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Key factors contributing to low birthweight among Aboriginal and Torres Strait Islander babies

Feature article

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COVID-19 pandemic

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Key factors contributing to low birthweight of Aboriginal and Torres Strait Islander babies

Feature Article, Aboriginal and Torres Strait Islander Health Performance Framework website

Contents

Summary

Aboriginal and Torres Strait Islander babies are more likely to have a healthy birthweight when they are born to women who are in good health and who attend antenatal care early and regularly throughout their pregnancy.

This report examines the key factors associated with birthweight of Indigenous babies and the relative contribution of these factors to low birthweight. Reducing the low birthweight rate is key to improving the healthy birthweight rate of Indigenous babies.

In 2019, 9.2% of Indigenous babies had a low birthweight (1,610 babies, excluding multiple births). Of all low birthweight babies, 982 or 61% were pre-term births (born before 37 weeks), while one in three (538 or 33%) were early term births (37–38 weeks gestation) and 90 (6%) were full-term births (39 or more weeks gestation). The low birthweight rate for Indigenous babies has not changed significantly since 2013.

According to the analysis in this report, the most important factors contributing to low birthweight among Indigenous babies are the following: maternal smoking during pregnancy; the mother being underweight pre-pregnancy (body mass index of less than 18.5); and the mother not attending antenatal care in the first trimester (before 14 weeks gestational age). If smoking during pregnancy was eliminated, an estimated 37% of low birthweight births among Indigenous babies could be prevented; for maternal underweight this proportion was 8%; and for not attending antenatal care in the first trimester, 4%.

In the decade to 2019, there were reductions in rates of smoking during pregnancy among Indigenous women living in non-remote areas (from 50% in 2010 to 42% in 2019), but no significant change in remote areas (52% in 2019). Maternal underweight is also more common in remote areas.

Given that smoking during pregnancy is a key modifiable risk factor that contributes to low birthweight, an estimate was made of the reduction in smoking required to reduce the low birthweight rate of Indigenous babies to 8% by 2031. This would correspond to achieving the Closing the Gap target of a 91% healthy birthweight rate by 2031, assuming a stable 1% high birthweight rate. To achieve this, smoking during pregnancy needs to decline from the current rate of 44% in 2019 to an estimated 27% in 2031.

Attending culturally safe antenatal care early and regularly throughout the pregnancy is key to achieving better outcomes for Indigenous babies and their mothers. The report shows that the proportion of Indigenous women who attend antenatal care is lower in remote areas where rates of smoking during pregnancy and being underweight pre-pregnancy are highest. There is a critical need to identify gaps in services for mothers and babies and ensure that these services are available where they are needed.

Pregnancy complications such as antepartum haemorrhage and pregnancy-induced hypertension (high blood pressure) are also associated with low birthweight. Indigenous babies born to women with pre-existing health conditions such as pre-existing diabetes and chronic hypertension are also more likely to have a low birthweight. While important at an individual level, at a population level the proportions of Indigenous women with these conditions were smaller than the proportions who smoked during pregnancy, were underweight pre-pregnancy, or who did not attend antenatal care in the first trimester of pregnancy.

In summary, preventing smoking and poor nutrition (reflected in a low body mass index) of Indigenous women and improving their access to antenatal care – with a focus on areas with service gaps – is critical to reducing low birthweight rates among Indigenous babies.

1. Introduction

A healthy birthweight helps to lay the foundations for lifelong health. Babies with a healthy birthweight have better chances of immediate survival, and good health as children and adults. Most Aboriginal and Torres Strait Islander babies are born with a healthy birthweight (89.5% in 2019), but the low birthweight rate among Indigenous babies remains relatively high at 9.2%, compared with 4.9% of non-Indigenous babies (AIHW 2022: Table D1.01.17).

This report uses the term 'healthy birthweight' (referred to as 'normal birthweight' in the AIHW standard) for consistency with the terminology used in the National Agreement on Closing the Gap (see Chapter 3: Box 3.1). Data in this feature article are sourced from the National Perinatal Data Collection (NPDC) (Appendix A). Throughout this report, all references to tables that include 'BW' in the table number (for example, Table BW1) are supplementary tables. These tables include notes and caveats to assist with interpretation and are available from https://indigenoushpf.gov.au/publications/factors-contributing-low-birthweight.

Low, healthy or high birthweight?

Very low birthweight	Less than 1.5 kilograms
Low birthweight	Less than 2.5 kilograms
Normal ("healthy") birthweight	2.5 to less than 4.5 kilograms
High birthweight	4.5 kilograms or greater

AIHW 2012; WHO 1992

Indigenous babies

In the NPDC, information is available on the Indigenous status of the woman giving birth (from 2005 onwards), as well as of the baby (from 2013 onwards).

Nearly 3 in 4 Indigenous babies born in 2019 had an Indigenous mother, while the remaining 1 in 4 had a non-Indigenous mother (Table 1).

Table 1: All babies[(a)], Indigenous status of the baby by Indigenous status of the mother, 2019

	Indigenous mother	Non-Indigenous mother	Total[(b)]
Indigenous babies	13,289	4,782	18,086
Non-Indigenous babies	1,053	279,232	281,695
Indigenous status of baby not stated	125	2,878	3,273
Total births	**14,467**	**286,892**	**303,054**

(a) Includes stillbirths.

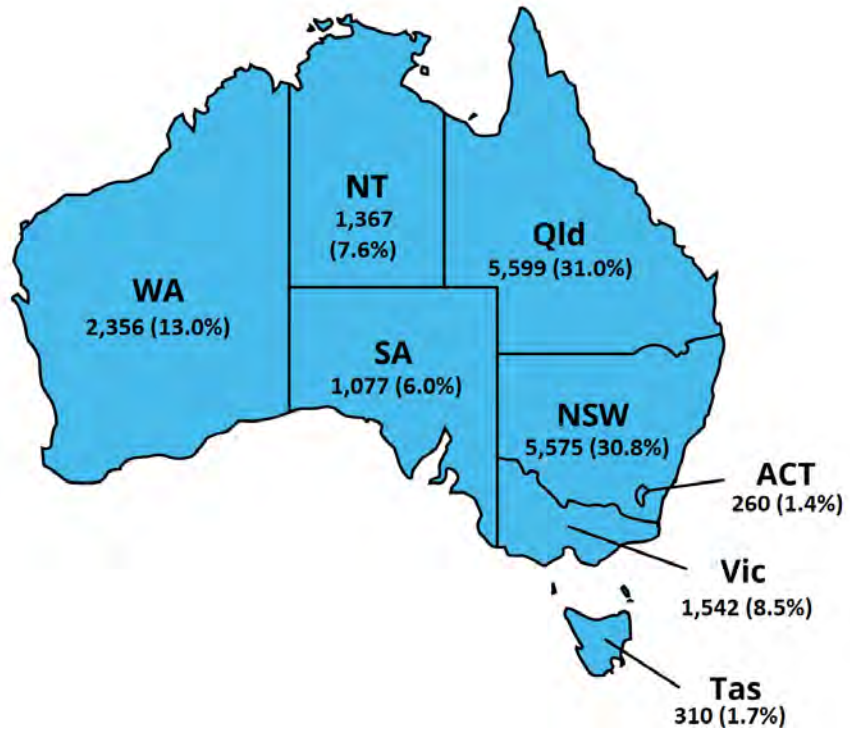
(b) Includes Indigenous status of mother not stated.

Source: AIHW 2022: Table D1.01.27 (based on AIHW analysis of the National Perinatal Data Collection).

In 2019, over 300,000 babies were born in Australia. Of these, 18,086 or 6% were identified as Indigenous babies. The majority of Indigenous babies were born in Queensland or New South Wales (31% each), followed by Western Australia (13%). The remaining 25% were born in Victoria, the Northern Territory, South Australia, Tasmania, and the Australian Capital Territory (Figure 1).

Within each state and territory, the proportion of babies who were Indigenous was variable with the highest proportion being in the Northern Territory (38%) and the lowest in Victoria (1.9%) (AIHW 2022: Table D1.01.27).

Figure 1: Distribution of Indigenous babies by state or territory of birth, 2019



Source: AIHW 2022: Table D1.01.27 (based on AIHW analysis of the National Perinatal Data Collection).

Birthweight and stage of pregnancy

Birthweight data in this report relate to singleton liveborn babies. Babies born from multiple births often have a low birthweight due to being born pre-term (AIHW 2020b). For this reason, multiple births are generally excluded from analysis of low birthweight. This makes it simpler to distinguish other factors that contribute to low birthweight.

Of the 17,917 liveborn Indigenous babies in 2019, 17,421 were singleton babies. Of these:

- 15,596 (89.5%) had a healthy birthweight
- 1,610 (9.2%) had a low birthweight
- 204 (1.2%) had a high birthweight (AIHW 2022: Table D1.01.14).

A low birthweight may be due to a baby being born prematurely (*pre-term*), and/or being smaller than expected given the mother's stage of pregnancy (*small for gestational age* or SGA). Babies who are both premature and small for their gestational age typically have the poorest outcomes (WHO 2014).

In Australia, births that occur at 37–41 completed weeks of gestation are called *term births* while those that occur before 37 weeks of completed gestation are called *pre-term births*, in line with the *International statistical classification of diseases and related health problems* (WHO 2004).

In 2013, in response to evidence of poorer outcomes, particularly for respiratory illness, for babies born before 39 weeks, the American College of Obstetricians and Gynecologists and the Society for Maternal-Fetal Medicine recommended that the category *term births* should be divided into the following categories:

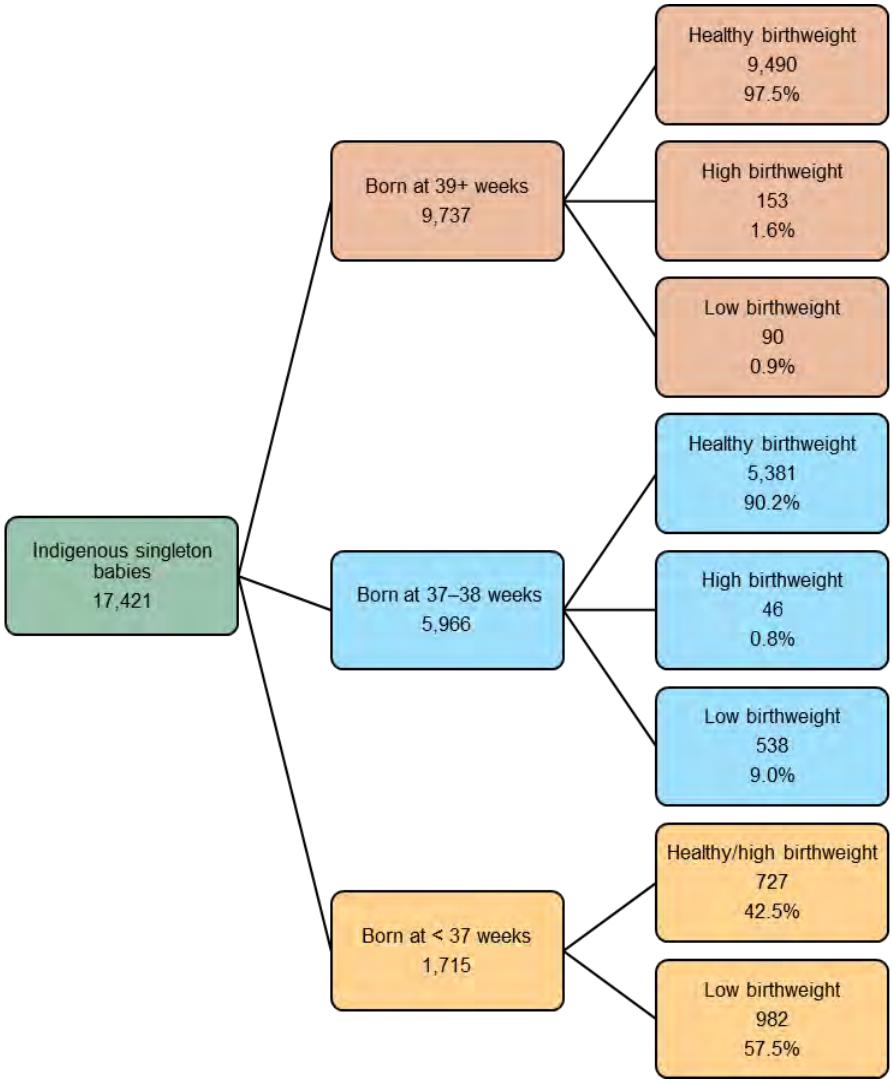
- early term, 37–38 weeks gestation.
- full term, 39–40 weeks gestation
- late term, 41 weeks gestation
- post term, 42 weeks gestation (ACOG 2013).

In this report, births at 39 weeks or more are referred to as *full-term births*.

In 2019, nearly 6 in 10 Indigenous singleton babies were born at 39 weeks or more, 3 in 10 were born early term, and 1 in 10 were born pre-term (before 37 weeks) (Figure 2).

Nearly 98% of Indigenous babies born at 39 weeks or later had a healthy birthweight. Among Indigenous babies born at 37–38 weeks (early term), about 90% had a healthy birthweight, while 9% had a low birthweight. Most Indigenous babies born pre-term had a low birthweight (58%) (Tables BW8–BW10).

Figure 2: Liveborn Indigenous singleton babies by gestational age and birthweight, 2019



Note: Data for this figure are shown in Supplementary Tables BW7–BW10.

Source: AIHW analysis of the National Perinatal Data Collection.

Trends in pre-term and early term births

Of the 1,610 Indigenous singleton babies with a low birthweight who were born in 2019:

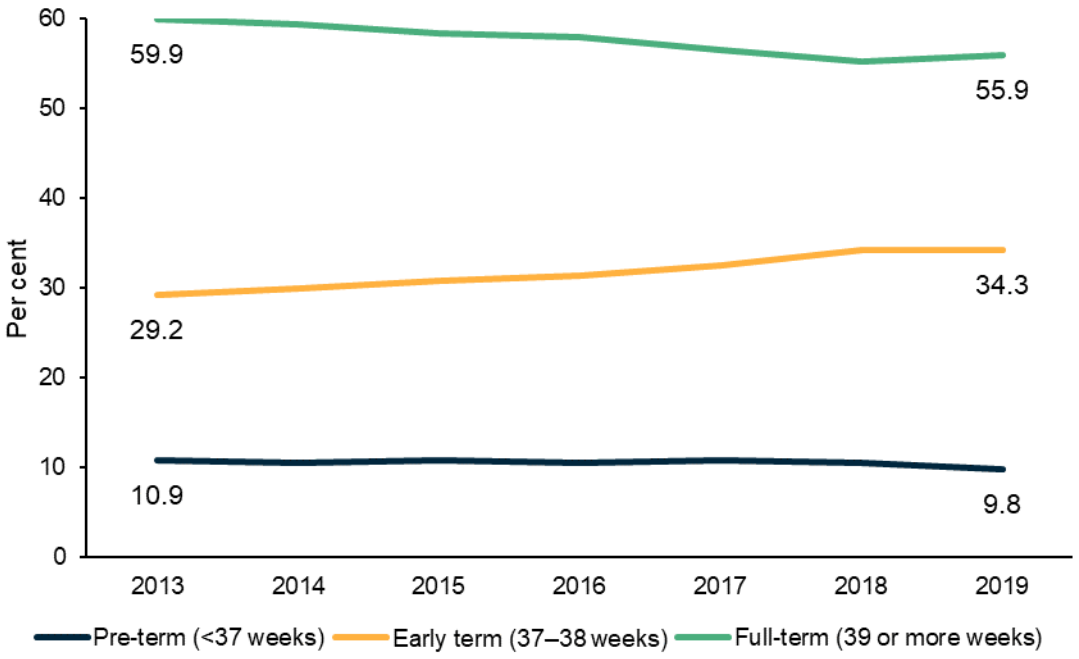
- 982 were pre-term births
- 538 were early term births
- 90 were full-term births (born at 39 weeks or more) (Tables BW8–BW10).

In recent years the proportion of Indigenous singleton babies born at 37–38 weeks (early term births) has increased (from 29% in 2013 to 34% in 2019), while the proportion born at 39 weeks or more has decreased (from 60% to 56%) (Figure 3).

This is important because the low birthweight rate is higher in the early term category (around 9%) than in the 39 weeks or more category (1%) (Tables BW9, BW10). Understanding changes in the pattern of pre-term, early term, and full-term births may shed light on changes in rates of low birthweight.

If the proportions of babies born early term and full-term in 2019 were similar to those in 2013, it is estimated that the low birthweight rate among Indigenous singleton babies would be 8.8%, compared with the current rate of 9.2% (based on analysis of data shown in Table BW7).

Figure 3: Trends in pre-term, early term, and full-term births among Indigenous babies, 2013–2019

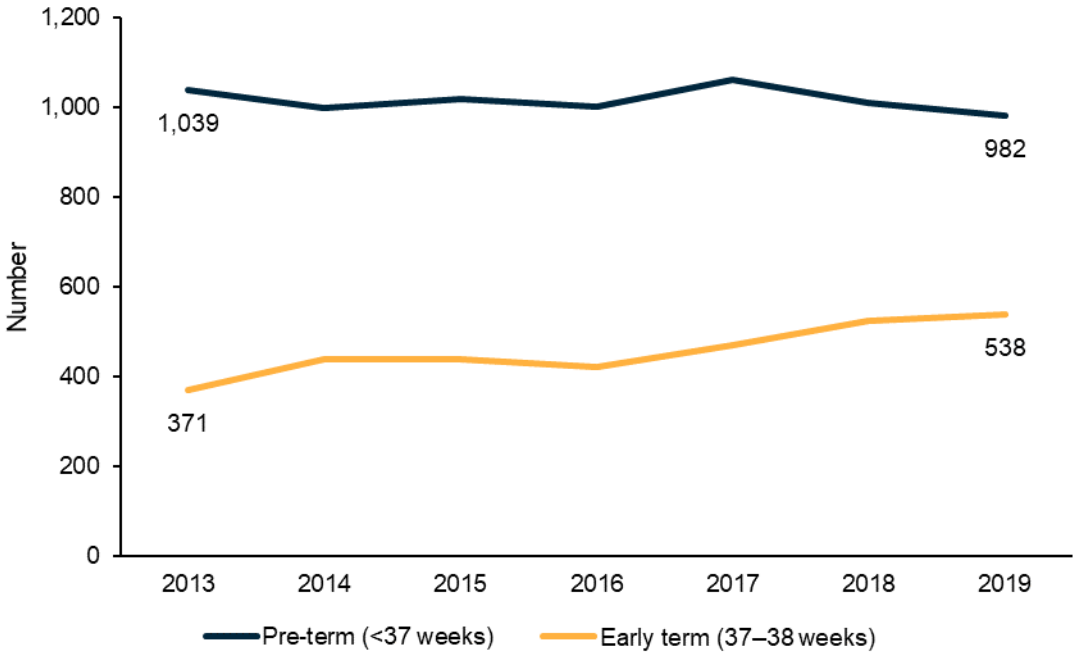


Note: Data for this figure are shown in Supplementary Table BW7.

Source: AIHW analysis of the National Perinatal Data Collection.

From 2013 to 2019, the number of low birthweight Indigenous babies *born at 37–38 weeks* increased, and this group now accounts for 1 in 3 low birthweight Indigenous babies (33%), compared with 1 in 4 (24%) in 2013 (Table BW7). The number of low birthweight Indigenous babies *born before 37 weeks* remained relatively steady over the same period (Figure 4).

Figure 4: Trends in number of low birthweight Indigenous babies born pre-term and early term, 2013–2019



Note: Data for this figure are shown in Supplementary Tables BW8–BW9.

Source: AIHW analysis of the National Perinatal Data Collection.

2 Key factors contributing to birthweight

Indigenous women who are in good health, do not smoke during pregnancy, and who first attend antenatal care in the first trimester, are more likely to have a baby with a healthy birthweight (AIHW 2020a, 2021b). Maternal cultural-based resilience and maternal smoking cessation are important protective factors, lowering the risk of adverse perinatal outcomes such as pre-term birth, low birthweight or being small for gestational age among Indigenous Australian children (Westrupp et al. 2019).

There are some differences in the factors associated with *pre-term birth* and those associated with *SGA birth*. Pregnancy complications are the main risk factors for pre-term birth, while maternal smoking and alcohol use, maternal malnutrition and maternal infections are factors in SGA birth (AIHW 2021b; Barreto et al. 2019; Sayers & Powers 1997; SCRGSP 2020).

Other research nominates 'persistent high rates of smoking during pregnancy, food insecurity and other socioeconomic disparities' as potential factors contributing to continuing high rates of low birthweight and pre-term birth, along with high rates of pre-term birth among women with pre-existing diabetes (Hare et al. 2020).

A review of studies of indigenous populations, mostly from the United States, Canada and Australia, found the main risk factors for pre-term birth included antepartum haemorrhage, pregnancy-induced hypertension, diabetes, history of pre-term births, maternal malnutrition and a low number of antenatal consultations. The main risk factors for fetal growth restriction (leading to babies being SGA) were maternal smoking and alcohol use, maternal malnutrition, gestational hypertension and urinary tract infections during pregnancy. The authors of the review observed that pre-term birth and fetal growth restriction 'show common causes related to poverty and limited access to health services' (Barreto et al. 2019).

Multiple studies have found smoking is a stronger risk factor for fetal growth restriction than for pre-term birth (Wills & Coory 2008) and that quitting smoking during early pregnancy reduced the risk that the baby would be born SGA to levels comparable with non-smokers (Bickerstaff et al. 2012; Hodyl et al. 2014).

This chapter updates and builds on previous AIHW analysis (AIHW 2021a), using logistic regression models to identify key factors associated with low birthweight, pre-term birth, or SGA birth.

Overview of factors associated with low birthweight

Logistic regression modelling can be used to identify key factors associated with an outcome of interest (see Appendix B). Table 2[1] presents the main contributors to Indigenous babies being born with low birthweight (full results are in the supplementary data tables).

[1] This table presents odds ratios. An odds ratio (OR) is a measure of association between an exposure (e.g. smoking) and an outcome. The OR represents the odds, or likelihood, that an outcome will occur given a particular exposure, compared with the odds of the outcome occurring in the absence of that exposure (e.g. not smoking). An OR of 2.0 means an outcome is twice as likely with an exposure as without it. The adjusted odds ratio is the odds ratio that is obtained after accounting for other explanatory variables included in the model.

Table 2. Characteristics with statistically significant positive associations with low birthweight (compared with the relevant reference group), among Indigenous babies born in 2017–2019, NSW, Qld, WA, SA, Tas, ACT and NT combined

Characteristic	Low birthweight		Pre-term births		SGA births	
	Adjusted odds ratio	Population attributable fraction (PAF)[(a)]	Adjusted odds ratio	Population attributable fraction (PAF)[(a)]	Adjusted odds ratio	Population attributable fraction (PAF)[(a)]
Pre-pregnancy BMI (ref group: Normal weight)		**-25%**		**-19%**		**-17%**
Underweight	1.9	8%	1.5	4%	1.8	6%
Pregnancy-induced hypertension (ref group: None)		**2%**		**2%**		**1%**
Had pregnancy-induced hypertension	1.9	2%	1.6	2%	1.4	1%
Chronic hypertension (ref group: None)		**1%**		**1%**		**<1%**
Had chronic hypertension	2.6	1%	2.5	1%	1.7	<1%
Pre-existing diabetes (ref group: None)		**1%**		**4%**		-1%
Had pre-existing diabetes	1.7	1%	4.4	4%	0.4	-1%
Smoking during pregnancy (ref group: Did not smoke at all during pregnancy)		**37%**		**22%**		**39%**
Smoked before and after 20th week of pregnancy	2.5	34%	1.8	21%	2.8	35%
Smoked only before or during 20th week of pregnancy	1.6	2%	—	—	1.9	3%
Smoked only after 20th week of pregnancy	3.0	1%	1.8	<1%	2.7	1%
State or territory of mother's usual residence (ref group: Queensland)		**-1%**		**0%**		**4%**
Western Australia	1.3	4%	1.3	4%	—	—
Northern Territory	—	—	1.2	1%	1.2	1%
Australian Capital Territory	—	—	—	—	1.5	<1%
When antenatal care first attended (ref group: First trimester)		**4%**		**3%**		**4%**
Attended antenatal care, but not in first trimester	1.1	4%	—	—	1.1	4%
Did not attend antenatal care at all	2.4	<1%	3.8	<1%	—	—

(a) Population-wide measure of how much a maternal characteristic contributes to the outcome of low birthweight birth, based on the individual risk of a baby being born low birthweight due to a particular characteristic, and the prevalence of that characteristic in the population.

Notes: Analysis excludes data for Victoria because data were not available for diabetes and hypertension for the full three-year period required. Explanatory variables included in the logistic regression model were: maternal age, state/territory of residence, remoteness area of residence, socioeconomic status, parity, sex of baby, pre-pregnancy BMI, smoking status, diabetes status, hypertension status and baby's gestational age at first antenatal care visit. Overall, BMI has a negative association with low birthweight because of the high prevalence of overweight and obesity (which contribute to high birthweight). See Supplementary Tables BW15–BW17 for full model results. Similarly, pre-existing diabetes has a positive association with low birthweight because of its positive association with pre-term birth but has a negative association with SGA births.

Source: AIHW analysis of the National Perinatal Data Collection.

Although hypertension (high blood pressure) is strongly associated with low birthweight (an Indigenous baby of a woman with chronic hypertension is 2.6 times as likely to have a low birthweight as an Indigenous baby of a woman who does not have hypertension), the proportion of Indigenous women who have hypertension before or during their pregnancy is low (around 4%) (Table 2, AIHW 2022: Table D2.21.12).

Similarly, an Indigenous baby of a woman who has diabetes and becomes pregnant is 1.7 times as likely to have a low birthweight as an Indigenous baby of a woman who does not have diabetes, but only 2% of Indigenous women have diabetes before they become pregnant (Table 2, AIHW 2022: Table D2.21.12).

On the other hand, an Indigenous baby of a woman who smokes at some time during her pregnancy is between 1.6 and 3 times as likely to have a low birthweight as an Indigenous baby of a woman who does not smoke at all (Table 2). Around 44% of Indigenous mothers (around 6,000) smoked at some time during their pregnancy (AIHW 2022: Table D2.21.1).

Indigenous babies of women who were underweight pre-pregnancy as indicated by their body mass index (BMI) were 1.9 times as likely to have a low birthweight compared with Indigenous babies of women with a normal BMI (Table 2). In 2017–2019, 6.8% of Indigenous women who gave birth were underweight pre-pregnancy; in *Very remote* areas, this percentage was 10% (Tables BW5a–BW5b).

Finally, Indigenous babies of women who never attended antenatal care during their pregnancy were 2.4 times as likely to have a low birthweight as Indigenous babies of women who attended antenatal care in the first trimester of pregnancy (during the first 3 months) (Table 2). Around 68% of Indigenous women attended antenatal care in the first trimester, while 31% attended antenatal care for the first time after the first trimester (around 1% did not attend antenatal care at all) (AIHW 2022: Tables D3.01.10, D3.01.1). Indigenous babies of women who attended antenatal care only after the first trimester were 1.1 times as likely to have a low birthweight as Indigenous babies of women who attended in the first trimester (Table 2).

Maternal smoking during pregnancy

Smoking during pregnancy is one of the main contributing factors to a range of poor perinatal outcomes including low birthweight, pre-term birth and perinatal death (AIHW 2020a).

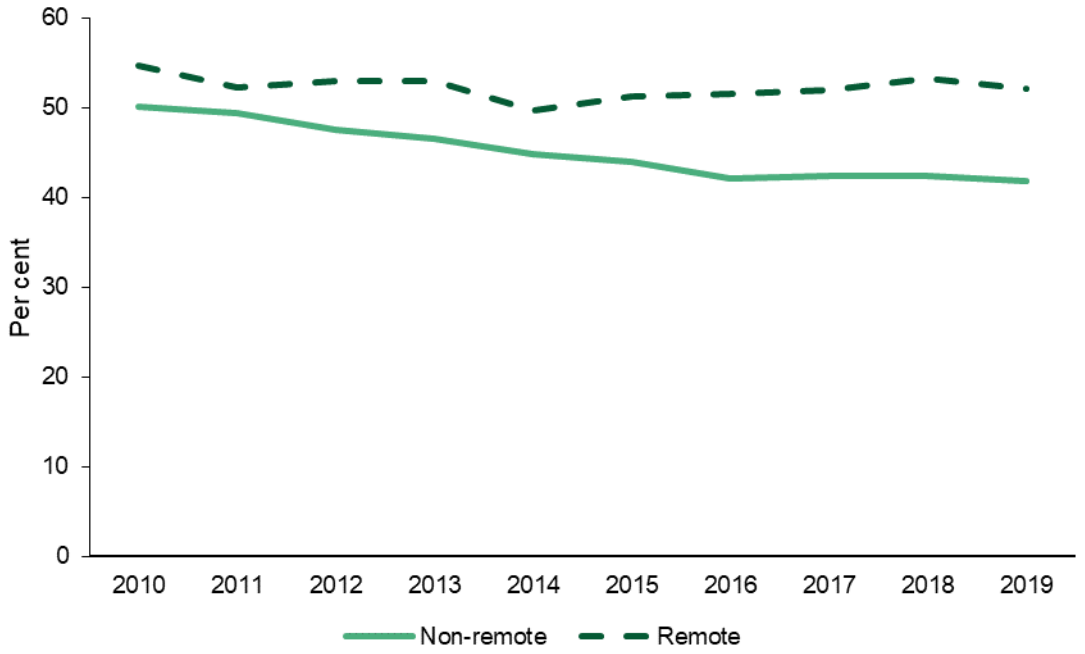
Reducing smoking during pregnancy therefore has the potential to make the greatest contribution to preventing low birthweight births among Indigenous women (Hodyl et al. 2014; Taylor et al. 2013). Even for women who quit smoking during pregnancy, particularly in the first 14 weeks of pregnancy, the risks of having a low birthweight baby are reduced to levels similar to those for non-smokers (Yan & Groothuis 2015).

Smoking during pregnancy is estimated to have a greater impact in relation to SGA births than pre-term births. If smoking during pregnancy was eliminated, 39% of SGA births and 22% of pre-term births of Indigenous babies could be prevented. Overall, an estimated 37% of low birthweight births of Indigenous babies could be prevented if smoking during pregnancy was eliminated (Table 2).

In 2019, the rate of smoking during pregnancy among Indigenous mothers was 44%, a decrease from 51% in 2010. This was due to a decrease in the rate of smoking during pregnancy among Indigenous mothers living in non-remote areas, from 50% in 2010 to 42% in 2019 (Figure 5). Smoking rates among Indigenous mothers decreased in non-remote areas of most states and territories except for Victoria and the Northern Territory over this period (AIHW 2022: Table D2.21.21).

Among Indigenous mothers living in remote areas, the rate of smoking during pregnancy in 2019 was 52% – this rate has not changed significantly over the last decade (Figure 5).

Figure 5: Smoking during pregnancy among Indigenous women, by remoteness, 2010–2019



Source: AIHW 2022: Table D2.21.21 (based on AIHW analysis of the National Perinatal Data Collection).

Among Indigenous women who smoked during the first 20 weeks of their pregnancy, about 1 in 8 (12%, or 661) quit smoking in the second 20 weeks (AIHW 2022: Table D3.01.26).

A review of anti-tobacco programs for Indigenous Australians found that effective anti-tobacco strategies included:

- advice from health professionals on how to quit, when delivered with pharmacotherapy such as nicotine replacement
- training health professionals to provide advice on quitting smoking
- quit smoking support groups
- well-delivered anti-tobacco programs with multiple components such as media campaigns, smoking bans and education of health professionals (Ivers 2011).

That review also observed that 'broader initiatives such as raising standards of living, and improving educational and employment opportunities, are also critical to reducing the harm resulting from tobacco use' (p 2). The review commented that while increased taxation leading to higher prices for cigarettes has reduced tobacco consumption in the general Australian population, among the Indigenous population this may lead to hardship for those who do not reduce their consumption (Ivers 2011). A more recent review argues that:

- to be effective, programs must be culturally appropriate and use holistic approaches to this complex issue
- programs aimed at addressing tobacco use could be strengthened through expanded coverage, long-term funding, and rigorous evaluation
- the tobacco industry needs to be prevented from promoting smoking and opposing tobacco control policies (Colonna et al. 2020).

Underweight mothers

Women being underweight (with a body mass index or BMI of less than 18.5) before pregnancy has been identified as a risk factor for pre-term births, low birthweight, and SGA births (Barreto et al. 2019; Goto 2017; Liu Lei et al. 2019; Liu P et al. 2016; SCRGSP 2020).

For a woman who is 162 cm tall (the average height of Australian women), a BMI of less than 18.5 equates to a weight of 48kg or under.

If being underweight pre-pregnancy was eliminated among the Indigenous population, 8% of low birthweight births could be prevented (Table 2). This is a smaller impact than for smoking throughout pregnancy. This is partly because smoking throughout pregnancy increases the chances of having a low birthweight baby more than being underweight pre-pregnancy does, but mainly because smoking throughout pregnancy is more prevalent (44% in 2019) than being underweight pre-pregnancy (7% in 2019) (AIHW 2022: Tables D2.21.1, D2.21.12).

Of the 41,500 Indigenous women who gave birth in 2017–2019:

- 38% (14,871) had a normal weight (body mass index or BMI from 18.5 to less than 25)
- 31% (12,069) were obese (BMI of 30 or greater)
- 25% (9,698) were overweight (BMI from 25 to less than 30)
- 6.8% (2,664) were underweight pre-pregnancy (BMI less than 18.5) (Table BW5a).

In 2017–2019, the proportion of Indigenous mothers who were underweight pre-pregnancy increased by remoteness, ranging from 5.9% in *Major cities* to 10.1% in *Very remote* areas (Table BW5b).

Body mass index is one measure of nutritional status (Sjöholm et al. 2020). Food insecurity contributes to diet-related, avoidable diseases that are prevalent among Indigenous Australians. A recent Australian government report (conducted during the COVID-19 pandemic) found ‘evidence of high prices in many remote communities’ that appeared to be reflective of ‘the genuine cost of operating supermarkets in remote communities’ but also reinforced long-held concerns about food security in remote areas including:

- higher food and grocery prices in remote areas than in the rest of the country
- the difficult trading environment for remote community stores, and an inability to purchase larger volumes at better wholesale prices
- supply chains for food, especially perishable food, which are costly and often affected by seasonal weather conditions
- mixed success with local food production (HoRSCIA 2020).

Antenatal care

Receiving early, regular, and culturally safe antenatal care is associated with better health outcomes for Indigenous women and their babies. Clinical and non-clinical programs can influence participation in antenatal care services.

A study of women attending a culturally safe Birthing on Country model of antenatal care (Birthing in Our Community) that is developed and delivered in partnership with Indigenous communities found that participating women were more likely to attend 5 or more antenatal visits, less likely to have a baby born pre-term, and more likely to exclusively breastfeed after leaving hospital (Kildea et al. 2021).

Antenatal care in the first trimester (before 14 weeks gestational age) has a positive impact on baby outcomes. After adjusting for a range of factors, analysis has shown 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 admission
- Having no antenatal care was associated with increased odds of pre-term birth and perinatal death (AIHW 2020a).

In 2019, Indigenous women who gave birth and had their first antenatal care visit during the first trimester of pregnancy were less likely to have a baby of low birthweight (8.9%), compared with those who either had their first visit after 20 weeks of pregnancy or did not have any antenatal care during pregnancy (14.3%) (AIHW 2022: Table D3.01.14).

The results of the logistic regression modelling presented in this chapter show that not attending antenatal care until after the first trimester of pregnancy was the third highest ranking modifiable factor contributing to low birthweight among Indigenous babies, after smoking during pregnancy and the mother being underweight.

If all Indigenous mothers attended antenatal care in the first trimester, around 4% of low birthweight births could be prevented (Table 2).

There has been an increase in the proportion of Indigenous women attending at least one antenatal visit during the first trimester of their pregnancy, from 50% (or 5,983 women) in 2012 to 68% (9,594 women) in 2019 (AIHW 2022: Table D3.01.21).

In 2019, Indigenous women who gave birth in non-remote areas were more likely than those in remote areas to attend antenatal care in the first trimester (69% compared with 64%), while there was no difference in the proportion attending 5 or more visits during pregnancy (both 89%) (Table 3).

Table 3: Indigenous women who gave birth in 2019–antenatal care attendance by remoteness

	Attended antenatal care in first trimester[(a)]		Attended 5 or more antenatal visits[(b)]	
Remoteness area	**Number**	**Per cent**	**Number**	**Per cent**
Non-remote areas	7,868	69	9,928	89
Remote areas	1,627	64	2,182	89
Australia	**9,495**	**68**	**12,110**	**89**

(a) Women who gave birth at 20 weeks or more gestation.

(b) Women who gave birth at 32 weeks or more gestation.

Source: AIHW 2022: Tables D3.01.11, D3.01.2 (based on AIHW analysis of the National Perinatal Data Collection).

Maternal health conditions

Various maternal health conditions are associated with having a low birthweight baby. These include pre-existing maternal diabetes and hypertension, and pregnancy complications such as pregnancy-induced hypertension, and antepartum haemorrhage (APH – bleeding from or into the genital tract in the second half of pregnancy).

While very important at an individual level, these conditions are much less prevalent at a population level than smoking, being underweight pre-pregnancy, and not attending antenatal care in the first trimester of pregnancy. As such, they have a relatively small impact on the overall low birthweight rate.

Diabetes diagnosed before pregnancy, or *pre-existing diabetes*, increases babies' risk of being born with abnormalities, being stillborn, and being large for gestational age. Diabetes that develops during pregnancy (gestational diabetes mellitus, or GDM) increases babies' risk of being large for gestational age and increases mothers' risk of developing type 2 diabetes in future (Deputy et al. 2018).

The rate of pre-existing diabetes among Aboriginal women has increased almost 10-fold over a 30-year period, along with large increases in the rate of GDM. Both are strongly associated with increases in the proportion of large-for-gestational-age babies (Hare et al. 2020). Diabetes differs from the other maternal health characteristics discussed, because it is associated with *higher* chances of preterm birth, but *lower* chances that a baby will be small for their gestational age. Therefore, the reason a woman with diabetes has higher chances of having a low birthweight baby is due to the greater likelihood of preterm birth, not SGA birth.

An estimated 1% of low birthweight births among Indigenous babies could be prevented if pre-existing diabetes was eliminated (Table 2).

Chronic hypertension (high blood pressure) is also associated with increased chances that a baby will be born pre-term/SGA and therefore low birthweight (see Panaretto et al. 2006). For an Indigenous baby of a woman with chronic hypertension, the chances of having a low birthweight were 2.6 times those of an Indigenous baby of a woman without the condition. An estimated 1% of low birthweight births among Indigenous babies could be prevented if chronic hypertension was eliminated (Table 2).

Pregnancy-induced hypertension has been associated with an increased risk that a baby will be born small for their gestational age (Kleijer et al. 2005; Schneider et al. 2011). For a baby of an Indigenous woman with pregnancy-induced hypertension, the chances of having a low birthweight were nearly 2 times those of an Indigenous baby of a woman without the condition. An estimated 2% of low birthweight births among Indigenous babies could be prevented if pregnancy-induced hypertension was eliminated (Table 2).

Antepartum haemorrhage APH is associated with an increased risk of pre-term birth (Kildea et al. 2017). Data on APH was not available in the NPDC for New South Wales or Western Australia (where 45% of Indigenous mothers lived in 2019), and so APH was not included in the main logistic regression model. Based on a separate logistic regression model that excluded these two states, it was found that for an Indigenous baby of a woman who experienced APH, the chances of having a low birthweight were 4.6 times those of an Indigenous baby of a woman who did not experience APH (Table BW15), and an estimated 8% of low birthweight births among Indigenous babies could be prevented if APH was eliminated. However, while APH is an important factor to address, it is less prevalent among Indigenous women than smoking during pregnancy and not attending antenatal care in the first trimester of pregnancy. In addition, smoking during pregnancy is a contributory factor to APH (AIHW 2021b) (Table 2).

3. Trends and pathways towards the Closing the Gap birthweight target

The National Agreement on Closing the Gap (the National Agreement) includes a target of increasing the proportion of Aboriginal and Torres Strait Islander babies with a healthy birthweight to 91% by 2031 (see Box 3.1).

This section examines:

- trends in birthweight[2]
- different scenarios for the pathway towards the Closing the Gap healthy birthweight target by examining trends in the low birthweight rate and smoking rates
- regional variation in birthweight and its key contributors.

Box 3.1: Policy context

The National Agreement on Closing the Gap has identified the importance of ensuring Indigenous Australian children are born healthy and strong, with a specific target on birthweight: 'By 2031, increase the proportion of Aboriginal and Torres Strait Islander babies with a healthy birthweight to 91 per cent'. The National Agreement is available at closingthegap.gov.au.

The Australian Government undertakes various activities to support Aboriginal and Torres Strait Islander women and families to improve pregnancy and birth outcomes. In August 2021, the Government announced the Healthy Mums, Healthy Bubs (HMHB) Budget Measure as part of the Commonwealth's Closing the Gap Implementation Plan. This measure provides $45 million over four years (2021-22 to 2024-25) to support Aboriginal and Torres Strait Islander mothers and babies and contribute to achieving the Closing the Gap target. Funding will support activities such as Birthing on Country, create jobs for registered midwives, and increase training for local Aboriginal health workers and other community members to provide culturally safe childbirth support in communities of need.

The package also includes expanding the Australian Nurse-Family Partnership Program (ANFPP) from 13 to 15 sites, to support more women pregnant with an Aboriginal or Torres Strait Islander baby. The ANFPP is a non-clinical program designed to empower first time mothers pregnant with an Aboriginal and Torres Strait Islander baby, offering long term culturally safe care through the stages of pregnancy and motherhood until the baby is two years of age. It operates in 13 sites nationally, including remote and very remote sites in the Northern Territory, servicing areas of highest need based on rates of low birthweight, maternal smoking, and access to services.

An evaluation of the ANFPP in Central Australia, delivered by a large Aboriginal Community Controlled Health Service, found that the program may have reduced child protection system involvement, especially among younger or first-time mothers (Segal et al. 2018). Further evaluation of the ANFPP is currently underway.

[2] To describe trends in birthweight, ordinary least squares linear regression has been used. This means that information from all years of the specified time period is used, rather than only the first and last points in the series.

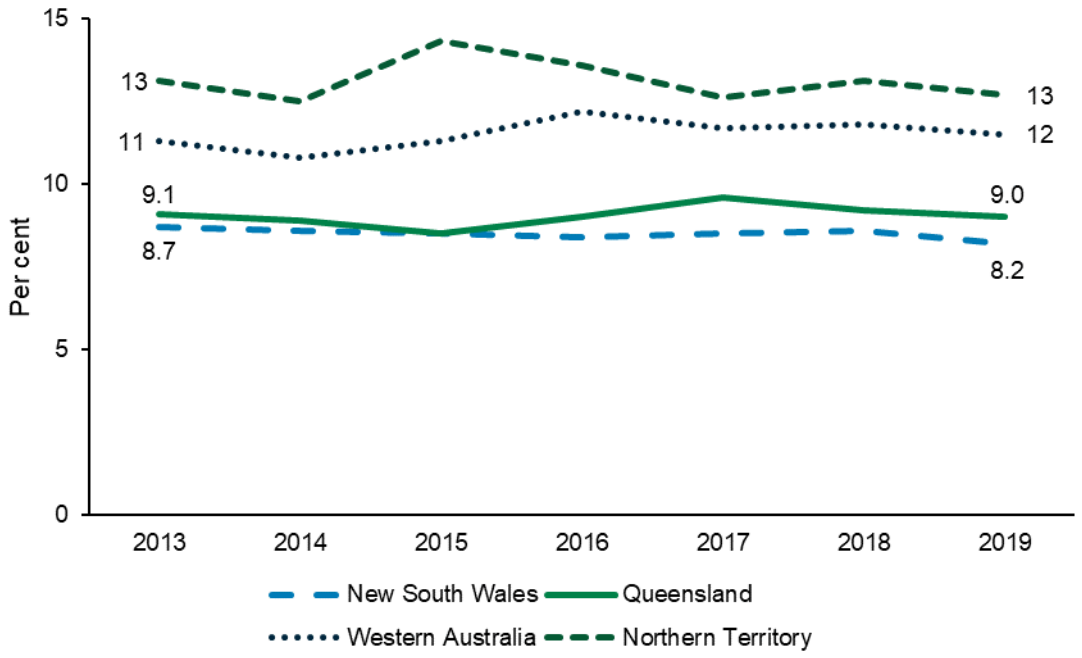
Trends in birthweight

Nearly 9 in 10 Indigenous singleton babies had a healthy birthweight in 2019 (AIHW 2022: Table D1.01.17).

Among Indigenous singleton babies, there was no statistically significant change in the healthy birthweight rate from 2013 (88.7%) to 2019 (89.5%) at the national level (AIHW 2022: Table D1.01.2). Across states and territories (based on mother's place of residence), healthy birthweight rates of Indigenous babies did not change significantly from 2013 to 2019.

Nationally, in 2019 the low birthweight rate for Indigenous babies was 9.2%, with no significant change over the period 2013 to 2019 (AIHW 2022: Table D1.01.2). Among Indigenous babies whose mother's state of residence was New South Wales, the low birthweight rate decreased from 8.7% in 2013 to 8.2% in 2019, the only jurisdiction where there was a statistically significant change over this period (D1.01.20). Figure 6 presents results for the four states and territories with the largest Indigenous populations.

Figure 6: Low birthweight Indigenous singleton babies by selected state or territory of mother's usual residence, 2013–2019



Source: AIHW 2022: Table D1.01.20 (based on AIHW analysis of the National Perinatal Data Collection).

Pathways to the Closing the Gap target

For the purposes of this analysis, it is assumed that the high birthweight rate among Indigenous babies remains relatively constant at around 1%. This means that in order to achieve the Closing the Gap healthy birthweight target rate of 91%, the low birthweight rate would need to be 8% in 2031.

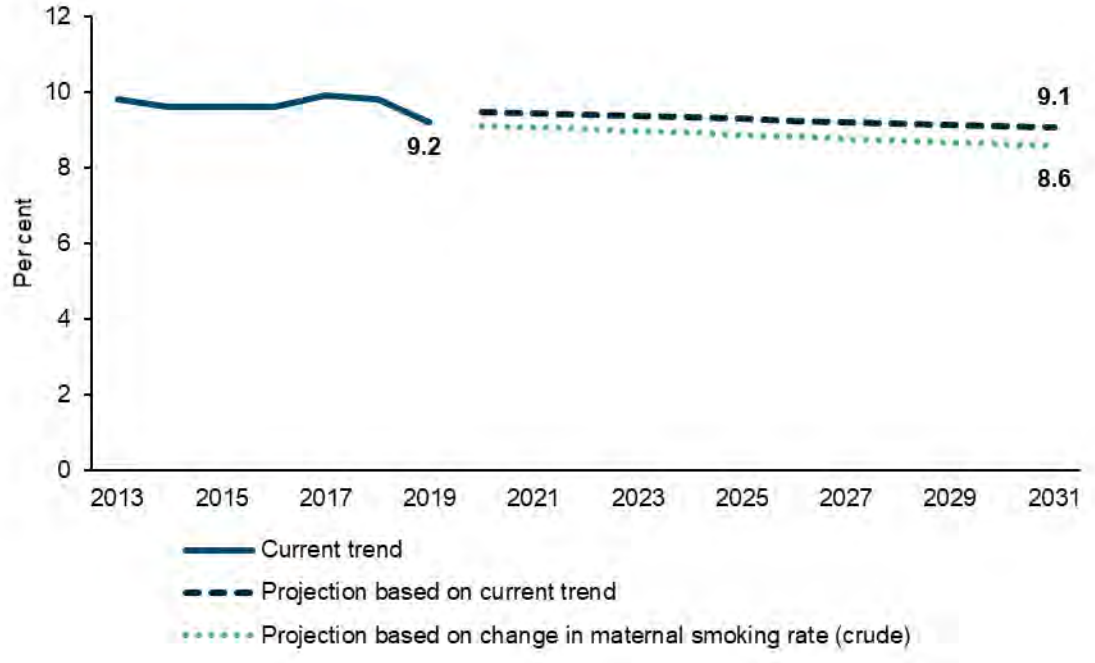
Two sets of estimates of future low birthweight rates to 2031 (projections) were calculated:

- the first set of projections of the low birthweight rate was calculated by using linear forecasting based on the current trend from 2013 to 2019
- the second set of projections of the low birthweight rate was calculated by applying the impact of changing rates of maternal smoking to low birthweight rates. The population-level impact of maternal smoking on low birthweight was quantified using logistic regression modelling.

The low birthweight rate among Indigenous babies is projected to decrease from 9.2% in 2019 to 9.1% by 2031, using linear forecasting based on the current trend from 2013 to 2019. If the low birthweight rate changes in accordance with projected changes in the maternal smoking rate, the low birthweight rate would be expected to decrease to 8.6% by 2031 (Figure 7). This suggests that the current rate of decrease in the low birthweight rate is not fully reflecting changes in the proportion of Indigenous women smoking during pregnancy.

Both sets of projections suggest that the current rate of decrease in the maternal smoking rate is not sufficient to achieve the low birthweight rate of 8% that is required to meet the Closing the Gap healthy birthweight target of 91%.

Figure 7: Low birthweight Indigenous babies, current and projected, Australia, 2013–2031



Note: In this analysis, the low birthweight rate relates to Indigenous babies, while the proportion of women smoking during pregnancy relates to Indigenous mothers. As shown in Table 1, around 1 in 4 Indigenous babies have a non-Indigenous mother, so the population of mothers does not completely align with the population of babies.

Source: AIHW analysis of the National Perinatal Data Collection.

Reduction in smoking to meet Closing the Gap target

Given that smoking during pregnancy was one of the main modifiable factors contributing to low birthweight, an estimate was made of the rate of decrease in the maternal smoking rate required to achieve a low birthweight rate of 8% in 2031.

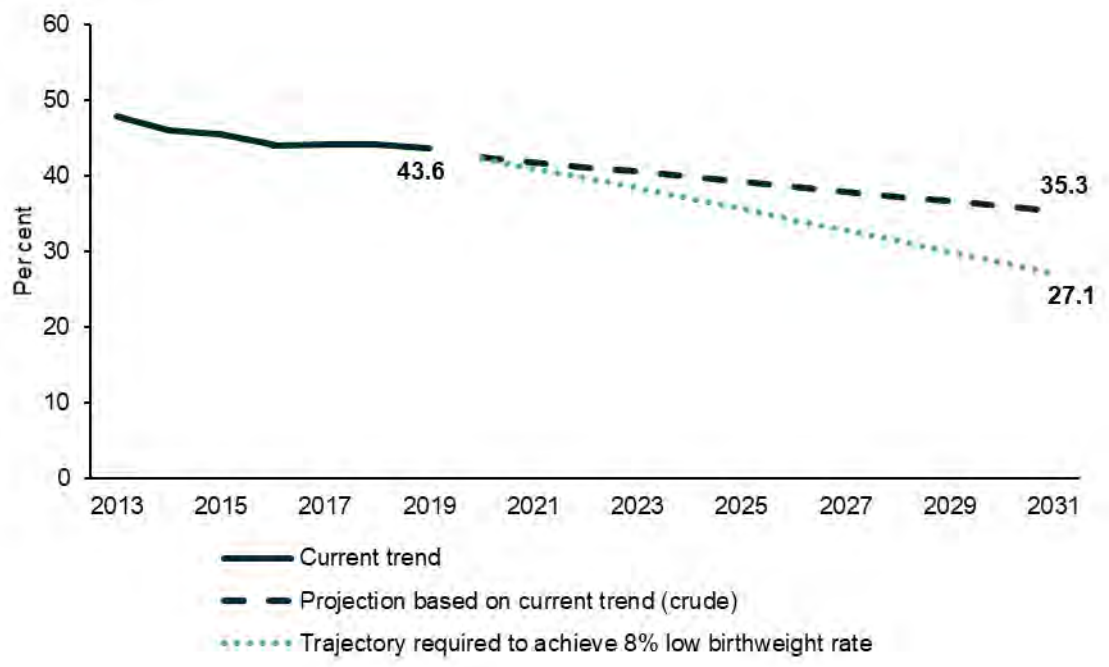
First, the maternal smoking rate to 2031 was projected by using linear forecasting based on the current trend (crude rates) from 2013 to 2019.

Second, the decrease in the smoking rate required to achieve a low birthweight rate of 8% by 2031 was calculated by:

- setting the low birthweight rate in 2031 to 8%
- taking the total change in the birthweight rate required over the forward projection period of 2020–2031 and apportioning it equally over the 12 years
- calculating the smoking rate trajectory that would be required to meet the target low birthweight rate of 8% in that timeframe, using the population-level impact of maternal smoking quantified using logistic regression modelling and factoring in the expected change to this impact over time due to the decreasing prevalence of maternal smoking.

The results of this analysis suggest that to achieve a low birthweight rate of 8% nationally, the maternal smoking rate would need to fall from 44% in 2019 to around 27% by 2031 (Figure 8).

Figure 8: Smoking during pregnancy among Indigenous women, current and projected, Australia, 2013–2031



Source: AIHW analysis of the National Perinatal Data Collection.

Variation by region

National results can mask important differences across jurisdictions and regions. This section presents some information on variation in birthweight and key contributors by jurisdiction and remoteness, and by Indigenous Region.

Variation by state/territory

States and territories have a key role in health service delivery. This may partly explain state and territory variations in low birthweight rates and smoking during pregnancy. Indigenous babies of mothers living in New South Wales were less likely to have a low birthweight (0.9 times that of Queensland[3]), while babies of mothers living in Western Australia were more likely to have a low birthweight (1.3 times higher than in Queensland) (keeping other factors constant) (Table BW15).

Trends in birthweight and smoking differ across states and territories (Figure 9). Trend results are presented for the four states and territories with the largest Indigenous populations. For the remaining states and territories, due to smaller numbers of births the data are more variable, and it is difficult to establish a reliable trend.

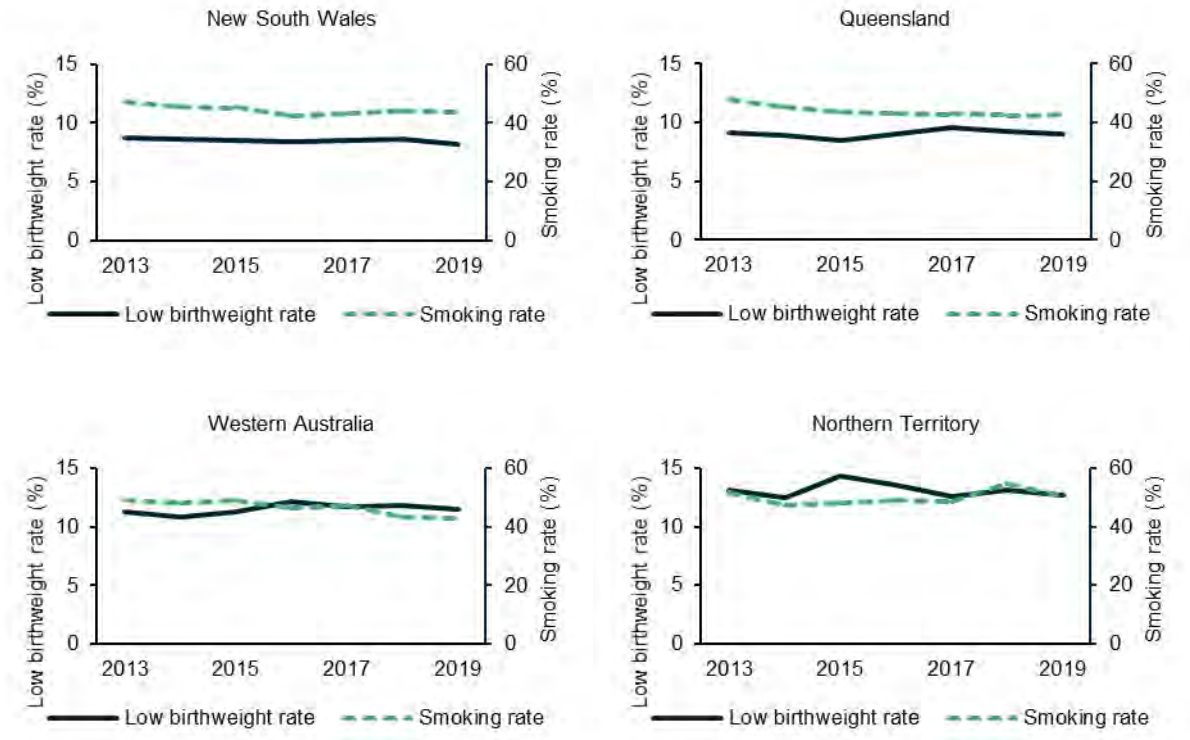
For this analysis, state or territory of Indigenous babies refers to the state or territory of their mother's usual residence. From 2013 to 2019:

- In New South Wales, the proportion of Indigenous women who smoked during pregnancy *decreased* from 47.3% to 43.8%, and the proportion of Indigenous babies with a low birthweight *decreased* from 8.7% to 8.2%
- In Queensland, the proportion of Indigenous women who smoked during pregnancy *decreased* from 47.9% to 42.7%, but the proportion of Indigenous babies with a low birthweight *did not change significantly*, remaining at around 9%
- In Western Australia, the proportion of Indigenous women who smoked during pregnancy *decreased* from 49.0% to 43.0%, but the proportion of Indigenous babies with a low birthweight *did not change significantly*, remaining at over 11%
- In the Northern Territory, the proportion of Indigenous women who smoked during pregnancy *did not change significantly*, remaining at over 50%, and the proportion of Indigenous babies with a low birthweight *did not change significantly*, remaining at around 13%.

To drive a stronger decline in the proportion of Indigenous babies with a low birthweight, reducing smoking during pregnancy among Indigenous women should continue to be a primary focus, particularly in the Northern Territory. However, different factors may come into play in other states – despite the proportion of Indigenous women who smoked during pregnancy decreasing in Queensland and Western Australia, the proportions of Indigenous babies with a low birthweight have not changed in these states (AIHW 2022: Tables D1.01.20, D2.21.21).

[3] Queensland was used as the reference category in the regression models because it is the state or territory with the largest Indigenous population for which the required data was available for all variables included in the models.

Figure 9: Low birthweight Indigenous babies and Indigenous mothers who smoked during pregnancy, by selected state or territory of mother's usual residence



Note: In this analysis, the low birthweight rate relates to Indigenous babies, while the proportion of women smoking during pregnancy relates to Indigenous mothers. As shown in Table 1, around 1 in 4 Indigenous babies have a non-Indigenous mother, so the population of mothers does not completely align with the population of babies.

Source: AIHW 2022: Tables D1.01.20, D2.21.21 (based on AIHW analysis of the National Perinatal Data Collection).

The proportion of Indigenous women who were underweight pre-pregnancy also varies by state and territory, ranging from 3% in Tasmania to 11% in the Northern Territory in 2017–2019 (Table BW5a). Care must be taken when comparing across jurisdictions as source data and collection methods vary across jurisdictions and there were relatively high proportions of cases where BMI information was not available for Indigenous mothers residing in Western Australia, South Australia and the Northern Territory.

Access to maternal health services among Indigenous women of child-bearing age is highest in New South Wales and lowest in the Northern Territory. In 2013–15, in New South Wales, almost all Indigenous women of childbearing age (15–44 years) (99.9%) lived within a 1-hour drive of a hospital with a public birthing unit; a general practitioner (GP); an Indigenous-specific primary health-care service (ISPHCS); and/or a Royal Flying Doctor Service (RFDS). In the Northern Territory, 85% of Indigenous women of child-bearing age lived within a 1-hour drive of at least one of these services (Table 4)).

Poorer access to either GPs, ISPHCs with maternal/antenatal services or hospitals with public birthing units, is associated with higher rates of low birthweight. Poorer access to ISHPHCs with maternal/antenatal services or hospitals with public birthing units is also associated with higher smoking rates. ISPHCs provide antenatal care 'within a broader framework of culturally safe services and protocols', with evidence of higher rates of attendance at antenatal care and improved birth outcomes (AIHW 2017).

Table 4: Percentage of Indigenous women of child-bearing age living within a 1-hour drive from different types of maternal health services, 2011 (population) and 2013–15 (service locations)

	Hospital with a public birthing unit	GP	ISPHCS	RFDS	Any of these services	Number of Indigenous women
New South Wales	90.9	99.9	91.2	19.8	99.9	38,252
Queensland	83.0	97.1	78.4	20.2	98.2	35,687
Western Australia	70.0	94.6	83.4	21.0	96.6	16,187
Northern Territory	36.0	63.4	72.2	16.0	84.7	14,203
Australia[(a)]	**79.5**	**93.7**	**84.7**	**17.4**	**97.0**	**124,101**

(a) Excluding other territories: Christmas Island, Cocos (Keeling) Islands and Jervis Bay.

Source: AIHW 2017.

Not attending antenatal care until after the first trimester of pregnancy is the third highest ranking modifiable factor that contributes to low birthweight among Indigenous babies (after maternal smoking during pregnancy, and the mother being underweight pre-pregnancy) (Table 2).

In 2019, the proportion of women who attended their first antenatal visit in the first trimester of pregnancy (before 14 weeks of pregnancy) was greatest in Tasmania (82%) and smallest in Western Australia (55%) (Table 5).

There was less variation across states and territories in the proportions of women who attended 5 or more antenatal visits, with the largest proportion in Tasmania (97%) and the lowest proportion in Western Australia (83%) (Table 5).

Table 5: Indigenous women who gave birth in 2019–antenatal care by state or territory of usual residence

	Attended antenatal care in first trimester[(a)]		Attended 5 or more antenatal visits[(b)]	
	Number	Per cent	Number	Per cent
New South Wales	3,414	76	3,965	90
Victoria	655	66	853	87
Queensland	2,947	67	3,913	91
Western Australia	985	55	1,455	83
South Australia	462	63	634	88
Tasmania	259	82	302	97
Australian Capital Territory[(c)]	71	59	100	86
Northern Territory	794	68	993	89
Australia	**9,594**	**68**	**12,222**	**89**

(a) Women who gave birth at 20 weeks or more gestation.

(b) Women who gave birth at 32 weeks or more gestation.

(c) Results for the Australian Capital Territory should be interpreted with care, as in the ACT, in many cases, early antenatal care provided by the woman's general practitioner is not reported.

Source: AIHW 2022: Tables D3.01.10, D3.01.1 (based on AIHW analysis of the National Perinatal Data Collection).

Variation by Indigenous Regions

The Australian Bureau of Statistics' Australian Statistical Geography Standard (ASGS) includes a region type called 'Indigenous Regions' (IREGs). There are 37 Indigenous Regions across Australia (see Appendix C), with populations ranging from a few thousand people up to about 85,000 people.

Analysis of low birthweight rates by Indigenous Region shows that Indigenous Regions with lower low birthweight rates tend to be in metropolitan or regional areas of New South Wales or Queensland, with relatively low rates of maternal smoking in the first 20 weeks of pregnancy (less than 40%) (Table 6).

Indigenous Regions with higher rates of low birthweight are more likely to be in remote areas with higher rates of maternal smoking in the first 20 weeks of pregnancy. Most Indigenous Regions with the highest low birthweight rates are in remote areas of Western Australia or the Northern Territory and have higher maternal smoking rates (45% or higher).

Table 6: Indigenous Regions by broad categories of low birthweight rate and maternal smoking in the first 20 weeks of pregnancy, 2016–2018

Indigenous Region	State or territory	Remoteness	Low birthweight rate category	Maternal smoking rate in first 20 weeks category
Dubbo	NSW	Regional	Low birthweight rate less than 9%	2nd lowest (40-44%)
Torres Strait	Qld	Remote		2nd highest (45-49%)
Sydney - Wollongong	NSW	Major cities		Lowest (35-39%)
South-Eastern NSW	NSW	Regional		2nd lowest (40-44%)
Melbourne	Vic	Major cities		Lowest (35-39%)
ACT	ACT	Major cities		Lowest (35-39%)
Toowoomba - Roma	Qld	Regional		2nd highest (45-49%)
Brisbane	Qld	Major cities		Lowest (35-39%)
Riverina - Orange	NSW	Regional		2nd highest (45-49%)
NSW Central and North Coast	NSW	Regional		Lowest (35-39%)
Broome	WA	Remote	Low birthweight rate 9–<10%	2nd lowest (40-44%)
Townsville - Mackay	Qld	Regional		2nd lowest (40-44%)
Darwin	NT	Regional/remote		2nd lowest (40-44%)
North-Eastern NSW	NSW	Regional		2nd highest (45-49%)
Victoria exc. Melbourne	Vic	Regional		2nd highest (45-49%)
Tasmania	Tas	Regional/remote		Lowest (35-39%)
Cairns - Atherton	Qld	Regional		2nd highest (45-49%)
Cape York	Qld	Remote		Highest (50-65+%)
Adelaide	SA	Major cities		2nd highest (45-49%)
Rockhampton	Qld	Regional	Low birthweight rate 10–<12%	2nd highest (45-49%)
Port Lincoln - Ceduna	SA	Remote		Highest (50-65+%)
Geraldton	WA	Regional		2nd highest (45-49%)
Alice Springs	NT	Remote		2nd lowest (40-44%)
Port Augusta	SA	Regional		Highest (50-65+%)
Kununurra	NT	Remote		Highest (50-65+%)
North-Western NSW	NSW	Regional/remote		Highest (50-65+%)
Perth	WA	Major cities		2nd lowest (40-44%)
Apatula	NT	Remote	Low birthweight rate 12% or greater	Lowest (35-39%)
Kalgoorlie	WA	Regional		2nd highest (45-49%)
Tennant Creek	NT	Remote		2nd highest (45-49%)
South Hedland	WA	Remote		2nd lowest (40-44%)
South-Western WA	WA	Regional		Lowest (35-39%)
Mount Isa	Qld	Remote		Highest (50-65+%)
Katherine	NT	Remote		Highest (50-65+%)
Nhulunbuy	NT	Remote		Highest (50-65+%)
West Kimberley	WA	Remote		Highest (50-65+%)
Jabiru - Tiwi	NT	Regional/remote		Highest (50-65+%)

Source: AIHW 2021c.

Areas of further research

The following areas of potential further research were identified during the preparation of this report and through consultation with stakeholders.

Other drivers of low birthweight rates

- Analysis of the relationship between decreasing perinatal mortality rates and low birthweight rates among Indigenous babies, that is, is there increased survival of low birthweight babies (a positive outcome) and how is this affecting low birthweight rates?
- Investigation into regional variation in the relationship between smoking and birthweight trends. For example, investigating the reasons for the reduction in rates of smoking during pregnancy and the improvement in low birthweight rates in New South Wales, to better understand what is driving these improvements in New South Wales and to consider whether any of these factors might support improved outcomes in other areas.

High birthweight

- Analysis of the drivers of high birthweight and its outcomes
- Understanding the relationships between gestational diabetes, gestational age and size for gestational age.

Role and impact of antenatal care

- Identifying where there are gaps in antenatal and maternal and child health care services
- Understanding Indigenous women's experiences with antenatal care, both mainstream and Indigenous-specific, and the barriers they face in engaging with antenatal care services
- Understanding the role and evaluating the effectiveness of antenatal care services (both mainstream and Indigenous-specific) in reducing smoking among Indigenous women and their exposure to second-hand tobacco smoke, and in improving nutrition.

Early term births

- Investigation into the factors associated with early term births, for example analysis of rates of medical interventions such as induced births and caesarean sections.

Wider social environment

- More investigation into the factors associated with maternal underweight and inadequate nutrition, for example food insecurity and socioeconomic disadvantage
- Understanding the impacts of the wider social environment on maternal health and pregnancy outcomes – for example, location, characteristics of the family and community, access to maternal health and child services, and clinical and non-clinical support
- Investigating the role of men/fathers in maternal health and the association with antenatal care, better pregnancy and birth outcomes, reduction in maternal smoking, drinking and better nutrition.

Appendix A: 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 Victoria and 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).

Indigenous status of the mother has been a mandatory data item for the Perinatal National Minimum Data Set (NMDS) since its inception in 1997. All jurisdictions have collected information on Indigenous status of the mother in accordance with the NMDS since 2005. Indigenous status of the baby was also added to the NMDS for collection for the first time in the 2012–13 reference year (from 1 July 2012).

This item, when used in conjunction with the mother's Indigenous status, is a better baseline measure of health for all Indigenous children. However, the outcomes of babies of Indigenous mothers remain a key data resource for assessing antenatal care in pregnancy and other interventions before or during pregnancy, aimed at improving the health of mothers and babies.

Nearly 3 in 4 Indigenous babies born in 2019 had an Indigenous mother, while the remaining 1 in 4 had a non-Indigenous mother (Table 1).

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/716326 (for 2017)
- https://meteor.aihw.gov.au/content/index.phtml/itemId/727886 (for 2018)
- https://meteor.aihw.gov.au/content/index.phtml/itemId/745304 (for 2019).

Appendix B: Logistic regression modelling

Logistic regression modelling is a statistical technique that can be used to identify characteristics that are significant in explaining an outcome of interest. These characteristics are typically a *category* (for example 25–34) in a *variable* (for example age). Variables that are included in a regression model to explain an outcome are called *explanatory variables*. By examining the relationships between multiple explanatory variables simultaneously and the outcome, regression modelling can assess the significance of each explanatory variable, while accounting for the effects of the other explanatory variables included in the model. This process can be likened to detecting a real signal from background noise.

Chances of an outcome occurring for an individual with a certain characteristic

The modelling process produces results called *odds ratios.* Essentially, an odds ratio represents the chances that the outcome would occur for an individual with a particular characteristic, that is, in a *comparison group*, compared with the chances that the outcome would occur for an individual without the characteristic in a nominated *reference group*.

Using *low birthweight* as an example of the *outcome* of interest, and *whether smoked during pregnancy* (yes/no) as an example of an *explanatory variable*, the odds ratio would show the chances of a baby having a low birthweight if the mother smoked during pregnancy (relative to the mother not smoking during pregnancy). The *adjusted odds ratio* is the odds ratio that is obtained after accounting for other explanatory variables included in the model.

An odds ratio of 1 means that the chances of the outcome occuring are the same for the *comparison group* and the *reference group*.

Population impact of a characteristic–Population Attributable Fraction (PAF)

The odds ratio represents the association between a characteristic and an outcome at an *individual level.* The impact of the same characteristic at a *population level*, referred to as the *population attributable fraction* (PAF), can also be estimated. This is done by using the odds ratio for the characteristic of interest along with information about how commonly the characteristic occurs in the population (the prevalence of the characteristic). In short, “when considering the health of populations, the PAF is important because it takes into account both the level of individual risk and the prevalence of the risk factor in the population” (Taylor et al. 2013).

Continuing with the previous example, the fraction or proportion of low birthweight babies attributable to smoking during pregnancy would be calculated using the odds ratio for ‘smoked during pregnancy’, and the proportion of women in the population who smoked during pregnancy.

Regression model details and results

For this report, logistic regression analyses were carried out for each of the following outcome variables:

- *low birthweight* in Indigenous babies – see Table BW15.
- *pre-term birth* in Indigenous babies – see Table BW16.
- *SGA birth* in Indigenous babies – see Table BW17.

For each outcome variable, two models were run:

- first, a model using data for 7 states and territories combined – all except Victoria. Victoria was excluded because data on diabetes and hypertension were not available for the full three-year period required. Most of the results presented in this report are from this model.
- second, a model using data for 5 jurisdictions combined, excluding New South Wales, Western Australia and Victoria. The purpose of including this second model was to enable APH to be included as an explanatory variable. Data on APH is not available for New South Wales and Western Australia.

All models are based on NPDC data for babies born in 2017–2019. Refer to the supplementary data tables for the results of all models, and to the footnotes of those tables for further details about the analysis.

Appendix C: Indigenous Regions

The Indigenous Structure of the Australian Statistical Geography Standard (ABS 2016) provides a geographical standard for the publication and analysis of statistics about the Indigenous population of Australia. It includes three levels of geographic units (from smallest to largest): Indigenous Locations, Indigenous Areas and Indigenous Regions.

There are 37 Indigenous Regions across Australia (Figure C1).

Figure C1: Map of Indigenous regions

Note: Based on Australian Statistical Geography Standard (ASGS) 2016. Offshore, migratory/shipping and no usual address IREGs not included.

Source: AIHW 2020a.

Acknowledgments

We acknowledge the traditional owners of country throughout Australia, and their continuing connection to land, sea and community. We pay our respects to them and their cultures, and to Elders both past and present.

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Abbreviations

ABS	Australian Bureau of Statistics
AIHW	Australian Institute of Health and Welfare
APH	Antepartum haemorrhage
BMI	Body Mass Index
HPF	Health Performance Framework
ISPHCS	Indigenous-specific primary health-care service
NPDC	National Perinatal Data Collection
RFDS	Royal Flying Doctor Service
WHO	World Health Organization

Symbols

—	nil or rounded to zero

Related publications

This feature article is the first in a series being produced for the Aboriginal and Torres Strait Islander Health Performance Framework (HPF) website, available from https://www.indigenoushpf.gov.au/.

Information about birthweight, health behaviours during pregnancy and antenatal care is updated regularly on the Aboriginal and Torres Strait Islander HPF website at the following links:

- Measure 1.01 Birthweight https://www.indigenoushpf.gov.au/Measures/1-01-birthweight
- Measure 2.21 Health behaviours during pregnancy https://www.indigenoushpf.gov.au/measures/2-21-health-behaviours-during-pregnancy
- Measure 3.01 Antenatal care https://www.indigenoushpf.gov.au/measures/3-01-antenatal-care

Other AIHW publications relating to Aboriginal and Torres Strait Islander pregnancy and birth outcomes and antenatal/maternal health services include:

- AIHW 2017. Spatial Variation in Aboriginal and Torres Strait Islander Women's Access to 4 Types of Maternal Health Services. Canberra: AIHW.
- AIHW 2020. Antenatal care use and outcomes for Aboriginal and Torres Strait Islander mothers and their babies 2016–2017. Canberra: AIHW.
- AIHW 2021. Pregnancy and birth outcomes for Aboriginal and Torres Strait Islander women: 2016–2018. Canberra: AIHW.

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Stronger evidence,
better decisions,
improved health and welfare