



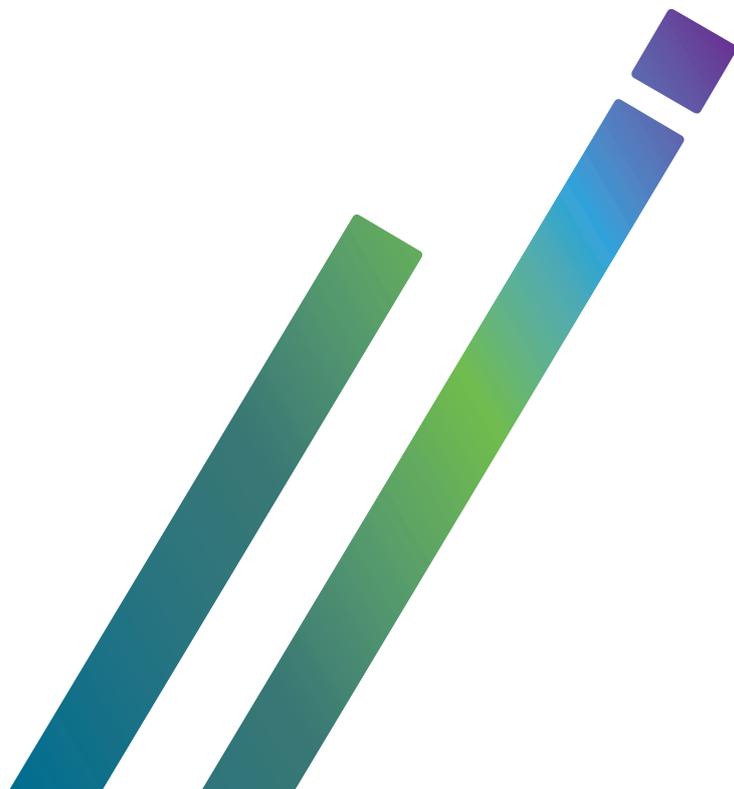
Australian Government

Australian Institute of
Health and Welfare



Antenatal care use and outcomes for Aboriginal and Torres Strait Islander mothers and their babies

2016–2017



AIHW

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2016–2017

Australian Institute of Health and Welfare
Canberra

Cat. no. IHW 237

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Summary

Timely and frequent antenatal care is key to improving health outcomes for both mothers and babies. This report explores the factors associated with antenatal care use among Aboriginal and Torres Strait Islander mothers, and how these may relate to baby outcomes—including how this varies spatially across the Indigenous Regions of Australia.

Antenatal care use varies geographically

The use of antenatal care varies across the Indigenous Regions of Australia. In the 2-year period 2016–2017:

- 63% of Indigenous mothers attended antenatal care in the first trimester—an increase from 55% in 2014–2015.
- across 37 Indigenous Regions, the proportion of Indigenous mothers attending antenatal care in the first trimester ranged from 40% to 84%.

Timing of antenatal care use associated with birth outcomes

Antenatal care in the first trimester has a positive impact on baby outcomes. After adjusting for a range of factors, an analysis showed that:

- having the first antenatal visit after the first trimester was associated with increased odds of low birthweight and neonatal intensive care unit/special care nursery (NICU/SCN) admission.
- having no antenatal care was associated with increased odds of pre-term birth and perinatal death.

Regional variation in antenatal care use and outcomes

To explore regional variation in antenatal care use and outcomes, 7 different measures were analysed by Indigenous Region: antenatal care in the first trimester, 5 or more antenatal care visits, smoking during pregnancy, pre-existing diabetes, pregnancy-induced hypertension, low birthweight and pre-term births. This showed that:

- Indigenous Regions that had higher proportions of mothers accessing antenatal care, tended to have lower rates of adverse mother and baby outcomes
- 3 of the 4 best performing Indigenous Regions (North-Eastern NSW, NSW Central and North Coast, Brisbane) were clustered along the centre of the east coast, with Broome being the fourth Indigenous Region.

1 Introduction

Antenatal care is a planned visit between a pregnant woman and a midwife or doctor to assess and improve the wellbeing of the mother and baby throughout the pregnancy.

Regular and early antenatal care, in particular in the first trimester, is associated with improved maternal health and positive child health outcomes—both soon after birth and later in life (AIHW 2019c).

The majority of Australian mothers receive some level of antenatal care; however, there is disparity in how antenatal care is accessed across different population groups. On average, Aboriginal and Torres Strait Islander mothers have lower rates of antenatal visits than non-Indigenous mothers, and face higher risks of adverse pregnancy and birth outcomes (AIHW 2019a). Over the period 2016–2017, 63% (16,700) of Indigenous mothers received antenatal care in the first trimester compared with 71% (404,700) of non-Indigenous mothers. Among Indigenous mothers giving birth after 32 weeks' gestation in the same time period, 87% (22,700) attended 5 or more antenatal visits during their pregnancy, compared with 95% (533,600) of non-Indigenous mothers.

Factors that influence the effectiveness of antenatal care programs in addressing the specific needs of Indigenous women include: geographic accessibility; availability of outreach services and home visits; access to transport; flexibility in service delivery and appointment times; continuity of care; carer integration with other services; and cultural safety (Health 2018b). It is important that antenatal care is available to Indigenous mothers and is respectful, understanding of local culture, and meets their emotional, practical and clinical needs (Wyndow & Jackiewicz 2014).

The Australian Government Department of Health has funded several programs and services to improve access to culturally safe and effective health care for Indigenous parents and babies, including (Health 2018a):

- The Australian Nurse–Family Partnership Program—a nurse-led home visiting program to support women pregnant with an Aboriginal and/or Torres Strait Islander child, both during their pregnancy and in the years immediately afterwards.
- The New Directions: Mothers and Babies Services (New Directions) program—aims to increase access to, and use of, child and maternal health-care services for Aboriginal and Torres Strait Islander families. Previous Australian Institute of Health and Welfare (AIHW) analysis using national Key Performance Indicators data concluded that there was improvement in 7 out of 8 of the maternal and child health measures for New Directions organisations, compared with 4 out of 8 measures for non-New Directions organisations (AIHW 2014b). While New Directions has ceased as a distinct funding stream, the participating organisations currently receive funding under the Primary Health Care component of the Indigenous Australians' Health Programme (IAHP).

Through the IAHP, the Department of Health also provides funding to Aboriginal Community Controlled Health Services (ACCHSs) and other organisations to deliver comprehensive and culturally appropriate primary health care services tailored to the needs of the local Indigenous community, including maternal and child health services. ACCHSs are primary health services that are run independently by a locally elected board of community members and provide 'holistic, comprehensive, and culturally appropriate' care to their community members (NACCHO 2020).

Many programs shown to be successful are built on partnerships with Indigenous care workers. For example:

- The Aboriginal Family Birthing Program (AFBP) in South Australia employs numerous Aboriginal Maternal and Infant Care workers who work alongside other health professionals to deliver antenatal care. Results of interviews show that clients 'highly valued' receiving care from other Aboriginal women (Middleton et al. 2017). Despite AFBP clients being more likely to be socially disadvantaged and more likely to have clinical complexities than Aboriginal women attending other services, AFBP clients have similar pregnancy outcomes to other Aboriginal women (Middleton et al. 2017).
- The Strong Women, Strong Babies, Strong Culture program, funded by the Northern Territory Department of Health, focuses on empowering rural Indigenous women to share their traditional knowledge of maternal and child health. Its approach has been successful in supporting culturally respectful healthcare (Lowell et al. 2015).
- The Aboriginal Maternity Group Practice Program employs Aboriginal grandmothers, Aboriginal Health Officers and midwives to provide care for pregnant Aboriginal women in partnership with existing antenatal services in south metropolitan Perth. It has been successful in reducing pre-term births, the need for resuscitation at birth and the length of post-birth hospital stays (Health 2019b).

In collaboration with state and federal governments, the Australian College of Midwives is working on a Birthing on Country Project, with the aims of bringing together community members and health services, and developing a Birthing on Country Framework for Maternity Care and a culturally safe training package (ACM 2019).

1.1 Methods and variables used in analysis

Previous AIHW research on spatial variation in Indigenous women's access to maternal health services showed that poor geographic accessibility to services offering maternal care is associated with poor birth outcomes. An analysis by Indigenous Region (IREG) showed that longer drive times to a general practitioner were associated with higher rates of pre-term birth and babies born of low birthweight (AIHW 2017).

This report adds to the earlier work by analysing data over the 2-year period 2016–2017 from the National Perinatal Data Collection (NPDC)—a national cross-sectional data collection on pregnancy and childbirth—to run regression analyses on:

- the characteristics associated with use of antenatal care among Indigenous mothers
- the association between antenatal care use among Indigenous mothers and birth outcomes among their babies.

This report presents descriptive information on some key characteristics of Aboriginal and Torres Strait Islander mothers and their pregnancy and birth outcomes, along with an analysis of any association with use of antenatal care. This includes an analysis of spatial variation by IREG. In this analysis, 37 IREGs were considered. Offshore, migratory/shipping and no usual address IREGs were not included due to small numbers.

Figure 1.1: Map of Indigenous regions



The analysis presented in this report is generally based on data from the National Perinatal Data Collection for women who gave birth in 2016 or 2017. However, there are 2 exceptions:

- For data relating to neonatal intensive care unit/special care nursery admission, data for NSW were not available for 2016–2017. Since NSW accounts for a third of Australia’s Indigenous population, it was decided that instead of using data for 2016–2017 excluding NSW, data from 2014–2015 (where NSW data were available) would be used.
- For perinatal death, the reference period covers 2014–2017 due to small numbers.

Data in the NPDC are obtained from a combination of midwives and other birth attendants, hospital records and completed notification forms for each birth (see also Appendix B).

Table 1.1 shows the definitions and notes about variables considered in the report.

Table 1.1: Variables used in report and their definitions

Variable	Definition	Notes
Antenatal care in the first trimester	Antenatal care accessed before 14 completed weeks of pregnancy	For the ACT, first antenatal visit is often the first hospital antenatal clinic visit. Earlier antenatal care provided by the woman's general practitioner is not always reported.
Number of antenatal visits	Total number of antenatal visits accessed during pregnancy	Analysis in this report includes only mothers who gave birth at 32 or more weeks' gestation. This is to prevent statistical confounding by pregnancies that do not reach term.
Maternal age	Mother's age at the birth of the baby	
Remoteness	Remoteness of usual residence	Does not necessarily reflect where services are accessed.
Indigenous Region (IREG)	Indigenous Region of usual residence	Based on concordance from SA2 of usual residence. Does not necessarily reflect where services are accessed.
SEIFA Index of Relative Socio-economic Disadvantage (IRSD)	This report uses the Socio-Economic Indexes for Areas (SEIFA) Index of Relative Socio-economic Disadvantage (IRSD), developed by the Australian Bureau of Statistics (ABS). IRSD ranks areas according to relative socioeconomic disadvantage. The score for each area is calculated using a range of information about the economic and social conditions of people and households in that area (e.g. income, education and occupation)	Derived from mother's area of usual residence. A low score indicates relatively greater disadvantage. Mothers living in the same area are all assigned the same score; therefore it may not capture individual socioeconomic differences.
Maternal smoking	Whether a mother smoked tobacco during pregnancy	Split into whether a mother smoked tobacco in the first 20 weeks of pregnancy (when analysing use of antenatal care services, Chapter 2) and after 20 weeks of pregnancy until the birth (when analysing birth outcomes, Chapter 3). Maternal smoking status during pregnancy is self-reported.
Pre-pregnancy BMI	Pre-pregnancy body mass index (BMI). BMI is the ratio of weight and height (kg/m ²)	The normal range of BMI for non-pregnant women is 18.5 to 24.9. While increases in BMI are expected during pregnancy, a BMI of 30 or more at the first antenatal visit is defined as pre-pregnancy obesity.
Pre-existing diabetes	Whether a mother had diabetes prior to the pregnancy	Includes pre-existing type 1, pre-existing type 2 and pre-existing unspecified diabetes. Diabetes data were not available for Victoria.
Pregnancy-induced hypertension	Hypertension (high blood pressure) that did not exist before pregnancy	Pregnancy-induced hypertension tends to appear after 20 weeks' gestation. Hypertension data were not available for Victoria.
Marital status	Maternal marital status: classified as 'currently married (including de facto)', 'never married' or 'widowed, divorced or separated'	This variable is included in regression analysis in Chapter 2 as marital status can directly affect use of antenatal services (Blondel & Zuber 1988; Joung et al. 1995; Rurangirwa et al. 2017). It is not included in the Chapter 3 regressions as the causal pathway between marital status and baby outcomes is more complex. Marital status data were not available for Western Australia.
Antepartum haemorrhage	Bleeding from or into the genital tract in the second half of pregnancy	Antepartum haemorrhage data were not available for New South Wales and Western Australia.
Parity	The number of previous pregnancies resulting in live or stillbirth	
Pre-term birth	Babies born before 37 completed weeks' gestation	
Low birthweight	Weight of a baby at birth that is less than 2,500 grams	Low birthweight calculations in this report include only liveborn singleton babies.
Neonatal intensive care unit/ special care nursery (NICU/SCN)	Wards to provide specialised care for liveborn babies who require it	Data not available for Western Australia (all time periods) and New South Wales (2016).
Perinatal death	A combination of stillbirths and neonatal deaths (deaths in the first 28 days of a baby's life)	

This report uses two measures of antenatal care: accessing antenatal care in the first trimester (before 14 completed weeks of pregnancy) and having 5 or more antenatal visits throughout pregnancy (see Box 1.1).

Box 1.1: Measures of antenatal care

This report uses two measures of antenatal care: antenatal care in the first trimester (before 14 completed weeks of pregnancy), and having 5 or more antenatal visits throughout pregnancy. These measures are included in various national reporting frameworks related to Aboriginal and Torres Strait Islander Australians. For example, they are both included as goals in the Implementation Plan for the National Aboriginal and Torres Strait Islander Health Plan 2013–2023 (AIHW 2019d; Health 2019a). They are also included as indicators of the healthy birthweight target in the new National Agreement on Closing the Gap (Closing the Gap 2020).

However, each of these measures has caveats.

Antenatal visits attended in early pregnancy are sometimes not recorded in perinatal data collections. For example, in the ACT the first recorded antenatal visit is often the first hospital antenatal clinic visit, and earlier antenatal care provided by the woman's general practitioner is not reported.

The relationship between the total number of antenatal visits and pregnancy and birth outcomes should be considered with caution. Generally, having a high number of antenatal visits is a positive outcome, but this can be confounded by:

- high-risk pregnancies (where mothers with certain conditions must make more frequent antenatal visits)
- pregnancies that do not reach term (and therefore mothers no longer require antenatal visits).

To address the second point, when measuring the number of antenatal visits, only mothers who gave birth at gestational age of 32 weeks or more have been included in the analysis.

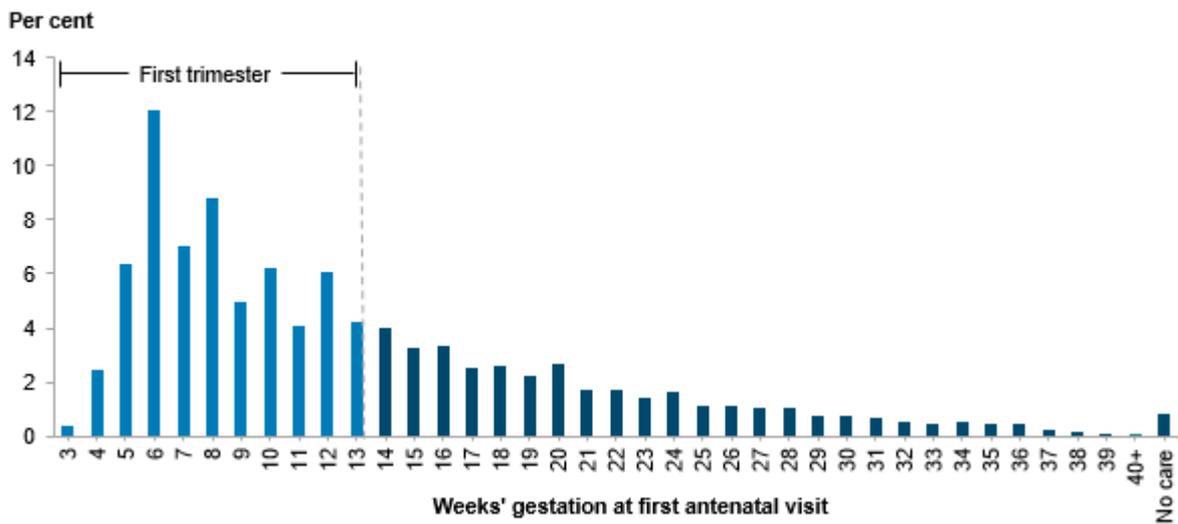
Analysis of the total number of antenatal visits also does not account for the increased benefits of accessing antenatal care in the early stages of pregnancy.

1.2 Overview of antenatal care use

Antenatal care in the first trimester is associated with improved maternal health, fewer interventions in late pregnancy and positive child health outcomes (AIHW 2018a; Health 2018b).

Nationally, in 2016–2017, 63% of Indigenous mothers were reported to have attended antenatal care in the first trimester (Figure 1.2), a large increase from 55% in 2014–2015 (see Table A1).

Figure 1.2: Timing of first antenatal visit among Indigenous mothers, 2016–2017

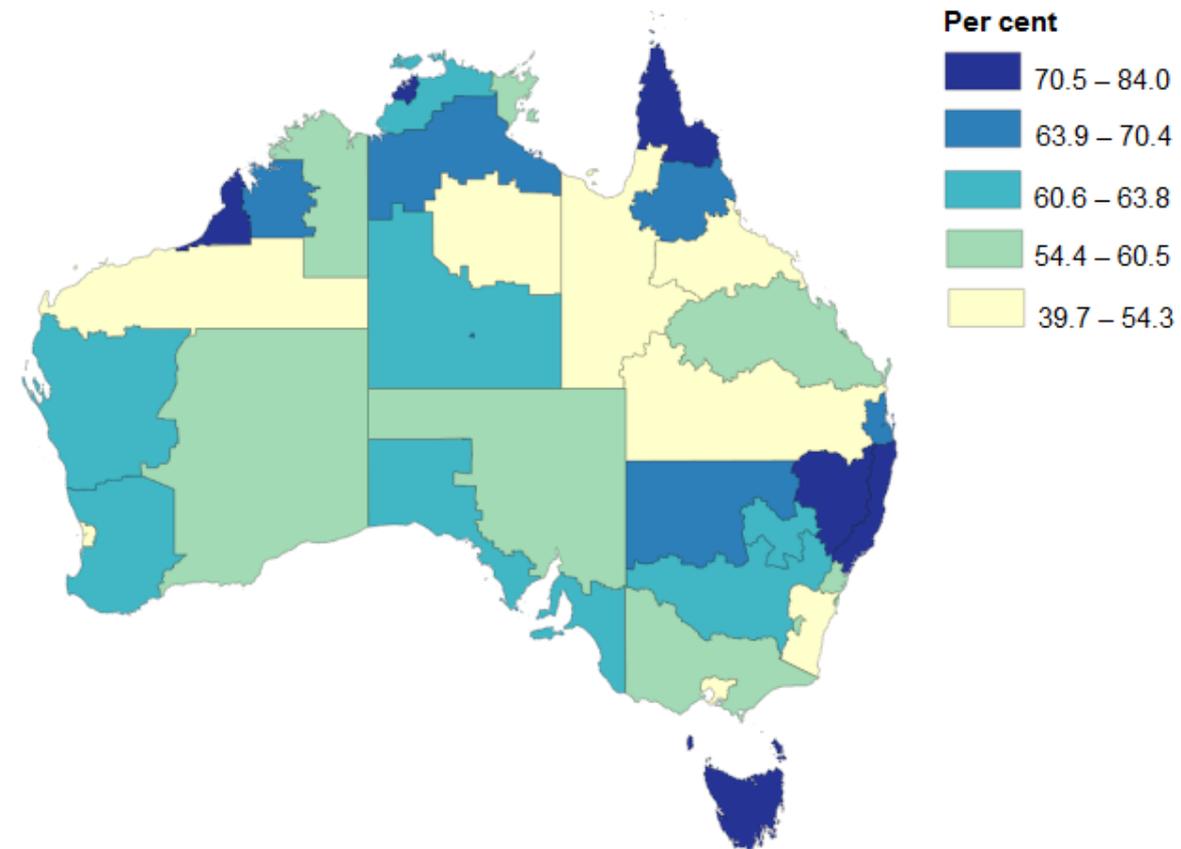


Source: AIHW analysis of NPDC.

Among Indigenous mothers giving birth in 2016–2017, the proportion reported as attending antenatal care in the first trimester varied considerably by IREG. In this period, 60% or more of mothers attended antenatal care in the first trimester in 23 of the 37 IREGs.

Figure 1.3 shows that over 2016–2017, the IREG with the highest proportion of reported antenatal care attendance in the first trimester was Tasmania, at 84% of Indigenous mothers. Toowoomba – Roma and Perth had among the lowest absolute proportion of Indigenous mothers attending in the first trimester (40% and 45%, respectively).

Figure 1.3: Proportion of Indigenous mothers receiving antenatal care in the first trimester, by Indigenous Region, 2016–2017



Notes

1. The map's colour scheme is coded so lighter-coloured IREGs have lower levels of antenatal care in the first trimester, and darker-coloured IREGs have higher levels. Data classified by splitting the range of values on this variable into 5 categories with the same number of IREGs in each. See Table A2 for further detail.

2. For the ACT, first antenatal visit is often the first hospital antenatal clinic visit. In many cases, earlier antenatal care provided by the woman's general practitioner is not reported.

Source: AIHW analysis of NPDC.

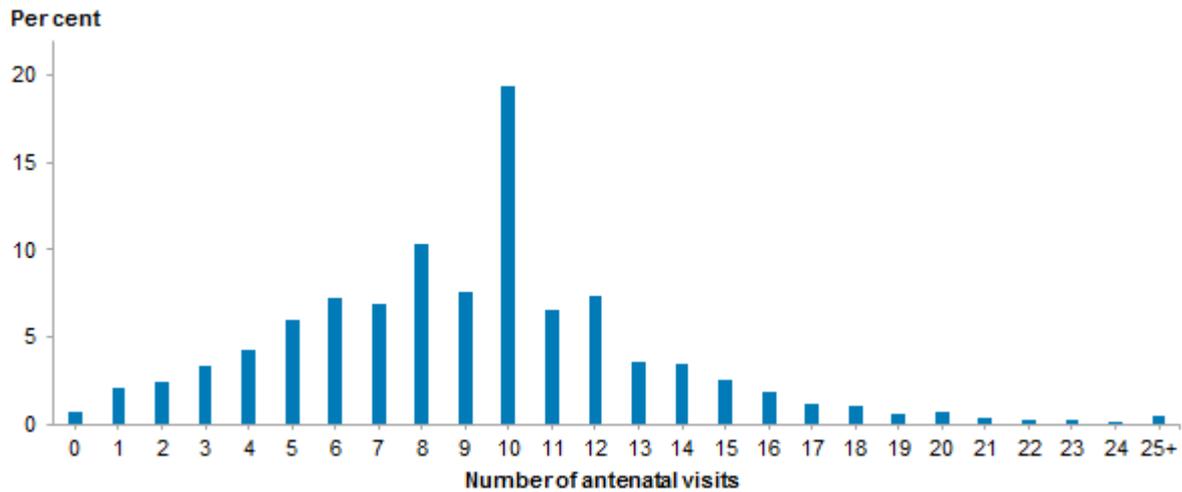
Another common measure of antenatal care use is the total number of antenatal visits during a pregnancy, with a recommended 10 visits for the first pregnancy among otherwise healthy mothers (and 7 visits for any subsequent uncomplicated pregnancies) (Health 2018b). This report uses 5 antenatal care visits as a benchmark, for consistency with key national reporting frameworks (see Box 1.1).

Nationally, in 2016–2017, among Indigenous women who gave birth:

- 13% attended fewer than 5 antenatal visits
- 38% attended between 5 and 9 antenatal visits
- 49% attended 10 or more visits (Figure 1.4).

This means that, during this period, 87% of Indigenous mothers attended 5 or more antenatal visits.

Figure 1.4: Total number of antenatal visits by Indigenous mothers throughout pregnancy, 2016–2017

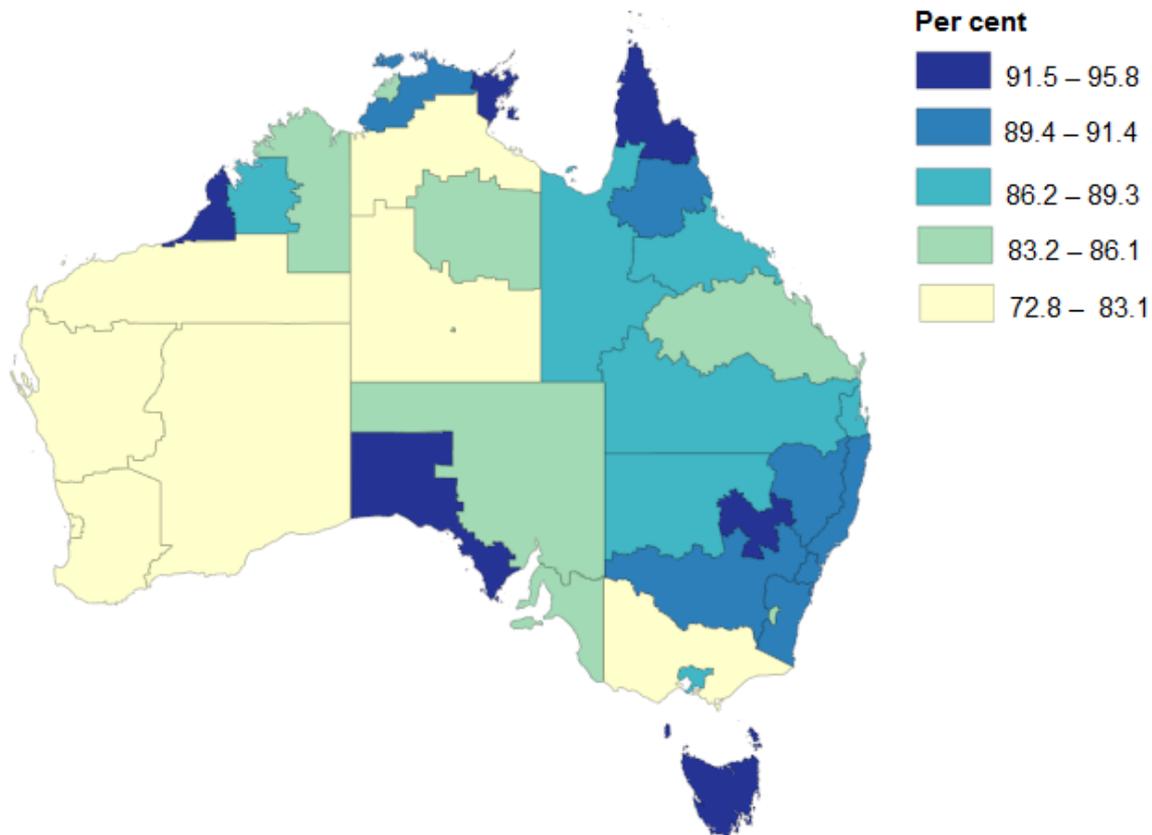


Note: Only including mothers who gave birth at 32 or more weeks' gestation to prevent confounding by pregnancies that do not reach term.
Source: AIHW analysis of NPDC.

In 2016–2017, the proportion of Indigenous mothers attending 5 or more antenatal visits throughout their pregnancy also varied by IREG.

In 30 of the 37 IREGs, more than 80% of Indigenous mothers attended 5 or more antenatal visits (Figure 1.5). Across the IREGs, Cape York and Torres Strait had the highest proportion of Indigenous mothers attending 5 or more antenatal visits (both 96%). Rates for IREGs across the north and east coast of Australia were generally high. IREGs across Western Australia tended to have lower rates—particularly South Hedland (73%) and Perth (75%).

Figure 1.5: Proportion of Indigenous mothers who attended 5 or more antenatal visits, by Indigenous Region, 2016–2017



Notes

1. The map's colour scheme is coded so lighter-coloured IREGs have lower levels of 5+ antenatal visits, and darker-coloured IREGs have higher levels. Data classified by splitting the range of values on this variable into 5 categories with the same number of IREGs in each. See Table A3 for further detail.

2. Data include only mothers who gave birth at 32 or more weeks' gestation.

Source: AIHW analysis of NPDC.

1.3 Report structure

The remainder of the report comprises 3 chapters:

- **Chapter 2: Indigenous mothers.** Provides background information on characteristics of Indigenous mothers and maternal health—including mother's age, parity, smoking status and body mass index. Information is also presented on factors associated with whether Indigenous mothers' attend timely and frequent antenatal care, based on multivariate logistic regression analyses.
- **Chapter 3: Babies born to Indigenous mothers.** Presents information on the prevalence of certain adverse birth outcomes—specifically low birthweight, pre-term births, admission to NICU/SCN and perinatal deaths—and how these vary across Indigenous regions. Information is also presented on how these adverse outcomes were affected by factors such as antenatal care.
- **Chapter 4: Spatial variation in baby outcomes and selected risk factors.** Analyses how antenatal care use and other selected maternal risk factors and adverse baby outcomes vary by Indigenous Region.

2 Aboriginal and Torres Strait Islander mothers

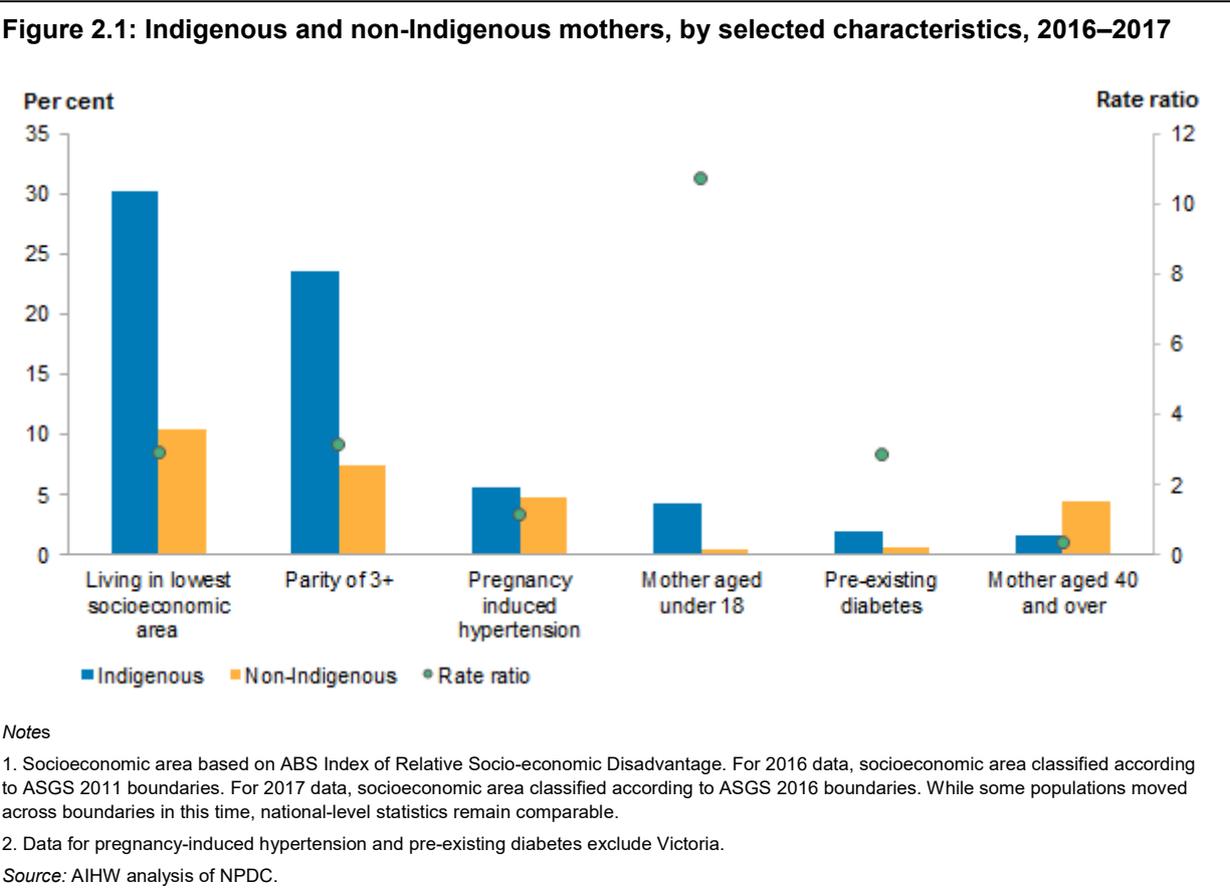
In 2017, 4.5% of Australian women who gave birth identified as Aboriginal and Torres Strait Islander (13,600 women) (AIHW 2019a).

Factors associated with poor infant health and child mortality are complex and reflect broader social, environmental and economic conditions. Antenatal care, particularly when delivered in a culturally appropriate manner, can be a protective factor (AIHW 2018b).

Over time, there have been reductions various maternal risk factors among Indigenous mothers. Between 2014–2015 and 2016–2017, the proportion of Indigenous mothers aged under 18, and the proportion who smoked during pregnancy, both decreased (see Appendix A, Table A1).

This chapter provides background information on characteristics of Indigenous mothers and maternal health. Information is also presented on factors associated with whether Indigenous mothers’ attend timely and frequent antenatal care, based on multivariate logistic regression analyses.

Figure 2.1 shows the rates of selected mother variables among Indigenous and non-Indigenous mothers.



2.1 Selected characteristics

This Section (2.1) presents information on the following:

- maternal age
- remoteness
- social determinants of health
- maternal smoking
- pre-pregnancy BMI
- diabetes
- hypertension
- antepartum haemorrhage
- parity.

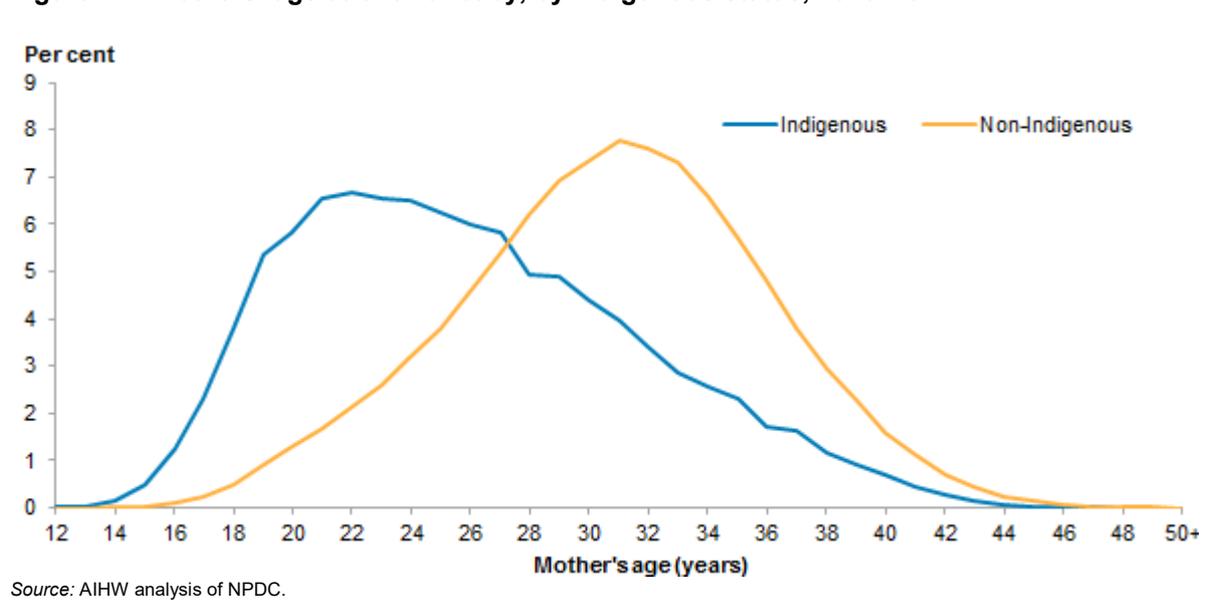
This also provides context for the analysis presented in Section 2.2, which looks at the association of these factors with antenatal care use among Indigenous mothers.

Maternal age

A mother's age can influence a number of outcomes for both mother and baby (AIHW 2018b). In general, younger mothers aged under 20 are more likely to be underweight, and their babies are more likely to be small for gestational age and pre-term (AIHW 2018a). Babies born to mothers aged under 20 also have a higher risk of deaths due to maternal conditions (AIHW 2019a). Babies born to mothers aged 40 and over are more likely to be born pre-term (AIHW 2018a), and have a higher risk of dying due to chromosomal anomalies (AIHW 2019a).

In 2017, the median maternal age among Indigenous mothers was 25 years, compared with 31 years for non-Indigenous mothers (AIHW 2019a). In 2016–2017, a higher proportion of Indigenous mothers were under the age of 18 at the birth of their baby (4.3% compared with 0.4%). However, a higher proportion of non-Indigenous mothers were aged 40 and over (4.4% compared with 1.7%) (Figure 2.2).

Figure 2.2: Mothers' age at birth of baby, by Indigenous status, 2016–2017



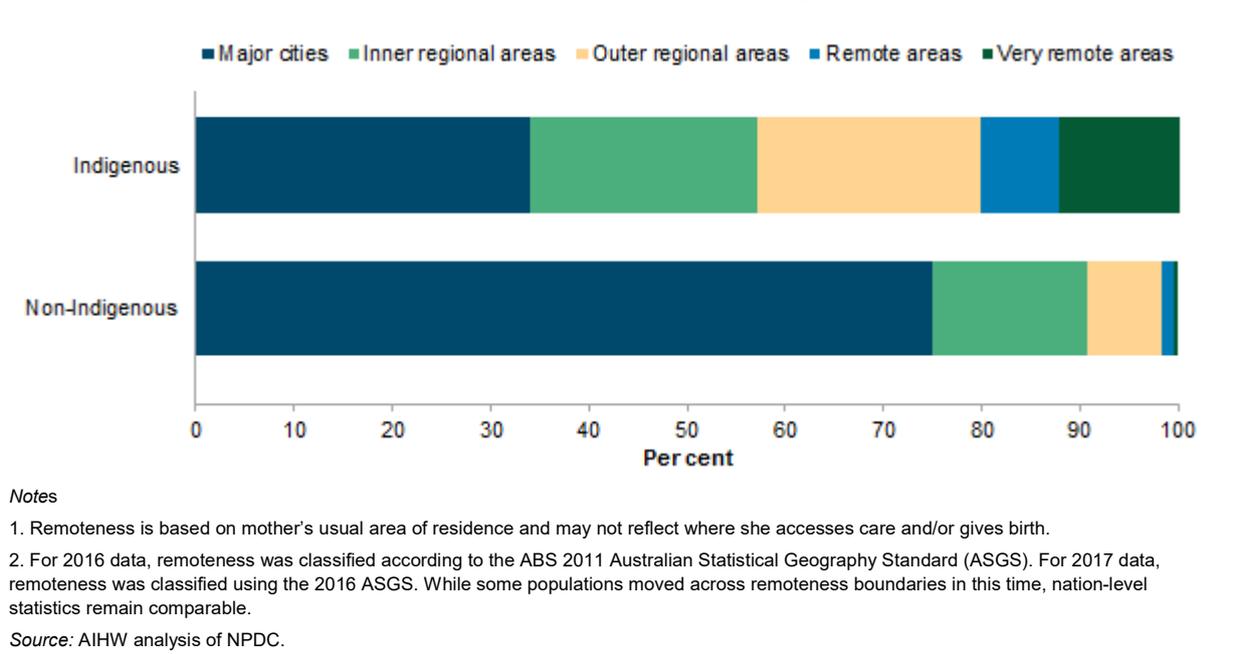
Remoteness

Increased remoteness is associated with decreased availability of and access to health services and changes in availability of nutritious food, which can affect maternal and infant health, potentially contributing to the risk of stillbirths and infant mortality (AIHW 2018b).

Although about 1 in 3 Indigenous mothers (34% in 2016–2017) live in *Major cities*, Indigenous mothers are much more likely than non-Indigenous mothers to live in regional and remote areas (Figure 2.3). In 2016–2017, 20% of Indigenous mothers lived in *Remote* and *Very remote* areas combined, compared with 1.6% of non-Indigenous mothers.

Women living in *Remote* and *Very remote* areas may be relocated to regional centres for birth due to factors such as accessibility of services. However, for Indigenous mothers, not giving birth on Country may be associated with poorer clinical and social outcomes as it can break the strong link between Country and cultural identity, and may involve mothers spending weeks removed from family (Health 2019b).

Figure 2.3: Mothers by remoteness of usual residence, by Indigenous status, 2016–2017

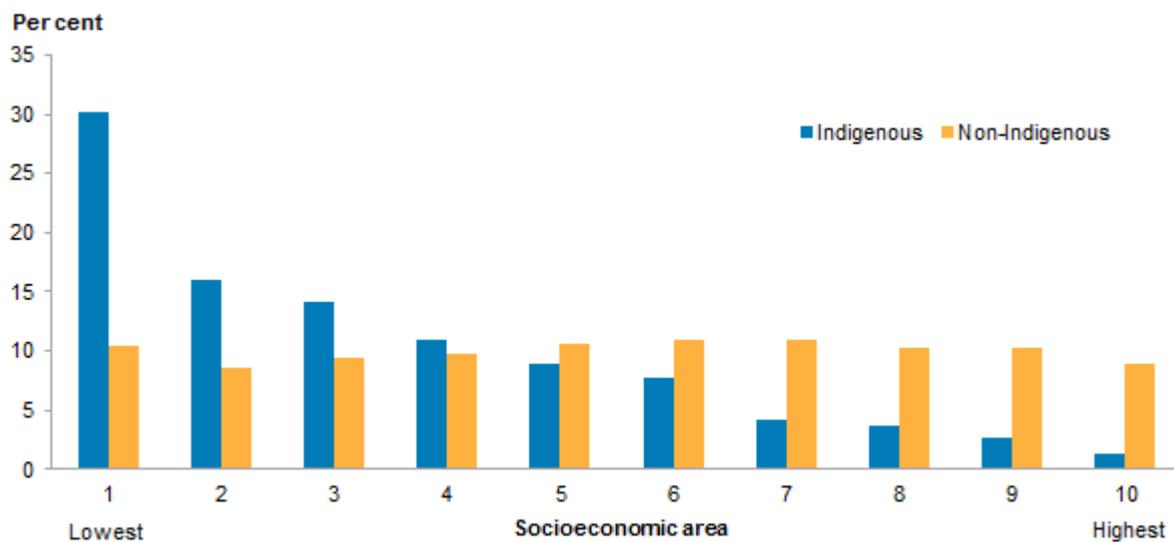


Socioeconomic disadvantage

Socioeconomic factors such as education, income and employment, can affect whether a mother accesses antenatal care, and how often (Mangrio et al. 2011).

In 2016–2017, Indigenous mothers were more likely than non-Indigenous mothers to live in the lowest socioeconomic areas (Figure 2.4). This analysis is based on the relative level of socioeconomic disadvantage of the area in which the mother usually lives, calculated using the ABS Index of Relative Socio-economic Disadvantage (IRSD) (ABS 2018).

Figure 2.4: Indigenous and non-Indigenous mothers, by socioeconomic area of usual residence, 2016–2017



Note: Socioeconomic area of usual residence is based on IRSD. For 2016 data, socioeconomic area classified according to ASGS 2011 boundaries. For 2017 data, socioeconomic area classified according to ASGS 2016 boundaries. While some populations moved across boundaries in this time, nation-level statistics remain comparable.

Source: AIHW analysis of NPDC.

Maternal smoking

The effects of smoking during pregnancy include intrauterine growth restriction (resulting in low birthweight and small for gestational age babies), poor lung development, stillbirth, pre-term birth and placental abruption (AIHW 2018b). Accessing antenatal care in the first trimester is associated with a reduction in smoking after 20 weeks' gestation.

Among Indigenous mothers in 2016–2017, 43% smoked during the first 20 weeks of pregnancy, decreasing to 38% in the second 20 weeks. In comparison, 8.0% of non-Indigenous mothers smoked during the first 20 weeks of gestation, decreasing to 5.8% after 20 weeks.

Between 2014–2015 and 2016–2017, among Indigenous mothers:

- the proportion who smoked during the first 20 weeks of pregnancy decreased from 45% to 43%
- the proportion who smoked after 20 weeks of pregnancy decreased from 40% to 38%.

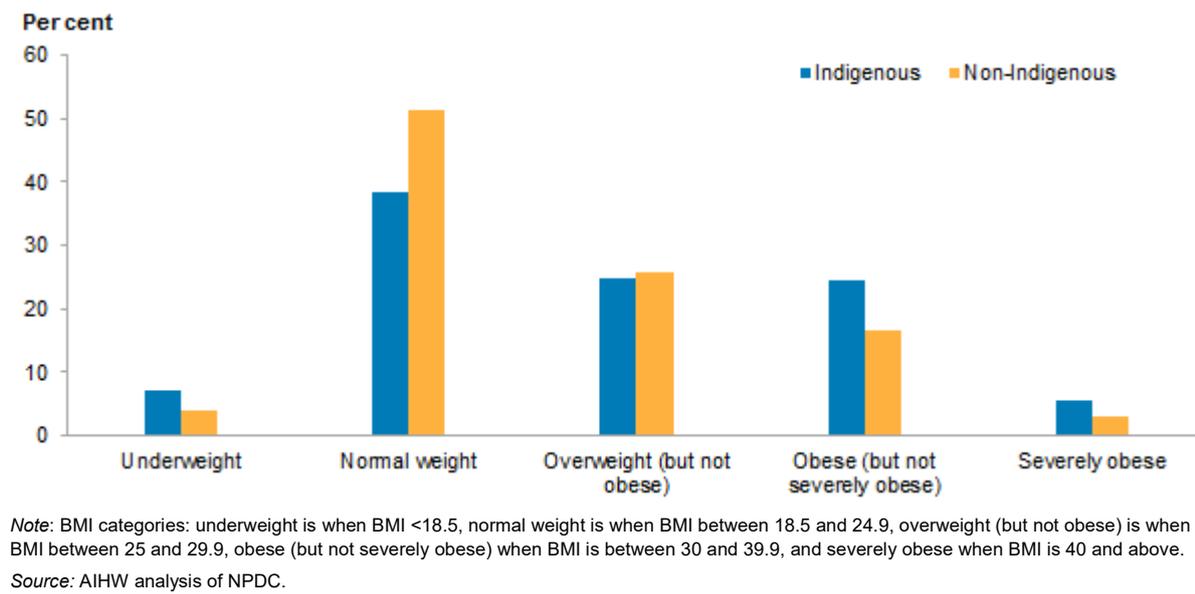
Pre-pregnancy BMI

Body mass index (BMI) is a ratio of weight and height. The normal range of BMI for non-pregnant women is 18.5 to 24.9. While increases in BMI are expected during pregnancy, a BMI of 30 or more at the first antenatal visit is defined as pre-pregnancy obesity.

Pre-pregnancy obesity is associated with an increased risk of gestational diabetes, infertility, infant mortality and congenital abnormalities, while being underweight pre-pregnancy is associated with small for gestational age babies and pre-term birth (AIHW 2018a; Block et al. 2013).

In 2016–2017, 39% of Indigenous mothers and 51% of non-Indigenous mothers were within the normal BMI range. Indigenous mothers were more likely to have a pre-pregnancy BMI that was underweight, obese or severely obese than non-Indigenous mothers (Figure 2.5).

Figure 2.5: Mother’s pre-pregnancy body mass index (BMI), by Indigenous status, 2016–2017



Diabetes

Diabetes during pregnancy can be gestational (occurring only during pregnancy) or chronic (occurring regardless of pregnancy status).

Research has shown that uncontrolled diabetes in mothers is associated with congenital anomalies in their babies (AIHW 2018b). There are specific ocular, renal, vascular and weight-related clinical recommendations for women with pre-existing diabetes, and universal testing for diabetes in early pregnancy is recommended in order to ensure timely and effective management (Blumer et al. 2013).

Pre-existing diabetes has also been associated with an increase in congenital anomalies. In 2016–2017, 2.0% of Indigenous mothers and 0.7% of non-Indigenous mothers had pre-existing diabetes (data exclude Victoria).

Hypertension

Hypertension (also known as high blood pressure) during pregnancy can be either chronic (that is, it existed before pregnancy), or pregnancy-induced. Pregnancy-induced hypertension can be expressed as hypertension alone, pre-eclampsia (including multi-organ dysfunction) or eclampsia (a complication of pre-eclampsia involving seizures) (Roberts et al. 2011). Hypertension among pregnant women is associated with pre-term birth, intrauterine growth restriction, perinatal death and maternal death. It is recommended that women are assessed for hypertension before pregnancy, and that they are monitored for pre-eclampsia throughout pregnancy (Seely & Ecker 2011).

Based on the NPDC in 2016–2017 among the jurisdictions where information was available, 6.6% of Indigenous mothers had a hypertensive disorder (of any kind), compared with 5.5% of non-Indigenous mothers (data exclude Victoria). In the same period 5.6% of Indigenous

mothers and 4.8% of non-Indigenous mothers had pregnancy-induced hypertension (data exclude Victoria).

Antepartum haemorrhage

Antepartum haemorrhage is a term used to describe bleeding from or into the genital tract in the second half of pregnancy. Causes of antepartum haemorrhage include placenta praevia, placental abruption or other/unspecified conditions. Antepartum haemorrhage is associated with maternal morbidity and mortality, pre-term birth, low birthweight and perinatal death (Mukherjee & Bhide 2008).

Based on data in 2016–2017 from the NPDC 3.8% of Indigenous mothers experienced antepartum haemorrhage, compared with 3.3% of non-Indigenous mothers (data exclude New South Wales and Western Australia).

Parity

The number of previous pregnancies resulting in live or stillbirth—known as parity—has associations with risks to maternal health. For example, over the period 2012–2017, mothers with a parity of 3 or more were 2.3 times as likely to die of a pregnancy-related cause (while pregnant or within 42 days of birth), compared to those with a parity of 0 to 2 (AIHW 2019b). Over the period 2016–2017, 24% of Indigenous mothers had a parity of 3 or over, compared with 8% of non-Indigenous mothers.

2.2 Mother’s characteristics and antenatal care use

This section presents results from 2 multivariate logistic regression analyses of the factors associated with antenatal care use among Indigenous mothers. The 2 outcomes analysed were whether:

- the first antenatal care visit was attended in the first trimester
- 5 or more antenatal care visits were attended throughout the pregnancy.

The set of explanatory variables chosen for the regression modelling is limited by the coverage of the variables in the NPDC. The main variables of interest were mother’s age, parity, smoking status, pre-existing diabetes and hypertension, BMI, remoteness and socioeconomic area. A mother’s marital status is included as a proxy for having a familial support system (as data on family support are not collected in the NPDC).

The same set of explanatory variables was used in both regression models. Results of the regression analyses are presented in Table 2.1 as odds ratio estimates (see Box 2.1).

Box 2.1: Interpreting results of the regression

The estimated odds ratios for a specific variable should be interpreted in comparison with the reference category of that variable (indicated in Table 2.1).

An odds ratio significantly higher (or lower) than 1 indicates that the category has a significant effect on increasing (or decreasing) the odds of the overall outcome variable occurring, compared to being in the reference category.

Caution is necessary in interpreting the results of these regressions. While some of the explanatory variables—such as socioeconomic area and remoteness—may align with accessibility of antenatal care, others—such as pre-pregnancy BMI and pre-existing health conditions—may reflect the increased need for antenatal care to mitigate risk.

Table 2.1: Estimated odds ratios of Indigenous mothers' use of antenatal care for selected explanatory variables, 2016–2017

Explanatory variable (reference category)	Level	Antenatal care in the 1 st trimester	5+ antenatal visits ^(a)
Mother's age (ref: 20–24)	≤19	0.70*	0.82*
	25–29	1.23*	1.32*
	30–34	1.22*	1.43*
	35–39	1.31*	1.48
	40+	1.50	0.84
Smoking in first 20 weeks (ref: no smoking in first 20 weeks)	Smoked in first 20 weeks	0.73*	0.49*
Pre-existing diabetes in mother (ref: no pre-existing diabetes)	Pre-existing diabetes of any type	1.36*	1.37
Pre-existing hypertension in mother (ref: no pre-existing hypertension)	Pre-existing hypertension	1.22	1.02
Parity (ref: no previous births)	1–2	0.78*	0.57*
	3+	0.60*	0.39*
Pre-pregnancy BMI (ref: normal BMI)	Underweight	1.16*	0.87
	Overweight or obese	1.04	1.21*
	Severely obese	1.22*	1.57*
Socioeconomic area (ref: highest)	Lowest	0.93	0.75*
	2 nd quintile	0.97	0.72*
	3 rd quintile	0.88	0.76
	4 th quintile	1.03	0.85
Remoteness of usual area of residence (ref: Major cities)	Inner regional	1.15	1.26*
	Outer regional	1.12	1.16
	Remote	1.06	1.23
	Very remote	0.87	1.03
Maternal marital status (ref: currently married (including de facto)) ^(b)	Never married	0.82*	0.70*
	Widowed, divorced or separated	0.61*	0.67*

* = estimated odds ratio is statistically significant at the 5% test level (i.e. with p-value < 0.05).

Legend

	indicates statistically significant protective factors (with odds ratios greater than 1)
	indicates statistically significant risk factors (with odds ratios less than 1)
	indicates risk factors that are not statistically significant at the 5% test level

(a) Analysis in this report includes only mothers who gave birth at 32 or more weeks' gestation.

(b) Marital status data not available for Western Australia.

Notes

1. Analysis included control variable for the ABS geographical classification of Indigenous Regions (IREG). Estimated odds ratio results for IREGs not reported since there are 37 separate IREGs. IREGs are wholly contained within jurisdictions so the IREG variable and state/territory variable cannot both be used in the same model. The IREG level analysis was preferred as it gives a more detailed estimate of regional effects on the timely use of antenatal care, and on whether there are 5 or more visit in total, allowing for differences within a specific jurisdiction.
2. Analysis included control variable for year (2016 versus 2017), but is not shown in table. There were no significant differences.
3. Analysis excluded mothers giving birth in Victoria due to data not being available for 2 of the explanatory variables used in the model (pre-existing hypertension and pre-existing diabetes).
4. Analysis included categories for missing data on the following variables: BMI, marital status, pre-existing diabetes, pre-existing hypertension, parity and socioeconomic area Odds ratios for those categories are not presented due to difficulties in interpretation.

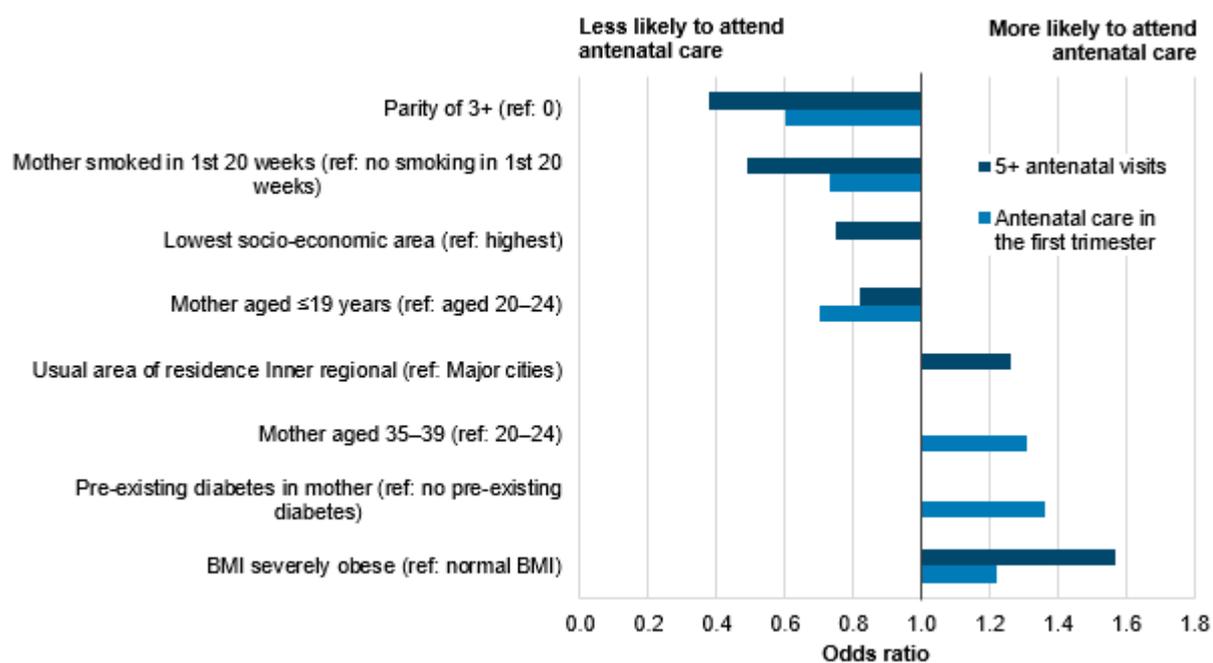
Source: AIHW analysis of NPDC.

Broad findings

In 2016–2017, across both models, among Indigenous mothers, the characteristics that had significant estimated associations with both measures of antenatal care (attending antenatal care in the first trimester and attending 5+ antenatal visits) were:

- being aged under 20, 25–29 or 30–34 (compared with being 20–24)
- having a severely obese pre-pregnancy BMI (compared with a being in the normal range)
- being a smoker in the first 20 weeks of pregnancy (compared with not smoking in the first 20 weeks)
- having a parity of 1–2 or 3+ (compared with a parity of 0) (Figure 2.6).

Figure 2.6: Odds ratios for selected explanatory variables explaining Indigenous mothers' use of antenatal care, 2016–2017



Note: Only statistically significant odds ratios included.

Source: AIHW analysis of NPDC.

Attending antenatal care in the first trimester

The estimated odds of Indigenous mothers accessing antenatal care in the first trimester during 2016–2017 were:

- 1.4 times as likely if the mother had pre-existing diabetes (compared with those who did not)
- 1.3 times as likely among those aged 35–39 and 1.2 times as likely among those aged 30–39 and 25–29 (compared with those aged 20–24)
- 0.6 times as likely if the mother had a parity of 3 or more, and 0.8 times as likely if the mother had a parity of 1 or 2 (compared with a parity of 0)

- 0.6 times as likely if the mother was widowed, divorced or separated, and 0.8 times as likely if the mother was never married (compared with being currently married or de facto) (Table 2.1).

Attending 5 or more antenatal visits throughout pregnancy

The estimated odds of Indigenous mothers accessing 5 or more antenatal visits throughout their pregnancy in 2016–2017 were:

- 1.6 times as likely if the mother’s BMI was severely obese, and 1.2 times as likely if the mother’s BMI was overweight or obese (compared with normal BMI)
- 1.4 times as likely among those aged 30–34 and 1.3 times as likely among those aged 25–29 (compared with those aged 20–24)
- 0.4 times as likely if the mother had a parity of 3 or more, and 0.6 times as likely if the mother had a parity of 1 or 2 (compared with a parity of 0)
- 0.5 times as likely if the mother smoked in the first 20 weeks of pregnancy (Table 2.2).

Areas for potential further analysis in relation to mothers’ characteristics and antenatal care use are in Box 2.2.

Box 2.2: Areas for further analysis

The following interpretations are based on the results modelled in Table 2.1, but they will require further analysis outside the scope of this report to establish the causal factors associated with these differences.

The results in Table 2.1 indicates Indigenous mothers are less likely to attend antenatal care if they have a parity of 1–2 or 3+ (indicating that they are likely to have other children at home). This may indicate that they also face barriers to attending antenatal care, or perhaps that they feel less need to attend antenatal care given their familiarity with pregnancy.

The results also suggest that while the socioeconomic area of usual residence does not affect whether Indigenous mothers attend antenatal care in the first trimester, Indigenous mothers living in lower socioeconomic areas are less likely to attend 5 or more antenatal visits. This may indicate that costs, including transport costs and the opportunity cost of missing work, could be a barrier for Indigenous women in lower socioeconomic groups to attend the recommended number of antenatal visits.

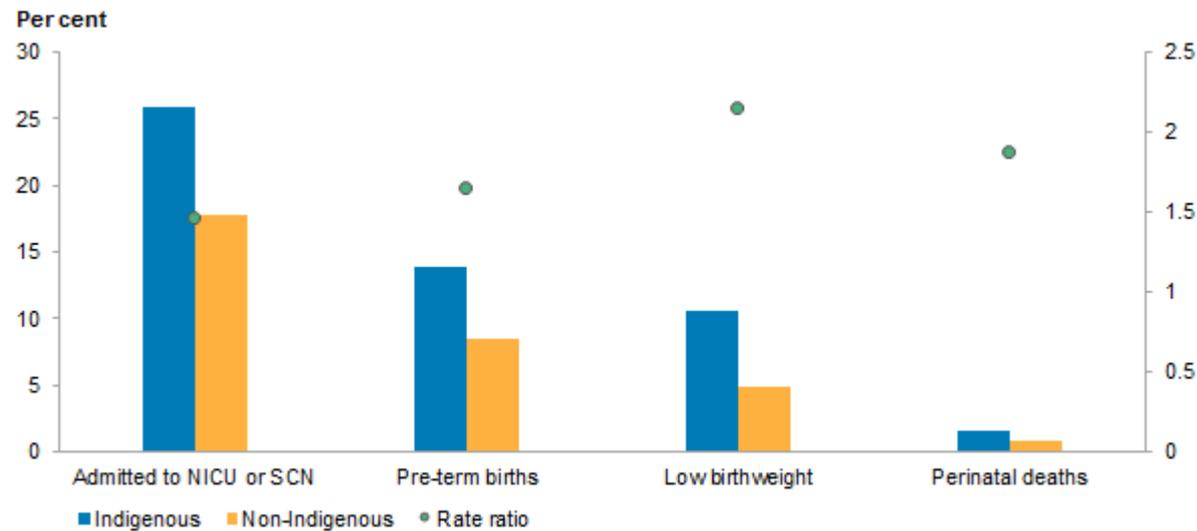
Table 2.1 also indicates that if Indigenous mothers are not currently married (that is, if they were never married, or widowed, divorced or separated), they are less likely to attend antenatal care. While marital status itself is not a health indicator, being married or de facto can be a proxy for having a stable partner who is able to provide support such as assistance with transportation, or child minding. These results indicate that pregnant Indigenous women without a regular partner may face barriers to accessing antenatal care.

3 Babies born to Aboriginal and Torres Strait Islander mothers

In 2017, 4.5% of babies (13,800) were born to Aboriginal and Torres Strait Islander mothers (AIHW 2019a).

In 2016–2017, babies born to Indigenous mothers were had higher rates of low birthweight, pre-term births, admission to NICU/SCN and deaths during the perinatal period (Figure 3.1). Reasons for higher rates of adverse outcomes such as these are complex and reflect broader social, environmental and economic conditions (AIHW 2018b).

Figure 3.1 Selected outcomes among babies, by Indigenous status of their mother, 2016–2017



Notes

- 1. Admission to NICU/SCN includes live births only. Admitted to NICU or SCN data exclude WA.
- 2. Low birthweight includes liveborn singleton babies only.

Source: AIHW analysis of NPDC.

This chapter provides an overview of babies born to Indigenous mothers, and highlights some key baby outcomes that have been identified in the literature as being positively influenced or mitigated against by antenatal care use (Section 3.1).

This chapter also presents results from a regression analysis looking at the associations between antenatal care attendance and improved baby outcomes (Section 3.2).

3.1 Selected birth and early infancy outcomes

The following birth and childhood outcomes are those that will appear in this chapter’s multivariate logistical regressions. To prevent confounding factors, low birthweight calculations include only singleton liveborn babies, and neonatal intensive care unit/special care nursery admission will include all liveborn babies, while pre-term births and perinatal death calculations include all births.

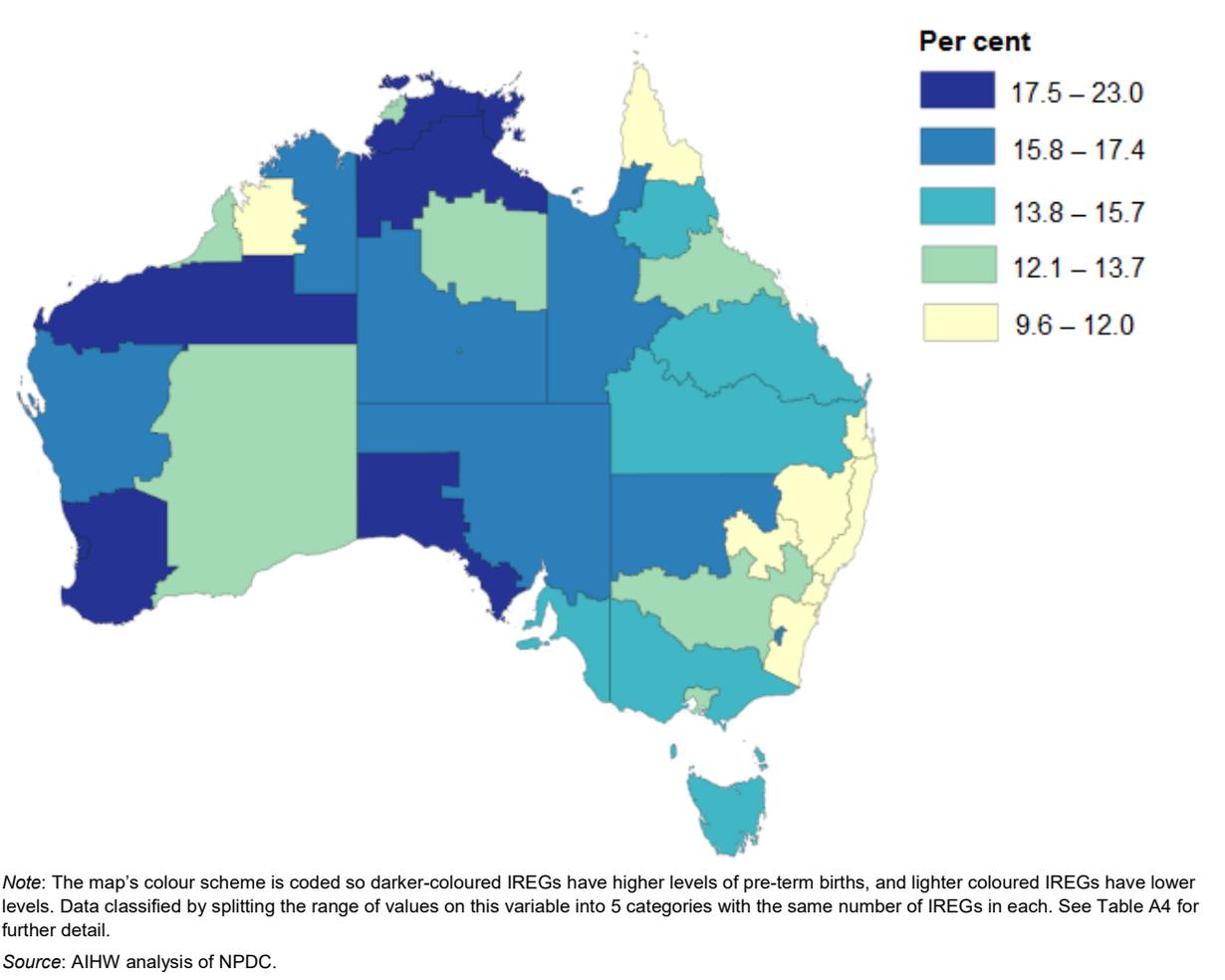
Pre-term birth

Pre-term birth—babies born before 37 completed weeks’ gestation is associated with a higher risk of adverse neonatal outcomes. In some cases, the risk of pre-term birth can be mitigated through treatments such as bed rest (at home or hospital) and antibiotics (to treat infections that can lead to premature birth) (AIHW 2018b).

Nationally, in 2016–2017, 14% of babies born to Indigenous mothers were pre-term, compared with 8.4% of babies of non-Indigenous mothers.

Figure 3.2 presents pre-term births among babies born to Indigenous mothers by Indigenous Region. In 17 of the 37 IREGs, more than 15% of babies born to Indigenous mothers were pre-term. The highest rates of pre-term birth were observed in Nhulunbuy (23%), Jabiru – Tiwi (21%) and Katherine (20%) in the Northern Territory. The east coast—particularly the south-east—had lower rates of pre-term birth. The IREGs with the lowest rates of pre-term birth include Torres Strait (10%), Dubbo, South-Eastern NSW, Sydney – Wollongong and Brisbane (all 11%).

Figure 3.2: Pre-term births among babies born to Indigenous mothers, by Indigenous Region, 2016–2017



Low birthweight

A baby's birthweight is a key indicator of infant health and a determinant of a baby's chances of survival. Low birthweight is a risk factor for sudden infant death syndrome and deaths from other unknown causes. It is associated with ill health in childhood and the development of chronic diseases (such as cardiovascular disease, high blood pressure, kidney disease and type 2 diabetes) later in life (AIHW 2018b). Early antenatal care can help reduce the risks of low birthweight by monitoring the health of both the mother and the baby, providing health advice, identifying complications and providing intervention if needed (AIHW 2014a).

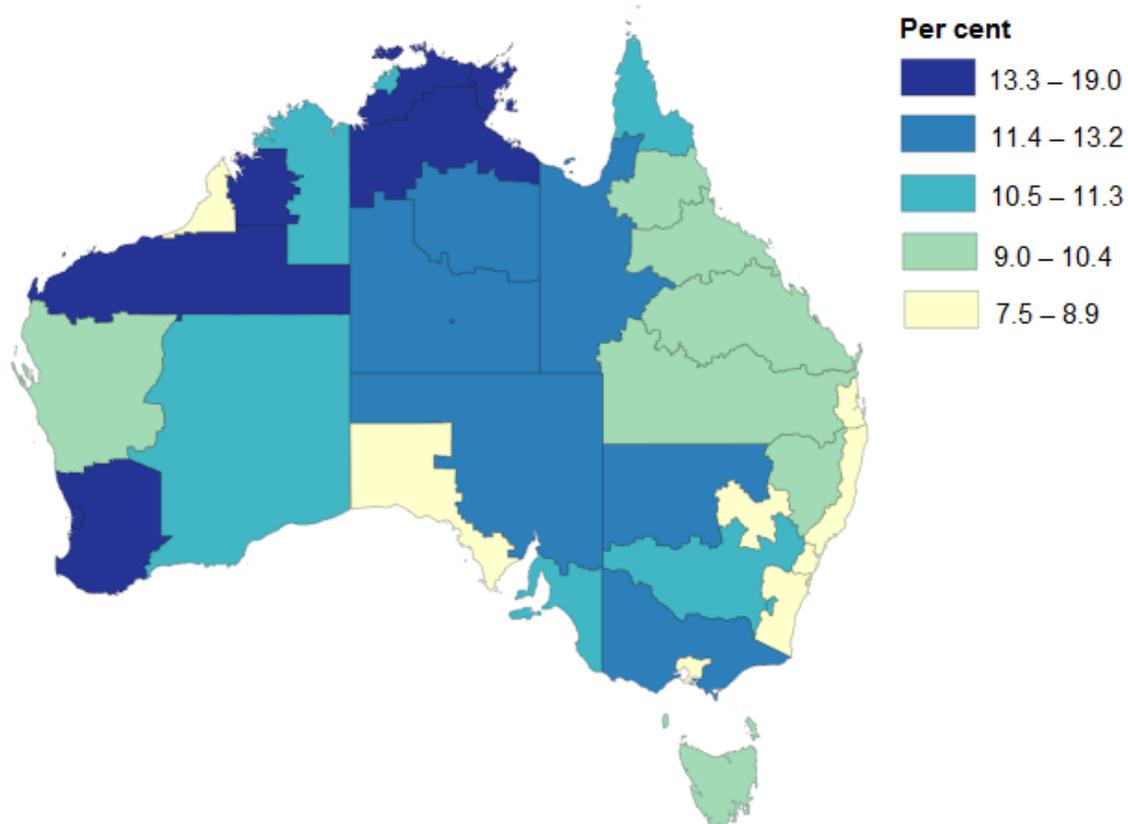
High birthweight is associated with adverse outcomes such as childhood obesity (AIHW 2020), but it was not analysed in this report due to small numbers.

In this report, low birthweight calculations include only liveborn singleton babies, to prevent confounding.

Nationally, in 2016 and 2017 combined, 11% of babies born to Indigenous mothers had a low birthweight, compared with 4.9% of babies born to non-Indigenous mothers.

Figure 3.3 presents low birthweight among babies born to Indigenous mothers by Indigenous Region. In 26 of the 37 IREGs, 10% or more of babies born to Indigenous mothers in 2016–2017 were low birthweight. Similar to pre-term births, the highest rates of low birthweight were observed in Jabiru – Tiwi (19%), Nhulunbuy and Katherine (both 16%), and rates tended to be lower on the east coast. The IREGs with the lowest rate of low birthweight include South-Eastern NSW (7.5%), Dubbo and Sydney – Wollongong (both 8.4%).

Figure 3.3: Low birthweight among babies born to Indigenous mothers, by Indigenous Region, 2016–2017



Notes

1. Includes singleton live births only.

2. The map's colour scheme is coded so darker-coloured IREGs have higher levels of low birthweight, and lighter-coloured IREGs have lower levels. Data classified by splitting the range of values on this variable into 5 categories with the same number of IREGs in each. See Table A5 for further detail.

Source: AIHW analysis of NPDC.

Neonatal intensive care unit/special care nursery

Liveborn babies who require more specialised care are admitted to the neonatal intensive care unit (NICU) or special care nursery (SCN). Risk factors for admission to a NICU or SCN include being born pre-term, low birthweight, and being part of a multiple birth (AIHW 2019a).

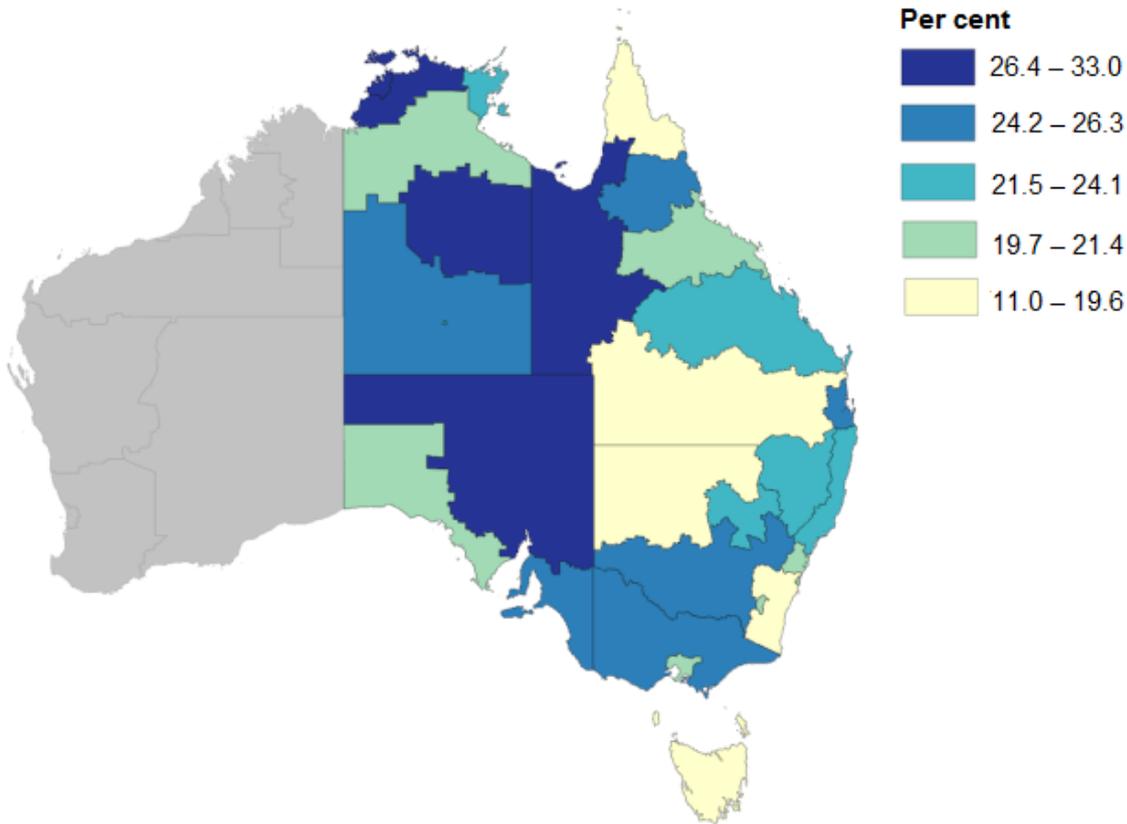
In 2017, babies born to Indigenous mothers were 1.5 times as likely to be admitted to a NICU or SCN as babies born to non-Indigenous mothers (AIHW 2019a). However, a high level of NICU/SCN admission is not necessarily a negative outcome—it may be seen as an indication that babies who need care are receiving it.

Data on NICU/SCN admission in NSW are not available for 2016–2017. Since around a third of Indigenous Australians live in NSW, it was decided that analysis related to NICU/SCN would be for the period 2014–2015 across all of Australia, to match NSW data availability. Data were not available for Western Australia across either time period.

In 2014–2015, 23% of babies born to Indigenous mothers and 16% of babies born to non-Indigenous mothers were admitted to NICU/SCN. In the same period, in 8 of the 29 IREGs with available data, at least one-quarter (25%) of babies born to Indigenous mothers were admitted to NICU/SCN. The highest rates of NICU/SCN admission were in Tennant Creek

(33%) and Jabiru – Tiwi (31%). IREGs with lower rates of NICU/SCN admission include Torres Strait (11%), Toowoomba – Roma (15%) and South-Eastern NSW (16%) (Figure 3.4).

Figure 3.4: NICU/SCN admission among babies born to Indigenous mothers, by Indigenous Region, 2014–2015



Notes

1. Includes live births only.
2. Data from 2014–2015, to match availability of NSW data.
3. Areas where data were unreliable, unavailable or suppressed are coloured grey.
4. The map's colour scheme is coded so darker-coloured IREGs have higher levels of NICU/SCN admission, and lighter-coloured IREGs have lower levels. Data classified by splitting the range of values on this variable into 5 categories with the same number of IREGs in each. See Table A6 for further detail.

Source: AIHW analysis of NPDC.

Perinatal deaths

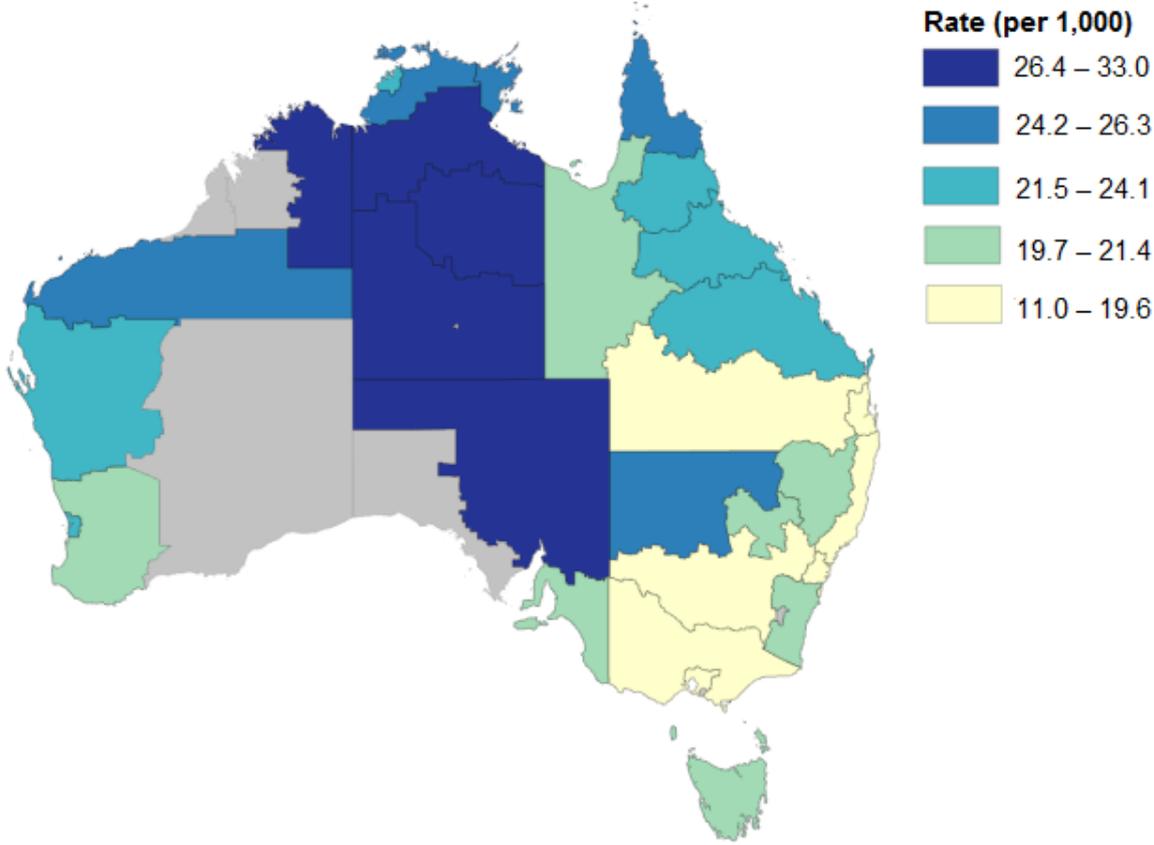
Perinatal deaths includes stillbirths (when a baby is born and does not breathe or show any other evidence of life), as well as neonatal deaths (death of a liveborn baby in the first 28 days of life). Due to small numbers, these are analysed together in this report.

Factors associated with stillbirth include poor fetal growth, pre-term birth, smoking during pregnancy and maternal obesity (AIHW 2019a). Neonatal deaths are generally indicative of the ability of health systems to ensure maternal health, treat pregnancy-related conditions and reduce the risk factors for pre-term birth and fetal growth restrictions (AIHW 2018b). In 2017, babies born to Indigenous mothers were twice as likely to die within their first 28 days of life as those born to non-Indigenous mothers (AIHW 2019a).

Due to small numbers, analysis of perinatal deaths in this report uses data over the 4-year period 2014–2017. Nationally over this period, 14 per 1,000 babies born to Indigenous mothers died in the perinatal period, compared with 9.0 per 1,000 babies born to non-Indigenous mothers.

Figure 3.5 presents the rates of perinatal deaths among babies born to Indigenous mothers by Indigenous Region. The highest rate of perinatal deaths was in Apatula (34 per 1,000), and rates remained high in the surrounding remote areas (Figure 3.5). The lowest rates of perinatal deaths were in Riverina – Orange (9.7 per 1,000), Brisbane (9.9 per 1,000) and Victoria excluding Melbourne (10 per 1,000).

Figure 3.5: Rate of perinatal deaths among babies born to Indigenous mothers, by Indigenous Region, 2014–2017



Notes

1. The rate of perinatal deaths is measured over the 4-year period 2014–2017, due to small numbers.
2. Areas where data were unavailable, unreliable or suppressed are coloured grey. For more information on data reliability and suppression see Appendix B.
3. The map's colour scheme is coded so darker-coloured IREGs have higher levels of perinatal deaths, and lighter-coloured IREGs have lower levels. Data classified by splitting the range of values on this variable into 5 categories with the same number of IREGs in each. See Table A7 for further detail.

Source: AIHW analysis of NPDC.

3.2 Association between selected factors and birth outcomes

This section presents results from multivariate logistic regression analyses of the factors that are associated with 4 adverse birth outcomes:

- whether the baby is born low birthweight
- whether the baby is born pre-term
- whether the baby is admitted to NICU/SCN
- whether the baby dies within the perinatal period (that is, it is stillborn or dies within the first 28 days of life).

The set of explanatory variables chosen for the regression modelling is limited by the coverage of the variables in the NPDC.

The models for these baby outcomes, extend the set of variables beyond the mother's characteristics and locational variables used to model use of antenatal care in Chapter 2. The additional variables included are characteristics of the pregnancy period itself, such as whether the mother experienced antepartum haemorrhage or pregnancy-induced hypertension, and the baby's gender.

Timeliness of antenatal care—that is, whether a mother's first antenatal visit was in the first trimester, after the first trimester or not at all—was used as the measure of antenatal care.

For the purpose of this analysis, the 5 usual categories of remoteness areas have been aggregated to 3 categories: *Major cities*, regional areas (combining *Inner* and *Outer regional*) and remote areas (combining *Remote* and *Very remote*). This reduced set was used because of small numbers once variables are split across remoteness areas.

The regression results for the 4 outcomes analysed are presented in Table 3.1 as the estimated odds ratios associated with each of the explanatory variables. The results for low birthweight and pre-term births are based on the outcomes observed among all Indigenous mothers who are in the 2016 and 2017 calendar years reporting cycle of the NPDC. Due to data availability, NICU/SCN results are based on 2014–2015, and due to low numbers, perinatal deaths are based on the 4-year period 2014–2017.

The estimated odds ratios for a specific variable sub-category should be interpreted in comparison with the reference category of that variable (which is also indicated in Table 3.1). Variable sub-categories with odds ratios significantly higher or significantly lower than 1 indicate that being in that sub-category has a significant effect on increasing or decreasing, respectively, the odds of that specific outcome occurring when compared with being in the reference category.

Table 3.1: Estimated odds ratio of risk factors associated with adverse birth outcomes among Indigenous mothers and their babies, Australia, 2016–2017

Explanatory variables (reference category)	Low birthweight ^(a)	Pre-term birth	NICU/SCN ^(b)	Perinatal death ^(c)
First antenatal care between 14 and 46 weeks (ref: antenatal care received in the first trimester)	1.15*	1.09	1.16*	1.06
No antenatal care (ref: antenatal care received in the first trimester)	1.62	2.94*	1.48	4.16*
Mother smoked during pregnancy (ref: mother did not smoke during pregnancy)	2.32*	1.54*	1.34*	0.94
Pre-existing diabetes in mother (ref: no pre-existing diabetes)	0.43*	4.09*	5.50*	1.15
Pre-existing hypertension in mother (ref: no pre-existing hypertension)	1.09	2.53*	0.83	0.96
Pregnancy-induced hypertension in mother (ref: no pregnancy-induced hypertension)	2.56*	4.27*	2.00*	0.44*
Antepartum haemorrhage (ref: no antepartum haemorrhage)	2.16*	6.86*	1.56*	5.02*
Parity of 1–2 (ref: parity of 0)	0.71*	0.95	0.67*	0.75*
3+ (ref: parity of 0)	0.64*	1.17	0.73*	0.72*
Mother's BMI underweight (ref: BMI normal)	1.86*	1.65*	1.09	1.18
Overweight or obese (ref: BMI normal)	0.53*	0.77*	1.06	1.24
Severely obese (ref: BMI normal)	0.33*	0.65*	1.23	1.72*
Mother aged ≤19 (ref: mother aged 20–24)	0.88	1.03	1.14*	1.04
25–29 (ref: mother aged 20–24)	1.06	1.09	1.12*	0.99
30–34 (ref: mother aged 20–24)	1.04	1.10	1.30*	0.92
35–39 (ref: mother aged 20–24)	1.72*	1.16	1.57*	0.86
40+ (ref: mother aged 20–24)	1.78	1.23	1.86*	0.91
Mother's usual area of residence Regional areas (ref: Major cities)	0.95	1.02	0.99	1.19
Remote areas (ref: Major cities)	0.87	0.86	0.74	1.61*
Lowest socioeconomic area (ref: highest)	1.82*	1.24	1.04	1.77
2 nd quintile (ref: highest)	1.56*	1.25	0.97	1.74
3 rd quintile (ref: highest)	1.59*	1.29	1.06	1.58
4 th quintile (ref: highest)	1.17	1.00	0.99	1.72
Female baby (ref: male)	1.51*	0.96	0.83*	0.89
Multiple birth (ref: singleton birth)	–	25.52*	2.50*	0.86
Baby was born pre-term (ref: full term)	40.42*	–	17.80*	34.81*

* = estimated odds ratio is statistically significant at the 5% test level (i.e. with p-value < 0.05).

(a) Data for low birthweight includes only liveborn singleton babies.

(b) Data for NICU/SCN from 2014–2015 (due to data availability). Includes only liveborn babies.

(c) Due to small numbers, perinatal deaths is combined for years 2014–2017.

Legend

	indicates statistically significant protective factors (with odds ratios less than 1)
	indicates statistically significant risk factors (with odds ratios greater than 1)
	indicates risk factors that are not statistically significant at the 5% test level

Notes

1. All regressions (except perinatal death) include control variables for IREG and year. Perinatal deaths not controlled by IREG or year due to small numbers.

2. Analysis excludes mothers giving birth in Victoria due to data not being available for 2 explanatory variables (hypertension and pre-existing diabetes).

3. Analysis includes variable categories indicating missing values for BMI, parity, pre-existing diabetes, pre-existing hypertension, pregnancy-induced hypertension, antepartum haemorrhage, socioeconomic area and smoking while pregnant, but these results are not presented due to difficulties in interpretation.

Source: AIHW analysis of NPDC.

Effects of antenatal care

Compared with babies of Indigenous mothers who attended their first antenatal visit in the first trimester:

- having the first antenatal visit after the first trimester is associated with increased odds of low birthweight and NICU/SCN admission
- having no antenatal care is associated with increased odds of pre-term birth and perinatal deaths.

Baby outcomes

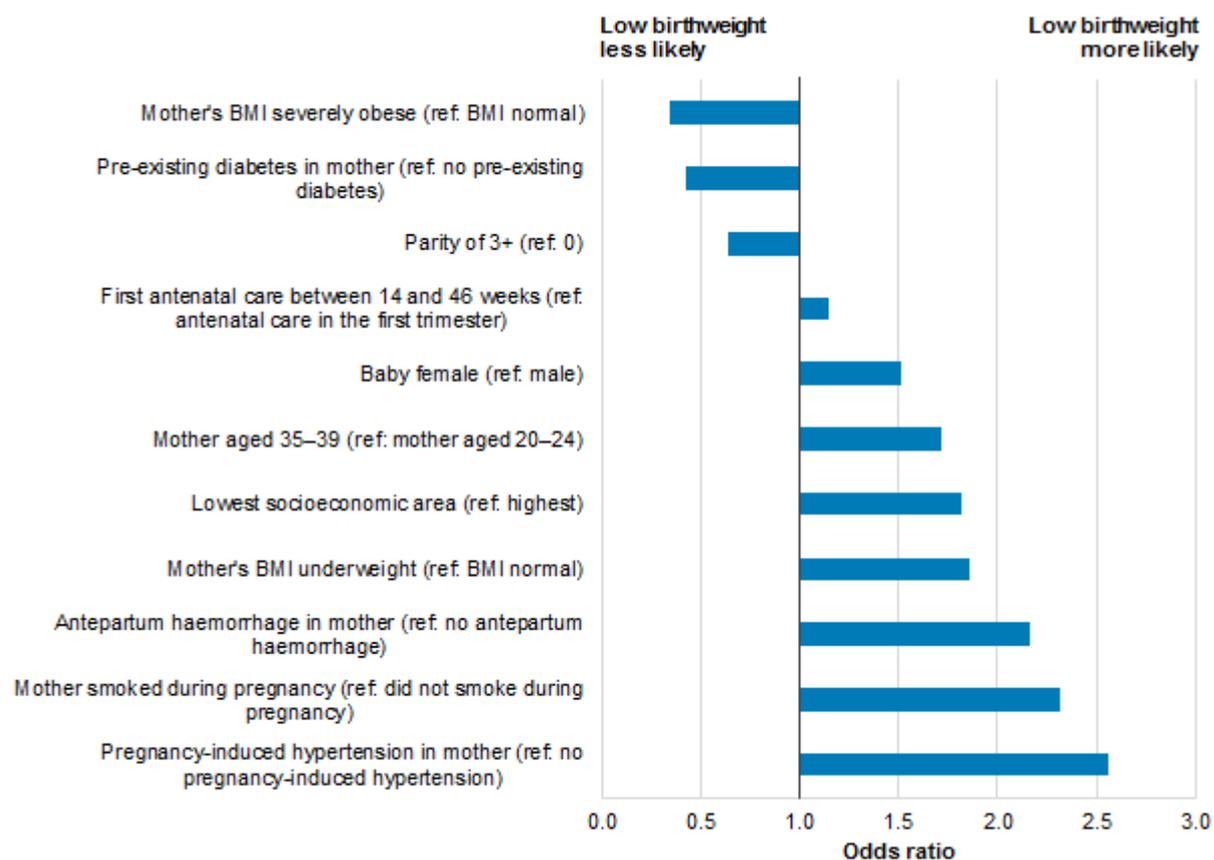
Low birthweight

In 2016–2017, the estimated odds that a liveborn singleton baby born to an Indigenous mother would be low birthweight were:

- 2.6 times as likely if the mother had pregnancy-induced hypertension (compared with mothers with no pregnancy-induced hypertension)
- 2.3 times as likely if the mother smoked during pregnancy (compared with did not smoke during pregnancy)
- 0.3 times as likely if the mother had a severely obese pre-pregnancy BMI (Figure 3.6).

These significant effects on the odds of having a low birthweight baby are observed even after controlling for the pre-term status of the baby (which had a large effect on the odds of low birth weight, at 40 times as likely as for a full-term baby).

Figure 3.6: Odds ratio of low birthweight among babies born to Indigenous mothers, by selected explanatory variables, 2016–2017



Notes

1. Only statistically significant odds ratios included.
 2. Includes singleton live births only.
- Source: AIHW analysis of NPDC (Table 3.1).

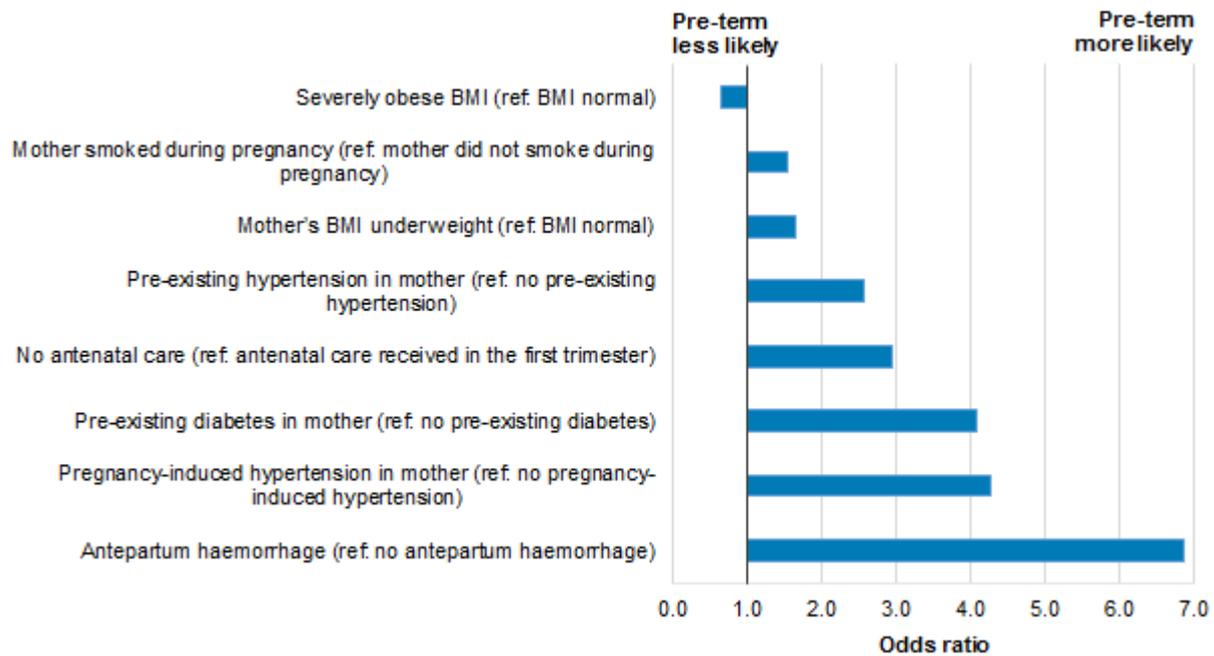
Pre-term birth

In 2016–2017, the estimated odds that a baby born to an Indigenous mother would be pre-term were:

- 6.9 times as likely if the mother had antepartum haemorrhage (compared with no antepartum haemorrhage)
- 4.1 times as likely if the mother had pre-existing diabetes (compared with no pre-existing diabetes)
- 0.7 times as likely if the mother was severely obese (compared with a normal pre-pregnancy BMI) (Figure 3.7).

These significant effects on the odds of having a pre-term birth are observed even after controlling for the multiple birth status of the baby (which had a large effect on the odds of pre-term birth, at 26 times as likely as for singleton births).

Figure 3.7: Odds ratio of pre-term birth among babies born to Indigenous mothers, by selected explanatory variables, 2016–2017



Note: Only statistically significant odds ratios included.

Source: AIHW analysis of NPDC (Table 3.1).

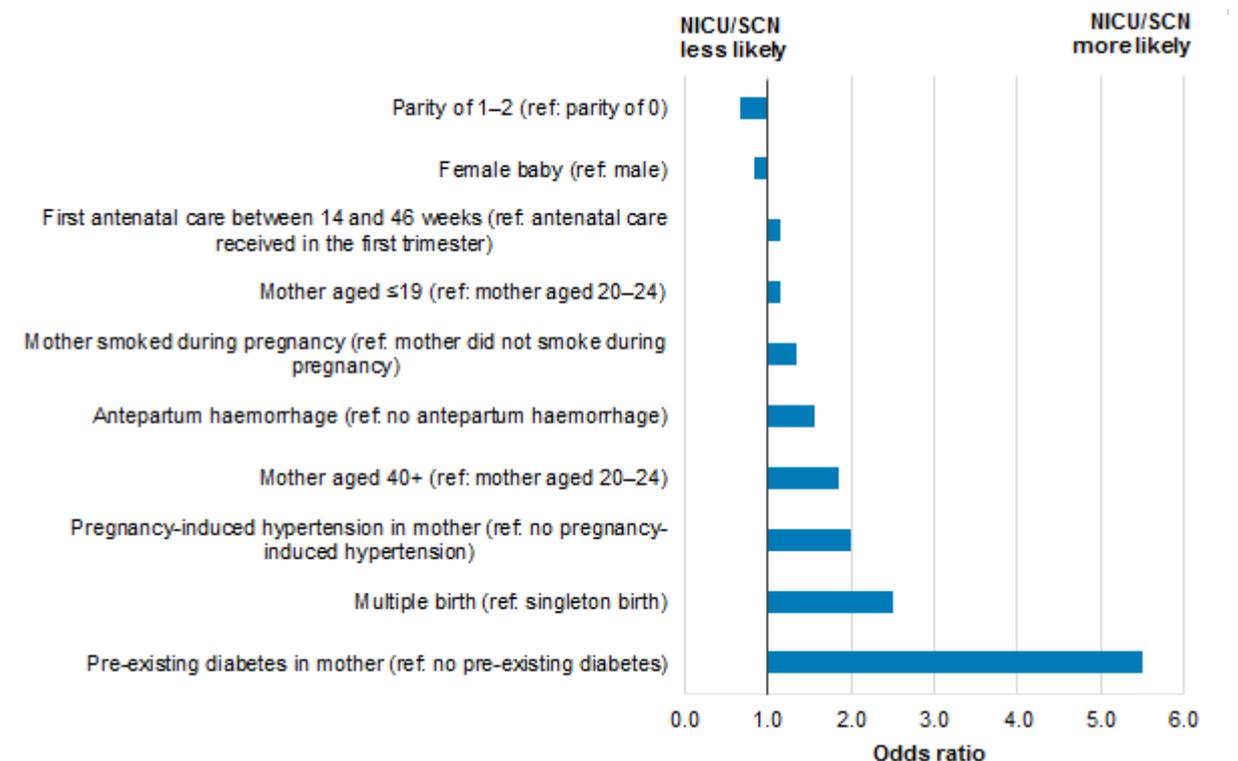
NICU/SCN

In 2014–2015, the estimated odds that a liveborn baby born to an Indigenous mother would attend NICU/SCN were:

- 5.5 times as likely if the mother had pre-existing diabetes
- 2.5 times as likely if the baby was a multiple birth (compared with singleton births)
- 0.7 times as likely if the mother had a parity of 1–2 or 3+ (compared with a parity of 0) (Figure 3.8).

These significant effects on the odds of NICU/SCN are observed even after controlling for the pre-term status of the baby (which had a large effect on the odds of NICU/SCN admission, at 18 times as likely as for full-term births).

Figure 3.8: Odds ratio of NICU/SCN admission among babies born to Indigenous mothers, by selected explanatory variables, 2014–2015



Notes

1. Only statistically significant odds ratios included.
2. Includes live births only.

Source: AIHW analysis of NPDC (Table 3.1).

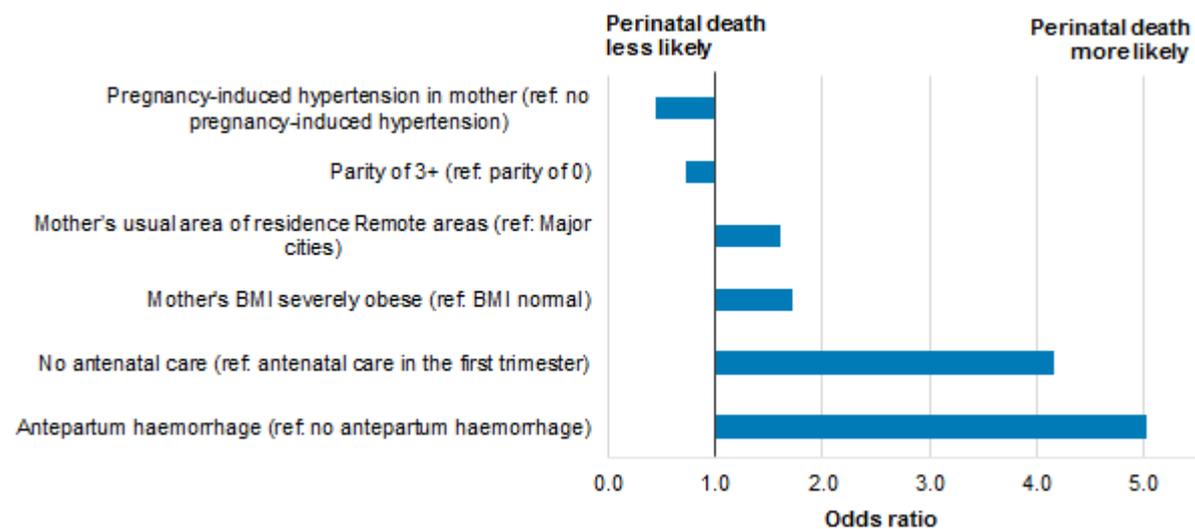
Perinatal deaths

In 2014–2017, the estimated odds that a baby born to an Indigenous mother would die during the perinatal period were:

- 5.0 times as likely if the mother had antepartum haemorrhage
- 4.2 times as likely if the mother had no antenatal care (compared with accessing antenatal care in the first trimester)
- 0.4 times as likely if the mother had pregnancy-induced hypertension
- 0.7 times as likely if the mother had a parity of 3+ (compared with a parity of 0) (Figure 3.9).

These significant effects on the odds of perinatal death are observed even after controlling for the pre-term status of the baby (which had a large effect on the odds of perinatal death, at 35 times as likely as for a full-term baby).

Figure 3.9: Odds ratio of perinatal death among babies born to Indigenous mothers, by selected explanatory variables, 2014–2017



Note: Only statistically significant odds ratios included.

Source: AIHW analysis of NPDC (Table 3.1).

Areas for potential further analysis in relation to risk factors and baby outcomes use are in Box 3.1.

Box 3.1: Areas for further analysis

Following this regression, several risk factors have been identified as affecting different adverse baby outcomes:

- Smoking during pregnancy is associated with increased odds of low birthweight, pre-term birth and NICU/SCN.
- A mother's pre-existing diabetes is associated with reduced odds of low birthweight babies, but greatly increased odds of pre-term birth and NICU/SCN admission.
- Pregnancy-induced hypertension is associated with increased odds of low birthweight, pre-term birth and NICU/SCN, but lower odds of perinatal death.
- Antepartum haemorrhage is associated with increased odds across all birth outcomes.

The relationship between some of these variables and the use of antenatal care will be explored spatially in Chapter 4.

4 Spatial variation in antenatal care use, baby outcomes and selected risk factors

In this chapter, information is provided on the spatial relationships between antenatal care use among Aboriginal and Torres Strait Islander mothers and the following selected measures:

- 3 maternal risk factors—smoking during pregnancy, pre-existing diabetes, and pregnancy-induced hypertension
- 2 baby outcomes—low birthweight and pre-term births

Perinatal death and antepartum haemorrhage were also identified as variables of interest but could not be disaggregated into IREGs due to small numbers.

NICU/SCN admission was considered for inclusion; however, it was excluded due to difficulties in interpreting variation in NICU/SCN rates by region. NICU/SCN admission could be affected by a combination of baby health (where low NICU/SCN admission may indicate a high proportion of healthy babies) and service availability (meaning that low NICU/SCN admission may indicate access differences and service gaps).

4.1 Analysis method

For each of the chosen variables, IREGs were sorted from high to low based on the value of the variable, and then split into 3 categories ('high', 'medium' and 'low') (Table 4.1). This was done in such a way that each category had about the same number of IREGs.

Being in the 'high' category is a positive outcome for variables related to antenatal care usage, but is a less favourable outcome for adverse baby and mother variables.

Therefore, IREGs were re-categorised to identify IREGs in the 'top third' of each variable:

- For antenatal care variables, the 'top third' included IREGs in the 'high' category, as high levels of antenatal care usage is a positive outcome.
- For variables relating to adverse baby and mother outcomes, the 'top third' included IREGs in the 'low' category, as low levels of these outcomes are favourable.

These 'top third' outcomes are shaded green in Table 4.1.

Table 4.1: Details on ‘high’, ‘medium’ and ‘low’ IREG categories for selected variables among Indigenous mothers and their babies, 2016–2017

Variable	‘High’ category		‘Medium’ category		‘Low’ category		Total	
	Range (%)	Number of IREGs	Range (%)	Number of IREGs	Range (%)	Number of IREGs	Range (%)	Number of IREGs
Antenatal care in the 1st trimester	64.4–84.1	12	58.3–64.3	12	39.8–58.2	13	39.8–84.1	37
5+ antenatal visits	89.7–95.9	12	85.1–89.6	12	72.9–85.0	13	72.9–95.9	37
Pre-term births	16.4–23.0	12	13.3–16.3	12	9.7–13.2	13	9.7–23.0	37
Low birthweight	11.8–19.1	12	10.2–11.7	12	7.5–10.1	13	7.5–19.1	37
Smoking while pregnant	48.8–68.6	12	44.5–48.7	12	32.4–44.4	13	32.4–68.6	37
Pre-existing diabetes	4.0–8.9	8	1.9–3.9	9	0.8–1.7	9	0.8–8.9	26
Pregnancy-induced hypertension	6.9–9.7	10	5.5–6.8	11	2.5–5.4	10	2.5–9.7	31

Legend

Green shading indicates positive outcomes, that is, being in the ‘top third’ in terms of being in the ‘high’ category for antenatal care usage and ‘low’ category for adverse mother and baby outcomes.

Notes

1. In general, IREGs categorised into ‘low’, ‘medium’ and ‘high’ by splitting each variable into 3 categories with the same number of IREGs, meaning that one third of IREGs should be in each category for each variable. If there were an uneven number of IREGs, generally the ‘low’ or ‘low’ and ‘medium’ categories are largest. However, with pregnancy-induced hypertension, IREGs are clustered at the cut-off value for the ‘low’ category, so the groups were manually edited to be as even as possible.

2. Some variables have fewer total IREGs as some frequencies have been suppressed due to unreliable or unavailable data.

Source: AIHW analysis of NPDC.

4.2 Spatial variation in outcomes

Being in the ‘top third’ of a variable indicates that an IREG has relatively favourable results for Indigenous mothers or their babies on that measure. Table 4.2 shows which IREGs appeared in the ‘top third’ for each variable (marked by a ‘tick’).

The analysis consisted of 7 variables in total, though this was reduced to a smaller number for some IREGs due to small numbers and/or data availability. The ‘Total applicable variables’ column specifies the number of variables included in the analysis for each IREG.

In general, IREGs that were in the ‘top third’ for antenatal care usage (meaning a high proportion of mothers access antenatal care) were more likely to be in the ‘top third’ for other mother and baby outcomes (meaning a low proportion of adverse mother and baby outcomes). This means that, in general, at the IREG level babies whose mothers attend early and frequent antenatal care are less likely to be pre-term and low birthweight.

Table 4.2: IREGs by whether they appeared in top third of selected variables for Indigenous mothers and their babies, 2016–2017

IREG name	Antenatal care in the 1st trimester	5+ antenatal visits	Pre-term births	Low birthweight	Smoking while pregnant	Pre-existing diabetes	Pregnancy-induced hypertension	Total in 'top third'	Total applicable variables
1 Brisbane	✓		✓	✓	✓	✓	✓	6	7
2 North-Eastern NSW	✓	✓	✓	✓	✓	✓		6	7
3 NSW Central and North Coast	✓	✓	✓	✓	✓	✓		6	7
4 Broome	✓	✓	✓	✓	✓			5	5
5 Sydney – Wollongong		✓	✓	✓	✓	✓		5	7
6 Dubbo		✓	✓	✓			✓	4	6
7 Tasmania	✓	✓		✓	✓			4	6
8 Cairns – Atherton	✓			✓			✓	3	7
9 Cape York	✓	✓	✓					3	7
10 South-Eastern NSW		✓	✓	✓				3	6
11 Townsville – Mackay					✓	✓	✓	3	7
12 Torres Strait	✓	✓	✓					3	6
13 Perth					✓	✓	✓	3	7
14 Melbourne				✓	✓			2	5
15 Alice Springs	✓				✓			2	7
16 Port Lincoln – Ceduna		✓		✓				2	5
17 Rockhampton				✓		✓		2	7
18 Toowoomba – Roma				✓		✓		2	7
19 Jabiru – Tiwi		✓					✓	2	7
20 West Kimberley	✓		✓					2	6
21 South Hedland					✓		✓	2	7
22 Riverina – Orange			✓					1	6
23 Adelaide						✓		1	7

(continued)

Table 4.2 (continued): IREGs by whether they appeared in top third of selected variables for Indigenous mothers and their babies, 2016–2017

IREG name	Antenatal care in the 1st trimester	5+ antenatal visits	Pre-term births	Low birthweight	Smoking while pregnant	Pre-existing diabetes	Pregnancy-induced hypertension	Total in 'top third'	Total applicable variables
24 Darwin	✓							1	7
25 ACT					✓			1	6
26 Geraldton							✓	1	7
27 South-Western WA					✓			1	6
28 Kalgoorlie			✓					1	7
29 Tennant Creek			✓					1	7
30 Apatula					✓			1	7
31 Kununurra							✓	1	7
32 Nhulunbuy		✓						1	7
33 Katherine	✓							1	7
34 Port Augusta								-	6
35 Victoria excluding Melbourne								-	5
36 North-Western NSW								-	6
37 Mount Isa								-	7

Legend

Appears in top third for 6 variables	Appears in top third for 5 variables	Appears in top third for 4 variables	Appears in top third for 3 variables	Appears in top third for 2 variables	Appears in top third for 1 variable	Appears in top third for 0 variables
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Notes

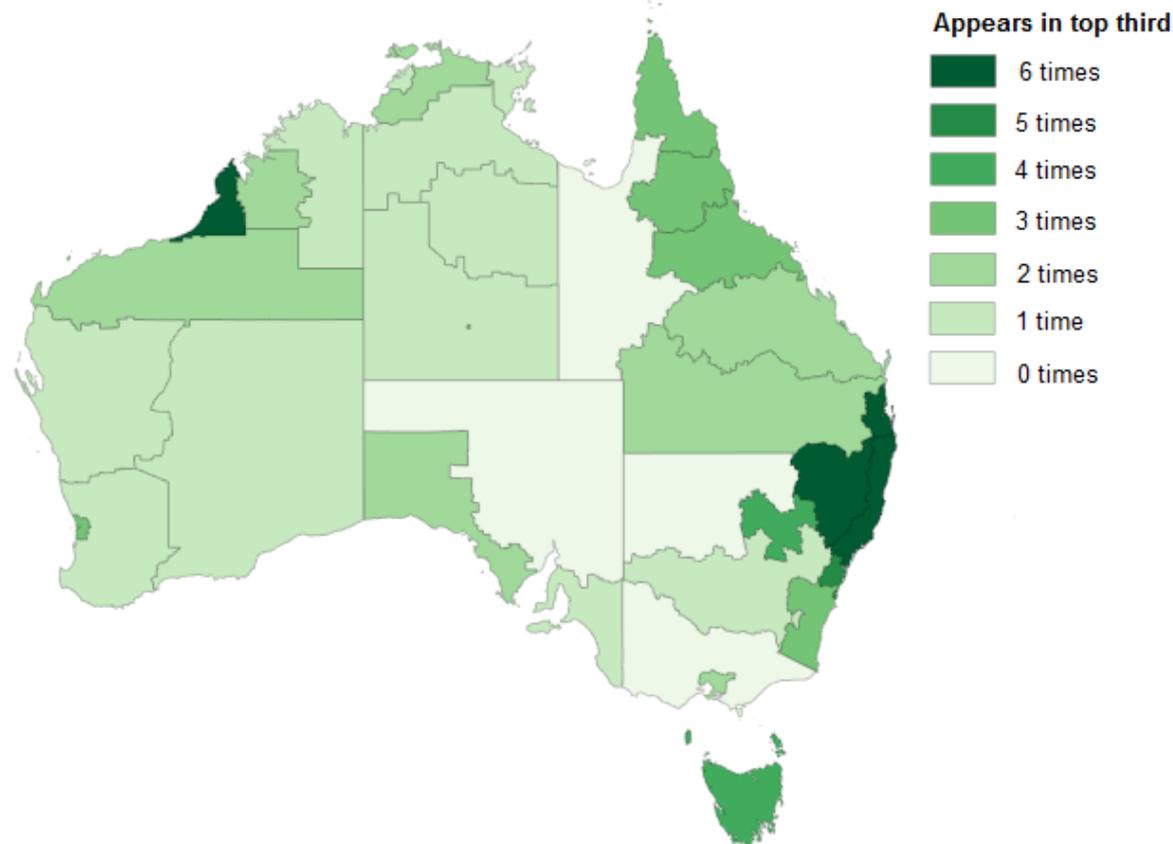
1. Table based on boundaries outlined in Table 4.1, with detailed results presented in tables A11 and A13.
2. 'Top third' is when an IREG has the most favourable outcome—'high' values for antenatal care usage and 'low' values for adverse mother and baby outcomes (pre-term birth, low birthweight, mothers smoking while pregnant, pre-existing diabetes in mother and pregnancy-induced hypertension).
3. IREGs ordered by number of times appearing in top third (highest first), then times appearing in bottom third (lowest first), and then alphabetically (see Table A11 for more detailed information).
4. 'Total in top third' is the count of the number of ticks for each IREG, indicating the number of selected variables for which the IREG is in the 'top third' category.
5. In general, 'Total applicable variables' is 7 as there are 7 variables of interest, but in some cases it is less because some IREGs do not have data for some variables due to issues of small numbers and data availability.
6. For the ACT, first antenatal visit is often the first hospital antenatal clinic visit. In many cases, earlier antenatal care provided by the woman's general practitioner is not reported.

Source: AIHW analysis of NPDC.

The data shown in Table 4.2 were re-scaled to account for the number of variables included in the analysis for each IREG. That is, proportions were calculated using the 'Total applicable variables' column as a denominator, so that IREGs where the analysis was limited to fewer than 7 variables were not disadvantaged. For example, Broome was in the 'top third' for 5 variables, but had not publishable data for the remaining 2 variables. Therefore, Broome was in the top third for 100% of the variables where it had available data, and was assigned the category 'Appears in top third 6+ times'. Further details on these calculations are available in Table A12.

These adjusted proportions were mapped to explore any spatial patterns (Figure 4.1). The darker the colour, the more variables where the IREG appears in the 'top third'. Three of the 4 best performing IREGs (North-Eastern NSW, NSW Central and North Coast, Brisbane) are clustered along the centre of the east coast, with Broome being the fourth IREG. Generally, IREGs with fewer appearances in the 'top third' are in more remote areas.

Figure 4.1: Number of times an IREG appears in the top third of selected variables among Indigenous mothers and their babies (out of 7 variables), 2016–2017



Notes

1. Map based on Table 4.2 (see Table A12 for further details).
2. Values from Table 4.2 re-scaled to account for variables where data have been suppressed for an IREG.
3. 'Top third' is when an IREG has 'high' values for antenatal care usage and 'low' values for adverse mother and baby outcomes (pre-term birth, low birthweight, mothers smoking while pregnant, pre-existing diabetes in mother and pregnancy-induced hypertension).

Source: AIHW analysis of NPDC.

Appendix A: Data tables

Table A1: Prevalence of various indicators used in this report, by 3 time periods

Indicator	Indigenous (%)				Non-Indigenous (%)			
	2014–2015	2016–2017	2014–2017	Trend	2014–2015	2016–2017	2014–2017	Trend
Accessed antenatal care in the first trimester	55.2	62.7	59.1	↑ 7.5	63.6	70.7	67.2	↑ 7.1
Accessed 5+ antenatal visits ^(a)	86.4	87.2	86.8	↑ 0.8	95.9	94.6	95.2	↓ 1.3
Accessed 10+ antenatal visits ^(a)	46.8	49.3	48.1	↑ 2.5	59.0	57.9	58.4	↓ 1.0
Maternal age under 18	5.4	4.3	4.8	↓ 1.2	0.5	0.4	0.5	—
Maternal age 40+	1.8	1.7	1.8	—	4.4	4.4	4.4	—
Usual residence in Major cities	32.3	34.0	33.2	↑ 1.7	74.4	75.0	74.7	↑ 0.6
Usual residence in Very remote areas	14.0	12.3	13.1	↓ 1.7	0.4	0.4	0.4	—
Lowest socioeconomic area (1 st decile)	32.2	30.2	31.2	↓ 2.0	10.8	10.4	10.6	—
Highest socioeconomic area (10 th decile)	1.4	1.3	1.3	—	9.1	8.8	9.0	—
Parity of 0	32.8	32.5	32.6	—	43.7	43.1	43.4	↓ 0.6
Parity of 3+	23.3	23.5	23.4	—	7.6	7.5	7.6	—
Pre-pregnancy BMI underweight ^(b)	7.3	7.0	7.1	—	3.8	3.9	3.9	—
Pre-pregnancy BMI overweight or obese (but not severely obese) ^(b)	49.7	49.2	49.4	↓ 0.5	42.6	42.1	42.3	—
Pre-pregnancy BMI severely obese ^(b)	4.8	5.4	5.2	↑ 0.6	2.9	2.9	2.9	—
Mother smoked in first 20 weeks of pregnancy	44.8	43.1	43.9	↓ 1.7	8.8	8.0	8.4	↓ 0.8
Mother smoked after 20 weeks' gestation	39.5	38.4	38.9	↓ 1.1	6.5	5.8	6.2	↓ 0.7
Mother smoked at all during pregnancy	45.8	44.2	45.0	↓ 1.6	9.2	8.3	8.7	↓ 0.9

(continued)

Table A1 (continued): Prevalence of various indicators used in this report, by 3 time periods

Indicator	Indigenous (%)				Non-Indigenous (%)			
	2014–2015	2016–2017	2014–2017	Trend	2014–2015	2016–2017	2014–2017	Trend
Pre-existing diabetes in mother ^(c)	2.1	2.0	2.0	—	1.0	0.7	0.8	—
Pre-existing hypertension in mother ^(c)	1.0	1.0	1.0	—	0.8	0.7	0.8	—
Pregnancy induced hypertension in mother	5.5	5.6	5.6	—	4.6	4.8	4.7	—
Antepartum haemorrhage ^(f)	3.2	3.8	3.5	↑0.6	3.0	3.3	3.2	—
Baby born pre-term	13.7	13.9	13.8	—	8.4	8.4	8.4	—
Baby low birthweight (under 2,500g) ^(h)	10.4	10.5	10.5	—	4.7	4.9	4.8	—
Baby high birthweight (4,500g and above) ^(h)	1.4	1.3	1.4	—	1.5	1.3	1.4	—
Baby attended NICU/SCN ^{(d) (i)}	23.1	25.9 ^(e)	24.1	↑ 2.8 ^(e)	15.5	17.7	16.4	↑ 2.2
Perinatal deaths ^(g)	13.2	15.4	14.3	—	9.2	8.9	9.0	—

(a) Including only mothers who gave birth at gestation age 32 weeks or above. Data not available for Victoria for 2014–2015.

(b) Data not available for NSW for 2014–2015.

(c) Data not available for Victoria across all years.

(d) Data not available for WA across all years.

(e) Data not available for NSW for 2016, making trends across 2014–2015 and 2016–2017 difficult to compare.

(f) Data not available for NSW or WA across 2014–2017, or in Victoria in 2014.

(g) Data for perinatal deaths is per 1,000 (rather than per cent) to align with usual reporting of perinatal deaths.

(h) Data including only singleton live births.

(i) Data including only live births.

Notes

1. In order to follow the same cohort, the Indigenous status of babies is based on that of their mother.

2. Differences of <0.5% (or 5 per 1,000 for perinatal death) between 2014–2015 and 2016–2017 were not considered a trend.

Source: AIHW analysis of NPDC.

Table A2: IREG level outcomes—Indigenous mothers attending antenatal care in the first trimester, 2016–2017

IREG name	Antenatal care in the first trimester (%)	Low, medium or high category	IREG name	Antenatal care in the first trimester (%)	Low, medium or high category
1 Tasmania	84.1	High	20 Dubbo	61.2	Medium
2 North-Eastern NSW	77.3	High	21 Adelaide	61.2	Medium
3 NSW Central and North Coast	77.1	High	22 Kalgoorlie	60.6	Medium
4 Darwin	77.1	High	23 Port Augusta	60.0	Medium
5 Broome	74.6	High	24 ACT	58.3	Medium
6 Cape York	73.2	High	25 Sydney – Wollongong	58.2	Low
7 Alice Springs	70.5	High	26 Nhulunbuy	57.9	Low
8 Brisbane	68.1	High	27 Rockhampton	57.7	Low
9 Katherine	67.9	High	28 Victoria excluding Melbourne	57.6	Low
10 Cairns – Atherton	67.7	High	29 Kununurra	56.9	Low
11 West Kimberley	67.3	High	30 South Hedland	54.4	Low
12 Torres Strait	66.9	High	31 Mount Isa	54.0	Low
13 North-Western NSW	64.3	Medium	32 Tennant Creek	54.0	Low
14 Geraldton	63.9	Medium	33 South-Eastern NSW	52.8	Low
15 Riverina – Orange	63.9	Medium	34 Townsville – Mackay	51.9	Low
16 Apatula	63.0	Medium	35 Melbourne	50.1	Low
17 Port Lincoln – Ceduna	62.4	Medium	36 Perth	44.5	Low
18 Jabiru – Tiwi	62.2	Medium	37 Toowoomba – Roma	39.8	Low
19 South-Western WA	61.4	Medium			

Notes

1. 'Low, medium or high category' column relates to analysis in Chapter 4. Categories based on splitting variable into thirds based on the value of the variable, with an equal number of IREGs in each group.

2. For the ACT, first antenatal visit is often the first hospital antenatal clinic visit. In many cases, earlier antenatal care provided by the woman's general practitioner is not reported.

Source: AIHW analysis of NPDC.

Table A3: IREG level outcomes—Indigenous mothers attending 5 or more antenatal visits, 2016–2017

IREG name	5+ antenatal visits (%)	Low, medium or high category	IREG name	5+ antenatal visits (%)	Low, medium or high category
1 Cape York	95.9	High	20 North-Western NSW	86.8	Medium
2 Torres Strait	95.7	High	21 Melbourne	86.5	Medium
3 Tasmania	95.3	High	22 Port Augusta	86.1	Medium
4 Nhulunbuy	93.2	High	23 Tennant Creek	85.5	Medium
5 Broome	92.8	High	24 Adelaide	85.2	Medium
6 Dubbo	92.5	High	25 Alice Springs	85.0	Low
7 Port Lincoln – Ceduna	92.4	High	26 ACT	84.8	Low
8 South-Eastern NSW	91.4	High	27 Kununurra	84.7	Low
9 Sydney – Wollongong	91.2	High	28 Rockhampton	84.7	Low
10 Jabiru – Tiwi	90.9	High	29 Darwin	83.8	Low
11 North-Eastern NSW	90.8	High	30 Katherine	83.2	Low
12 NSW Central and North Coast	90.3	High	31 Kalgoorlie	79.5	Low
13 Cairns – Atherton	89.6	Medium	32 Victoria excluding Melbourne	79.4	Low
14 Riverina – Orange	89.4	Medium	33 Geraldton	79.2	Low
15 Brisbane	89.3	Medium	34 South-Western WA	78.8	Low
16 Mount Isa	88.8	Medium	35 Apatula	77.5	Low
17 West Kimberley	88.5	Medium	36 Perth	74.7	Low
18 Toowoomba – Roma	88.3	Medium	37 South Hedland	72.9	Low
19 Townsville – Mackay	87.3	Medium			

Notes

1. 'Low, medium or high category' column relates to analysis in Chapter 4. Categories based on splitting variable into thirds based on the value of the variable, with an equal number of IREGs in each group.

2. Including only mothers who gave birth at gestation age 32 weeks or above.

Source: AIHW analysis of NPDC.

Table A4: IREG level outcomes—pre-term births among babies born to Indigenous mothers, 2016–2017

	IREG name	Pre-term births (%)	Low, medium or high category		IREG name	Pre-term births (%)	Low, medium or high category
1	Nhulunbuy	23.0	High	20	Rockhampton	13.9	Medium
2	Jabiru – Tiwi	21.4	High	21	Adelaide	13.9	Medium
3	Katherine	19.9	High	22	Darwin	13.7	Medium
4	South Hedland	19.2	High	23	Melbourne	13.5	Medium
5	Port Lincoln – Ceduna	17.7	High	24	Townsville – Mackay	13.3	Medium
6	Perth	17.7	High	25	Kalgoorlie	13.2	Low
7	South-Western WA	17.5	High	26	Riverina – Orange	13.0	Low
8	Geraldton	17.4	High	27	Broome	12.6	Low
9	Mount Isa	17.1	High	28	Tennant Creek	12.3	Low
10	Apatula	16.8	High	29	West Kimberley	12.0	Low
11	North-Western NSW	16.7	High	30	Cape York	12.0	Low
12	Kununurra	16.4	High	31	North-Eastern NSW	11.7	Low
13	Port Augusta	16.3	Medium	32	NSW Central and North Coast	11.6	Low
14	ACT	15.9	Medium	33	Brisbane	11.4	Low
15	Cairns – Atherton	15.7	Medium	34	Sydney – Wollongong	11.3	Low
16	Tasmania	15.1	Medium	35	South-Eastern NSW	11.3	Low
17	Victoria excluding Melbourne	15.1	Medium	36	Dubbo	10.7	Low
18	Toowoomba – Roma	14.7	Medium	37	Torres Strait	9.7	Low
19	Alice Springs	14.3	Medium				

Note: 'Low, medium or high category' column relates to analysis in Chapter 4. Categories based on splitting variable into thirds based on the value of the variable, with an equal number of IREGs in each group.

Source: AIHW analysis of NPDC.

Table A5: IREG level outcomes—low birthweight births among babies born to Indigenous mothers, 2016–2017

IREG name	Low birthweight births (%)	Low, medium or high category	IREG name	Low birthweight births (%)	Low, medium or high category
1 Jabiru – Tiwi	19.1	High	20 Kununurra	10.6	Medium
2 Nhulunbuy	16.4	High	21 Riverina – Orange	10.5	Medium
3 Katherine	15.6	High	22 Townsville – Mackay	10.4	Medium
4 West Kimberley	14.5	High	23 Geraldton	10.2	Medium
5 South-Western WA	14.5	High	24 Torres Strait	10.2	Medium
6 South Hedland	14.3	High	25 Rockhampton	10.1	Low
7 Perth	13.8	High	26 Tasmania	10.0	Low
8 North-Western NSW	13.2	High	27 Cairns – Atherton	9.9	Low
9 Mount Isa	12.3	High	28 Toowoomba – Roma	9.6	Low
10 Port Augusta	11.9	High	29 North-Eastern NSW	9.2	Low
11 Victoria excluding Melbourne	11.8	High	30 Port Lincoln – Ceduna	8.9	Low
12 Tennant Creek	11.8	High	31 Melbourne	8.9	Low
13 Apatula	11.7	Medium	32 Broome	8.9	Low
14 Alice Springs	11.7	Medium	33 Brisbane	8.9	Low
15 Kalgoorlie	11.3	Medium	34 NSW Central and North Coast	8.8	Low
16 Darwin	11.2	Medium	35 Sydney – Wollongong	8.4	Low
17 ACT	10.9	Medium	36 Dubbo	8.4	Low
18 Adelaide	10.8	Medium	37 South-Eastern NSW	7.5	Low
19 Cape York	10.8	Medium			

Notes

1. 'Low, medium or high category' column relates to analysis in Chapter 4. Categories based on splitting variable into thirds based on the value of the variable, with an equal number of IREGs in each group.

2. Includes singleton live births only.

Source: AIHW analysis of NPDC.

Table A6: IREG level outcomes—NICU/SCN admission among babies born to Indigenous mothers, 2014–2015

IREG name		NICU/SCN admission (%)	IREG name		NICU/SCN admission (%)
1	Tennant Creek	33.0	16	Rockhampton	21.9
2	Jabiru – Tiwi	30.6	17	Nhulunbuy	21.6
3	Mount Isa	28.6	18	ACT	21.4
4	Darwin	27.4	19	Townsville – Mackay	21.4
5	Port Augusta	26.6	20	Sydney – Wollongong	21.4
6	Apatula	26.3	21	Melbourne	21.3
7	Victoria excluding Melbourne	25.7	22	Katherine	21.1
8	Riverina – Orange	25.0	23	Port Lincoln – Ceduna	19.7
9	Adelaide	24.9	24	Cape York	19.6
10	Brisbane	24.9	25	North-Western NSW	19.2
11	Cairns – Atherton	24.5	26	Tasmania	19.0
12	Alice Springs	24.1	27	South-Eastern NSW	16.3
13	NSW Central and North Coast	23.6	28	Toowoomba – Roma	14.7
14	North-Eastern NSW	23.0	29	Torres Strait	11.0
15	Dubbo	22.9			

Notes

1. Data for NICU/SCN admission is from 2014–2015 due to data availability.
2. 'Low, medium or high category' column not included as this variable not used in analysis in Chapter 4.
3. Data not available for WA across all years.
4. Data including only live births.

Source: AIHW analysis of NPDC.

Table A7: IREG level outcomes—perinatal death among babies born to Indigenous mothers, 2014–2017

IREG name	Perinatal deaths (per 1,000)	IREG name	Perinatal deaths (per 1,000)
1 Apatula	34.3	17 Perth	14.4
2 Port Augusta	27.2	18 Mount Isa	14.2
3 Kununurra	26.8	19 South-Western WA	14.2
4 Tennant Creek	25.5	20 Adelaide	13.3
5 Katherine	24.2	21 Dubbo	13.3
6 North-Western NSW	22.1	22 Tasmania	12.8
7 Torres Strait	21.8	23 North-Eastern NSW	12.3
8 Jabiru – Tiwi	20.8	24 South-Eastern NSW	12.2
9 South Hedland	20.2	25 NSW Central and North Coast	11.5
10 Cape York	20.1	26 Melbourne	11.0
11 Nhulunbuy	19.6	27 Sydney – Wollongong	10.4
12 Rockhampton	18.5	28 Toowoomba – Roma	10.3
13 Darwin	18.1	29 Victoria excluding Melbourne	10.1
14 Townsville – Mackay	17.2	30 Brisbane	9.9
15 Cairns – Atherton	15.2	31 Riverina – Orange	9.7
16 Geraldton	14.4		

Notes

1. Perinatal death is expressed as rate per 1,000 (rather than per cent) to align with usual reporting of perinatal deaths.
2. Data for perinatal death is from 2014–2017 due to small numbers.
3. 'Low, medium or high category' column not included as this variable not used in analysis in Chapter 4.
4. Data from some IREGs not published due to reliability and confidentiality reasons. See Appendix B for more information.

Source: AIHW analysis of NPDC.

Table A8: IREG level outcomes—Indigenous mothers smoking during pregnancy, 2016–2017

IREG name	Smoked during pregnancy (%)	Low, medium or high category	IREG name	Smoked during pregnancy (%)	Low, medium or high category
1 West Kimberley	68.6	High	20 Cairns – Atherton	46.5	Medium
2 North-Western NSW	61.1	High	21 Tennant Creek	46.5	Medium
3 Cape York	60.1	High	22 Dubbo	46.4	Medium
4 Nhulunbuy	59.3	High	23 Adelaide	46.3	Medium
5 Kununurra	56.8	High	24 South-Eastern NSW	45.2	Medium
6 Katherine	56.8	High	25 Broome	44.4	Low
7 Jabiru – Tiwi	56.5	High	26 ACT	44.4	Low
8 Port Augusta	54.7	High	27 South-Western WA	43.2	Low
9 Mount Isa	52.7	High	28 Alice Springs	43.1	Low
10 Torres Strait	52.3	High	29 South Hedland	42.6	Low
11 Geraldton	50.9	High	30 Perth	42.3	Low
12 Port Lincoln – Ceduna	50.8	High	31 Townsville – Mackay	41.1	Low
13 North-Eastern NSW	48.7	Medium	32 NSW Central and North Coast	39.6	Low
14 Riverina – Orange	47.6	Medium	33 Sydney – Wollongong	37.5	Low
15 Toowoomba – Roma	47.2	Medium	34 Melbourne	37.5	Low
16 Darwin	47.2	Medium	35 Tasmania	37.1	Low
17 Victoria excluding Melbourne	47.0	Medium	36 Brisbane	35.2	Low
18 Rockhampton	46.8	Medium	37 Apatula	32.4	Low
19 Kalgoorlie	46.7	Medium			

Note: 'Low, medium or high category' column relates to analysis in Chapter 4. Categories based on splitting variable into thirds based on the value of the variable, with an equal number of IREGs in each group.

Source: AIHW analysis of NPDC.

Table A9: IREG level outcomes—Indigenous mothers with pre-existing diabetes, 2016–2017

IREG name	Pre-existing diabetes (%)	Low, medium or high category	IREG name	Pre-existing diabetes (%)	Low, medium or high category
1 Apatula	8.9	High	14 Port Augusta	2.8	Medium
2 Alice Springs	8.6	High	15 Mount Isa	2.7	Medium
3 Katherine	7.3	High	16 Darwin	2.4	Medium
4 West Kimberley	6.6	High	17 Cairns – Atherton	2.4	Medium
5 Tennant Creek	5.5	High	18 Perth	1.7	Low
6 Kalgoorlie	5.2	High	19 Toowoomba – Roma	1.5	Low
7 Torres Strait	4.9	High	20 Townsville – Mackay	1.4	Low
8 Kununurra	4.7	High	21 North-Eastern NSW	1.3	Low
9 Jabiru – Tiwi	3.9	Medium	22 Adelaide	1.3	Low
10 Cape York	3.7	Medium	23 Sydney – Wollongong	1.1	Low
11 South Hedland	3.5	Medium	24 Rockhampton	1.0	Low
12 Nhulunbuy	3.1	Medium	25 Brisbane	0.9	Low
13 Geraldton	3.1	Medium	26 NSW Central and North Coast	0.8	Low

Notes

1. 'Low, medium or high category' column relates to analysis in Chapter 4. Categories based on splitting variable into thirds based on the value of the variable, with an equal number of IREGs in each group.
2. Data not available for Victoria.
3. Data from some IREGs not published due to reliability and confidentiality reasons. See Appendix B for more information.

Source: AIHW analysis of NPDC.

Table A10: IREG level outcomes—Indigenous mothers with pregnancy-induced hypertension, 2016–2017

IREG name	Pregnancy-induced hypertension (%)	Low, medium or high category	IREG name	Pregnancy-induced hypertension (%)	Low, medium or high category
1 Port Augusta	9.7	High	17 NSW Central and North Coast	5.6	Medium
2 Apatula	9.0	High	18 South-Western WA	5.6	Medium
3 Mount Isa	8.8	High	19 Sydney – Wollongong	5.6	Medium
4 Toowoomba – Roma	8.0	High	20 Rockhampton	5.5	Medium
5 Adelaide	7.7	High	21 Tennant Creek	5.5	Medium
6 Katherine	7.3	High	22 Dubbo	5.3	Low
7 Nhulunbuy	7.2	High	23 Cairns – Atherton	5.0	Low
8 ACT	7.1	High	24 Townsville – Mackay	4.9	Low
9 North-Western NSW	6.9	High	25 Perth	4.9	Low
10 Kalgoorlie	6.9	High	26 Jabiru – Tiwi	4.9	Low
11 Alice Springs	6.6	Medium	27 North-Eastern NSW	4.7	Low
12 South-Eastern NSW	6.5	Medium	28 Brisbane	4.5	Low
13 Darwin	6.1	Medium	29 Kununurra	3.4	Low
14 Riverina – Orange	6.0	Medium	30 South Hedland	3.3	Low
15 Tasmania	6.0	Medium	31 Geraldton	2.5	Low
16 Cape York	5.8	Medium			

Notes

1. 'Low, medium or high category' column relates to analysis in Chapter 4. Categories based on splitting variable into thirds based on the value of the variable, with an equal number of IREGs in each group.

2. Data not available for Victoria.

3. Data from some IREGs not published due to reliability and confidentiality reasons. See Appendix B for more information.

Source: AIHW analysis of NPDC.

Table A11: Frequency assessment of IREGs appearing in top third, middle third and bottom third for selected variables among Indigenous mothers and their babies (out of 7 variables)

Times appearing in:					Times appearing in:				
IREG name	Top third	Middle third	Bottom third	Not publishable	IREG name	Top third	Middle third	Bottom third	Not publishable
1 Brisbane	6	1	0	0	20 West Kimberley	2	1	3	1
2 North-Eastern NSW	6	1	0	0	21 South Hedland	2	1	4	0
3 NSW Central and North Coast	6	1	0	0	22 Riverina – Orange	1	5	0	1
4 Broome	5	0	0	2	23 Adelaide	1	5	1	0
5 Sydney – Wollongong	5	1	1	0	24 Darwin	1	5	1	0
6 Dubbo	4	2	0	1	25 ACT	1	3	2	1
7 Tasmania	4	2	0	1	26 Geraldton	1	3	3	0
8 Cairns – Atherton	3	4	0	0	27 South-Western WA	1	2	3	1
9 Cape York	3	3	1	0	28 Kalgoorlie	1	3	3	0
10 South-Eastern NSW	3	2	1	1	29 Tennant Creek	1	3	3	0
11 Townsville – Mackay	3	3	1	0	30 Apatula	1	2	4	0
12 Torres Strait	3	1	2	1	31 Kununurra	1	1	5	0
13 Perth	3	0	4	0	32 Nhulunbuy	1	1	5	0
14 Melbourne	2	2	1	2	33 Katherine	1	0	6	0
15 Alice Springs	2	3	2	0	34 Port Augusta	0	4	3	1
16 Port Lincoln – Ceduna	2	1	2	2	35 Victoria excluding Melbourne	0	2	3	2
17 Rockhampton	2	3	2	0	36 North-Western NSW	0	2	4	1
18 Toowoomba – Roma	2	3	2	0	37 Mount Isa	0	2	5	0
19 Jabiru – Tiwi	2	2	3	0					

Notes

1. 'Top third' is when an IREG has 'high' values for antenatal care usage and 'low' values for adverse mother and baby outcomes (pre-term birth, low birthweight, mothers smoking while pregnant, pre-existing diabetes in mother and pregnancy-induced hypertension).
 2. 'Bottom third' is when an IREG has 'low' values for antenatal care usage and 'high' values for adverse mother and baby outcomes (pre-term birth, low birthweight, mothers smoking while pregnant, pre-existing diabetes in mother and pregnancy-induced hypertension).
 3. IREGs ordered by number of times appearing in top third (highest first), then times appearing in bottom third (lowest first) and then alphabetically.
- Source: AIHW analysis of NPDC.

Table A12: Adjusted proportion of IREGs being in the ‘top third’

IREG name	Total in top third	Total applicable variables	Adjusted proportion in top third (applicable variables only)
Broome	5	5	100.0
Brisbane	6	7	85.7
North-Eastern NSW	6	7	85.7
NSW Central and North Coast	6	7	85.7
Sydney – Wollongong	5	7	71.4
Dubbo	4	6	66.7
Tasmania	4	6	66.7
South-Eastern NSW	3	6	50.0
Torres Strait	3	6	50.0
Cairns – Atherton	3	7	42.9
Cape York	3	7	42.9
Perth	3	7	42.9
Townsville – Mackay	3	7	42.9
Melbourne	2	5	40.0
Port Lincoln – Ceduna	2	5	40.0
West Kimberley	2	6	33.3
Alice Springs	2	7	28.6
Jabiru – Tiwi	2	7	28.6
Rockhampton	2	7	28.6

IREG name	Total in top third	Total applicable variables	Adjusted proportion in top third (applicable variables only)
South Hedland	2	7	28.6
Toowoomba – Roma	2	7	28.6
ACT	1	6	16.7
South-Western WA	1	6	16.7
Riverina – Orange	1	6	16.7
Adelaide	1	7	14.3
Apatula	1	7	14.3
Darwin	1	7	14.3
Geraldton	1	7	14.3
Kalgoorlie	1	7	14.3
Katherine	1	7	14.3
Kununurra	1	7	14.3
Nhulunbuy	1	7	14.3
Tennant Creek	1	7	14.3
Mount Isa	0	7	0.0
North-Western NSW	0	6	0.0
Port Augusta	0	6	0.0
Victoria excluding Melbourne	0	5	0.0

Legend

Considered to appear in top third 6+ times, based on adjusted proportion (85.7%–100.0%)	Considered to appear in top third 5 times, based on adjusted proportion (71.4%–85.6%)	Considered to appear in top third 4 times, based on adjusted proportion (57.1%–71.3%)	Considered to appear in top third 3 times, based on adjusted proportion (42.9%–57.0%)	Considered to appear in top third 2 times, based on adjusted proportion (28.6%–42.8%)	Considered to appear in top third 1 time, based on adjusted proportion (14.3%–28.5%)	Considered to appear in top third 0 times, based on adjusted proportion (0.0%–14.2%)
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Note: The map in Figure 4.1 is based on this table. IREGs ordered by adjusted proportion and then alphabetically.

Source: AIHW analysis of NPDC.

Table A13: IREG level outcomes among Indigenous mother and their babies, 'low', 'medium' and 'high' categories and mean percentages, 2016–2017

Indigenous Region		Antenatal care (%)		Selected risk factors (%)			Mothers' characteristics (%)		
		Antenatal care in the 1st trimester	5+ antenatal visits	Pre-term births	Low birthweight	NICU/SCN ^(a)	Smoking while pregnant	Pre-existing diabetes	Pregnancy-induced hypertension
Code	Name								
101	Dubbo	Medium (61.2)	High (92.5)	Low (10.7)	Low (8.4)	Medium (22.9)	Medium (46.4)	n.p.	Low (5.3)
102	North-Eastern NSW	High (77.3)	High (90.8)	Low (11.7)	Low (9.2)	Medium (23.0)	Medium (48.7)	Low (1.3)	Low (4.7)
103	North-Western NSW	Medium (64.3)	Medium (86.8)	High (16.7)	High (13.2)	Low (19.2)	High (61.1)	n.p.	High (6.9)
104	NSW Central and North Coast	High (77.1)	High (90.3)	Low (11.6)	Low (8.8)	Medium (23.6)	Low (39.6)	Low (0.8)	Medium (5.6)
105	Riverina – Orange	Medium (63.9)	Medium (89.4)	Low (13.0)	Medium (10.5)	High (25.0)	Medium (47.6)	n.p.	Medium (6.0)
106	South-Eastern NSW	Low (52.8)	High (91.4)	Low (11.3)	Low (7.5)	Low (16.3)	Medium (45.2)	n.p.	Medium (6.5)
107	Sydney – Wollongong	Low (58.2)	High (91.2)	Low (11.3)	Low (8.4)	Medium (21.4)	Low (37.5)	Low (1.1)	Medium (5.6)
201	Melbourne	Low (50.1)	Medium (86.5)	Medium (13.5)	Low (8.9)	Low (21.3)	Low (37.5)	n.p.	n.p.
202	Victoria excluding Melbourne	Low (57.6)	Low (79.4)	Medium (15.1)	High (11.8)	High (25.7)	Medium (47.0)	n.p.	n.p.
301	Brisbane	High (68.1)	Medium (89.3)	Low (11.4)	Low (8.9)	High (24.9)	Low (35.2)	Low (0.9)	Low (4.5)
302	Cairns – Atherton	High (67.7)	Medium (89.6)	Medium (15.7)	Low (9.9)	Medium (24.5)	Medium (46.5)	Medium (2.4)	Low (5.0)
303	Cape York	High (73.2)	High (95.9)	Low (12.0)	Medium (10.8)	Low (19.6)	High (60.1)	Medium (3.7)	Medium (5.8)
304	Mount Isa	Low (54.0)	Medium (88.8)	High (17.1)	High (12.3)	High (28.6)	High (52.7)	Medium (2.7)	High (8.8)
305	Rockhampton	Low (57.7)	Low (84.7)	Medium (13.9)	Low (10.1)	Medium (21.9)	Medium (46.8)	Low (1.0)	Medium (5.5)
306	Toowoomba – Roma	Low (39.8)	Medium (88.3)	Medium (14.7)	Low (9.6)	Low (14.7)	Medium (47.2)	Low (1.5)	High (8.0)

(continued)

Table A13 (continued): IREG level outcomes among Indigenous mother and their babies, 'low', 'medium' and 'high' categories and mean percentages, 2016–2017

Indigenous Region		Antenatal care (%)		Selected risk factors (%)			Mothers' characteristics (%)		
		Antenatal care in the 1st trimester	5+ antenatal visits	Pre-term births	Low birthweight	NICU/SCN ^(a)	Smoking while pregnant	Pre-existing diabetes	Pregnancy-induced hypertension
Code	Name								
307	Torres Strait	High (66.9)	High (95.7)	Low (9.7)	Medium (10.2)	Low (11.0)	High (52.3)	High (4.9)	n.p.
308	Townsville – Mackay	Low (51.9)	Medium (87.3)	Medium (13.3)	Medium (10.4)	Medium (21.4)	Low (41.1)	Low (1.4)	Low (4.9)
401	Adelaide	Medium (61.2)	Medium (85.2)	Medium (13.9)	Medium (10.8)	High (24.9)	Medium (46.3)	Low (1.3)	High (7.7)
402	Port Augusta	Medium (60.0)	Medium (86.1)	Medium (16.3)	High (11.9)	High (26.6)	High (54.7)	Medium (2.8)	High (9.7)
403	Port Lincoln – Ceduna	Medium (62.4)	High (92.4)	High (17.7)	Low (8.9)	Low (19.7)	High (50.8)	n.p.	n.p.
501	Broome	High (74.6)	High (92.8)	Low (12.6)	Low (8.9)	n.p.	Low (44.4)	n.p.	n.p.
502	Geraldton	Medium (63.9)	Low (79.2)	High (17.4)	Medium (10.2)	n.p.	High (50.9)	Medium (3.1)	Low (2.5)
503	Kalgoorlie	Medium (60.6)	Low (79.5)	Low (13.2)	Medium (11.3)	n.p.	Medium (46.7)	High (5.2)	High (6.9)
504	Kununurra	Low (56.9)	Low (84.8)	High (16.4)	Medium (10.6)	n.p.	High (56.8)	High (4.7)	Low (3.4)
505	Perth	Low (44.5)	Low (74.7)	High (17.7)	High (13.8)	n.p.	Low (42.3)	Low (1.7)	Low (4.9)
506	South Hedland	Low (54.4)	Low (72.9)	High (19.2)	High (14.3)	n.p.	Low (42.6)	Medium (3.5)	Low (3.3)
507	South-Western WA	Medium (61.4)	Low (78.8)	High (17.5)	High (14.5)	n.p.	Low (43.2)	n.p.	Medium (5.6)
508	West Kimberley	High (67.3)	Medium (88.5)	Low (12.0)	High (14.5)	n.p.	High (68.6)	High (6.6)	n.p.
601	Tasmania	High (84.1)	High (95.3)	Medium (15.1)	Low (10.0)	Low (19.0)	Low (37.1)	n.p.	Medium (6.0)
701	Alice Springs	High (70.5)	Low (85.0)	Medium (14.3)	Medium (11.7)	Medium (24.1)	Low (43.1)	High (8.6)	Medium (6.6)

(continued)

Table A13 (continued): IREG level outcomes among Indigenous mother and their babies, 'low', 'medium' and 'high' categories and mean percentages, 2016–2017

Indigenous Region		Antenatal care (%)		Selected risk factors (%)			Mothers' characteristics (%)		
		Antenatal care in the 1st trimester	5+ antenatal visits	Pre-term births	Low birthweight	NICU/SCN ^(a)	Smoking while pregnant	Pre-existing diabetes	Pregnancy-induced hypertension
702	Apatula	Medium (63.0)	Low (77.5)	High (16.8)	Medium (11.7)	High (26.3)	Low (32.4)	High (8.9)	High (9.0)
703	Darwin	High (77.1)	Low (83.8)	Medium (13.7)	Medium (11.2)	High (27.4)	Medium (47.2)	Medium (2.4)	Medium (6.1)
704	Jabiru – Tiwi	Medium (62.2)	High (90.9)	High (21.4)	High (19.1)	High (30.6)	High (56.5)	Medium (3.9)	Low (4.9)
705	Katherine	High (67.9)	Low (83.2)	High (19.9)	High (15.6)	Low (21.1)	High (56.8)	High (7.3)	High (7.3)
706	Nhulunbuy	Low (57.9)	High (93.2)	High (23.0)	High (16.4)	Medium (21.6)	High (59.3)	Medium (3.1)	High (7.2)
707	Tennant Creek	Low (54.0)	Medium (85.5)	Low (12.3)	High (11.8)	High (33.0)	Medium (46.5)	High (5.5)	Medium (5.5)
801	ACT ^(b)	Medium (58.3)	Low (84.8)	Medium (15.9)	Medium (10.9)	Medium (21.4)	Low (44.4)	n.p.	High (7.1)

(a) Data for NICU/SCN admission is from 2014–2015 due to data availability.

(b) For the ACT, first antenatal visit is often the first hospital antenatal clinic visit. In many cases, earlier antenatal care provided by the woman's general practitioner is not reported.

Note: 'Low', 'medium' and 'high' categories established using quantiles (that is, each variable was split into 3 categories with the same number of IREGs).

Source: AIHW analysis of NPDC.

Appendix B: National Perinatal Data Collection

The National Perinatal Data Collection (NPDC) is a national population-based cross-sectional collection of data on pregnancy and childbirth. The data are based on births reported to the perinatal data collection in each state and territory in Australia. Midwives and other birth attendants, using information obtained from mothers and from hospital or other records, complete notification forms for each birth. Information is included in the NPDC for both live births and stillbirths, where gestational age is at least 20 weeks' gestation or birthweight is at least 400 grams (except in Western Australia, where births are included if gestational age is at least 20 weeks or, if gestation is unknown, birthweight is at least 400 grams).

All states and territories have a data item to record Indigenous status of the mother on their perinatal form, although there are some differences among the jurisdictions. Overall, in the NPDC for years 2016–2017, only 0.3% (1,800) of records had no Indigenous status recorded. Of the mothers who identified as Indigenous, 90% (24,500) were Aboriginal only, 4.6% (1,300) were Torres Strait Islander only and 5.3% (1,500) were both Aboriginal and Torres Strait Islander. In the same time period, among babies born to Indigenous mothers, 90% (24,800) were Aboriginal only, 4.6% (1,300) were Torres Strait Islander only and 5.3% (1,500) were both Aboriginal and Torres Strait Islander.

Throughout the report, results based on small numbers (fewer than 10 events) are not published (np). Also, rates based on denominators of less than 100 are not published (np) for reliability reasons.

Detailed information on completeness, accuracy and other aspects of data quality for the NPDC is in the data quality statements at:

- <https://meteor.aihw.gov.au/content/index.phtml/itemId/693978> (for 2016)
- <https://meteor.aihw.gov.au/content/index.phtml/itemId/716326> (for 2017).

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Abbreviations

ABS	Australian Bureau of Statistics
ACCHS	Aboriginal Community Controlled Health Service
ACT	Australian Capital Territory
AFBP	Aboriginal Family Birthing Program
AIHW	Australian Institute of Health and Welfare
ASGS	Australian Statistical Geography Standard
BMI	body mass index
IAHP	Indigenous Australians' Health Programme
IREG	Indigenous Region
IRSD	Index of Relative Socio-economic Disadvantage
NICU	neonatal intensive care unit
NPDC	National Perinatal Data Collection
NSW	New South Wales
NT	Northern Territory
SA2	Statistical Areas Level 2
SCN	special care nursery
WA	Western Australia

Symbols

n.p.	not publishable because of small numbers, confidentiality or other concerns about the quality of the data
≥	greater than or equal to
>	greater than
≤	less than or equal to
<	less than
%	per cent

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**.

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

antenatal care: A planned visit between a pregnant woman and a midwife or doctor to assess and improve the wellbeing of the mother and baby throughout pregnancy.

antenatal care in the first trimester: Antenatal care accessed before 14 completed weeks of pregnancy.

antepartum haemorrhage: Bleeding from the uterus that occurs during pregnancy or early in labour but before birth.

Australian Statistical Geography Standard (ASGS): Common framework defined by the Australian Bureau of Statistics for collecting and disseminating geographically classified statistics.

birthweight: The first weight of the baby (stillborn or liveborn) obtained after birth (usually measured to the nearest 5 grams and obtained within 1 hour of birth).

body mass index: The most commonly used method of assessing whether a person is normal weight, underweight, overweight or obese. 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, the normal range is from 18.5 to less than 25, overweight but not obese is from 25 to less than 30, obese is 30 to less than 40 and severely obese is 40 and over.

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. Insulin, a hormone produced by the pancreas, 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 can have a serious short- and long-term effects.

chronic: See **pre-existing**.

fetal death (stillbirth): 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. 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.

first trimester: The first 13 weeks of pregnancy (before 14 completed weeks of pregnancy).

gestational age: 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.

hypertension: Definitions vary but a well-accepted one is from the World Health Organization: a systolic blood pressure of 140 mmHg or more or a diastolic blood pressure of 90 mmHg or more, or [the person is] receiving medication for high blood pressure.

Index of Relative Socio-economic Disadvantage: A general socioeconomic index that summarises a range of information about the economic and social conditions of people and households within an area (ABS 2018). This index includes only measures of relative disadvantage.

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

Indigenous Region (IREG): Geographical units made up of a combination of Indigenous Areas, loosely based on the former Aboriginal and Torres Strait Islander Commission boundaries. They do not cross state and territory borders.

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 liveborn (WHO definition).

low birthweight: Weight of a baby at birth that is less than 2,500 grams.

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

multiple birth: When there is more than 1 birth resulting from the pregnancy.

neonatal death: Death of a liveborn baby within 28 days of birth.

neonatal intensive care unit/special care nursery: Provide more specialised care to liveborn babies who require additional attention at birth.

non-Indigenous: People who have declared that they are not of Aboriginal or Torres Strait Islander descent.

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

perinatal death: A **fetal death** or **neonatal death** of at least 20 weeks' gestation or at least 400 grams birthweight.

pregnancy-induced: the new development of a condition during pregnancy (used in regard to hypertension within this report).

pre-term birth: Birth before 37 completed weeks of gestation.

pre-existing: A persistent and long-lasting health condition, present before pregnancy (used in regard to diabetes and hypertension within this report).

singleton birth: When there is only 1 birth resulting from the pregnancy.

smoking status after 20 weeks' gestation: Whether a mother smoked tobacco after 20 weeks of pregnancy until the birth.

Stillbirth: See **fetal death (stillbirth)**.

References

ABS (Australian Bureau of Statistics) 2018. Census of Population and Housing: Socio-economic Index for Areas (SEIFA), Australia, 2016: IRSD. Canberra: Australian Bureau of Statistics. <<https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/2033.0.55.001~2016~Main%20Features~IRSD~19>>. Accessed 16 October 2020.

ACM (Australian College of Midwives) 2019. Birthing on Country Project. <<https://www.midwives.org.au/birthing-country-project>>. Accessed 25 November 2019.

AIHW (Australian Institute of Health and Welfare) 2014a. Birthweight of babies born to Indigenous mothers. Cat. no. IHW 138. Canberra: AIHW.

AIHW 2014b. New Directions: Mothers and Babies Services—assessment of the program using nKPI data December 2012 to December 2013. Cat. no. IHW 145. Canberra: AIHW.

AIHW 2017. Spatial variation in Aboriginal and Torres Strait Islander women's access to 4 types of maternal health services. Cat. no. IHW 187. Canberra: AIHW.

AIHW 2018a. Australia's mothers and babies 2016—in brief. Cat. no. PER 97. Canberra: AIHW.

AIHW 2018b. Closing the Gap targets: 2017 analysis of progress and key drivers of change. Cat. no. IHW 193. Canberra: AIHW.

AIHW 2019a. Australia's mothers and babies 2017—in brief. Cat. no. PER 100. Canberra: AIHW.

AIHW 2019b. Maternal deaths in Australia. Cat. no. PER 99. Canberra: AIHW.

AIHW 2019c. National Core Maternity Indicators 2017: summary report. Cat. no. PER 104. Canberra: AIHW.

AIHW 2019d. Tracking progress against the Implementation Plan goals for the Aboriginal and Torres Strait Islander Health Plan 2013–2023. Cat. no. IHW 201. Canberra: AIHW. Accessed 29 April 2020.

AIHW 2020. Australia's children. Cat. no. CWS 69. Canberra: AIHW.

Block SR, Watkins SM, Salemi JL, Rutkowski R, Tanner JP, Correia JA & Kirby RS 2013. Maternal pre-pregnancy body mass index and risk of selected birth defects: evidence of a dose-response relationship. *Paediatric and Perinatal Epidemiology* 27(6):521–531.

Blondel B & Zuber MC 1988. Marital status and cohabitation during pregnancy: relationship with social conditions, antenatal care use and pregnancy outcome in France. *Paediatric and Perinatal Epidemiology* 2(2):125–137.

Blumer I, Hadar E, Hadden DR, Jovanović L, Mestman JH, Hassan Murad M & Yogev Y 2013. Diabetes and pregnancy: an endocrine society clinical practice guideline. *The Journal of Clinical Endocrinology & Metabolism*. 98(11):4227–49.

Closing the Gap 2020. National Agreement of Closing the Gap: at a glance. Canberra: Australian Government. <<https://www.closingthegap.gov.au/national-agreement-closing-gap-glance>>. Accessed 23 September 2020.

Health (Department of Health) 2018a. Child and Family Health. Canberra: Australian Government Department of Health. <<https://www.health.gov.au/internet/main/publishing.nsf/Content/indigenous-maternal-health-ip>>. Accessed 16 July 2019.

Health 2018b. Clinical Practice Guidelines: Pregnancy Care. Canberra: Australian Government Department of Health. <https://www.health.gov.au/sites/default/files/pregnancy-care-guidelines_0.pdf>. Accessed 22 July 2019.

Health 2019a. Implementation Plan for the National Aboriginal and Torres Strait Islander Health Plan 2013–2023. Canberra: Australian Government Department of Health. <<https://www1.health.gov.au/internet/main/publishing.nsf/Content/indigenous-implementation-plan>>. Accessed 19 October 2020.

Health 2019b. Pregnancy care for Aboriginal and Torres Strait Islander women. Canberra: Australian Government Department of Health. <<https://www.health.gov.au/resources/pregnancy-care-guidelines/part-a-optimising-pregnancy-care/pregnancy-care-for-aboriginal-and-torres-strait-islander-women#34-birthing-on-country>>. Accessed 25 November 2019.

Joung IM, van der Meer JB & Mackenbach JP 1995. Marital status and health care utilization. *International Journal of Epidemiology* 24(3):569–75.

Lowell A, Kilea A, Liddle M, Cox B & Paterson B 2015. Supporting aboriginal knowledge and practice in health care: lessons from a qualitative evaluation of the strong women, strong babies, strong culture program. *BMC Pregnancy and Childbirth* 15: 19.

Mangrio E, Hansen K, Lindström M, Köhler M & Rosvall M 2011. Maternal education level, preventive behaviour, risk behaviour, social support and medical care consumption in 8-month-old children in Malmö, Sweden. *BMC Public Health* 11(891).

Middleton P, Bubner T, Glover K, Rumbold A, Weetra D, Scheil W & Brown S 2017. 'Partnerships are crucial': an evaluation of the Aboriginal Family Birthing Program in South Australia. *Australia and New Zealand Journal of Public Health* 41(1):21–6.

Mukherjee S & Bhide A 2008. Antepartum haemorrhage. *Obstetrics, Gynaecology & Reproductive Medicine* 18(12):335–39.

NACCHO (National Aboriginal Community Controlled Health Organisation) 2020. About NACCHO. Canberra: NACCHO. <<https://www.naccho.org.au/about/>>. Accessed 23 September 2020.

Productivity Commission 2019. National Indigenous Reform Agreement. Canberra: Australian Government Productivity Commission. <<https://www.pc.gov.au/research/supporting/national-agreements/indigenous-reform>>. Accessed 29 April 2020.

Roberts CL, Ford JB, Algert CS, Antonsen S, Chalmers J, Cnattingius S et al. 2011. Population-based trends in pregnancy hypertension and pre-eclampsia: an international comparative study. *BMJ Open*. 1(1): 1–9.

Rurangirwa AA, Mogren I, Nyirazinyoye L, Ntaganira J & Krantz G 2017. Determinants of poor utilization of antenatal care services among recently delivered women in Rwanda; a population based study. *BMC Pregnancy and Childbirth* 17:142.

Seely EW & Ecker J 2011. Chronic hypertension in pregnancy. *The New England Journal of Medicine* 365(5):439–46.

Wyndow P & Jackiewicz T 2014. Identifying and supporting pregnant Aboriginal women and their families during their patient journey through services and across geographical areas: a feasibility study. Telethon Kids Institute, The University of Western Australia under contract with the Department of Health, Western Australia.

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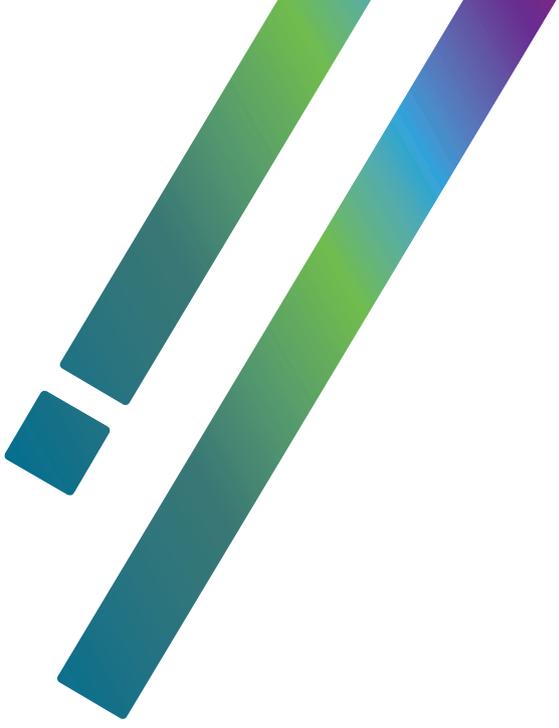
Related publications

AIHW (Australian Institute of Health and Welfare) 2014. *New Directions: Mothers and Babies Services—assessment of the program using nKPI data December 2012 to December 2013*. Cat. no. IHW 145. Canberra: AIHW.

AIHW 2017. *Spatial variation in Aboriginal and Torres Strait Islander women's access to 4 types of maternal health services*. Cat. no. IHW 187. Canberra: AIHW.

AIHW 2018. *Closing the Gap targets: 2017 analysis of progress and key drivers of change*. Cat. no. IHW 193. Canberra: AIHW.

AIHW 2020. *Australia's mothers and babies 2018—in brief*. Cat. no. PER 108. Canberra: AIHW.



This report explores the factors associated with antenatal care use among Aboriginal and Torres Strait Islander mothers, and how these may relate to baby outcomes—including how this varies spatially across the Indigenous Regions of Australia.

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