her pregnancy she experienced acute uterine bleeding and required an urgent caesarean section. At laparotomy uterine rupture secondary to placenta accreta was found. Death occurred due to massive blood loss complicated by severe disseminated intravascular coagulopathy.

### **Good practice guidance:**

All maternity services should have a clear plan for the management of obstetric haemorrhage in women who decline blood transfusion. Such a plan should include a requirement that the woman be asked to complete an Advanced Care Directive, and management of obstetric haemorrhage in such women should be supervised by the most senior obstetrician available, with involvement of other specialists (for example, physicians, haematologists) as needed.

*Source:* Kidson-Gerber et al, 2016.

## **Deaths by suicide**

Deaths included in this category are those where the available evidence suggested that the woman died as a result of self-inflicted injury.

The overall incidence of suicide among Australian women decreased between 1960 and 2010, from 7.1 per 100,000 women to 4.8 per 100,000 women (AIHW: Harrison & Henley 2014c). The suicide rate in the 15–45-year-old Australian female population between 2006 and 2010 was 6.0 per 100,000 women (AIHW: Harrison & Henley 2014c, using data from the AIHW National Mortality Database and General Record of Incidence of Mortality (GRIM Books)).

There were 5 maternal deaths due to suicide between 2012 and 2014 (tables 5.1–5.3); the MMR was 0.5 per 100,000 women who gave birth. The MMR for suicidal death was 0.5 per 100,000 women who gave birth in both 2006–2008 and 2009–2011, further detail is available in Supplementary Table A10 at <<https://www.aihw.gov.au/reports/mothers-babies/maternal-deaths-in-australia-2012-2014/data>>. Unlike most other causes of maternal death, the incidence of suicidal death (previously included in psychosocial deaths) does not appear to be decreasing. A similar finding has recently been noted in the United States (Wallace et al. 2016).

Given that pregnant women are usually closely monitored by health professionals before and after birth, the incidence of suicidal maternal death is a matter of concern. There is a growing belief that a significant portion of late maternal deaths are also related to suicide (QMPQC 2013); however, without a clear review of the cases by multidisciplinary committees, the relationship in Australia between pregnancy and suicide more than 42 days after the end of pregnancy remains speculative.

### **Case vignette: Hanging death of an at-risk young woman**

An adolescent woman in her first pregnancy hanged herself in the second trimester of her pregnancy. She had attended two antenatal clinic visits and had not had mental health and/or domestic violence screening tools administered. She had a long-standing history of depression, self-harm, and social issues including domestic violence.

### **Case vignette: Overdose in a woman with a history of mental health illness**

An older woman was being treated by her general practitioner with anti-depressant medications as she had a history of anxiety/depression. She stopped anti-depressant medications postpartum, and subsequently died of an overdose of that medication. There was no record of mental health and domestic violence screening during the pregnancy. The jurisdictional maternal mortality committee concluded that mental health care during and after the pregnancy was inadequate.

### **Good practice guidance**

The National Maternal and Perinatal Mortality Advisory Group strongly supports the premise that all pregnant women should be offered screening for mental health and domestic violence issues, and the Clinical practice guidelines – Antenatal care guidelines that recommend:

- At the first antenatal visit, explain to all women that asking about domestic violence is a routine part of antenatal care and enquire about each woman's exposure to domestic violence.
- Ask about domestic violence when alone with the woman, tailoring the approach to her individual situation and your own skills and experience (for example, use open-ended questions about her perception of safety at home or use an assessment tool).

Source: AHMAC 2012.

## **Hypertensive disorders**

Deaths allocated to the hypertensive disorders category have their primary origin in the effects of raised blood pressure. The most frequent deaths in this category relate to pre-eclampsia and its complications, such as HELLP syndrome and intracerebral haemorrhage. The Society of Obstetric Medicine of Australia and New Zealand defines hypertension in pregnancy as systolic blood pressure greater than or equal to 140 mmHg and/or diastolic blood pressure greater than or equal to 90 mmHg (Lowe et al. 2015). Severe hypertension requiring urgent treatment is defined as a systolic blood pressure greater than or equal to 170 mmHg with or without diastolic blood pressure greater than or equal to 110 mmHg.

Four maternal deaths were attributed to hypertensive disorders during pregnancy between 2012 and 2014 (tables 5.1–5.3); the MMR was 0.4 per 100,000 women who gave birth. The MMR for hypertensive deaths was 0.3 per 100,000 women in 2006–2008 and 0.5 per 100,000 women in 2009–2011, further detail is available in Supplementary Table A10 at <<https://www.aihw.gov.au/reports/mothers-babies/maternal-deaths-in-australia-2012-2014/data>>.

### **Case vignette: Severe pre-eclampsia with HELLP syndrome**

A pregnant woman gave birth at a country hospital. In the third trimester of her pregnancy she had fluid retention, normal blood pressure and a small amount of protein in her urine. Blood tests showed low platelets and low haemoglobin. Because of a history of one previous caesarean section she gave birth by uncomplicated elective caesarean section under spinal anaesthetic. Post-operatively the woman's blood pressure was raised and she complained of a throbbing headache, wound pain and nausea. She was given analgesia and anti-nausea medication. Three hours later her blood pressure remained moderately raised and she developed difficulties with speech and movement. Her blood pressure remained high thereafter and her condition deteriorated progressively, requiring assisted respiration. A CT scan showed a large haemorrhage in the base of the brain. She was transferred to a major facility with a neurosurgical service where she died despite further treatment. Blood tests during this terminal admission showed features consistent with HELLP syndrome.

## **Sepsis**

Deaths categorised to sepsis have their primary origin in infection. That infection may arise from complications of the pregnancy, such as retained products of conception after an early pregnancy loss or chorioamnionitis in late pregnancy, or infection elsewhere in the mother's body, such as H1N1 influenza.

There were 5 maternal deaths due to sepsis between 2012 and 2014 (tables 5.1–5.3); the MMR was 0.5 per 100,000 women who gave birth. The MMR for sepsis deaths was 0.3 per 100,000 women who gave birth in 2006–2008 and 0.9 per 100,000 women in 2009–2011, further detail is available in Supplementary Table A10 at <<https://www.aihw.gov.au/reports/mothers-babies/maternal-deaths-in-australia-2012-2014/data>>.

Four deaths occurred in the postpartum period and timing of death was not stated in one instance. Two of the postpartum deaths related to methicillin-resistant *Staphylococcus aureus* (MRSA) infection of caesarean section sites; one was related to a *Streptococcus pyogenes* tubo-ovarian abscess and septicaemia in the settings of substance abuse, and one was related to *Escherichia coli* acute pyelonephritis in a morbidly obese woman with insulin-requiring gestational diabetes.

## **Deaths in early pregnancy**

For the purpose of this report, an early pregnancy death is defined as one occurring during the first 14 weeks of pregnancy (the first trimester). The most common examples of such deaths are those associated with miscarriage, termination of pregnancy and ectopic pregnancy.

There were 3 maternal deaths in early pregnancy from 2012 to 2014 (tables 5.1–5.3); the MMR was 0.3 per 100,000 women who gave birth. The MMR for deaths in early pregnancy in both 2006–2008 and 2009–2011 was 0.3 per 100,000 women who gave birth (further detail is available in Supplementary Table A10 at <<https://www.aihw.gov.au/reports/mothers-babies/maternal-deaths-in-australia-2012-2014/data>>. Two of the early pregnancy deaths were direct deaths related to ectopic pregnancies (one woman collapsed and died at home and one woman died of haemorrhagic complications of surgical management). One early pregnancy death was an indirect death due to intracerebral haemorrhage from a ruptured

vascular malformation in a morbidly obese woman two weeks after a termination of pregnancy.

It is important to note that the denominator for the calculation of MMR is the number of women who gave birth, rather than the number of women who had a pregnancy. This is because the number of non-progressing early pregnancies, miscarriages, pregnancy terminations and ectopic pregnancies is unknown.

#### **Case vignette: Early pregnancy death due to ectopic pregnancy**

A previously well woman in her first pregnancy attended her general practitioner in early pregnancy with abdominal pain and vomiting. No specific diagnosis was made and she was advised to rest at home and drink fluids when she was able to. She had a witnessed cardiac arrest at home the following day and was not able to be resuscitated. A ruptured ectopic pregnancy was found at autopsy.

### **Amniotic fluid embolism**

Deaths categorised to amniotic fluid embolism have their primary origin in the effects of amniotic fluid and the fetal cells that it contains entering the maternal circulation. The reasons for this causing severe maternal illness and/or death are poorly understood. Diagnosis is usually possible only by microscopic demonstration at autopsy of fetal cells and other debris within the mother's major blood vessels.

Two maternal deaths were attributed to amniotic fluid embolism from 2012 to 2014 (tables 5.1–5.3); the MMR was 0.2 per 100,000 women who gave birth. The MMR for similar deaths was 0.7 per 100,000 women who gave birth in 2006–2008 and 0.6 per 100,000 women in 2009–2011 (further detail is available in Supplementary Table A10 at <<https://www.aihw.gov.au/reports/mothers-babies/maternal-deaths-in-australia-2012-2014/data>>. The low incidence of death due to amniotic fluid embolism in this 3-year period is unusual, and not consistent with the 2 triennia before it and with the findings of an Australian-New Zealand study in 2010–2011 showing a case fatality rate of 0.8 per 100,000 women who gave birth (McDonnell 2015). The reasons for the low incidence in this triennium are unclear.

#### **Case summaries: Amniotic fluid embolism**

A pregnant woman had labour induced at term after spontaneously rupturing her membranes. She collapsed unexpectedly in labour. Perimortem caesarean section was performed to deliver the baby.

An obese pregnant woman had a planned caesarean section for known placenta praevia and suffered a seizure and severe bleeding shortly after delivery. Resuscitation attempts were not successful.

In both cases, amniotic fluid embolism was found at autopsy.

### **Anaesthetic-related deaths**

In 2012–2014 the relevant STMMC concluded that 2 maternal deaths were anaesthesia-related (Table 5.11). In one case, a woman collapsed in the recovery area of an operating suite after examination under anaesthesia and suffered severe hypoxic brain damage, and in the other case a woman suffered a seizure, thought to be due to eclampsia, during an attempted assisted vaginal birth under regional anaesthesia and post-seizure resuscitation was not successful.

## Other causes of maternal deaths

Tables 5.1–5.3 provide information regarding the causes of death and classification of 9 maternal deaths from *Other* causes from 2012 to 2014.

## 5.2 Incidental deaths

Incidental maternal deaths are deaths that occur in pregnancy or within 6 weeks of the end of a pregnancy from causes unrelated to the pregnancy. Internationally, cases of such incidental deaths are included in maternal mortality reporting, although only direct, indirect and unclassified deaths are counted for statistical purposes. In addition to the 61 maternal deaths reported between 2012 and 2014, there were 10 incidental maternal deaths (Table 5.4).

**Table 5.4: Causes of incidental maternal deaths, Australia, 2012–2014**

Cause of death	Number of deaths
Motor vehicle accident trauma	2
Asphyxia related to epilepsy	1
Acute right heart failure	1
Ischaemic heart disease and substance abuse	1
Congenital long QT syndrome exacerbated by caffeine intake	1
Intracerebral haemorrhage	1
Acute promyelocytic leukaemia	1
Homicide	1
Not stated	1
<b>Total</b>	<b>10</b>

### Notes

1. Data for incidental maternal death from WA not available.
2. Congenital long QT syndrome is a condition of abnormal electrical conduction in the heart muscle.

# Appendix A: Methodology

## Data used in this report

This report is compiled from data held in the National Maternal Mortality Data Collection (NMMDC). The NMMDC has been established within the Australian Institute of Health and Welfare (AIHW) and collates data from state and territory sources to be used in the preparation of national maternal death reports (see Appendix C for more detailed information). The AIHW only receives such jurisdictional data and does not source, compile, validate or review data regarding maternal deaths independently.

The NMMDC contains information on the deaths of women reported to have died while pregnant or within 42 days of the end of pregnancy between 2006 and 2014. The state and territory health authorities and other jurisdictional bodies responsible for primary data collection and review regarding maternal deaths receive clinical data on the women who died from patient administrative and clinical records, as well as from the State and Territory Maternal Mortality Committees (STMMC) where death reviews are undertaken. This information is usually collected through a variety of sources, including notifications from health professionals, coronial reports and notifications from related data collections, including the jurisdictional register of births, deaths and marriages.

The NMMDC is an ongoing data set collected specifically, in the first instance, for use in *Maternal deaths in Australia* triennial reports. Only summary data on maternal deaths in Western Australia were made available for review due to their health and privacy legislation (WA 1911).

There is no standardised method of identifying and collecting data on maternal deaths and no nationally agreed process of reporting or investigation. The organisational structure, including relevant legislation, policy and process for maternal death data collection, varies by state and territory. The NMMDC reflects these variations. In all cases, the best available information was used to form the NMMDC.

Data for this publication was also sourced from the AIHW's National Perinatal Data Collection which includes accurate general population data for the number of women in Australia who gave birth to at least 1 baby (either a live birth or a stillbirth) of 20 weeks' completed gestation or more or birthweight of 400 grams or more.

## Reporting maternal deaths in 2012–2014

The methodology used for this report is similar to that used in previous reports in the *Maternal deaths in Australia* series. It includes epidemiological data on maternal deaths, the use of illustrative vignettes known as 'case summaries', clinical commentary and references to published guidelines for further education on specific clinical management where available and relevant. Illustrative vignettes are developed from de-identified case information and sometimes combined to protect anonymity.

Maternal mortality in Australia has been reported nationally on an ad hoc basis since 1964. Reports were triennial until the 2003–2005 triennium, followed by overlapping quinquennial reports for the periods 2006–2010 and 2008–2012 (AIHW: Johnson et al. 2014b; AIHW: Humphrey et al. 2015). This 2012–2014 report period overlaps the previous period and includes re-calculated triennial information for the periods 2006–2008 and 2009–2011 and allows for a return to triennial reporting.

Some states and territories were unable to provide retrospective access to previously supplied data. Consequently past *Maternal deaths in Australia* reports were the source of data for years prior to 2012. Data elements, such as maternal place of residence (and hence remoteness of residence), could not be presented with the necessary degree of accuracy for this report due to differing legislative frameworks governing the ability of STMMCs and health departments to share information regarding maternal deaths and their jurisdictional review.

## **Identifying Aboriginal and Torres Strait Islander women**

An Aboriginal and Torres Strait Islander woman is defined for Australian health data collections as a woman of Aboriginal and/or Torres Strait Islander descent who identifies herself as such. Information on the Indigenous status of the women who died is collected as part of the NMMDC and has been analysed in this report.

The quality of data collected on Indigenous status (as measured by the proportion of individuals where Indigenous status was not stated) has improved in most data collections since the AIHW's 2007 data quality report (AIHW 2012). Since the 2007 report, a number of activities have been, or are being, undertaken to improve the identification of Indigenous people in the community services' data collections. These include modifying client forms and client information management systems and the provision of staff training, including cultural awareness training, and training on how to collect Indigenous status data.

## **Deaths by suicide**

In 2011 and 2012, the World Health Organization (WHO) recommended classifying all maternal suicidal deaths as direct maternal deaths (Pattinson et al. 2009). However, in 2012 the National Maternal Mortality Advisory Committee (NMMAC), with advice from the Royal Australian and New Zealand College of Psychiatrists came to the conclusion that puerperal psychosis, which may be related to 'a dramatic change in hormone levels after the end of pregnancy' is extremely rare. The NMMAC further concluded that deaths in situations in which there was clear evidence of a pre-existing mental health disorder were to be regarded as indirect deaths, whereas suicidal deaths in the setting of a previously undiagnosed severe mental health illness with no pre-existing condition would be regarded as direct deaths.

## **Remoteness area**

In calculating the RA for women covered by this report, where a postcode included areas in more than one remoteness area category, the category making up the largest proportion of that postcode was chosen.

## **Case vignettes**

Case vignettes or summaries have been incorporated to provide opportunities for teaching and learning and practice improvement, as in previous reports. Care has been taken to remove or change information that could potentially identify any individual. Perturbation, where a number of cases may have been combined, was used in the case summaries to prevent identification.

## Frequency of reporting maternal deaths

Australian maternal deaths have been reported on a triennial basis since the first report in 1964–1966. Between 2006 and 2012 overlapping quinquennial reports were published. This report returns to a triennial format and includes review of 2006 to 2014 data in a triennial format where appropriate.

## National Maternity Data Development Project

The NMDDP was set up in response to Priority Actions 1.1 and 2.1 of the National Maternity Services Plan (AHMC 2011) Priority Action 1.1: ‘Increase access for Australian women and their family members to information that supports their needs for maternity care’; Priority Action 2.1: ‘Ensure Australian maternity services provide high-quality, evidence-based maternity care’ (AHMC 2011). The primary aims of the NMDDP are to develop a nationally consistent and comprehensive maternal and perinatal mortality and morbidity data collection and reporting in Australia. High-quality and nationally consistent data are required to assess the safety and outcomes of current and emerging models of maternity care in Australia and will enable the monitoring of disparities in health outcomes for population subgroups compared with the general population. The project is managed by the NMDDP Advisory Group. Reports on stages of the NMDDP process have been published, available at <[www.aihw.gov.au/reports/mothers-babies/enhancing-maternity-data-collection-and-reporting](http://www.aihw.gov.au/reports/mothers-babies/enhancing-maternity-data-collection-and-reporting)>.

## National Maternal and Perinatal Mortality Advisory Group

The NMPMAG was convened in 2015 to provide guidance to the development of the national *Maternal deaths in Australia* and *Perinatal deaths in Australia* reports and is a subcommittee of the NMDDP Advisory Group. The NMPMAG provides expert advice on the development of *Maternal Deaths in Australia* reports, including strategic advice, facilitation of data supply and provision of clinical commentary, and good practice guidance.

NMPMAG has replaced the previous National Maternal Mortality Advisory Committee that advised AIHW and the National Perinatal Epidemiology and Statistics Unit of the University of New South Wales in its collaboration with AIHW regarding the production of previous *Maternal deaths in Australia* reports from 1994 to 2012.

# Appendix B: National maternal mortality data collection (NMMDC) project governance

## The National Maternity Services Plan

In 2008, a national review of maternity services was carried out in Australia, led by the Commonwealth Chief Nurse and Midwifery Officer. The findings were presented in 2009 in *Improving maternity services in Australia: the report of the Maternity Services Review* (DOH 2009). The report aimed to identify key gaps in maternity care and to inform development of the first National Maternity Services Plan (AHMC 2011).

The National Maternity Services Plan (the Plan) was launched in February 2011 and set out a 5-year vision for maternity care that provides a strategic national framework to guide policy and program development across Australia (AHMC 2011). Though the 5-year period encompassed by the Plan has ended its guiding principles continue to be observed.

The purpose of the Plan is to maintain Australia's high standard of maternity and newborn care while seeking to improve access to services and choice in care, which includes increasing and supporting the maternity workforce, strengthening infrastructure and building the evidence base of what works well in Australia. In particular, the Plan's priority areas are to: meet the needs of women and their families living in rural and remote areas; improve birth outcomes for Aboriginal and Torres Strait Islander people; and meet the requirements of women and babies who are vulnerable due to medical or other risk factors. The Plan targets primary maternity services during the antenatal, intrapartum and 6-week postnatal period for both women and babies (AHMC 2011). In 2011, the Australian government provided funding for the National Maternity Data Development Project (NMDDP).

## National Maternity Data Development Project

The NMDDP was set up in response to Recommendation 1 of the Plan. The primary aims of the NMDDP are to develop a nationally consistent and comprehensive maternal and perinatal mortality and morbidity data collection in Australia. High-quality and nationally consistent data are required to assess the safety and outcomes of current and emerging models of maternity care in Australia and will enable the monitoring of disparities in health outcomes for population subgroups compared with the general population. The project is managed by the NMDDP Advisory Group. Reports on stages of the NMDDP process have been published, available at <[www.aihw.gov.au/reports/mothers-babies/enhancing-maternity-data-collection-and-reporting](http://www.aihw.gov.au/reports/mothers-babies/enhancing-maternity-data-collection-and-reporting)>.

## National Maternal and Perinatal Mortality Advisory Group

The NMPMAG was convened in 2015 to provide guidance and national relevance to the development of the national *Maternal deaths in Australia* and *Perinatal Deaths in Australia* reports, and is a subcommittee of the NMDDP Advisory Group. The NMPMAG provides expert advice on the development of *Maternal deaths in Australia* reports, including strategic

advice, facilitation of data supply and provision of clinical commentary, and good practice guidance.

NMPMAG has replaced the previous National Maternal Mortality Advisory Committee that advised the AIHW and the National Perinatal Epidemiology and Statistics Unit of the University of New South Wales in its collaboration with the AIHW regarding the production of the reports *Maternal deaths in Australia 2006–2010* (AIHW: Johnson et al. 2014b) and *Maternal deaths in Australia 2008–2012* (AIHW: Humphrey et al. 2015).

# Appendix C: Data quality statement regarding national maternal mortality data collection

## Summary of key issues

- The National Maternal Mortality Data Collection (NMMDC) provides national information for use in preparing a national report on women who died while pregnant or within 42 days of termination of pregnancy, between 2006 and 2014.
- Data sources, supply and quality varied considerably by state and territory.
- Legislative privacy restrictions and data approval processes differed by state and territory, and in some jurisdictions precluded full supply of maternal death data.
- Not all states and territories had active maternal mortality committees or subcommittees for the period of deaths. This has limited the quality and completeness of data supplied.
- Data collection for some jurisdictions was retrospective and not from existing collections. Retrospective data collection limited the quality and completeness of data supplied.
- Methodology, definitions, classifications and reference periods for maternal death data collections differ significantly across states and territories, and comparisons between collections should be made with caution.

## Description

The NMMDC is a data collection established within the AIHW and collates data from state and territory sources to be used in the preparation of national maternal death reports. The data set contains information on the deaths of women reported to have died while pregnant or within 42 days of termination of pregnancy, between 2006 and 2014. State and territory health authorities and other jurisdictional bodies responsible for primary data collection and review regarding maternal deaths supplied data to the AIHW under individual data agreements between the AIHW and each state or territory health authority. The AIHW only receives such jurisdictional data and does not source, compile, validate or review data regarding maternal deaths independently.

The data supplied by states and territories were primarily compiled from state and territory maternal death data collections or, where not available, other data sources. Data were entered into the NMMDC via an electronic data collection system (electronic National Maternal Death Reporting tool or e-NMDR). Data in the NMMDC includes data collected retrospectively and specifically by some states and territories to produce the maternal deaths reports for 2006–2012.

The state and territory health authorities receive clinical data on the women who died from patient administrative and clinical records, as well as from the state and territory maternal mortality committees or subcommittees where death reviews are undertaken. This information is usually collected through a variety of sources, including notifications from health professionals involved in the case, coronial reports and notifications from related data collections, including the jurisdictional register of births, deaths and marriages. States and territories use these data to determine cause of death, classification of death and for service planning, monitoring and internal and public reporting.

The organisational structure, roles and responsibilities of STMMCs vary across states and territories. There is no standardised method of identifying and collecting data on maternal deaths, and no nationally agreed process of reporting or investigation. Data from the NMMDC, used to populate this report, reflect these inconsistencies.

## Institutional environment

The AIHW is a national agency set up by the Australian Government under the *Australian Institute of Health and Welfare Act 1987* to provide reliable, regular and relevant information and statistics on Australia's health and welfare. It is an independent statutory authority, governed by a management board, and accountable to the Australian Parliament through the Health portfolio.

The AIHW aims to improve the health and wellbeing of Australians through better health and welfare information and statistics. It collects and reports information on a wide range of topics and issues, from health and welfare expenditure, hospitals, disease and injury, and mental health to ageing, homelessness, disability and child protection.

The Institute also plays a role in developing and maintaining national metadata standards. This work contributes to improving the quality and consistency of national health and welfare statistics. The Institute works closely with governments and non-government organisations to achieve greater adherence to these standards in administrative data collections to promote national consistency and comparability of data and reporting.

One of the main functions of the AIHW is to work with the states and territories to improve the quality of administrative data and, where possible, to compile national data sets based on data from each jurisdiction, to analyse these data sets and disseminate information and statistics.

For further information, see the AIHW website <[www.aihw.gov.au](http://www.aihw.gov.au)>.

## Timeliness

Data are published in the *Maternal deaths in Australia* series. National data were published within 3 months of receipt of data from all jurisdictions for 2012–2014 after collection of the data by the AIHW, and within 3 years of the time frame for including maternal deaths of 31 December 2014.

## Interpretability

The organisational structure, including relevant legislation, policy and process for maternal death data collection, varies by state and territory. The NMMDC reflects these variations. In all cases, the best available information was used to form the NMMDC.

An overview of each state's maternal death data collection process is outlined below:

- The New South Wales Ministry of Health is notified of maternal deaths through a variety of organisations and methods, including hospitals, the Department of Forensic Medicine at Glebe, Ministry of Health systematic searches of New South Wales population health data sets (for example Admitted Patient Data Collection and the New South Wales Perinatal Data Collection) and through the National Coronial Information System. The number of maternal deaths for each year is assessed against Australian Bureau of Statistics (ABS) mortality data, where available (deaths with an International Statistical

Classification of Diseases and Related Health Problems, 10th edition (ICD-10) cause of death code commencing with an 'O') to maximise ascertainment.

- In Victoria, maternal deaths are identified through direct notification by health services, Victorian Perinatal Data Collection Unit (birth forms), the Coroner's Office, the Registrar of Births, Deaths and Marriages and through media reports. Under the *Public Health and Wellbeing Act 2008*, the Consultative Council on Obstetric and Paediatric Mortality and Morbidity (CCOPMM) is responsible for receiving and reporting information regarding maternal deaths, including late maternal deaths; the cases are classified and reviewed by the maternal mortality sub-committee of CCOPMM. In 2010, automatic electronic notification through coronial e-Medical Deposition Form was introduced, and that form includes a tick box 'was the patient pregnant in the last 12 months'.
- Queensland Health conducts dedicated searches of hospital administrative data sets intended for the sole purpose of identifying maternal deaths. In 2012, the Minister of Health approved changes to the *Public Health Act 2005* to mandate reporting of maternal deaths to the Department (working with the Queensland Maternal and Perinatal Quality Council).
- South Australia Health has no formal process of maternal death notification. The Maternal Mortality Committee accesses multiple notifications, including review of media articles, word of mouth, clinicians, pathologists and sentinel event reporting from hospitals. Although there is a tick box on death certificates to indicate if a woman has been pregnant in the last 3 months, this has never been a source of notification to the Maternal Mortality Committee of a maternal death. Hospital separation discharge codes are also reviewed as a quality check to identify maternal deaths. However, to date, this process has never informed the Maternal Mortality Committee of a maternal death the committee was not already aware of. Similarly, sentinel event reporting has not identified a new maternal death to this committee.
- The Tasmanian Department of Health and Human Services is notified of maternal deaths through the following sources: health statistics, the Register of Births, Deaths and Marriages and local clinicians who are members of the Tasmanian Council of Obstetric and Paediatric Mortality and Morbidity (state-wide) and local hospital morbidity and mortality committees.
- In Western Australia the Maternal Mortality Committee appoints an investigator when it is notified of such a death. After the committee considers the report of that investigator the committee chair reports to the Executive Director of Public Health on the findings of the committee.
- Review of maternal deaths in the Australian Capital Territory was previously carried out in conjunction with such review in New South Wales. Since 2011 the ACT Maternal and Perinatal Morbidity and Mortality Committee has completed such review independently.
- Northern Territory Department of Health undertook a process of maternal death ascertainment and review specifically to supply data to the NMMDC.

## Relevance

The NMMDC data were compiled primarily from state and territory maternal death data collections or, where not available, other data sources. Data were requested on the death of all women reported to have died while pregnant or within 42 days of termination of pregnancy in Australia in hospitals, birth centres and the community between 2006 and 2014. Specifications for the e-NMDR form were developed using nationally standardised data as entered into the *National health data dictionary*, which has a repository,

<METeOR - AIHW online metadata repository>. It includes data items relating to the mother, including demographic characteristics and factors relating to the pregnancy, labour and birth; details of death; classification of death and data items relating to the baby, including birth status; and any additional case summaries.

A National Maternal and Perinatal Mortality Advisory Group was convened in 2015 to oversee the process of data collection for the maternal and perinatal death reports and has taken over the responsibilities of the previous National Maternal Mortality Advisory Committee.

## Accuracy

Inaccurate responses may occur in all data provided to the AIHW. The AIHW does not have direct access to maternal mortality committee records to determine the accuracy of the data provided. However, the AIHW undertakes validation on receipt of data. Data received from states and territories are checked for completeness, validity and logical errors. Potential errors are queried with jurisdictions, and corrections and resubmissions are made in response to these edit queries. The AIHW does not adjust data to account for possible data errors.

Two cases were reported on by two state committees—these were instances where the woman had a place of normal residence in one state but died in another state. As this report includes, where possible, a review of contributing factors to deaths, analysis by state or territory of death is a more relevant analysis than state or territory of normal residence. The two cases concerned were, therefore, included only in the state where death occurred.

Errors may occur during the processing of data by the states and territories or at the AIHW. Processing errors prior to data supply may be found through the validation checks applied by the AIHW. The data are corrected when verification of an error is supplied. The AIHW does not adjust the data to correct for missing values.

Prior to publication, data are referred back to jurisdictions for checking and review. Note that because of data editing and subsequent updates of state/territory information, numbers reported may differ from those in reports published by the states and territories.

## Coherence

The NMMDC is an ongoing data set collected specifically, in the first instance, for use in the *Maternal deaths in Australia 2012–2014* report; it will be a continuing collection and will be available as it expands for future reports in that series. Similar data sets have been compiled for previous reports in the *Maternal deaths in Australia* series, though the data sets prior to 2006 are not available for further analysis.

Although definitions and some individual data elements have changed over time in response to expert review, changes in international definitions and coding relating to maternal deaths, in many cases it is possible to map these changes and make meaningful comparisons over time. Due to the overlapping time periods in the *Maternal deaths in Australia 2006–2010* and *Maternal deaths in Australia 2008–2012* reports, caution should be used in interpreting recent trends from those reports. However, this report includes trends for the periods 2006–2008, 2009–2011 and 2012–2014 that have been re-calculated from the supplied data.

State and territory health authorities compile statistics and publish reports on maternal deaths. Methodology, definitions, classifications and reference periods for these collections differ significantly across states and territories, and comparisons between states and territories should be made.

# Glossary

**Aboriginal and Torres Strait Islander:** A person of Aboriginal and/or Torres Strait Islander descent who identifies as an Aboriginal and/or Torres Strait Islander. See also **Indigenous**.

**acute:** Coming on sharply and often brief, intense and severe.

**age-specific rate:** A rate for a specific age group. The numerator and denominator relate to the same age group.

**age-standardisation:** A method of removing the influence of age when comparing populations with different age structures. This is usually necessary because the rates of many diseases vary strongly (usually increasing) with age. The age structures of the different populations are converted to the same 'standard' structure, and then the disease rates that would have occurred with that structure are calculated and compared.

**amniotic fluid embolism (AFE):** A rare obstetric emergency in which it is postulated that amniotic fluid, fetal cells, hair or other debris enter the maternal circulation, causing cardiorespiratory collapse.

**anaesthetic-related death:** Deaths where the cause was related to anaesthesia (usually in association with a surgical procedure).

**aneurysm:** A localised swelling of the wall of an artery.

**antenatal:** The period covering conception up to the time of birth. Synonymous with **prenatal**.

**arrhythmia:** A disturbed rhythm of the heartbeat—too fast, too slow or irregular.

**arteriovenous malformation:** A congenital malformation of blood vessels.

**ascending aortic aneurysm:** A swelling in the wall of the ascending aorta, which is the main artery to the body immediately after it leaves the heart.

**assisted vaginal birth (AVB):** A method of birth in which instruments (forceps or vacuum extraction) are used to assist the woman to give birth to her baby via the vagina.

**asthma:** A common, chronic inflammatory disease of the air passages that presents as episodes of wheezing, breathlessness and chest tightness due to widespread narrowing of the airways and obstruction of airflow. The symptoms may reverse without treatment, but often treatment is required. Different medications can prevent the episodes or relieve them.

**atherosclerosis:** A process in which fatty and fibre-like deposits build up on the inner walls of arteries, often forming plaques that can then cause blockages. It is the main underlying condition in heart attack, angina, stroke and peripheral vascular disease.

**autopsy:** A post-mortem examination to discover the cause of death or the extent of disease.

**blood pressure:** The force exerted by the blood on the walls of the arteries as it is pumped around the body by the heart. It is written, for example, as 134/70 mmHg, where the upper number is the systolic pressure (the maximum force against the arteries as the heart muscle contracts to pump the blood out) and the lower number is the diastolic pressure (the minimum force against the arteries as the heart relaxes and fills again with blood). Levels of blood pressure can vary greatly from person to person and from moment to moment in the same person.

**body mass index (BMI):** The most commonly used method of assessing whether a person is of normal weight, underweight, overweight or obese (see **obesity**). It is calculated by dividing the person's weight (in kilograms) by their height (in metres) squared; that is,  $\text{kg} \div \text{m}^2$ . For both men and women, underweight is a BMI below 18.5, acceptable weight is from 18.5 to less than 25, overweight is from 25 to less than 30, and obese is 30 and over. Sometimes overweight and obese are combined, and defined as a BMI of 25 and over.

**caesarean section (CS):** A method of birth in which a surgical incision is made into the mother's womb via the abdomen to directly remove the baby.

**cardiovascular:** The heart and/or major blood vessels.

**cardiomyopathy:** Inflammation of the heart muscle.

**cholecystitis:** Inflammation of the gallbladder.

**chorioamnionitis:** An inflammation, usually from an infection, of the membranes surrounding the fetus.

**confidence interval (CI):** A statistical term describing a range (interval) of values within which we can be 'confident' that the true value lies, usually because it has a 95% or higher chance of doing so.

**diabetes (diabetes mellitus):** A chronic condition in which the body cannot properly use its main energy source: the sugar glucose. This is due to a relative or absolute deficiency in insulin: a hormone that is produced by the pancreas and helps glucose enter the body's cells from the bloodstream and then be processed by them. Diabetes is marked by an abnormal build-up of glucose in the blood, and it can have serious short- and long-term effects.

**direct maternal death:** Those resulting from obstetric complications of the pregnant state (pregnancy, labour and puerperium) from interventions, omissions, incorrect treatment or from a chain of events resulting from any of the above.

**early pregnancy:** The first 13 weeks of pregnancy; the first trimester of pregnancy.

**eclampsia:** The occurrence of 1 or more convulsions not caused by other conditions, such as epilepsy or cerebral haemorrhage, in a woman with pre-eclampsia. The onset of convulsions may be preceded by a sudden rise in blood pressure and/or a sudden increase in oedema and development of oliguria.

**ectopic pregnancy:** The development of a fetus at a site other than in the uterus. This may happen if the fertilised egg cell remains in the ovary or in the tube leading from near the ovary to the uterus (the Fallopian tube), or if it lodges in the free abdominal cavity.

**embolism:** The condition in which an embolus becomes lodged in an artery and obstructs its blood flow. The most common form of embolism is **pulmonary embolism**, in which a blood clot is carried in the circulation to lodge in the pulmonary artery.

**endocarditis:** Inflammation of thin, smooth membrane which lines the inside of the chambers of the heart and forms the surface of the valves.

**epilepsy:** A disturbance of brain function marked by recurrent fits and loss of consciousness.

**factor V Leiden deficiency:** A genetically inherited disorder of blood clotting that causes an increase in blood clotting (thrombophilia).

**gestational age:** The duration of pregnancy in completed weeks calculated from the date of the first day of a woman's last menstrual period and her baby's date of birth, or via ultrasound, or derived from clinical assessment during pregnancy or from examination of the baby after birth.

**gestational diabetes:** A form of diabetes that is first diagnosed during pregnancy (gestation). It may disappear after pregnancy but signals a high risk of diabetes occurring later on.

**grand multipara:** Pregnant woman who has had 4 or more previous pregnancies resulting in a live birth or stillbirth.

**haematoma:** A solid swelling of clotted blood within the tissues.

**haemopericardium:** Blood in the pericardial sac that surrounds the heart.

**haemorrhage (bleeding):** The escape of blood from a ruptured blood vessel, externally or internally.

**haemothorax:** Blood within the chest cavity but outside the lungs and heart (in the pleural space).

**HELLP syndrome:** A severe complication of pre-eclampsia characterised by Haemolysis, Elevated Liver enzymes and Low Platelet count; the syndrome name is an abbreviation of the 3 main features of the syndrome.

**hypertension in pregnancy:** Defined by the Society of Obstetric Medicine of Australia and New Zealand as systolic blood pressure greater than or equal to 140 mmHg and/or diastolic blood pressure greater than or equal to 90 mmHg. **Severe hypertension** is defined as a systolic blood pressure greater than or equal to 170 mmHg with or without diastolic blood pressure greater than or equal to 110 mmHg.

**hypertensive disease:** Occurs when high blood pressure (hypertension) is severe or prolonged enough to cause damage to the heart, brain or kidneys.

**hypoxaemic ischaemic encephalopathy (HIE):** A type of brain damage caused by an inadequate oxygen supply.

**incidental maternal death:** Deaths from unrelated causes that happen to occur in pregnancy or the puerperium.

**Indigenous:** A person of Aboriginal and/or Torres Strait Islander descent who identifies as an Aboriginal and/or Torres Strait Islander. See also **Aboriginal and Torres Strait Islander**.

**indirect maternal death:** Those resulting from previous existing diseases or diseases that developed during pregnancy, and which were not due to a direct obstetric cause, but were aggravated by the physiologic effects of pregnancy.

**induction of labour:** Intervention to stimulate the onset of labour.

**intrapartum:** Occurring during childbirth or during the birth process.

**intracerebral:** Within the brain substance.

**in-utero:** In a woman's uterus; before birth.

**ischaemic heart disease:** Also heart attack and angina (chest pain). Also known as coronary heart disease.

**live birth:** The complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of the pregnancy, which, after such separation, breathes or shows any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached; each product of such a birth is considered live born (WHO definition).

**maternal age:** Mother's age in completed years at the birth of her baby.

**maternal death:** The death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.

**maternal mortality ratio (MMR):** The number of direct and indirect maternal deaths per 100,000 women giving birth.

**mediastinal:** Relating to the membranous partition between the lungs.

**Millennium Development Goal (MDG):** Goals agreed to between the United Nations and national governments to facilitate global health and socioeconomic improvements.

**morbidity:** Refers to ill health in an individual and to levels of ill health in a population or group.

**mortality:** Death.

**multipara (M):** Pregnant woman who has had at least 1 previous pregnancy resulting in a live birth or stillbirth. Such a woman is called **multiparous**. A woman who has had at least 5 previous pregnancies resulting in a live birth or stillbirth may be called a **grand multipara (GM)**.

**myocardial infarction:** Term still commonly used to mean a heart attack, but more correctly refers only to those heart attacks that have caused some death of heart muscle.

**National Maternal and Perinatal Mortality Advisory Group (NMPMAG):** Expert advisory group providing advice to AIHW regarding maternal and perinatal deaths in Australia.

**National Maternal Mortality Data Collection (NMMDC):** Data provided by states and territories to AIHW for collation regarding Australian maternal deaths.

**non-Indigenous:** People who have declared they are not of Aboriginal or Torres Strait Islander descent. Compare with **other Australians**.

**non-obstetric haemorrhage:** Haemorrhage in pregnancy from blood vessels other than those in the genital tract; most commonly haemorrhage from a ruptured blood vessel in the brain or in the abdomen (the splenic artery).

**nullipara (N):** A woman who has not given birth prior to the current pregnancy. Such a woman is called **nulliparous**.

**obesity:** Marked degree of overweight, defined for population studies as a **body mass index** of 30 or over.

**obstetric haemorrhage:** Haemorrhage from the female genital tract associated with pregnancy and birth.

**other Australians:** People who have declared they are not of Aboriginal or Torres Strait Islander descent, and those for whom their Indigenous status is unknown. Compare with **non-Indigenous**.

**parity:** Number of previous pregnancies resulting in live births or stillbirths, excluding the current pregnancy.

**parous:** A woman who has had at least 1 previous pregnancy resulting in a live birth or stillbirth.

**peri-mortem:** At or near the time of death.

**perinatal:** Pertaining to or occurring in the period shortly before or after birth (usually up to 28 days after).

**placenta accreta:** Abnormal attachment of the placenta to the uterine wall (other variants are placenta increta and placenta percreta).

**placental cotyledon:** A discrete developmental portion of the placenta.

**placenta praevia:** The placenta attaches to the lower uterine wall and may partially or completely obstruct the outlet of the uterus.

**primipara (P):** A woman giving birth for the first time.

**post-mortem:** After death.

**postnatal:** Occurring after birth, with reference to the newborn.

**postpartum:** Occurring after childbirth, with reference to the mother.

**pre-eclampsia:** A condition that complicates pregnancy, is characterised by the presence of high blood pressure, fluid retention and protein in the urine. The placental function may be compromised.

**puerperium:** The period of up to about 6 weeks after childbirth, during which the uterus returns to its normal size.

**pulmonary:** Relating to the lungs.

**pyelonephritis:** Infection of the kidneys and ureters.

**quinquennial:** Five-yearly.

**rate:** Is one number (the numerator) divided by another number (the denominator). The numerator is commonly the number of events in a specified time. The denominator is the population 'at risk' of the event. Rates (crude, age-specific and age-standardised) are generally multiplied by a number such as 100,000 to create whole numbers.

**relative risk:** The relative risk compares 2 groups for their likelihood of an event. Another term for the relative risk is the risk ratio because it is the ratio of the risk in the 'exposed' divided by the risk in the 'unexposed'. It is also known as the rate ratio.

**sepsis:** Refers to a bacterial or viral infection in the bloodstream or body tissues. This is a very broad term covering the presence of many types of microscopic disease-causing organisms.

**socioeconomic status:** An indication of how 'well off' a person or group is. In this report, socioeconomic status is mostly reported using the **Socio-Economic Indexes for Areas**, typically for 5 groups, from the most disadvantaged (worst off) to the least disadvantaged (best off).

**Socio-Economic Indexes for Areas:** A set of indexes, created from Census data, that aim to represent the socioeconomic status of Australian communities and identify areas of advantage and disadvantage. The index value reflects the overall or average level of disadvantage of the population of an area; it does not show how individuals living in the same area differ from each other in their socioeconomic status. This report uses the **Index of Relative Socio-Economic Advantage and Disadvantage**.

**State and Territory Maternal Mortality Committees (STMMCs):** Committees in each state and territory of Australia that review maternal deaths in that jurisdiction.

**stillbirth (fetal death):** Death before the complete expulsion or extraction from its mother of a product of conception of 20 or more completed weeks of gestation or of 400 grams or more birthweight. The death is indicated by the fact that after such separation, the fetus does not

breathe or show any other evidence of life, such as beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles.

**suicide:** Deliberately ending one's own life.

**termination of pregnancy (abortion):** A medical process of ending a pregnancy so that it does not result in the birth of a baby.

**tertiary hospital:** A hospital with all levels of care available.

**thromboembolism:** Obstruction of a blood vessel (most frequently the pulmonary blood vessels) by a blood clot that has become dislodged from another site in the circulation.

**triennial:** Three-yearly.

**trimester:** Three-month divisions of the duration of pregnancy.

**unassisted vaginal birth:** Birth without intervention in which the baby's head is the presenting part.

**vignette:** A short illustrative de-identified case summary.

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The following publications might also be of interest:

- Trends in maternal mortality 1990 to 2015: Estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division. [http://apps.who.int/iris/bitstream/10665/193994/1/WHO\\_RHR\\_15.23\\_eng.pdf?ua=1](http://apps.who.int/iris/bitstream/10665/193994/1/WHO_RHR_15.23_eng.pdf?ua=1).
- Tenth annual report of the Perinatal and Maternal Mortality Review Committee: Reporting mortality 2014. Wellington: Health Quality & Safety Commission, New Zealand.
- Saving lives, improving mothers' care—Surveillance of maternal deaths in the UK 2011–13 and lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2009–13. Oxford: National Perinatal Epidemiology Unit, University of Oxford 2015.



The maternal mortality rate in Australia in 2012–2014 was 6.8 deaths per 100,000 women giving birth, which is among the lowest rates in the world. The most common causes of maternal death were bleeding in the brain and in the abdomen (non-obstetric haemorrhage). Women over the age of 35 and under 20 were more likely to die in association with childbirth.

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