

Incidence of gestational diabetes in Australia

Web report | Last updated: 04 Sep 2019 | Topic: [Diabetes](#) | [Media release](#)

About

The Incidence of gestational diabetes in Australia web report presents information on new cases of gestational diabetes in Australia, their treatment and the short-term pregnancy and delivery outcomes for women affected by the condition. Using the National Hospital Morbidity Database (NHMD), the data can be explored by age, trends, population groups, geographic areas and treatment type using a visualisation tool.

Cat. no: CVD 85

Findings from this report:

- In 2016-17, gestational diabetes affected 15% of all women aged 15-49 who gave birth in hospital - over 40,800 women
- Women aged 45-49 were 4 times as likely to be diagnosed with gestational diabetes as women aged 15-19
- The incidence of gestational diabetes increased with the level of socioeconomic disadvantage
- Women with gestational diabetes experienced higher intervention rates for labour and delivery



What is gestational diabetes?

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 & Conn 2013).

Gestational diabetes is an important health issue associated with pregnancy which has implications for the immediate and longer term health of both the mother and baby. It usually resolves after the baby is born, but can often recur in later pregnancies and, among other adverse outcomes, increases the risk of type 2 diabetes for the mother and baby in the future.

Often women are able to manage their gestational diabetes with lifestyle modifications including diet, exercise and careful blood glucose monitoring. If blood glucose levels cannot be maintained in the optimum range, then medication may be required including oral hypoglycaemic (blood glucose-lowering) medications, insulin therapy, or both.

Note

A definitive diagnosis of diabetes type cannot be made until after the birth of the baby, hence the initial diagnosis of gestational diabetes can include women with other forms of diabetes, detected for the first time in pregnancy (Nankervis et al. 2014).

References

Nankervis A & Conn J 2013. Gestational diabetes mellitus: negotiating the confusion. *Australian Family Physician* 42:528-31.

Nankervis A, McIntyre H, Moses R, Ross G, Callaway L, Porter C et al. 2014. [ADIPS consensus guidelines for the testing and diagnosis of gestational diabetes mellitus in Australia](#). Sydney: Australasian Diabetes in Pregnancy Society.





Data source

National Hospital Morbidity Database

The [National Hospital Morbidity Database](#) (NHMD) is the primary data source used for this web report with data available up to 2016-17. The NHMD contains episode-level records from admitted patient data collection systems in Australian public and private hospitals and include administrative, demographic and clinical data. The NHMD captures virtually all births in Australia, with 97% of babies born in a hospital (AIHW 2019), and allows the calculation of a national estimate of gestational diabetes incidence. Individual women cannot be identified in the NHMD.

Note

- Direct age-standardisation was used in this report to remove the influence of differences in age structure from the analysis.
- Diagnosis of gestational diabetes, coded on hospital records, may include women with other forms of diabetes, detected for the first time in pregnancy.

Refer to the [Methods](#) section for further detail.

References

AIHW (Australian Institute of Health and Welfare) 2019. [Australia's mothers and babies 2017—in brief](#). Perinatal statistics series no. 35. Cat. no. PER 100. Canberra: AIHW.





Risk factors

The following factors increase a woman's risk of developing gestational diabetes:

- Ethnicity: Asian, Indian subcontinent, Aboriginal, Torres Strait Islander, Pacific Islander, Maori, Middle Eastern, non-white African
- Pre-pregnancy body mass index (BMI) $>30 \text{ kg/m}^2$
- Previous hyperglycaemia in pregnancy
- Previous elevated blood glucose level
- Maternal age ≥ 40 years
- Family history of diabetes mellitus (close relative with diabetes or a sister with hyperglycaemia in pregnancy)
- Previous macrosomia (baby with birth weight $>4500\text{g}$ or $>90\text{th}$ percentile)
- Polycystic ovary syndrome
- Medications: corticosteroids, antipsychotics (Nankervis et al. 2014).

References

Nankervis A, McIntyre HD, Moses R, Ross G, Callaway L, Porter C et al. 2014. [ADIPS consensus guidelines for the testing and diagnosis of gestational diabetes mellitus in Australia](#). Sydney: Australasian Diabetes in Pregnancy Society.



Testing and diagnosis

The 2014 Australasian Diabetes in Pregnancy Society (ADIPS) consensus guidelines (Nankervis et al. 2014) recommend early testing in pregnancy for women with risk factors for gestational diabetes using the 75g pregnancy Oral Glucose Tolerance Test (OGTT). Routine testing for gestational diabetes using the OGTT is recommended for all women at 24-28 weeks gestation, including higher risk women recording normal blood glucose results in early pregnancy.

Diagnostic criteria

A diagnosis for gestational diabetes is made based on the 75g OGTT with one or more of the following values:

- Fasting plasma glucose ≥ 5.1 mmol/L
- 1-hour post 75g oral glucose load ≥ 10.0 mmol/L
- 2-hour post 75g oral glucose load ≥ 8.5 mmol/L.

The ADIPS guidelines recommend re-testing with the 75g OGTT at 6-12 weeks post-partum for women diagnosed with gestational diabetes (identifying ongoing glucose abnormalities which may indicate other forms of diabetes, first detected in pregnancy) and regular ongoing monitoring due to the high risk of recurrence in subsequent pregnancy and of developing type 2 diabetes in the future.

References

Nankervis A, McIntyre HD, Moses R, Ross G, Callaway L, Porter C et al. 2014. ADIPS consensus guidelines for the testing and diagnosis of gestational diabetes mellitus in Australia. Sydney: Australasian Diabetes in Pregnancy Society.

Gestational diabetes incidence

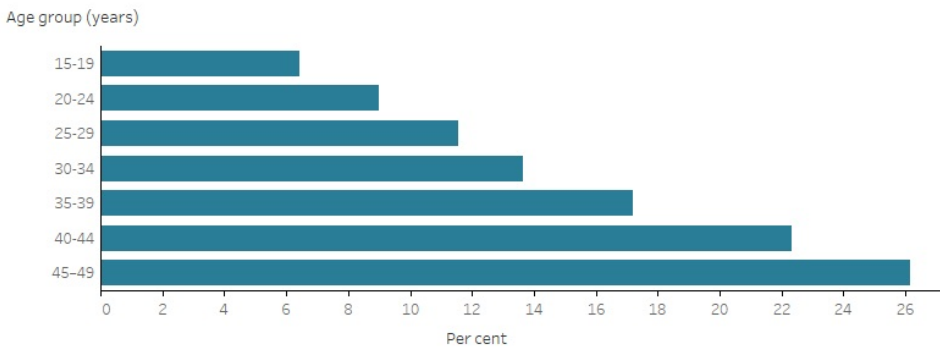
1 in 7

pregnant women were affected by gestational diabetes in 2016-17

In 2016-17:

- 15% of all women (aged 15-49) who gave birth in hospital were diagnosed with gestational diabetes (40,800 women).
- The incidence rate for gestational diabetes increased with age, peaking in the 45-49 year age group at 26% (Figure 1).
- Compared to the national rate of 15%, incidence rates were slightly higher in the Australian Capital Territory and the Northern Territory (both 17%) and lower in Western Australia (12%) (Figure 2).

Figure 1: Incidence of gestational diabetes 2016-17, by age group

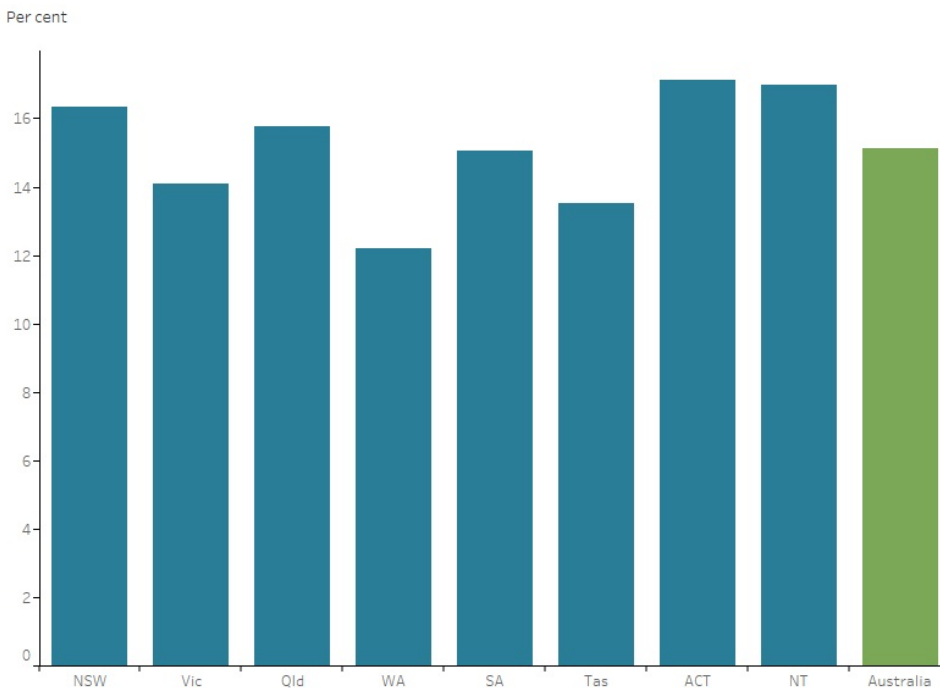


Note: Population (women aged 15-49 giving birth in Australian hospitals) based on ICD-10-AM diagnosis codes. Refer to statistical notes for method.

Chart: AIHW. Source: National Hospital Morbidity Database.

Figure 2: Incidence of gestational diabetes 2016-17, by state and territory

Measure filter
Age-standardised rate



Notes:
 1. Age-standardised to the 2001 Australian resident female population aged 15-49.
 2. Population (women aged 15-49 giving birth in Australian hospitals) based on ICD-10-AM diagnosis codes. Refer to statistical notes for method.

Chart: AIHW. Source: National Hospital Morbidity Database.

Variation among population groups

In 2016-17:

- The incidence of gestational diabetes increased with the level of socioeconomic disadvantage. Women from the lowest socioeconomic group were 1.6 times as likely to be diagnosed with gestational diabetes as women in the highest socioeconomic group (19% and 12%, respectively).
- The incidence of gestational diabetes was similar by remoteness area.
- Compared with women born in Australia, women born in Southern and Central Asia were more than twice as likely to be diagnosed with gestational diabetes (13% and 28%, respectively). Women born in South-East Asia (22%) were 1.7 times as likely while women born in North Africa and the Middle East (21%) and North-East Asia (21%) were 1.6 times as likely to be diagnosed with gestational diabetes.
- Women born in North-West Europe and the Americas experienced similar gestational diabetes incidence rates as Australian born women (11% compared with 13%).

See the [Incidence of gestational diabetes data visualisation](#) for further detail.

Aboriginal and Torres Strait Islander women

In 2016-17:

- There were over 1,600 new cases of gestational diabetes among Aboriginal and Torres Strait Islander women, equating to 12% of Indigenous women aged 15-49 who gave birth.
- Incidence increased with age, peaking in the 40+ year age group at 32%. Women in this age group were 4 times as likely to be diagnosed with gestational diabetes as Indigenous women aged 15-19 and 20-24 (7% and 9%, respectively).

After adjusting for differences in the age structure of the populations, the incidence rate among Aboriginal and Torres Strait Islander women was 1.3 times the rate for non-Indigenous women.

Notes

Ethnicity is a known risk factor for gestational diabetes (Yuen & Wong 2015). Groups at higher risk include Asian, Indian subcontinent, Aboriginal, Torres Strait Islander, Pacific Islander, Maori, Middle Eastern, non-white African (Nankervis et al. 2014). Data on ethnicity is not collected in the National Hospital Morbidity Database, hence country of birth (grouped into regions) is used as a proxy measure for ethnicity.

Data for Aboriginal and Torres Strait Islander women aged 40-44 and 45-49 combined due to small numbers.

References

Nankervis A, McIntyre HD, Moses R, Ross G, Callaway L, Porter C et al. 2014. [ADIPS consensus guidelines for the testing and diagnosis of gestational diabetes mellitus in Australia](#). Sydney: Australasian Diabetes in Pregnancy Society.

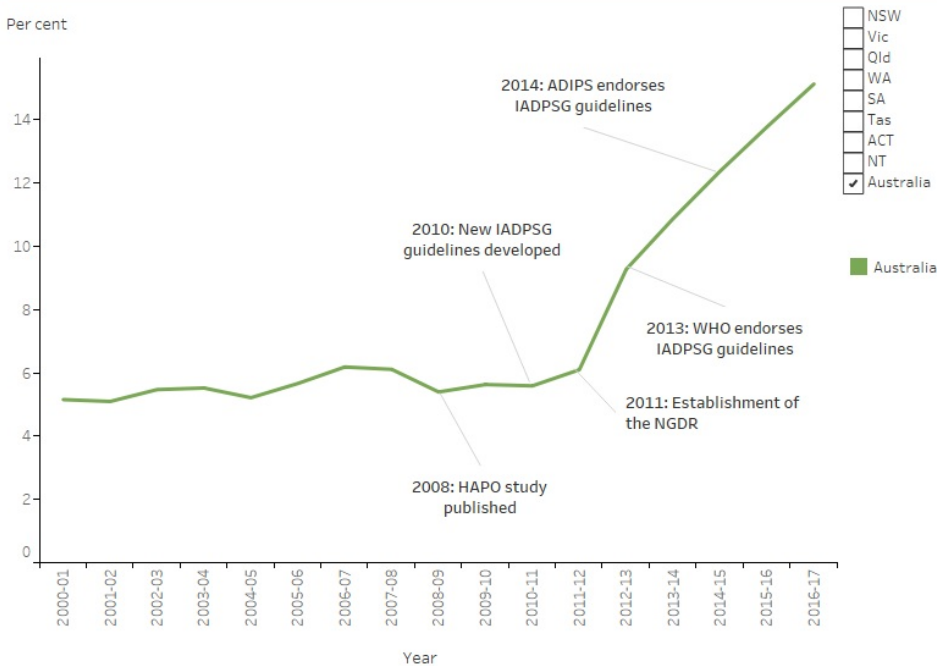
Yuen L & Wong VW 2015. Gestational diabetes mellitus: Challenges for different ethnic groups. *World Journal of Diabetes* 6(8):214-1032.

Changing trends

Between 2000-01 and 2016-17, the rate of women being diagnosed with gestational diabetes in Australia, tripled from 5% to 15% with steep increases recorded from 2012-13 (Figure 3).

This pattern of increase was seen across all age groups and all states and territories. Caution should be taken when comparing rates over time however, as a number of factors are likely to have affected the incidence of gestational diabetes in Australia in recent years. These include the introduction of new diagnostic guidelines and increasing risk factors in the population. Refer to [Trends discussion](#) for more information.

Figure 3: Incidence of gestational diabetes, 2000–01 to 2016–17



Notes:

1. Age-standardised to the 2001 Australian resident female population aged 15–49.
 2. Population—women aged 15–49 giving birth in Australian hospitals.
 3. Recent changes to the diagnostic criteria for gestational diabetes may influence the number of cases reported within a given year.
- HAPO (Hyperglycaemia and Adverse Outcomes Study)
IADPSG (International Association of Diabetes in Pregnancy Study Groups)
WHO (World Health Organization)
ADIPS (Australasian Diabetes in Pregnancy Society)
Chart: AIHW. Source: National Hospital Morbidity Database.

Trends discussion

Several factors are likely to have influenced the trend in the incidence of gestational diabetes in Australia in recent years, with notable increases recorded from 2012-13.

Changing guidelines for the testing and diagnosis of gestational diabetes

The Australasian Diabetes in Pregnancy Society (ADIPS) originally formulated national guidelines for the testing and diagnosis of gestational diabetes in 1991, based on expert opinion.

Publication of the [Hyperglycemia and Adverse Pregnancy Outcome \(HAPO\) study](#) in 2008 resulted in the development of new consensus guidelines for the testing and diagnosis of gestational diabetes in 2010, by the International Association of Diabetes and Pregnancy Study Groups (IADPSG) with Australasian representation. The HAPO study, a multinational observational study involving more than 23,000 women, found significant associations between adverse pregnancy outcomes and increasing maternal glucose levels, within what had previously been considered a non-diabetic range (HAPO Study Cooperative Research Group 2008).

Whilst the IADPSG guidelines were not endorsed by ADIPS until 2014, establishment of the National Gestational Diabetes Register (NGDR) by Diabetes Australia in 2011 (to assist in the post-natal support of women diagnosed with gestational diabetes and to remind them to have regular diabetes screening) and endorsement of the IADPSG guidelines by the World Health Organisation in 2013, may have had an impact on awareness and screening in Australia.

The endorsement of the IADPSG guidelines by ADIPS in 2014 represented a significant change to the practice of testing and diagnosing gestational diabetes in Australia. The guidelines were implemented across most jurisdictions by mid-2016. Reflecting international trends, Australian studies found increases in the number of women diagnosed with gestational diabetes, following the introduction of the IADPSG guidelines, of between 20% (Laafira et al. 2015), 35% (Moses et al. 2011) and 74% (Cade et al. 2019).

ADIPS guidelines: 1991-2014

The diagnostic pathway outlined in the 1991 ADIPS guidelines, involved a 2-step approach:

- Step 1: all women were screened for gestational diabetes using the non-fasting Glucose Challenge Test (GCT) at 24-28 weeks gestation, with high-risk women screened earlier in pregnancy.
- Step 2: women testing positive with the GCT were sent for diagnostic testing using the fasting Oral Glucose Tolerance Test (OGTT).

ADIPS diagnostic criteria: 1991-2014

- Fasting plasma glucose ≥ 5.5 mmol/L; or
- Two-hour plasma glucose or random glucose ≥ 8.0 mmol/L

As a screening test, the GCT had a high false-negative rate which may have resulted in women being under-diagnosed (van Leeuwen et al. 2012).

ADIPS guidelines: 2014-current

The new ADIPS guidelines (based on IADPSG) introduced two main changes to the diagnostic pathway for gestational diabetes:

- Firstly, the 2-step approach was replaced with a universal single-step 75g OGTT at 24-28 weeks gestation for all women, with high-risk women tested earlier in pregnancy.
- Secondly, new diagnostic criteria were introduced for the diagnosis of gestational diabetes with a lowering of the fasting, introduction of a one-hour and raising of the two-hour blood glucose thresholds.

IADPSG (ADIPS-endorsed) diagnostic criteria: 2014-current

- Fasting plasma glucose ≥ 5.1 mmol/L; or
- One-hour post ≥ 10.0 mmol/L; or
- Two-hour post ≥ 8.5 mmol/L

Other factors

A number of other factors may influence gestational diabetes incidence rates. In particular, changes in the population associated with key risk factors, including:

Increasing overweight and obesity rates

Overweight and obesity is a known risk factor both for gestational (Nankervis et al. 2014) and type 2 diabetes (Ganz et al. 2014). National overweight and obesity rates in Australia have increased in recent decades, up from 56.3% in 1995 to 67% in 2017-18, largely driven by the increase in the proportion of those categorised as obese. Whilst a greater proportion of men than women are classified as overweight and obese, the pattern of increase is similar, with overweight and obesity rates for women increasing from 49.4% in 1995 to 59.7% in 2017-18 (ABS 2011, 2019). Among mothers who gave birth in 2017, one-fifth (20%) were classified as obese while just over a quarter (25.6%) were overweight (AIHW 2019).

Increasing maternal age

While the average age of women giving birth continues to rise from 29.9 years in 2007 to 30.6 years in 2017 (AIHW 2019), the influence of this factor has been controlled for in this report with age-standardisation of the data.

Immigration

Overseas migration continues to be a major contributor to Australia's overall population growth. The country profile for those born overseas has changed significantly in recent decades with Asian countries comprising six of the top ten countries of birth in 2016 (ABS 2017).

Ethnicity is a known risk factor for gestational diabetes, with incidence higher among Asian, Indian subcontinent, Aboriginal, Torres Strait Islander, Pacific Islander, Maori, Middle Eastern, non-white African women (Nankervis et al. 2014). Using country of birth as a proxy for ethnicity, the results from this web report found in 2016-17, women born in Southern and Central Asia, South-East Asia and North Africa and the Middle East were more likely to be diagnosed with gestational diabetes than Australian born women.

References

ABS (Australian Bureau of Statistics) 2011. *Overweight and Obesity in Adults in Australia: A Snapshot, 2007-08*. ABS cat. no. 4842.0.55.001. Canberra: ABS.

ABS 2017. *Cultural Diversity in Australia, 2016*. ABS cat. no. 2071.0. Canberra: ABS.

ABS 2019. *National Health Survey: First Results, 2017-18*. ABS cat. no. 4364.0.55.001. Canberra: ABS.

AIHW (Australian Institute of Health and Welfare) 2019. *Australia's mothers and babies 2017—in brief*. Perinatal statistics series no. 35. Cat. no. PER 100. Canberra: AIHW.

Cade TJ, Polyakov A & Brennecke SP 2019. Implications of the introduction of new criteria for the diagnosis of gestational diabetes: a health outcome and cost of care analysis. *BMJ Open* 2019;9:e023293. doi:10.1136/bmjopen-2018-023293.

Ganz ML, Wintfeld N, Li Q, Alas V, Langer J & Hammer M 2014. The association of body mass index with the risk of type 2 diabetes: a case-control study nested in an electronic health records system in the United States. *Diabetology & Metabolic Syndrome* 2014 6:50.

HAPO Study Cooperative Research Group, Metzger BE & Lowe LP 2018. Hyperglycemia and adverse pregnancy outcomes. *New England Journal of Medicine* 2008 358(19):1991-2002.

International Association of Diabetes and Pregnancy Study Groups Consensus Panel 2010. IADPSG recommendations for the Diagnosis and Classification of Hyperglycemia in Pregnancy. *Diabetes Care* 33(3):676-682.

Moses GR, Morris JG, Petocz P, San Gil F & Garg D 2011. The impact of potential new diagnostic criteria on the prevalence of gestational diabetes mellitus in Australia. *The Medical Journal of Australia* 194(7):338-340.

Nankervis A, McIntyre H, Moses R, Ross G, Callaway L, Porter C et al. 2014. Australasian Diabetes in Pregnancy Society consensus guidelines for the testing and diagnosis of gestational diabetes mellitus in Australia. Sydney: ADIPS.

Van Leeuwen M, Louwse MD, Opmeer BC, Limpens J, Serlie MJ, Reitsma JB et al. 2012. Glucose challenge test for detecting gestational diabetes mellitus: a systematic review. *BJOG An International Journal of Obstetrics and Gynaecology* 119(4):393-401.

© Australian Institute of Health and Welfare 2023

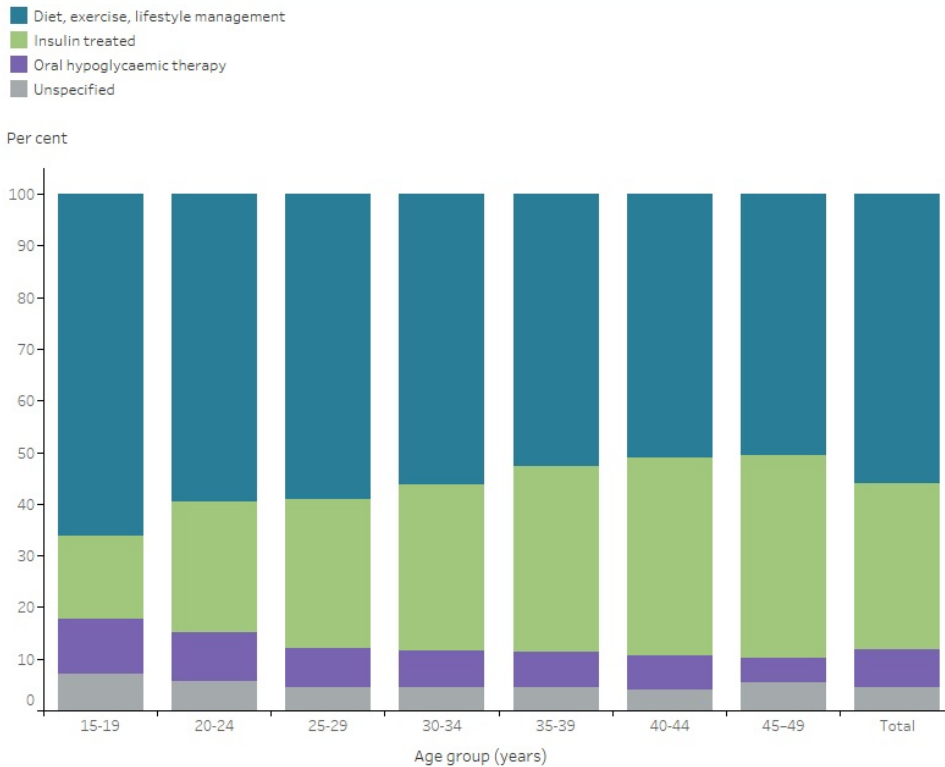


Management

Of all women (aged 15-49) diagnosed with gestational diabetes in 2016-17, at the time of giving birth in hospital:

- More than half (56%) were recorded as having managed their condition without medication through the use of diet, exercise and/or lifestyle management.
- Just under a third (32%) had been treated with insulin therapy.
- 8% had been treated with oral hypoglycaemic (blood glucose lowering) medications, while the treatment of 5% remained unspecified (Figure 4).

Figure 4: Gestational diabetes management type 2016-17, by age group



Notes:

Population (women aged 15-49 giving birth in Australian hospitals) based on ICD-10-AM diagnosis codes. Refer to statistical notes for method.

Chart: AIHW. Source: National Hospital Morbidity Database.

Variation among population groups

Women treated with insulin for gestational diabetes were more likely to:

- be older—women aged 45-49 were 2.4 times as likely to be treated with insulin as women aged 15-19 (39% compared with 16%)
- be born in North Africa and the Middle East (39%) and Southern and Central Asia (38%) compared with 33% of Australian born mothers
- live in a *Major city*—33% of women with gestational diabetes living in a *Major city* were treated with insulin therapy compared with 24% of women living in *Remote and very remote* areas.

Women treated with oral hypoglycaemic medications were more likely to:

- be younger—women aged 15-19 were 2.2 times as likely to be treated with oral hypoglycaemic medications as women aged 45-49 (11% compared with 5%)
- Live in *Remote and very remote* areas—(20% compared with 7%-10%, respectively for women living in other areas)
- be socioeconomically disadvantaged—9% of women in the lowest socioeconomic group used oral hypoglycaemic medications compared with 6% of women from the highest socioeconomic group.

Women who treated their gestational diabetes through diet, exercise and/or lifestyle management were more likely to:

- be younger—women aged 15-19 were 1.3 times as likely to be treated without medication as women aged 45-49 (66% compared with 51%)
- be born in North-East Asia (72% compared with 53% of Australian born mothers)
- be in the highest socioeconomic group (59% compared with 54% of mothers from the lowest socioeconomic group).

See the [Incidence of gestational diabetes data visualisation](#) for further detail.

Aboriginal and Torres Strait Islander women

In 2016-17:

- just over half (52%) of Indigenous women diagnosed with gestational diabetes, managed their condition without medication through diet, exercise and/or lifestyle management. Almost one-third (29%) were treated with insulin therapy while 13% were treated with oral hypoglycaemic medications.

After adjusting for differences in the age structure of the populations:

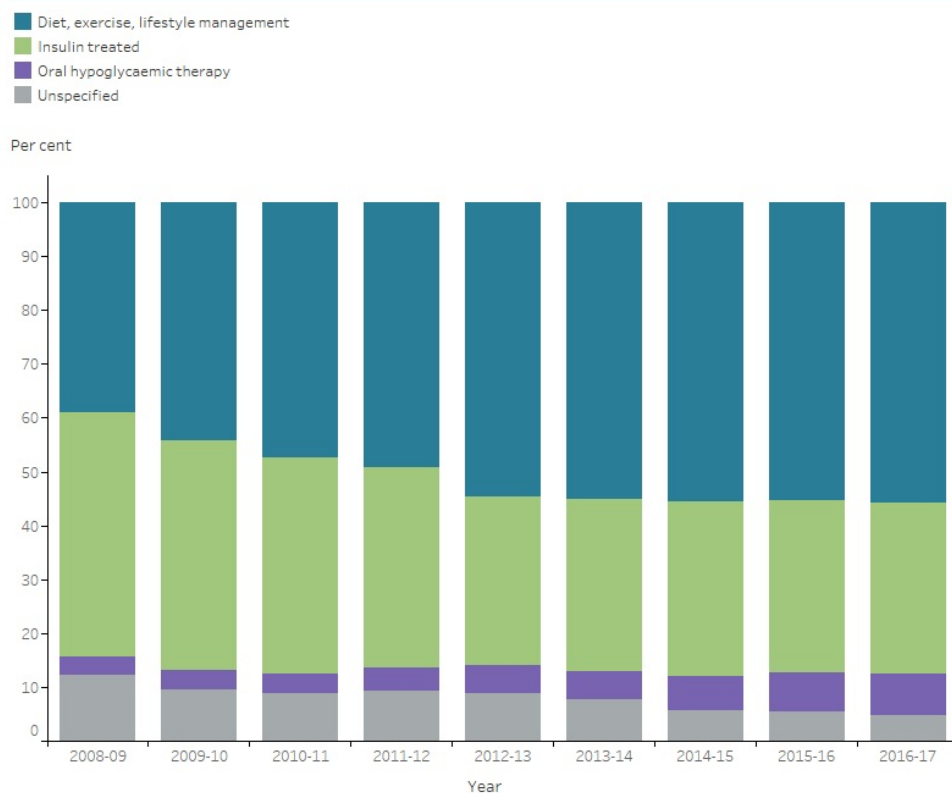
- the use of insulin for the treatment of gestational diabetes was similar between Indigenous and non-Indigenous women (around one-third of cases)
- Aboriginal and Torres Strait Islander women were twice as likely to be treated with oral hypoglycaemic (blood glucose lowering) medications (14% compared with 7%).

Management trends

Between 2008-09 and 2016-17:

- the proportion of gestational diabetes cases treated with insulin therapy decreased from 46% to 32%—remaining unchanged at around 32% since 2012-13
- the proportion of gestational diabetes cases managed through diet, exercise and/or lifestyle management increased from 39% to 56%—remaining steady at between 55% and 56% since 2012-13
- the proportion of gestational diabetes cases treated with oral hypoglycaemic medications has continued to increase steadily from 3.5% to 7.6% (Figure 5).

Figure 5: Gestational diabetes management type 2008-09 to 2016-17



Notes:

Population (women aged 15-49 giving birth in Australian hospitals) based on ICD-10-AM diagnosis codes. Refer to statistical notes for method.

Chart: AIHW. Source: National Hospital Morbidity Database.

Outcomes

Gestational diabetes is associated with an increased risk of adverse outcomes for the mother and child both during pregnancy and birth and in the longer-term.

The AIHW's [Diabetes in pregnancy 2014-15](#) report found that compared to women with no diabetes, women with gestational diabetes had higher rates of caesarean section, induced labour, pre-existing and gestational hypertension, and pre-eclampsia. Longer antenatal and postnatal stays in hospital were also experienced by these women. The report also found higher rates of complications (pre-term birth, resuscitation, special care nursery/neonatal intensive care unit admission and longer hospital stay) for babies of mothers with gestational diabetes than babies of mothers with no diabetes (AIHW 2019).

Longer-term consequences of gestational diabetes to the mother include a significantly increased risk for the development of type 2 diabetes, metabolic syndrome and cardiovascular disease. Babies of mothers with gestational diabetes are also at an increased risk of type 2 diabetes, metabolic syndrome and obesity in later life (Kampmann et al. 2015).

For this web report, the [National Hospital Morbidity Database \(NHMD\)](#) has been used to report the short-term complications for women with gestational diabetes during pregnancy and delivery in 2016-17.

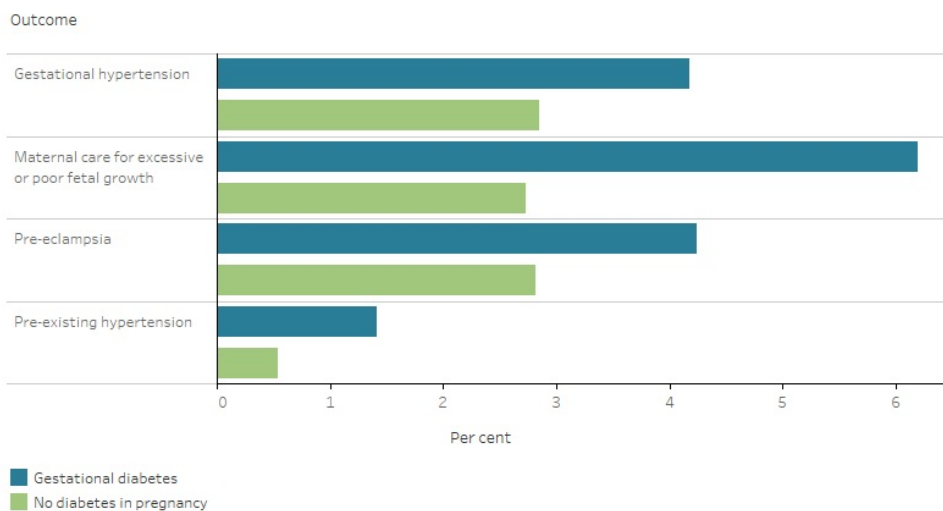
In 2016-17, women who gave birth in hospital who were diagnosed with gestational diabetes, experienced a number of differences in pregnancy and birth outcomes compared to women with no diabetes—even after adjusting for differences in the age structure of the populations.

Pregnancy outcomes

During pregnancy, women with gestational diabetes were more likely than women with no diabetes to:

- be diagnosed with pre-eclampsia (4.2% compared with 2.8%)
- be diagnosed with pre-existing hypertension (1.4% compared with 0.5%)
- be diagnosed with gestational hypertension (4.2% compared with 2.9%)
- receive maternal care for excessive fetal growth (6.2% compared with 2.7%) (Figure 6).

Figure 6: Selected pregnancy outcomes for women giving birth in hospital, 2016-17, by diabetes status



Notes:

1. Age-standardised to the 30 June 2001 Australian female resident population aged 15-49.
2. Pregnancy outcome includes Primary and Additional diagnosis.

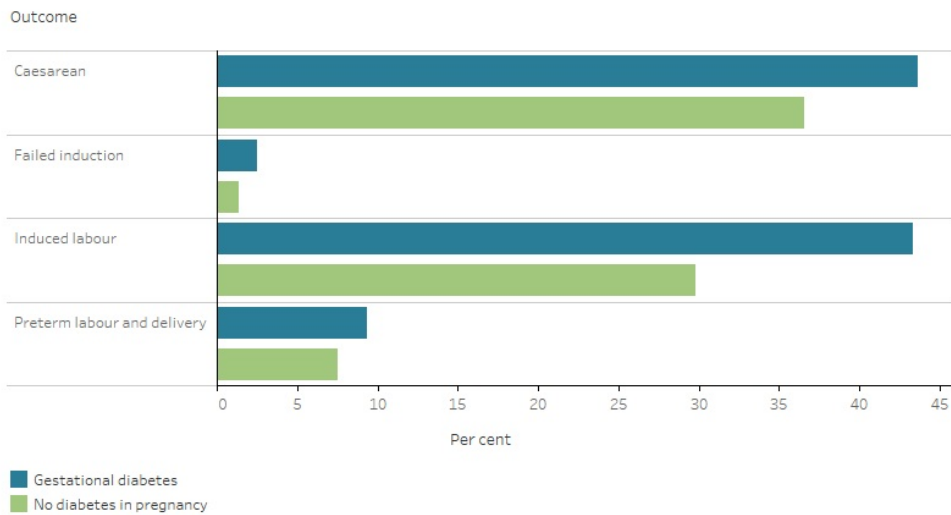
Chart: AIHW. Source: National Hospital Morbidity Database.

Labour and delivery outcomes

During labour and delivery, women with gestational diabetes were more likely than women with no diabetes to experience:

- Induced labour (43% compared with 30%)
- Caesarean section (elective and emergency) (44% compared with 37%)
- Pre-term labour and delivery (9.3% compared with 7.5%)
- Failed induction of labour (2.5% compared with 1.4%) (Figure 7).

Figure 7: Selected labour and delivery outcomes for women giving birth in hospital, 2016–17, by diabetes status



Notes:
 1. Age-standardised to the 30 June 2001 Australian female resident population aged 15–49.
 2. Outcome includes Primary and Additional diagnosis.
 Chart: AIHW. Source: National Hospital Morbidity Database.

References

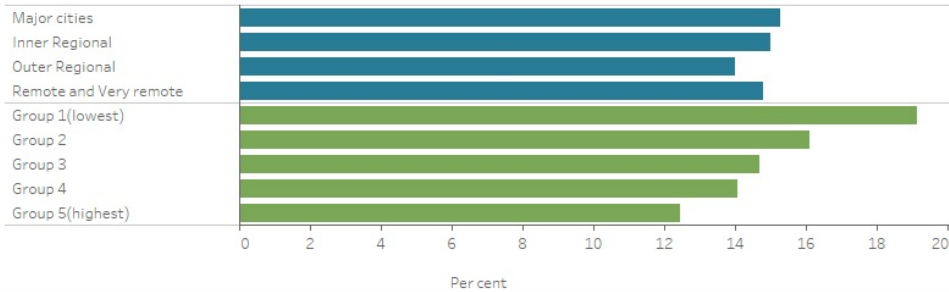
AIHW (Australian Institute of Health and Welfare) 2019. [Diabetes in pregnancy 2014-2015](#). Bulletin no. 146. Cat. no. CDK 7. Canberra: AIHW.

Kampmann U, Madsen LR, Skajaa GO, Iversen DS, Moeller N & Ovesen P 2015. Gestational diabetes: a clinical update. *World Journal of Diabetes* 6:1065-72.

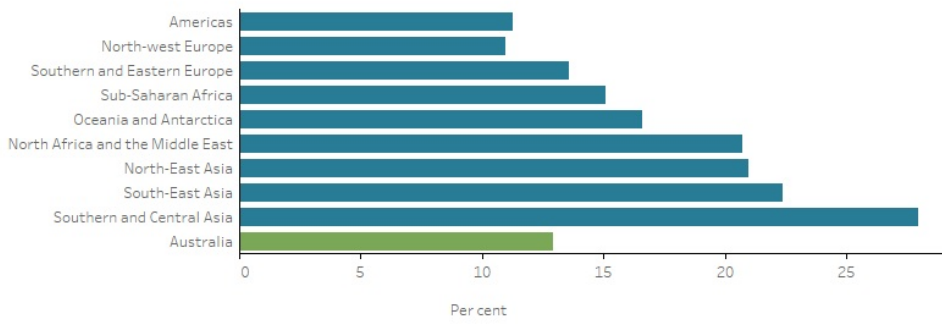
Data visualisation

In this Incidence of gestational diabetes data visualisation, you can explore the data over time (financial years 2000-01 to 2016-17) by age group. Incidence and treatment data can also be explored by population group and birth region.

Incidence of gestational diabetes 2016-17, by selected population group



Incidence of gestational diabetes 2016-17, by birth region



Notes:
 1. Age-standardised to the 30 June 2001 Australian female resident population aged 15-49.
 2. Population (women aged 15-49 giving birth in Australian hospitals) based on ICD-10-AM diagnosis codes.
 3. Birth region analysis excludes 1,556 women whose birth region couldn't be determined.
 Chart: AIHW. Source: National Hospital Morbidity Database.

Data gaps

A number of data gaps have been identified for the comprehensive reporting on gestational diabetes.

Reporting recurrence

Gestational diabetes usually resolves after the baby is born, however women who have had a pregnancy complicated by gestational diabetes have a significantly increased risk for the recurrence of the condition in later pregnancies. Studies have shown recurrence rates to vary between 30% and 84% (Kim et al. 2007) with the risk of recurrence increasing with the number of pregnancies and among higher risk ethnic groups (Non-Hispanic black, Hispanic and Asian/Pacific Islander) (Schwartz et al. 2015).

Reporting on the recurrence of gestational diabetes is not possible using the National Hospital Morbidity Database (NHMD)—the primary data source for this web report, as the NHMD provides information on de-identified episodes of care that cannot be linked across multiple admissions.

The National Diabetes Services Scheme (NDSS) is an Australian Government subsidy scheme which has been administered by Diabetes Australia for the Australian Government since 1987. By registering with the NDSS, people with diabetes are provided with subsidised diabetes-related products, information and support. The NDSS captures people with type 1, type 2, gestational and other forms of diabetes.

Data Snapshots from the [NDSS](#) currently provide an indication of the number of NDSS registrations for repeat gestational diabetes diagnoses within a 12-month period, dating back to 2014.

Reporting pre-existing diabetes in pregnancy

There are currently limitations to national reporting on outcomes of mothers who have pre-existing diabetes and their babies. Further, it is not always possible to decipher from the data if the diabetes is pre-existing or gestational. It is an important subgroup with the AIHW's [Diabetes in pregnancy 2014-2015](#) report finding that compared with mothers with no diabetes in pregnancy, mothers with pre-existing type 1 and type 2 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). 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 (AIHW 2019).

The NPDC is a national population-based cross-sectional collection of data on pregnancy and childbirth and contains information about the diabetes status of women who gave birth. While it is a useful data source, the current information on maternal diabetes that it contains has several limitations, including the inability of some states and territories to distinguish between pre-existing types of diabetes, and differences in data collection methods across jurisdictions. Data on diabetes status in Victoria are not collected in a format comparable with the specification for the NPDC and were excluded in the report when reporting on gestational diabetes and pre-existing diabetes.

The NHMD provides national data on pregnancies affected by diabetes, but ICD-10-AM coding changes and the accuracy of recording diabetes type affects the ability to report on the number of pregnancies affected by, and complications from pre-existing diabetes type.

Reporting longer-term complications

Longer-term health complications associated with gestational diabetes for the mother include a significantly increased risk for the development of type 2 diabetes, metabolic syndrome and cardiovascular disease. Babies of mothers with gestational diabetes are also at an increased risk of type 2 diabetes, metabolic syndrome and obesity in later life (Kampmann et al. 2015).

The NHMD allows the reporting of short-term outcomes for the mother, relating to pregnancy and the birth event. However, as records in the NHMD are for individual episodes of care, longer-term complications cannot be reported.

Babies affected by maternal diabetes can be identified through the NHMD with ICD-10-AM Chapter XVI P70 codes. Using the P70 codes and any additional diagnoses reported on the records of the babies, will provide information on the impact of maternal diabetes on babies. However, the codes are not able to comprehensively identify all babies born to mothers with diabetes, as they only identify babies affected by maternal diabetes, and not all babies born to a mother with diabetes will experience complications.

The NPDC contains information about the diabetes status of women who gave birth, and associated adverse maternal and perinatal outcomes around the time of birth. However, the NPDC does not collect information to assess longer-term health implications for the mother and baby. Reporting of some pregnancy-related outcomes—such as eclampsia, antepartum haemorrhage, postpartum haemorrhage, and complications of the puerperium—is also voluntary, and might not be provided by all jurisdictions.

Linkage of maternal records with other data sources would be required in order to accurately report, at a national level, on the recurrence of gestational diabetes, identifying women with pre-existing and other diabetes types and to report longer-term complications from gestational diabetes, both for the mother and the baby.

For further information, refer to the AIHW's [Improving national reporting on diabetes in pregnancy: technical report](#).

References

AIHW (Australian Institute of Health and Welfare) 2019. [Diabetes in pregnancy 2014-2015](#). Bulletin no. 146. Cat. no. CDK 7. Canberra: AIHW.

Kampmann U, Madsen LR, Skajaa GO, Iversen DS, Moeller N & Ovesen P 2015. Gestational diabetes: a clinical update. *World Journal of Diabetes* 6:1065-72.

Kim C, Berger DK & Chamany S 2007. Recurrence of Gestational Diabetes Mellitus: a systematic review. *Diabetes Care* 30(5):1314-1319.

Schwartz N, Nachum Z & Green MS 2015. The prevalence of gestational diabetes mellitus recurrence—effect of ethnicity and parity: a meta analysis. *American Journal of Obstetrics & Gynecology* 213(3):310-317. doi:10.1016/j.ajog.2015.03.01.

© Australian Institute of Health and Welfare 2023



Methods

This section outlines the data source and statistical methods for analysing the data presented in the Incidence of gestational diabetes in Australia web report and accompanying fact sheet.

The [National Hospital Morbidity Database](#) (NHMD) is the main data source used for this web report. The NHMD is a collection of episode-level records from the Admitted Patient Care National Minimum Data Set. It contains information on episodes of care for admitted patients in hospital, and includes demographic, diagnostic, outcomes, interventions and procedural information.

Further information about the NHMD 2016-17 can be found in the [Admitted patient care 2016-17: Australian hospital statistics](#) report (Appendix A).

Counting births in the NHMD

The number of new cases of gestational diabetes (numerator) was calculated based on the number of hospitalisations of females with a birth event code (ICD-10-AM code Z37) and coexisting diagnosis of gestational diabetes (ICD-10-AM code O24.4) in the year of interest. A single birth event code is entered for each woman, regardless of the number of times she is hospitalised during the same pregnancy or the number of babies born.

As a result, this method counts unique pregnancies affected by gestational diabetes resulting in a hospital birth.

The population at risk of gestational diabetes (denominator population) was based on the number of hospitalisations (pregnancies) with a birth event code (Z37) in the year of interest.

All pregnancies, regardless of outcome (that is, stillbirth or live birth) are counted by this method.

The numerator, pregnancies affected by gestational diabetes, were divided by the denominator population, total hospitalisations (pregnancies) to give the proportion of pregnancies affected by gestational diabetes in the year of interest.

Diabetes in pregnancy status

Two sets of diabetes codes in ICD-10-AM have been taken into account: diabetes 'E-codes' and diabetes in pregnancy 'O24-codes'. The matrix below shows the method used to assign diabetes in pregnancy status to records from the NHMD, where a record also includes an outcome of delivery code (Z37). The method uses a hierarchy, whereby a record with any E-code is assigned to pre-existing diabetes in pregnancy status first, and the remaining records are assigned a status based on the diabetes in pregnancy O24-codes. Gestational diabetes is only assigned where an O24.4 code exists in the absence of any E-code.

Table 1: Matrix of ICD-10-AM codes for assigning diabetes in pregnancy status

		Diabetes (E-codes)			
		Type 1 (E10)	Type 2 (E11)	Other/unspecified (E13 and E14)	No E-code
	Pre-existing type 1 diabetes (O24.0)	Pre-existing type 1 diabetes	Pre-existing type 2 diabetes	Pre-existing other/unspecified diabetes	Pre-existing type 1 diabetes
	Pre-existing type 2 diabetes (O24.1)	Pre-existing type 1 diabetes	Pre-existing type 2 diabetes	Pre-existing other/unspecified diabetes	Pre-existing type 2 diabetes
Diabetes in pregnancy codes (O24-codes)	Pre-existing other/unspecified diabetes (O24.2 and O24.3)	Pre-existing type 1 diabetes	Pre-existing type 2 diabetes	Pre-existing other/unspecified diabetes	Pre-existing other/unspecified diabetes
	Gestational diabetes (O24.4)	Pre-existing type 1 diabetes	Pre-existing type 2 diabetes	Pre-existing other/unspecified diabetes	Gestational diabetes
	Diabetes in pregnancy , unspecified onset (O24.9)	Pre-existing type 1 diabetes	Pre-existing type 2 diabetes	Pre-existing other/unspecified diabetes	Diabetes in pregnancy, unspecified onset

No O24-code	Pre-existing type 1 diabetes	Pre-existing type 2 diabetes	Pre-existing other/unspecified diabetes	No diabetes in pregnancy
-------------	------------------------------	------------------------------	---	--------------------------

Source: ICD-10-AM/ACHI/ACS, Ninth edition.

ICD-10-AM codes

The following table presents the variables and ICD-10-AM codes used to count the population of women giving birth (outcome of delivery), their diabetes status, treatment status and the effects of pregnancy, labour and delivery.

Table 2: Analysis variables and ICD-10-AM code

Definition	ICD-10-AM code
Outcome of delivery (birth event)	Z37
<i>Diabetes in pregnancy status</i>	
Type 1 diabetes	E10
Type 2 diabetes	E11
Other specified diabetes	E13
Unspecified diabetes	E14
Pre-existing diabetes, type 1, in pregnancy	O24.0
Pre-existing diabetes, type 2, in pregnancy	O24.1
Pre-existing diabetes, type 2, other specified type, in pregnancy	O24.2
Pre-existing diabetes, type 2, unspecified specified type, in pregnancy	O24.3
Diabetes arising in pregnancy (gestational diabetes)	O24.4
Diabetes in pregnancy , unspecified onset	O24.9
<i>Treatment of gestational diabetes</i>	
Insulin-treated	O24.42
Oral hypoglycaemic therapy	O24.43
Other (diet, exercise and lifestyle management)	O24.44
Unspecified	O24.49
<i>Effects: outcomes and complications</i>	
Pre-existing hypertension complicating pregnancy, childbirth and the puerperium	O10
Pre-eclampsia superimposed on chronic hypertension	O11
Gestational (pregnancy-induced) hypertension	O13
Pre-eclampsia	O14
Maternal care for excessive fetal growth	O36.6
Pre-term labour and delivery	O60
Failed induction of labour	O61
Single delivery by forceps and vacuum extractor; Multiple delivery, all by forceps and vacuum extractor	O81 and O84.1
Single spontaneous delivery; Multiple delivery, all spontaneous	O80 and O84.0
Induced labour	ACHI Block number 1334
Caesarean section (includes emergency and elective)	ACHI Block number 1340

Source: ICD-10-AM/ACHI/ACS, Ninth edition.

Age-standardised proportions

Direct age-standardisation was used in this report to remove the differences in age structure from the analysis, and highlight the contributions of diabetes to differences in the occurrence of effects of pregnancy, labour, and delivery between diabetes in pregnancy status groups.

Of all women who gave birth, those with gestational diabetes tend to be older than women with no diabetes in pregnancy. Aboriginal and Torres Strait Islander women who gave birth were younger than non-Indigenous or other Australian women who gave birth. So, age-standardising these groups removed the influence of older or younger maternal age, making comparisons of outcomes more valid.

Proportions have been calculated by dividing the number of cases of a particular outcome in a single diabetes in pregnancy status group (for example, gestational diabetes) by the total number of women (aged 15-49) who gave birth in hospital.

Age-standardised proportions have been calculated using the direct method, using the 30 June 2001 Australian female estimated resident population, based on the 2001 Census as the standard population.

Confidence intervals

In the Incidence of gestational diabetes in Australia web report and fact sheet, 95% confidence intervals were calculated around age-standardised proportions, to determine whether differences in pregnancy outcomes between diabetes pregnancy status groups were significant. A difference was deemed statistically significant if the 95% confidence intervals of the age-standardised proportions did not overlap. Confidence intervals have not been presented in the report.

Incidence

Incidence is the number of new cases (of an illness or event) occurring in a population during a given period. Incidence can be described as either a whole number or rate relative to the total number of people at risk.

Incidence should not be confused with prevalence, which refers to the total number or proportion of cases (of an illness or event) in a population at a given point in time.

In this report, incidence of gestational diabetes is reported by financial year—that is, the number of new cases from 1 July to 30 June in the year being reported.

Throughout this report, incidence is calculated and presented as a proportion of the age-standardised population.

For example, the incidence of gestational diabetes is calculated as a proportion of women aged 15-49 who gave birth in an Australian hospital.

Estimated resident populations

Population data were used to derive incidence of gestational diabetes. Population data that the AIHW holds are sourced from the Australian Bureau of Statistics (ABS), and updated as revised or new estimates become available.

All population estimates that the ABS currently produces are based on area of usual residence. These estimated resident populations are derived from the ABS Census of Population and Housing, and adjusted for deaths, births and net migration. The estimated resident populations used in this report are based on the population estimates for 30 June 2017.

Remoteness

Comparisons of regions in this report use the ABS Australian Statistical Geography Standard (ASGS) 2011 Remoteness Structure, which groups Australian regions into 6 remoteness areas. The 6 remoteness areas are Major cities, Inner regional, Outer regional, Remote, Very remote and Migratory. These areas are defined using the Accessibility/Remoteness Index for Australia (ARIA), which is a measure of the remoteness of a location from the services that large towns or cities provide.

Accessibility is based on distance to a metropolitan centre. A higher ARIA score denotes a more remote location. The category Major cities includes Australia's capital cities, with the exceptions of Hobart and Darwin, which are classified as Inner regional. Note that Remote and Very remote areas have been combined in this publication, and the sixth remoteness area, Migratory, is excluded.

Further information on the ASGS, see [Australian Statistical Geography Standard](#) is available on the ABS website.

The coverage of the NDSS may be lower in Remote and very remote areas or across states and territories with large remote communities, which may influence estimates on the number of people with insulin-treated diabetes in these areas on the NDR. This may in part be due to the distribution of NDSS Access Points which assist in delivering support services and products to people with diabetes in all states and territories. These Access Points may be limited in rural Australia and unavailable in remote communities, with other programs sometimes being available in these areas to assist with the purchase of diabetes-related products.

Socioeconomic group

Socioeconomic classifications in this report are based on the ABS Index of Relative Socio-economic Disadvantage (IRSD). Geographic areas are assigned a score based on social and economic characteristics of that area, such as income, educational attainment, public sector housing, unemployment and jobs in low skill occupations.

A low score means an area has, on average, more low-income families, people with less training, and higher unemployment, and may be considered disadvantaged relative to other areas with higher scores. High scores reflect a relative lack of disadvantage, rather than advantage, and the IRSD relates to the average disadvantage of all people living in a geographical area. It cannot be presumed to apply to all individuals living in the area.

For the analysis in this report, the population is divided into 5 socioeconomic groups, with roughly equal populations (each around 20% of the total), based on the level of disadvantage of the statistical local area of their usual residence. The first group includes the 20% of the population living in areas with the highest levels of relative disadvantage (referred to as Group 1, most disadvantaged), while the last group includes the 20% of the population living in areas with the lowest levels of relative disadvantage (referred to as Group 5, least disadvantaged).

Further information about the IRSD values used in this report are based on the 2011 Census. Further information is available on the [ABS website](#).

© Australian Institute of Health and Welfare 2023





Notes

Amendments

18 Sep 2019 - Excel data tables re-loaded following correction of spelling error that was discovered on the contents page.

Acknowledgements

The authors and data analysts for this report were Heidi Dietz, James Pearce, Pearl Ng and Anne-Marie Waters. Valuable input was provided by Ashleigh Bennett and Rachel Burnett.

Contributions of Miriam Lum On in the development of methods and internal review process are gratefully acknowledged.

Valuable comments were received from Lynelle Moon, Richard Juckes, George Bodilsen and Fadwa Al-Yaman on the data analysis and presentation of results. Valuable comments received from Professor David Simmons and individuals of the Department of Health are also acknowledged.

This report was prepared under the guidance of the AIHW's Diabetes Expert Advisory Group (DEAG), chaired by Professor Jonathan Shaw. Members of the DEAG at the time of preparation of the report were Professor Maria Craig, Research Associate Professor Wendy Davis, Professor Mark Harris, Adjunct Professor Greg Johnson, Associate Professor Glynis Ross and Professor Sophia Zoungas.

Funding from the Department of Health contributed to the production of this report.



Data





Related material

Resources

Latest related reports

- Incidence of insulin-treated diabetes in Australia |
Web report | 08 Feb 2022
- Diabetes in pregnancy 2014-2015 |
Publication | 12 Feb 2019

Related topics

- [Diabetes](#)
 - [Mothers & babies](#)
-

