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Diabetes in pregnancy

2014–2015

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Summary

Diabetes in pregnancy can be pre-existing (that is, type 1 or type 2 diabetes), or might arise as a result of the pregnancy (gestational diabetes). It is known to adversely affect mothers and their babies during pregnancy, labour and delivery. The type and severity of complications experienced by mothers and their babies differs by maternal diabetes type.

Diabetes affects nearly 1 in 10 pregnancies

In the 2-year period from 2014–2015, more than 45,000 mothers who gave birth in Australia (excluding Victoria) had diabetes, representing about 9.9% of all births recorded in the National Perinatal Data Collection (NPDC). Of all births recorded, about 40,500 (8.9%) had gestational diabetes, and 4,700 (1.0%) had pre-existing diabetes (Supplementary Table 1.1).

Mothers with pre-existing diabetes were at highest risk of adverse effects

Compared with mothers with no diabetes in pregnancy, mothers with pre-existing diabetes and gestational diabetes had higher rates of caesarean section, induced labour, pre-existing and gestational hypertension, and pre-eclampsia. They also had longer antenatal and postnatal stay in hospital (5 or more days).

Mothers with gestational diabetes experienced complications at a lower rate than mothers with pre-existing diabetes.

Babies of mothers with pre-existing diabetes were at highest risk of adverse effects

Compared with babies of mothers with gestational diabetes or no diabetes, babies of mothers with pre-existing diabetes had higher rates of pre-term birth, stillbirth, low and high birthweight, low Apgar score, resuscitation, and special care nursery/neonatal intensive care unit admission, and stayed longer in hospital.

Babies of mothers with gestational diabetes had higher rates of complications than babies of mothers with no diabetes, but showed similar levels of risk as babies of mothers with no diabetes for high birthweight and low Apgar score.

Having diabetes in pregnancy increased the risk of complications among some population groups

Among Aboriginal and Torres Strait Islander mothers, the incidence of some complications occurred at a greater rate among mothers with pre-existing diabetes than among mothers with no diabetes. Babies of Indigenous mothers with pre-existing and gestational diabetes also experienced greater rates of complications than babies of Indigenous mothers with no diabetes.

In *Remote/Very remote* areas, mothers with pre-existing and gestational diabetes and their babies experienced greater rates of some complications than mothers with no diabetes and their babies.

Contents

Introduction

A woman who has diabetes during pregnancy faces an increased risk of serious complications throughout pregnancy and during the birth of her child (HSCRG 2009; Owens et al. 2015; Sacks et al. 2015).

Diabetes can also increase the risk of perinatal morbidity and mortality. Adverse effects can be short term—affecting pregnancy-related outcomes during and after pregnancy—or long term, increasing the future risk of other chronic diseases, such as type 2 diabetes, for both mothers with gestational diabetes during pregnancy and their babies.

Two kinds of diabetes can affect pregnancy—pre-existing diabetes (type 1, type 2 or other forms), or gestational diabetes, which can arise because of the pregnancy. The type and severity of complications differ by diabetes type.

This report focuses on the short-term impact of pre-existing diabetes (type 1 or type 2) and gestational diabetes on mothers in pregnancy and their babies around the time of birth.

It also presents summary information for Aboriginal and Torres Strait Islander mothers and babies—Indigenous mothers are more likely to have type 2 diabetes, and are at a greater risk of gestational diabetes than non-Indigenous mothers (AIHW 2015; AIHW: Holdenson et al. 2003; Nankervis & Conn 2013; Shai et al. 2006).

Indigenous mothers with diabetes and their babies are also more likely to experience adverse effects of pregnancy, labour, and delivery than their non-Indigenous counterparts (AIHW 2010).

The report also looks at the effects of diabetes in pregnancy by socioeconomic areas and remoteness areas, both of which are associated with increased risk of poorer maternal and perinatal outcomes (AIHW 2018).

Analyses are based on 2 years of combined data—from 1 January 2014 to 31 December 2015—from the Australian Institute of Health and Welfare (AIHW) National Perinatal Data Collection (NPDC). Data presented in the report exclude Victoria, as data for diabetes status and type of diabetes are not collected in a format that is comparable with the specifications for the NPDC.

Proportions presented for all outcomes in this report have been adjusted for age. Full results are available in the supplementary tables at: <https://www.aihw.gov.au/reports/diabetes/diabetes-in-pregnancy-2014-2015/data>.

There are some limitations to the current information on maternal diabetes that is available from the NPDC, including the lack of data for Victoria, the inability of some states and territories to distinguish between type of diabetes, and differences in data collection methods across jurisdictions. So, results should be interpreted with caution.

The potential of using other data sources or data linkages for future reporting can be found in an accompanying report at: <https://www.aihw.gov.au/reports/diabetes/improving-national-reporting-diabetes-pregnancy/contents/summary>.

What is diabetes in pregnancy?

Diabetes in pregnancy, whether pre-existing or gestational, increases the risk of serious complications in both mother and child (WHO 2014). The complications and adverse outcomes differ by type of diabetes, likely due to the different causes and effects of each type.

Box 1: Type of diabetes in pregnancy

Pre-existing

Type 1 diabetes is an autoimmune disease, which destroys the cells in the pancreas. The pancreas produces insulin, and people need insulin replacement to survive. It is usually diagnosed in childhood or early adulthood.

Type 2 diabetes is the most common form of diabetes at the population level. People with Type 2 diabetes produce insulin, but do not produce enough, and/or cannot use it effectively. It involves a genetic component, but is largely preventable, and associated with a later onset.

Modifiable risk factors for type 2 diabetes include physical inactivity, poor diet, being overweight or obese, and tobacco smoking. Type 2 diabetes can be managed with changes to diet and exercise, oral glucose-lowering drugs, non-insulin injectable glucose-lowering medications, insulin injections, or a combination of these methods.

Mothers with type 1 and type 2 diabetes are advised to strictly control blood glucose levels before and during pregnancy, and to be screened for diabetes complications before conception (McElduff et al. 2005).

Mothers with type 2 diabetes are also advised to introduce insulin therapy before and during pregnancy, and to stop or review the use of oral glucose-lowering agents, non-insulin injectable, antihypertensive medications, and statins before pregnancy or when pregnancy has been confirmed (McElduff et al. 2005; RACGP 2016).

Children of mothers with pre-existing diabetes have an increased risk of developing type 2 diabetes.

Gestational

Gestational diabetes is characterised by glucose intolerance of varying severity, which develops or is first recognised during pregnancy, mostly in the second or third trimester (Nankervis et al. 2013).

It usually disappears after the baby is born, but can recur in later pregnancies. Some cases are managed with changes to diet and exercise, and some might need treatment with medication. Mothers with gestational diabetes and their children have an increased risk of developing type 2 diabetes later in life.

(continued)

Box 1 (continued): Type of diabetes in pregnancy

What are the risks for developing gestational diabetes?

Various factors can increase a woman's chance of developing gestational diabetes, including:

- previous gestational diabetes
- previous elevated blood glucose level
- ethnicity—South and South-East Asian, Aboriginal or Torres Strait Islander, Pacific Islander, Maori, Middle Eastern, or non-Caucasian African women are at greater risk than other women
- age—women aged over 40 are at greater risk than younger women
- family history of diabetes
- pre-pregnancy obesity (body mass index of more than 30 kg/m^2)
- previously having a high birthweight baby (greater than 4,500 grams)
- polycystic ovary syndrome
- medications the mother is taking, including corticosteroids or antipsychotics (Nankervis et al. 2014; Nankervis et al. 2018).

Why is monitoring diabetes in pregnancy important?

The *Australian National Diabetes Strategy 2016–2020* aims to reduce the impact of pre-existing diabetes and gestational diabetes in pregnancy. Regular reporting is essential to:

- understand and reduce the impact of pregnancy-related diabetes complications
- identify groups at higher risk, to tailor prevention and treatment strategies
- allocate public health resources, including planning and providing services for those most affected
- monitor the impact of prevention and management programs over time.

Profile of mothers with diabetes

In the 2-year period from 2014 to 2015, the NPDC recorded information on about 455,000 mothers who gave birth in Australia (excluding Victoria). Of these:

- 410,000 (90.1%) did not have diabetes
- 40,500 (8.9%) had gestational diabetes
- 4,700 (1.0%) had pre-existing diabetes (Supplementary Table 1.1).

These data exclude Victoria, as data for diabetes status are not currently available according to the specifications for the NPDC.

Broadly, compared with mothers with no diabetes, mothers with pre-existing diabetes are more likely to:

- be older
- identify as Indigenous
- live in *Remote/Very remote* areas
- live in areas of socioeconomic disadvantage (Figure 1; Supplementary Tables 1.2–1.5).

Mothers with gestational diabetes were also generally older, but showed similarities to mothers with no diabetes in other demographic characteristics, such as remoteness and socioeconomic disadvantage.

Factors related to the antenatal period, such as maternal health behaviours and receiving antenatal care, play a large role in the wellbeing of mothers and babies (AIHW 2012).

Tobacco smoking during pregnancy is associated with poorer perinatal outcomes, including low birthweight, being small for gestational age, pre-term birth, and perinatal death (AIHW 2018). Mothers with pre-existing diabetes (15.5%) were slightly more likely to smoke than those with gestational diabetes (12.8%) or with no diabetes during pregnancy (12.7%) (Figure 1; Supplementary Table 1.6).

Box 2: Recommended number of antenatal visits

Mothers are recommended to have their first antenatal care visit within the first 10 weeks of pregnancy. First-time mothers with an uncomplicated pregnancy are recommended to attend 10 visits, with 7 visits for subsequent uncomplicated pregnancies (Department of Health 2018).

Mothers with pre-existing diabetes are recommended to have at least 12 antenatal care visits during pregnancy, with regular antenatal care every 1–4 weeks during the first 30 weeks, and every 1–2 weeks until delivery for obstetric care.

This is for diabetes related management including monitoring of blood glucose levels and periodic diabetes complications assessment, as well as obstetric management with monitoring of blood pressure and baby's growth and wellbeing, including obstetric scanning. Mothers are also recommended to have an eye review every 3 months if they have an early form of diabetic retinopathy, have unstable glucose control, or if there has been a long duration of pre-existing diabetes (McElduff et al. 2005).

Antenatal care visits in the NPDC refers to all pregnancy-related appointments with medical doctors, where documentation related to the visit has been entered on the health record of pregnancy and/or birth.

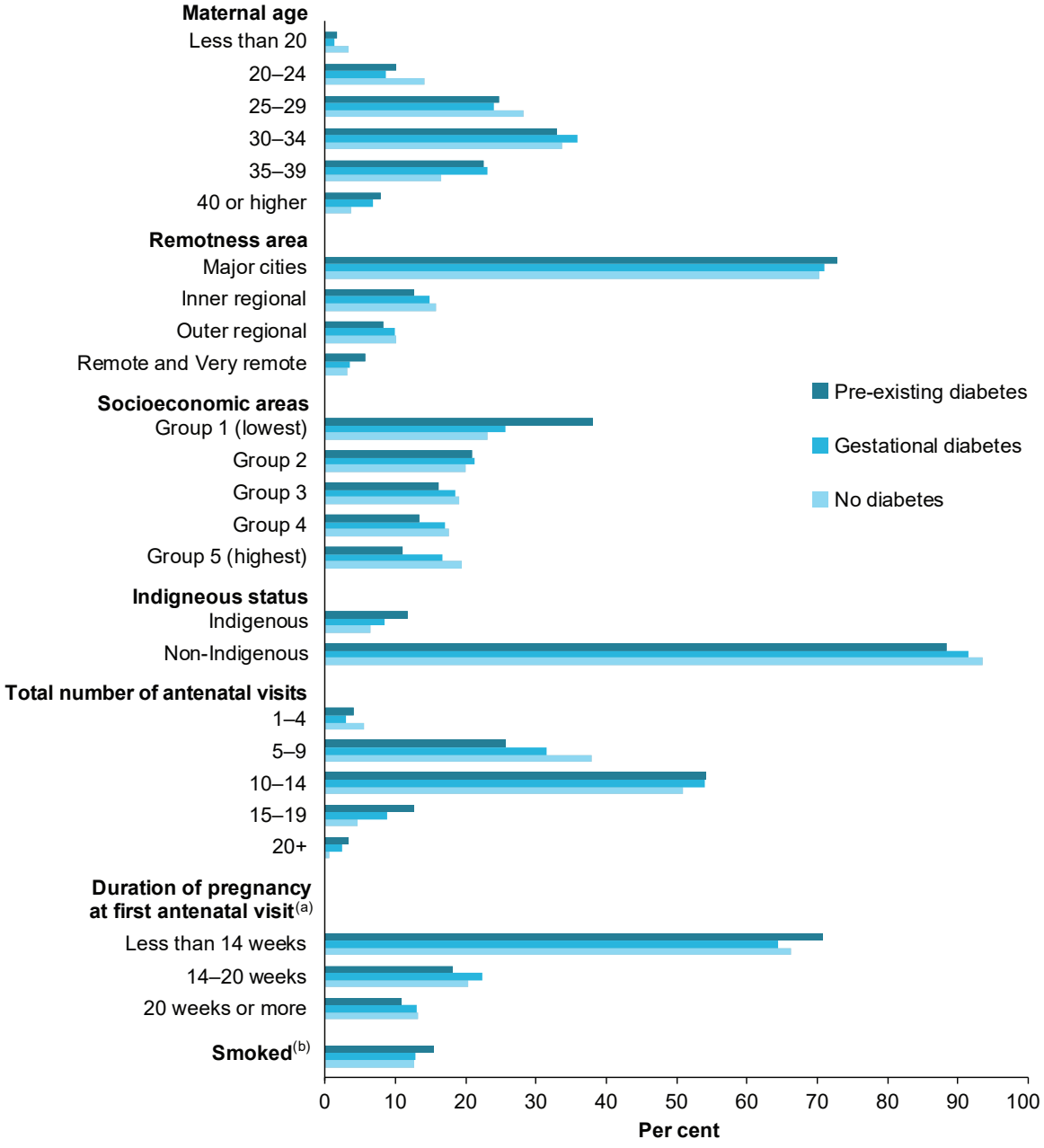
Antenatal care in the first trimester (before 14 weeks' gestational age) is associated with better maternal health in pregnancy, fewer interventions in late pregnancy, and positive child health outcomes (AHMAC 2012; WHO 2015).

Rates of antenatal visits in the first trimester were higher among mothers with pre-existing diabetes (70.8%) than mothers with gestational diabetes (64.5%) and with no diabetes (66.3%) (Figure 1; Supplementary Table 1.9).

Compared with mothers with no diabetes (4.6%), mothers with pre-existing diabetes (12.6%) were nearly 3 times as likely to have 15–19 antenatal visits, while mothers with gestational diabetes (8.9%) were nearly twice as likely.

Mothers with pre-existing diabetes (3.4%) were also 5 times as likely as mothers with no diabetes to have more than 20 antenatal visits (0.6%), while mothers with gestational diabetes (2.5%) were 4 times as likely (Figure 1; Supplementary Table 1.10).

Figure 1: Distribution of maternal characteristics among mothers who gave birth, by diabetes in pregnancy status, 2014–2015



(a) Proportions for duration of pregnancy at first antenatal visit were calculated after excluding records with not stated values.
(b) Mother's tobacco smoking status during pregnancy is self-reported. Proportions for smoking status were calculated after excluding records with not stated values.

Notes

1. Data for all variables, except for maternal age, are directly age-standardised to the Australian female population aged 15–44 as at 30 June 2001.
2. Data presented exclude mothers who gave birth in Victoria.
3. Proportions for remoteness area and socioeconomic areas exclude mothers not usually resident in Australia, and those whose state or territory of usual residence was not stated.
4. Socioeconomic areas are based on the Australian Bureau of Statistics' 2011 Socio-Economic Index for Areas Index of Relative Disadvantage.
5. Remoteness area is based on the Australian Statistical Geography Standard Remoteness Structure, which groups geographic areas into 6 classes of remoteness area based on their relative access to services, using the Accessibility/ Remoteness Index of Australia.

Sources: NPDC; supplementary tables 1.1–1.10.

Outcomes for mothers

Overall, compared with mothers with no diabetes in pregnancy, those with pre-existing diabetes and gestational diabetes were more likely to have induced labour, pre-existing hypertension, and pre-eclampsia, and to stay longer in hospital.

Mothers with pre-existing diabetes were more likely to have gestational hypertension and caesarean sections than those with gestational diabetes or no diabetes. The rate of complications for mothers with pre-existing diabetes and gestational diabetes differed between population groups.

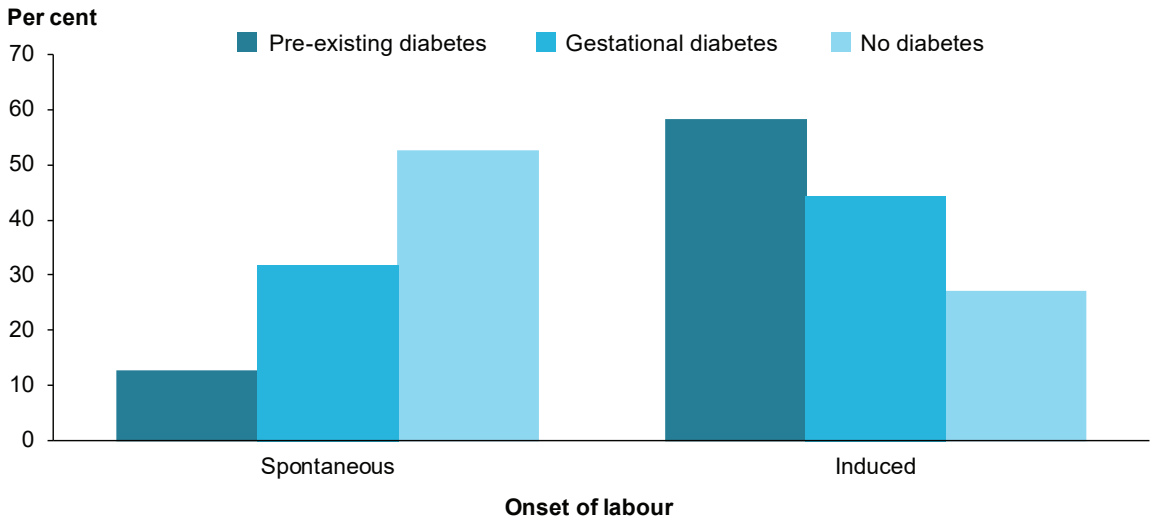
Labour

Labour can occur spontaneously, or it might be induced through medical or surgical intervention (AIHW 2017). If there is no labour, then a caesarean section is performed. Labour may be induced in pregnancies complicated by diabetes to prevent the development or progression of pregnancy-related complications, such as pre-eclampsia or unstable blood glucose levels in the mother, or complications to baby growth and risk of stillbirth (Berger & Melamed 2014).

Spontaneous labour was less common among mothers with pre-existing diabetes (12.7%) and gestational diabetes (31.8%) than those with no diabetes (52.6%).

Compared with mothers with no diabetes (27.2%), induced labour was about twice as high for mothers with pre-existing diabetes (58.3%), and 1.6 times as high for mothers with gestational diabetes (44.4%) (Figure 2; Supplementary Table 2.1).

Figure 2: Onset of labour among mothers who gave birth, by diabetes in pregnancy status, 2014–2015



Notes
1. Data are directly age-standardised to the Australian female population aged 15–44 as at 30 June 2001.
2. Data presented exclude mothers who gave birth in Victoria.
3. Induced labour might include cases where induction of labour was attempted, but labour did not result.

Sources: NPDC; Supplementary Table 2.1.

Hypertension

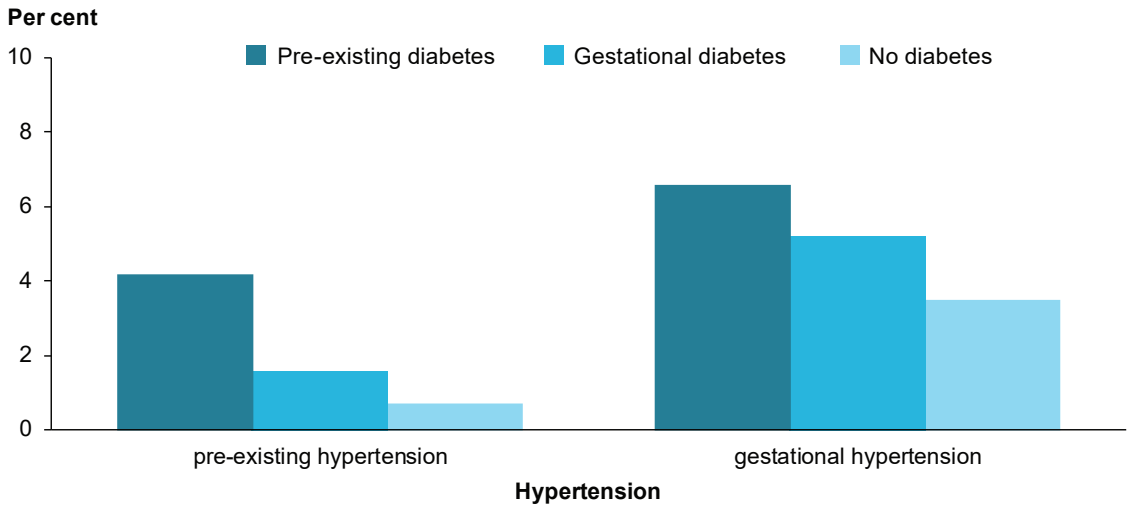
Hypertension (high blood pressure) in pregnancy can cause various harms for mothers and babies, including pre-eclampsia (Bramham et al. 2014; Hassan et al. 2015; Saadat et al. 2007). Hypertension that complicates pregnancy can either be pre-existing or gestational (new onset of hypertension diagnosed after 20 weeks of gestation).

Mothers with pre-existing diabetes (4.2%) were 5.6 times as likely as mothers with no diabetes (0.7%) to have pre-existing hypertension. Women with gestational diabetes (1.6%) were about twice as likely as those with no diabetes (0.7%) to have pre-existing hypertension.

The differences between the groups were smaller for gestational hypertension, which affected:

- 6.6% of women with pre-existing diabetes
- 5.2% of those with gestational diabetes
- 3.5% of those with no diabetes during pregnancy (Figure 3; Supplementary Table 2.5).

Figure 3: Hypertension among mothers who gave birth, by diabetes in pregnancy status, 2014–2015



Notes

1. Data are directly age-standardised to the Australian female population aged 15–44 as at 30 June 2001.
2. Data presented exclude mothers who gave birth in Victoria.
3. Due to differences in the definitions and methods for collecting data on hypertension between jurisdictions, care should be taken when interpreting these data.

Sources: NPDC; Supplementary Table 2.5.

Pre-eclampsia

Pre-eclampsia is a serious pregnancy complication related to high blood pressure. It is associated with adverse maternal complications, morbidity, and caesarean deliveries, as well as adverse perinatal outcomes, such as pre-term birth, low birthweight, and hospitalisation in intensive care units (Abalos et al. 2014; Lisonkova et al. 2014).

Mothers with pre-existing diabetes (5.0%) were more than 1.6 times as likely as mothers with gestational diabetes (3.0%) to have pre-eclampsia, and about 2.6 times as likely as those with no diabetes (1.9%) (Supplementary Table 2.9).

Length of hospital stay

A woman might be admitted to hospital before birth (antenatal stay) earlier than usual due to signs of pre-term labour, or for the treatment of conditions or complications affecting her or her baby.

She might stay longer than average in hospital after giving birth (postnatal stay), for example, after a caesarean section, or for treatment for labour and/or delivery complications.

The length of antenatal hospital stay is calculated from the mother's date of admission to the baby's date of birth, and does not include information on any previous antenatal hospitalisations in the same pregnancy. Postnatal hospital stay is calculated from the baby's date of birth to the mother's date of discharge from the hospital.

Mothers with pre-existing diabetes were more likely to require extended hospital care. They were 4.2 times as likely as mothers with no diabetes to have an antenatal stay of 2–4 days (19.8% and 4.7%, respectively), and 5.4 times as likely to have an antenatal stay of 5 or more days (5.6% and 1.1%, respectively).

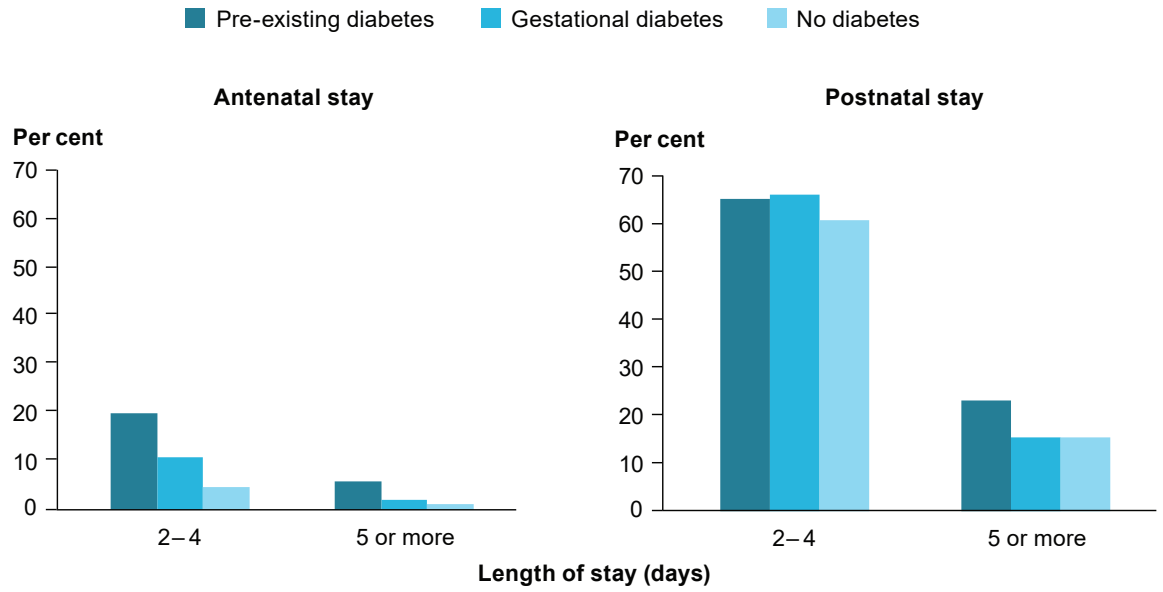
Rates of extended antenatal stay were also higher among mothers with gestational diabetes. They were about twice as likely as those with no diabetes to stay 2–4 days (10.7% and 4.7%, respectively), or 5 or more days (2.0% and 1.1%, respectively).

The remaining mothers were admitted on the day of, or the day before, the birth of the baby (Supplementary Table 2.13).

Postnatal stays of 5 or more days were also 1.5 times as high among mothers with pre-existing diabetes (23.1%) as among mothers with no diabetes (15.2%). Rates of extended postnatal stay were similar for mothers with gestational diabetes (15.4%) and those with no diabetes (Figure 4; Supplementary Table 2.17).

Data presented for antenatal and postnatal length of hospital stay only include mothers who gave birth in hospital as admitted patients. Data presented in the report exclude Victoria, where data for diabetes status are not collected in a format that is comparable with the specifications for the NPDC, and Western Australia, who did not provide data. Postnatal length of stay in hospital data only include women who were discharged home.

Figure 4: Length of hospital stay among mothers who gave birth, by diabetes in pregnancy status, 2014–2015



Notes

1. Data are directly age-standardised to the Australian female population aged 15–44 as at 30 June 2001.
2. Data presented exclude mothers who gave birth in Western Australia and Victoria.
3. Data for antenatal hospital stay are for women who gave birth in hospitals only, and exclude women who gave birth in birth centres attached to hospitals.
4. Data for postnatal stay only include women who were discharged home and who gave birth in hospital, and exclude women who gave birth in birth centres attached to hospitals.

Sources: NPDC; supplementary tables 2.13 and 2.17.

Outcomes for babies

Babies of mothers with pre-existing diabetes are at higher risk of adverse complications, and need more care than babies of mothers with gestational diabetes or no diabetes in pregnancy. This includes pre-term birth, high birthweight, longer stay in hospital, low Apgar score, admission to special care nurseries and neonatal intensive care units, and resuscitation.

Babies of mothers with gestational diabetes showed a similar level of risk as babies of mothers with no diabetes for several risk factors. Risks for babies of mothers with pre-existing and gestational diabetes differed between population groups.

For more information, see the supplementary tables at <https://www.aihw.gov.au/reports/diabetes/diabetes-in-pregnancy-2014-2015/data>.

Gestational age

Babies born pre-term (less than 37 completed weeks of gestation) have a higher risk of developmental delays, chronic health issues, and death (Glass et al. 2015). Babies of mothers with pre-existing diabetes (22.4%) were about twice as likely as babies of mothers with gestational diabetes (10.9%), and babies of mothers with no diabetes (8.6%) to be born pre-term (Supplementary Table 3.1).

Caesarean section

A caesarean section may be performed where there is a risk of adverse outcomes for the mother and/or baby from labour and vaginal delivery, or when there is no labour.

The proportion of births with a caesarean section was highest among babies born to mothers with pre-existing diabetes (49.1%), followed by babies born to mothers with gestational diabetes (40.4%), and babies born to mothers with no diabetes (33.0%) (Supplementary Table 3.5).

Birthweight

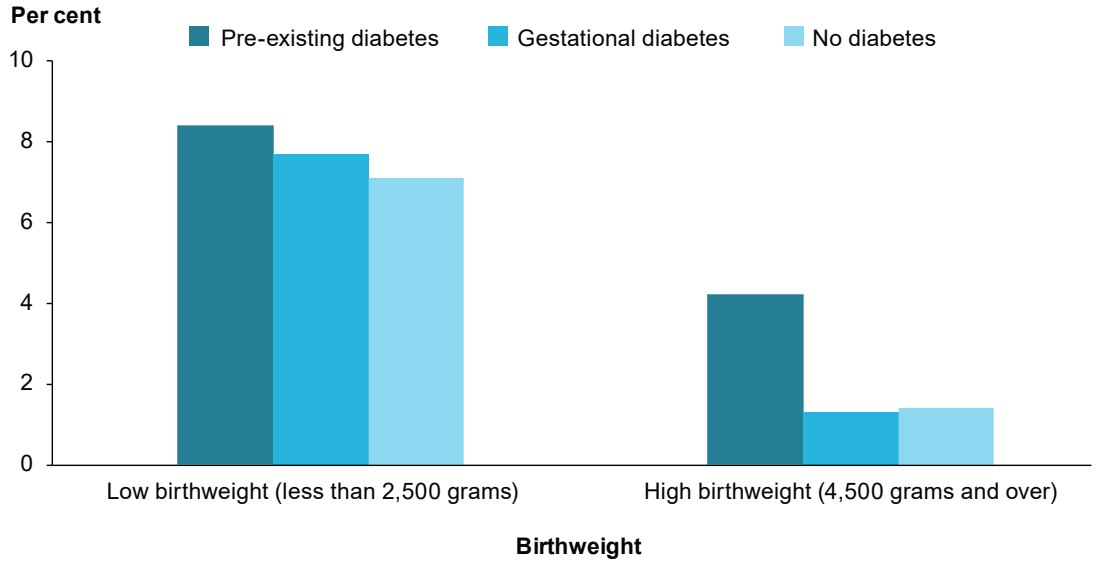
Infant birthweight is a measure of newborn health. High birthweight (4,500 grams and over) increases the risk of birth injury (shoulder dystocia and associated brachial plexus injury), perinatal asphyxia, meconium aspiration, hypoglycaemia and fetal death.

Low birthweight (under 2,500 grams) is associated with an increased risk of hypoglycaemia, hypothermia, jaundice, respiratory distress syndrome, low Apgar score, more complications during delivery, and neonatal death (Negrato & Gomes 2013). Both low and high birthweight also increase the risk of obesity and type 2 diabetes in later life (Harder et al. 2007; Johnsson et al. 2015; Jornayvaz et al. 2016).

Babies born to mothers with pre-existing diabetes (4.2%) were 3.0 times as likely as babies of mothers with gestational diabetes (1.3%) and babies of mothers with no diabetes (1.4%) to be of high birthweight.

Low birthweight was also slightly higher among babies born to mothers with pre-existing diabetes (8.4%) or gestational diabetes (7.7%) as among babies of mothers without diabetes (7.1%) (Figure 5; Supplementary Table 3.9).

Figure 5: Birthweight of babies, by maternal diabetes in pregnancy status, 2014–2015



Notes
1. Data are directly age-standardised to the Australian female population aged 15–44 as at 30 June 2001.
2. Data presented exclude babies born in Victoria.

Sources: NPDC; Supplementary Table 3.9.

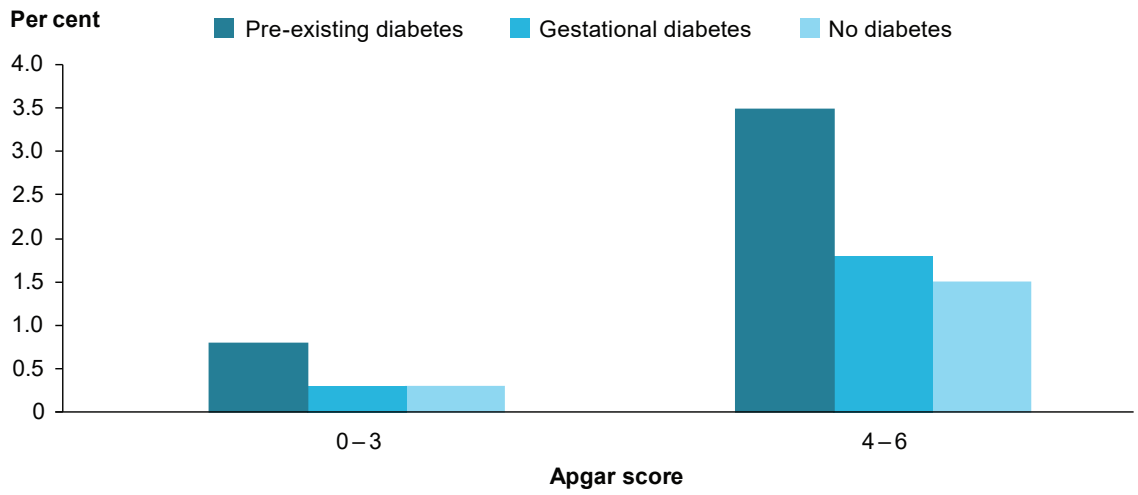
Apgar scores

Apgar scores are clinical indicators of a baby's condition shortly after birth. The score is based on 5 characteristics of the baby—skin colour, pulse, breathing, muscle tone, and reflex irritability.

Each characteristic is given 0–2 points, with a total score 0–10 points. An Apgar score of 7 or more at 5 minutes after birth indicates the baby is adapting well to the environment, while a score of less than 7 indicates complications for the baby (AIHW 2018).

Babies born to mothers with pre-existing diabetes were about twice as likely to have a low (4–6) (3.5%) or very low (0–3) (0.8%) Apgar score at 5 minutes than babies born to mothers with gestational diabetes (1.8% for low, and 0.3% for very low) and those with no diabetes (1.5% for low, and 0.3% for very low) (Figure 6; Supplementary Table 3.17).

Figure 6: Apgar score at 5 minutes for live births, by maternal diabetes in pregnancy status, 2014–2015



Notes

1. Data are directly age-standardised to the Australian female population aged 15–44 as at 30 June 2001.
2. Data presented exclude babies born in Victoria.

Sources: NPDC; Supplementary Table 3.17.

Resuscitation

Active resuscitation is done to establish independent breathing and heartbeat, or to treat depressed respiratory effect and correct metabolic disturbances. Resuscitation types range in severity—from suction to external cardiac massage and ventilation. The level of resuscitation administered to a baby immediately after birth is an indication of a baby's health and expected wellbeing (AIHW 2018).

More than 1 in 4 (26.9%) live-born babies of mothers with pre-existing diabetes needed active resuscitation, compared with 1 in 5 live-born babies of mothers with gestational diabetes (20.6%) and of mothers with no diabetes (18.3%) (Supplementary Table 3.21).

Data on resuscitation in this report are not available for Western Australia and Victoria, and have been excluded from the analysis. Data presented only include where active resuscitation was administered.

Length of hospital stay

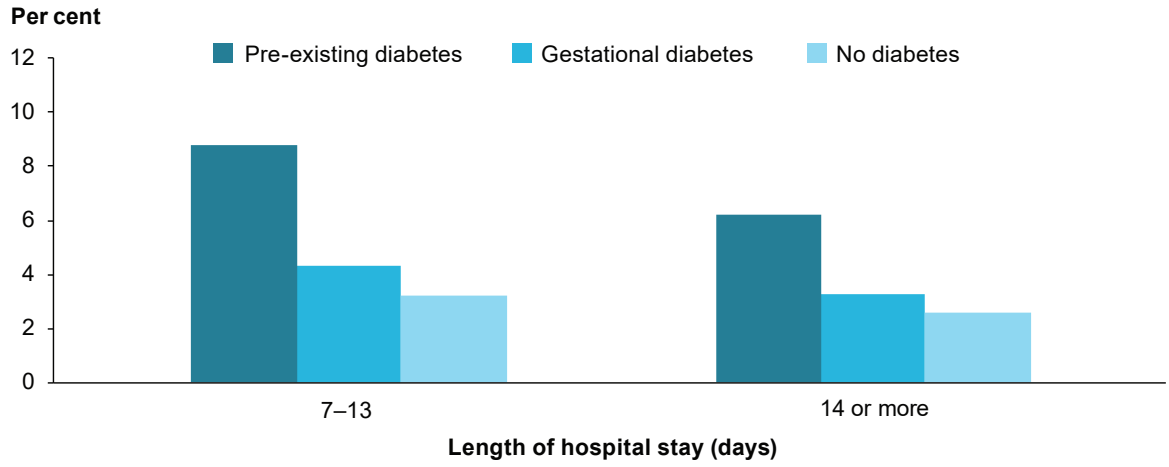
A baby's length of stay in hospital is calculated from the day of birth until the baby is discharged from hospital.

Babies born of low birthweight or pre-term, who are admitted to the special care nursery (SCN) or neonatal intensive care unit (NICU), or who have difficulties feeding might stay in hospital until they reach developmental milestones, such as those related to feeding, breathing, and body temperature (Laws & Sullivan 2009).

Babies born to mothers with pre-existing diabetes were at least twice as likely to stay in hospital for 7–13 days (8.8%) or 14 days or more (6.2%) than babies born to mothers with gestational diabetes (4.3% and 3.3%, respectively), or to mothers with no diabetes (3.2% and 2.6%, respectively) (Figure 7; Supplementary Table 3.13).

Data for length of hospital stay exclude Western Australia and Victoria. Data presented only include babies born to mothers admitted to the hospital, and babies who were discharged home.

Figure 7: Length of stay for live births in hospital, by maternal diabetes in pregnancy status, 2014–2015



Notes
1. Data are directly age-standardised to the Australian female population aged 15–44 as at 30 June 2001.
2. Data presented exclude babies born in Western Australia and Victoria.
3. Data only include babies who were discharged home.
4. Data exclude babies who were born in birth centres attached to hospitals.

Sources: NPDC; Supplementary Table 3.13.

Admission to special care nurseries and neonatal intensive care units

Admission to SCN and NICU provides more specialised care for babies than that available in the general maternity ward (Laws & Sullivan 2009). This care might be for conditions associated with prematurity and other complications, and conditions affecting the newborn baby.

Admission to SCN and NICU was higher among babies of mothers with pre-existing diabetes (41.1%) and gestational diabetes (26.5%) than among babies of mothers with no diabetes (14.8%) in pregnancy (Supplementary Table 3.25).

Data for admission to SCN and NICU exclude Western Australia and Victoria.

Indigenous mothers and babies

The NPDC recorded information on about 23,800 Aboriginal and Torres Strait Islander mothers who gave birth in Australia (excluding Victoria) during 2014–2015. Of these:

- 21,000 (88.1%) did not have diabetes
- 2,300 (9.7%) had gestational diabetes
- 500 (2.1%) had pre-existing diabetes (Supplementary Table 1.3).

Indigenous mothers were more likely than non-Indigenous mothers to have pre-existing diabetes or gestational diabetes during pregnancy.

Indigenous mothers and their babies were also more likely than non-Indigenous mothers and their babies to have pregnancy-related complications and increased care requirements, regardless of the mother's diabetes status (pre-existing diabetes, gestational diabetes, or no diabetes).

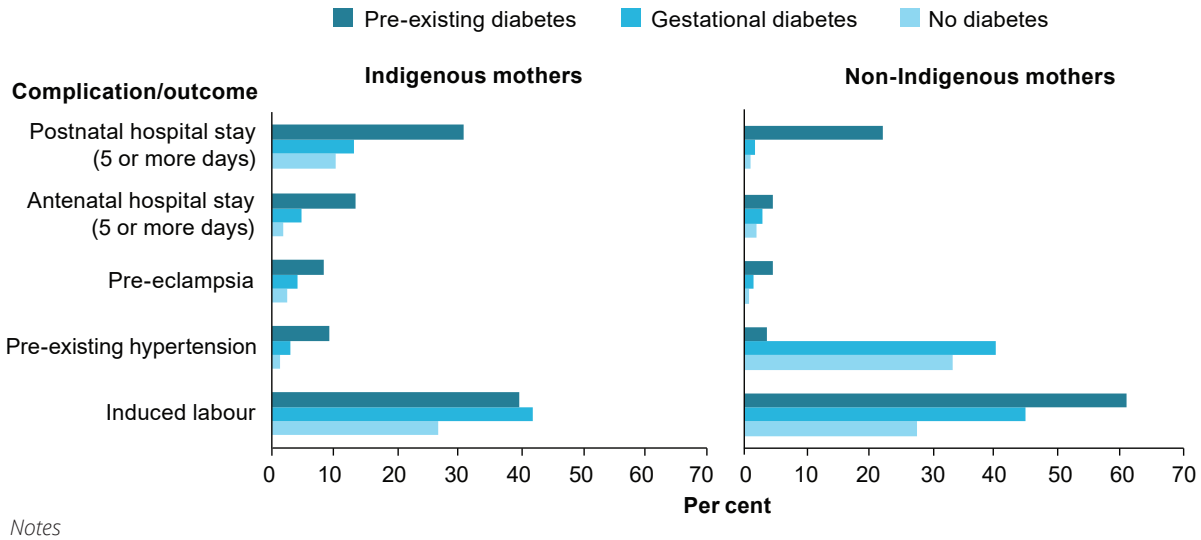
Outcomes for mothers

Among Indigenous mothers, the incidence of extended antenatal stay (5 or more days) was about 8 times as high among those with pre-existing diabetes (13.3%) as among those with no diabetes (1.7%) (Figure 8; Supplementary Table 2.14).

The incidence of extended postnatal stay (5 or more days) was about 3 times as high among Indigenous mothers with pre-existing diabetes (30.7%) as among those with gestational diabetes (13.1%) and no diabetes (10.2%).

Indigenous mothers with pre-existing diabetes (8.2%) were 3.4 times as likely as Indigenous mothers with no diabetes (2.4%) to have pre-eclampsia (Figure 8; Supplementary Table 2.10).

Figure 8: Outcomes for mothers, by diabetes type and Indigenous status, 2014–2015



Notes

1. Data are directly age-standardised to the Australian female population aged 15–44 as at 30 June 2001.
2. Data exclude mothers who gave birth in Victoria for all outcomes, except for antenatal and postnatal hospital stay, where data exclude Western Australia and Victoria.
3. Data for antenatal and postnatal hospital stay exclude women who gave birth in birth centres attached to hospitals, and are presented only for women who gave birth in a hospital. Postnatal stay only includes women who were discharged home.
4. Due to the differences in definitions and methods for data collection between jurisdictions for pre-eclampsia and pre-existing hypertension, results should be interpreted with caution.
5. Data for induced labour might include cases where induction of labour was attempted, but labour did not result.

Sources: NPDC; supplementary tables 2.2, 2.6, 2.10, 2.14, and 2.18.

Outcomes for babies

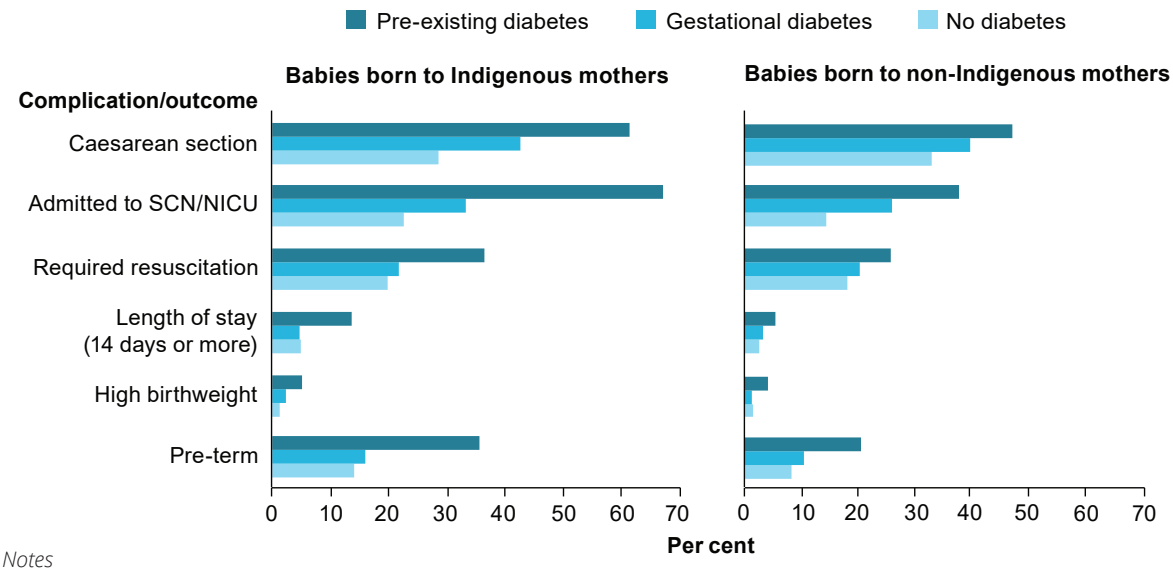
Babies born to Indigenous mothers with pre-existing diabetes were more likely to experience complications than babies born to Indigenous mothers with gestational diabetes and no diabetes.

Regardless of maternal diabetes status in pregnancy, the incidence of high birthweight and active resuscitation were also higher among babies born to Indigenous mothers than among babies born to non-Indigenous mothers.

Babies born to Indigenous mothers with pre-existing diabetes (5.1%) were 4.1 times as likely to have high birthweight as those born to Indigenous mothers with no diabetes (1.2%), and babies born to Indigenous mothers with gestational diabetes (2.4%) were twice as likely (Figure 9; Supplementary Table 3.10).

Babies born to Indigenous mothers with pre-existing diabetes (36.5%) were 1.8 times as likely as babies born to Indigenous mothers with no diabetes (19.8%) to require resuscitation (Figure 9; Supplementary Table 3.22).

Figure 9: Outcomes for babies, by diabetes type and Indigenous status, 2014–2015



Notes

1. Data are directly age-standardised to the Australian female population aged 15–44 as at 30 June 2001.
2. Data exclude babies born in Victoria for all outcomes, except for length of hospital stay, resuscitation, and admission to SCN/NICU, where data exclude Western Australia and Victoria.
3. Data for length of hospital stay exclude babies who were born in birth centres attached to hospitals, and only include babies who were discharged home. Exclude data from Western Australia and Victoria.
4. Data only include where active resuscitation was performed for live-born babies.
5. Data for pre-term include 4 babies of less than 20 weeks' gestation.

Sources: NPDC; supplementary tables 3.2, 3.6, 3.10, 3.14, 3.22, and 3.26.

Location

Mothers living in remote parts of Australia are at greater risk of some complications and adverse outcomes during pregnancy than other mothers.

The risk rose with increasing remoteness for all mothers and babies, regardless of the diabetes status. However, having diabetes during pregnancy further increased the risk of some complications and adverse outcomes for mothers and babies living in *Remote/Very remote* areas.

For most complications, the risks differed only slightly between socioeconomic areas for mothers with diabetes and those with no diabetes (and their babies).

Remoteness areas

Outcomes for mothers

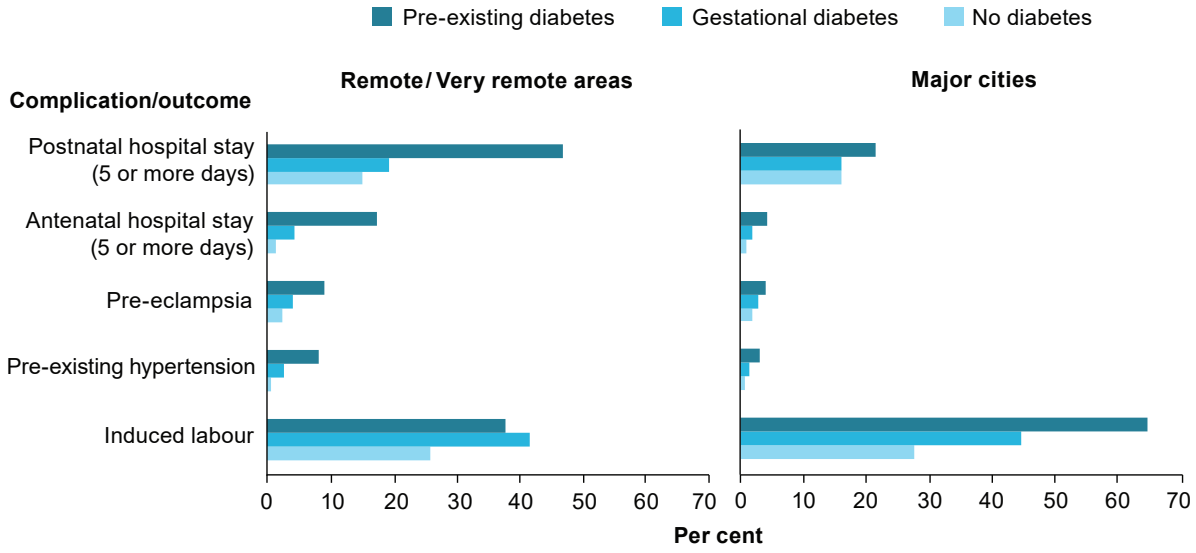
Mothers living in *Remote/Very remote* areas were more likely than those in *Major cities* to have pre-eclampsia and longer hospital stays regardless of diabetes in pregnancy status. But they were less likely to have an induced labour than those living in *Major cities*.

In *Remote/Very remote* areas, mothers with pre-existing diabetes (17.3%) were 12.3 times as likely as mothers with no diabetes (1.4%) to have an antenatal hospital stay of 5 or more days, and those with gestational diabetes (4.4%) were 3 times as likely.

The risk of extended antenatal hospital stay was slightly lower among mothers with diabetes living in *Major cities*. There, compared with mothers with no diabetes (1.0%), those with pre-existing diabetes (4.2%) were about 4 times as likely as to have an antenatal hospital stay of 5 or more days, and those with gestational diabetes (1.9%) were about twice as likely (Supplementary Table 2.16).

In *Remote/Very remote* areas, mothers with pre-existing diabetes (9.0%) were 3.7 times as likely as mothers with no diabetes (2.4%) to have pre-eclampsia, and those with gestational diabetes (4.1%) were about twice as likely. In *Major cities*, mothers with pre existing diabetes (3.9%) were about twice as likely as mothers with no diabetes (1.8%) to have pre-eclampsia, and those with gestational diabetes (2.7%) were 1.5 times as likely (Figure 10; Supplementary Table 2.12).

Figure 10: Outcomes for mothers, by diabetes type and remoteness areas, 2014–2015



Notes

1. Data are directly age-standardised to the Australian female population aged 15–44 as at 30 June 2001.
2. Data exclude mothers who gave birth in Victoria for all outcomes, except for antenatal and postnatal hospital stay, where data exclude Western Australia and Victoria.
3. Data for antenatal and postnatal hospital stay exclude women who gave birth in birth centres attached to hospitals, and are presented only for women who gave birth in a hospital. Postnatal stay only includes women who were discharged home.
4. Due to the differences in definitions and methods for data collection between jurisdictions for pre-eclampsia and pre-existing hypertension, results should be interpreted with caution.
5. Data for induced labour might include cases where induction of labour was attempted, but labour did not result.
6. Remoteness areas are derived by applying the Australian Bureau of Statistics 2011 Australian Statistical Geography Standard to area of the mother's usual residence. Remoteness areas are only calculated where geographic area of usual residence was provided.

Sources: NPDC; supplementary tables 2.4, 2.8, 2.12, 2.16, and 2.20.

Outcomes for babies

Babies of mothers from *Remote/Very remote* areas were more likely than babies of mothers from *Major cities* to be born pre-term, require resuscitation, and be admitted to an SCN/NICU, regardless of maternal diabetes in pregnancy status.

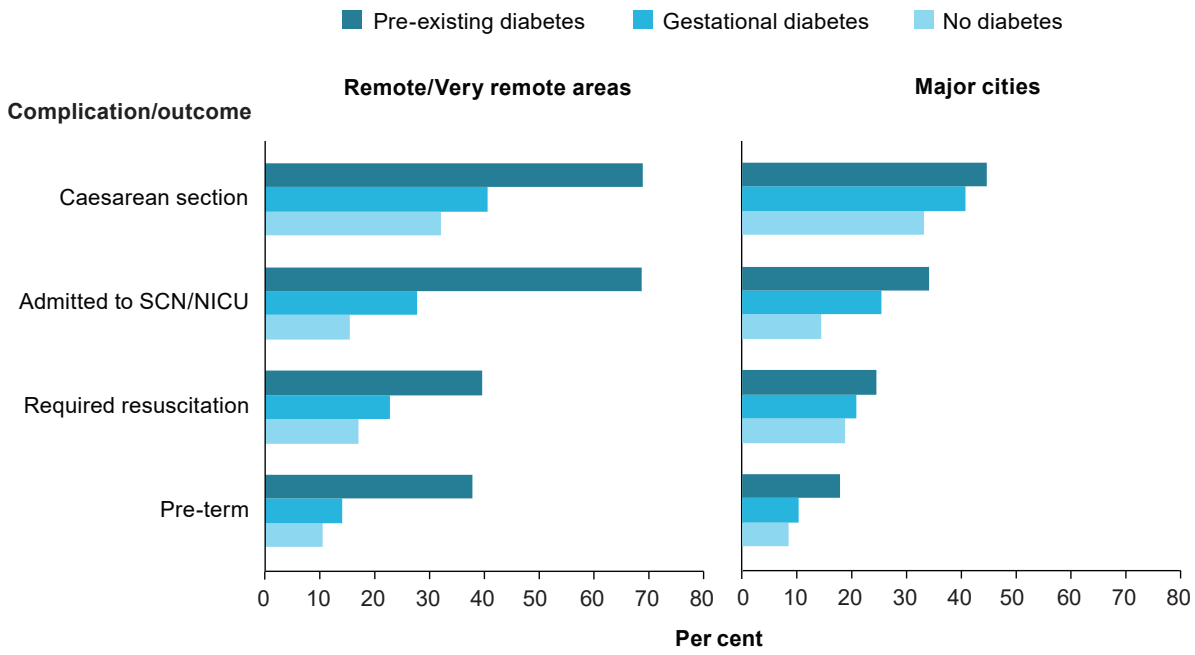
In *Remote/Very remote* areas, babies of mothers with pre-existing diabetes (37.6%) were about 3.7 times as likely as those of mothers with no diabetes (10.3%) to be born pre-term.

In *Major cities*, babies of mothers with pre-existing diabetes (17.8%) were twice as likely as babies of mothers with no diabetes (8.3%) to be born pre-term (Supplementary Table 3.4).

In *Remote/Very remote* areas, babies of mothers with pre-existing diabetes (68.6%) were 4.5 times as likely as those of mothers with no diabetes (15.4%) to be admitted to SCN/NICU.

In *Major cities*, babies born to mothers with pre-existing diabetes (34.0%) were 2.4 times as likely as babies of mothers with no diabetes (14.4%) to be admitted to SCN/NICU (Figure 11; Supplementary Table 3.28).

Figure 11: Outcomes for babies, by diabetes type and remoteness areas, 2014–2015



Notes

1. Data are directly age-standardised to the Australian female population aged 15–44 as at 30 June 2001.
2. Data for admissions to SCN/NICU and resuscitation are not available for Western Australia and Victoria, so babies born in Western Australia and Victoria have been excluded from analysis.
3. Data presented for caesarean section and pre-term exclude babies born in Victoria.
4. Data only include where active resuscitation was performed for live-born babies.
5. Data for pre-term include 4 babies of less than 20 weeks' gestation, and exclude data from Victoria.
6. Remoteness areas are derived by applying the Australian Bureau of Statistics' 2011 Australian Statistical Geography Standard to area of the mother's usual residence. Remoteness areas are only calculated where geographic area of usual residence was provided.

Sources: NPDC; supplementary tables 3.4, 3.8, 3.24, and 3.28.

Socioeconomic areas

Outcomes for mothers

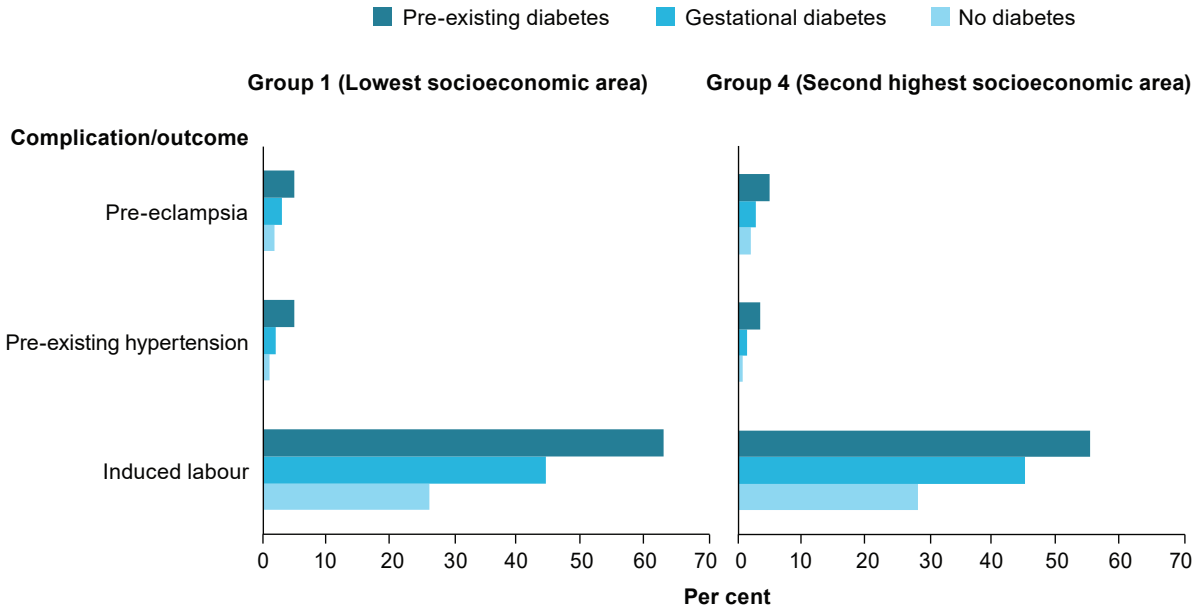
Comparing mothers with and without diabetes showed only slight differences in risks for most complications between socioeconomic areas.

The increased risk of complications and adverse outcomes from diabetes were relatively small after controlling for socioeconomic area.

Due to the small number of recorded cases of mothers with pre-existing diabetes, and to maintain comparability, data for those living in the highest socioeconomic areas are not presented for any diabetes group.

The incidence of induced labour increased with socioeconomic disadvantage among mothers with pre-existing diabetes. In the lowest socioeconomic area, 63.0% of mothers with pre existing diabetes had an induced labour, compared with 44.5% of mothers with gestational diabetes, and 26.1% of mothers with no diabetes (Figure 12; Supplementary Table 2.3).

Figure 12: Outcomes for mothers, by diabetes type and socioeconomic areas, 2014–2015



Notes

1. Due to the small number of recorded cases of mothers with pre-existing diabetes, data for mothers living in the highest socioeconomic areas are not presented for all maternal diabetes in pregnancy status groups.
2. Data exclude mothers who gave birth in Victoria.
3. Data are directly age-standardised to the Australian female population aged 15–44 as at 30 June 2001.
4. Due to the differences in definitions and methods for data collection between jurisdictions for pre-eclampsia and pre-existing hypertension, results should be interpreted with caution.
5. Data for induced labour might include cases where induction of labour was attempted, but labour did not result.
6. Socioeconomic areas are based on the Australian Bureau of Statistics' 2011 Socio-Economic Index for Areas Index of Relative Disadvantage, and is only calculated where geographic area of usual residence was provided.

Sources: NPDC; supplementary tables 2.3, 2.7, and 2.11.

Outcomes for babies

Comparing babies born to mothers with and without diabetes showed little difference in risks for most complications between higher socioeconomic areas.

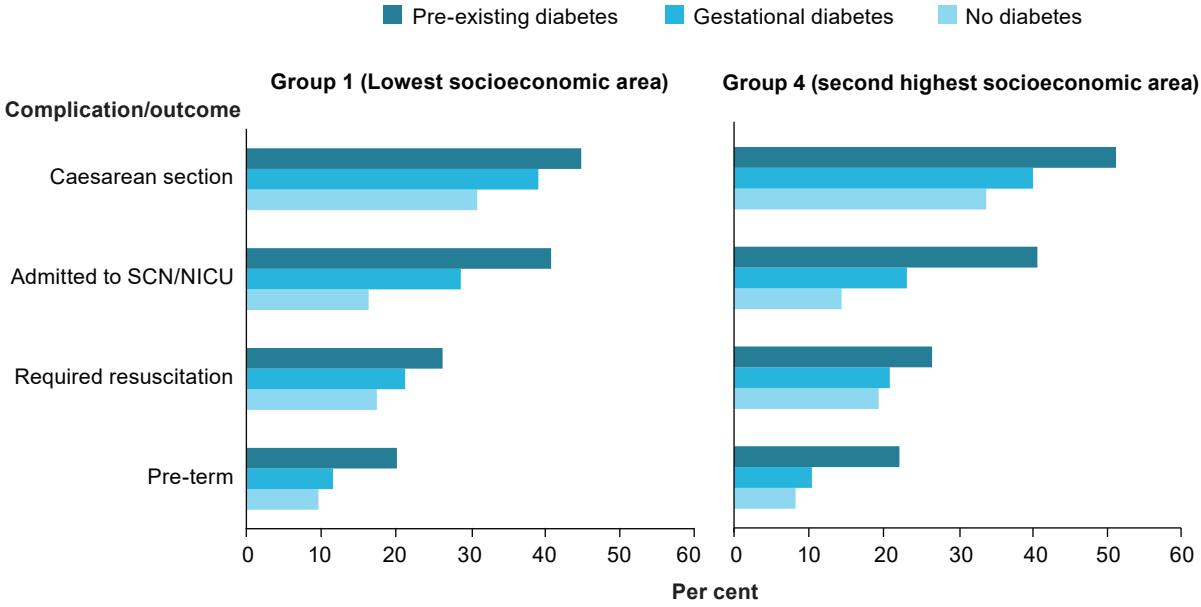
The increased risk of complications and adverse outcomes due to maternal diabetes were relatively small after controlling for socioeconomic areas. Due to the small number of recorded cases of mothers with pre-existing diabetes, and to maintain comparability, data for those living in the highest socioeconomic areas are not presented for any diabetes group.

The incidence of caesarean sections decreased with socioeconomic disadvantage among all babies, regardless of maternal diabetes status (Supplementary Table 3.7).

In the lowest socioeconomic areas, babies born to mothers with pre-existing diabetes (26.3%) were about 1.5 times as likely as babies of mothers with no diabetes (17.5%) to require resuscitation.

The incidence of babies born to mothers with gestational diabetes (21.3%) and babies born to mothers with no diabetes (17.5%) requiring resuscitation were relatively similar in the lowest socioeconomic areas (Figure 13; Supplementary Table 3.23).

Figure 13: Outcomes for babies, by diabetes type and socioeconomic areas, 2014–2015



Notes

1. Due to the small number of recorded cases of mothers with pre-existing diabetes, data for mothers living in the highest socioeconomic areas are not presented for all maternal diabetes in pregnancy status groups.
2. Data are directly age-standardised to the Australian female population aged 15–44 as at 30 June 2001.
3. Data for admissions to SCN/NICU and resuscitation are not available for Western Australia and Victoria, so babies born in Western Australia and Victoria have been excluded from analysis.
4. Data presented for caesarean section and pre-term exclude babies born in Victoria.
5. Data only include where active resuscitation was performed for live-born babies.
6. Data for pre-term includes 4 babies of less than 20 weeks' gestation. Excludes data from Victoria.
7. Socioeconomic areas are based on the Australian Bureau of Statistics 2011 Socio-Economic Index for Areas Index of Relative Disadvantage, and is only calculated where geographic area of usual residence was provided.

Sources: NPDC; supplementary tables 3.3, 3.7, 3.23, and 3.27.

Appendix

Information about the data source methods are available from: <https://www.aihw.gov.au/reports/diabetes/diabetes-in-pregnancy-2014-2015/related-material>.

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Abbreviations

AIHW	Australian Institute of Health and Welfare
Apgar	appearance, pulse, grimace, activity, and respiration
NICU	neonatal intensive care unit
NPDC	National Perinatal Data Collection
SCN	specialised care nurseries

Glossary

Aboriginal or 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.**

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

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

Apgar score: Numerical score used to indicate the baby's condition at 1 minute and at 5 minutes after birth; 0–2 points are given for each of 5 characteristics—heart rate, breathing, colour, muscle tone, and reflex irritability. The total score is 0–10.

baby's length of stay: Number of days between date of birth and date of separation from the hospital of birth (calculated by subtracting the date of birth from the date of separation).

birth status: Status of the baby immediately after birth (stillborn or live born).

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

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

diabetes: A chronic condition in which the body cannot properly use its main energy source, the sugar glucose. This is due to a relative or absolute deficiency in insulin, a hormone that is produced by the pancreas and helps glucose enter the body's cells from the bloodstream and then be processed by them. Diabetes is marked by an abnormal build-up of glucose in the blood, and it can have serious short- and long-term effects. For the 3 main types of diabetes, see type 1 diabetes, type 2 diabetes and gestational diabetes.

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 calculated via ultrasound, or derived from clinical assessment during pregnancy or from examination of the baby after birth.

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

high birthweight: Weight of a baby at birth that is more than 4,500 grams.

incidence: The number of new cases (of an illness or event, and so on) occurring during a given period.

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

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

insulin: A hormone produced in the pancreas that helps glucose to enter body cells for energy metabolism.

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.

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

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

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

resuscitation of baby: Active measures taken shortly after birth to assist the baby's ventilation and heartbeat, or to treat depressed respiratory effort, and to correct metabolic disturbances.

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.

spontaneous labour: Onset of labour without intervention.

type 1 diabetes: A form of diabetes mostly arising among children or younger adults, marked by a complete lack of insulin and needing insulin replacement to survive.

type 2 diabetes: The most common form of diabetes, occurring mostly in people aged 40 and over, and marked by reduced or less effective insulin.

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