Diabetes: Australian facts

Web report | Last updated: 30 Jun 2023

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Diabetes: Australian facts

Web report | Last updated: **30 Jun 2023** | Topic: Diabetes | Media release

About

This web report is part of Australian Centre for Monitoring Population Health

Diabetes: Australian facts provides key information for monitoring diabetes in the Australian population, focussing on diabetes risk factors, major subtypes, treatment and impact. The report includes information on incidence, prevalence, hospitalisation and deaths, with additional analysis of priority population groups. An interactive data tool allows for further exploration of available data.

Cat. no: CVD 96

- Explore the data
- Australian stories about diabetes
- Data tables

Findings from this report:

- More than 1.3 million (1 in 20) Australians were living with diabetes in 2021

- Diabetes contributed to 11.2% of all deaths in 2021

- 1 in 6 women who gave birth in 2021–22 was diagnosed with gestational diabetes

- 11% of total hospitalisations (1.3 million) were associated with diabetes in 2020–21

In this report:

Diabetes risk factors

Explore the factors that increase the risk of a person developing type 2 diabetes

- Insufficient physical activity
- Smoking
- Waist circumference
- Inadequate fruit and/or vegetable intake
- High blood pressure
- Impaired fasting glucose
- Diabetes risk factors
- Overweight and obesity
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How common is diabetes?

Explore diabetes prevalence (existing cases) and incidence (new cases) by key subtypes

- Type 2 diabetes
- Type 1 diabetes
- Gestational diabetes
- All diabetes

Comorbidity of diabetes

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- Comorbidity of diabetes

Treatment and management

Explore the treatment and management of diabetes

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Impact of diabetes

Explore the impact of diabetes on the Australian population including diabetes deaths

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- Burden of diabetes
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Impact of COVID-19

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- Impact of COVID-19

Summary

Diabetes is an <u>Australia's health</u> topic

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Diabetes

Diabetes is a chronic condition marked by high levels of glucose (sugar) in the blood. It is caused by the inability to produce insulin (a hormone made by the pancreas to control blood glucose levels) or to use insulin effectively, or both.

The main types of diabetes are type 1 diabetes, type 2 diabetes, gestational diabetes and other diabetes.

Treatment aims to maintain healthy blood glucose levels to prevent both short- and long-term complications, such as cardiovascular disease, kidney disease, blindness and lower limb amputation. Insulin replacement therapy is required by all people with type 1 diabetes, as well as some people with other forms of diabetes if their condition is not controlled by non-insulin diabetes medications.

See <u>What is diabetes?</u> for more information.

How common is diabetes?

In 2021, an estimated 1 in 20 (just over 1.3 million) Australians were living with diabetes (prevalence) and were registered with the <u>National Diabetes Services Scheme</u> (NDSS) and <u>Australasian Paediatric Endocrine Group</u> (APEG) state-based registers. This includes people with type 1 diabetes, type 2 diabetes and other diabetes, but excludes gestational diabetes.

In 2021, the prevalence of diabetes increased with age with almost 1 in 5 Australians aged 80–84 living with diabetes – almost 30 times as high as for those aged under 40 (0.7%). Diabetes was 1.3 times as common in males compared with females, after controlling for age.

The <u>age-standardised</u> prevalence rate of diabetes increased by over 80% between 2000 and 2012 and has remained largely unchanged in the 10 years since then (Figure 1).

> ### Limitations of estimating diabetes prevalence
>
> The rates presented above are likely to underestimate the true prevalence of diabetes in the Australian population due to a range of factors, including:
>
> - prevalence rates are based on people who have received a formal medical diagnosis of diabetes, however, Australian studies have shown that many people are living with undiagnosed type 2 diabetes. For example, in the 1999–2000 AusDiab Study, half of all diabetes was undiagnosed (Dunstan et al. 2001) and in the 2011–12 Australian Bureau of Statistics (ABS) Australian Health Survey, which collected blood glucose data, 20% of participating adults aged 18 and over had undiagnosed diabetes prior to the survey (ABS 2013).
> - registration with the NDSS is voluntary for eligible individuals and is estimated to capture 80–90% of people with diagnosed diabetes. People with type 2 diabetes are more likely to register if they access diabetes consumables to monitor their diabetes at home or require insulin.
> - Indigenous Australians are under-represented on the NDSS (see <u>Using the NDSS for reporting on Indigenous Australians</u>).
>
> Despite these limitations, these data sources provide the best picture into the number of people living with diabetes in Australia to monitor changes in populations at risk and trends over time.
>
> Further research is required to examine whether the proportion of people with undiagnosed type 2 diabetes in Australia has changed over time and the impact of this on the prevalence of disease in Australia.

Figure 1: Prevalence of diabetes from linked NDSS and APEG data, 2000 to 2021

This chart shows the estimated age-standardised proportion of people with diabetes based on data from the linked National Diabetes Services Scheme and Australasian Paediatric Endocrine Group between 2000 and 2021. The proportion increased from 2.4% in 2000 to 4.3% in 2021 and has remained relatively stable since 2014.
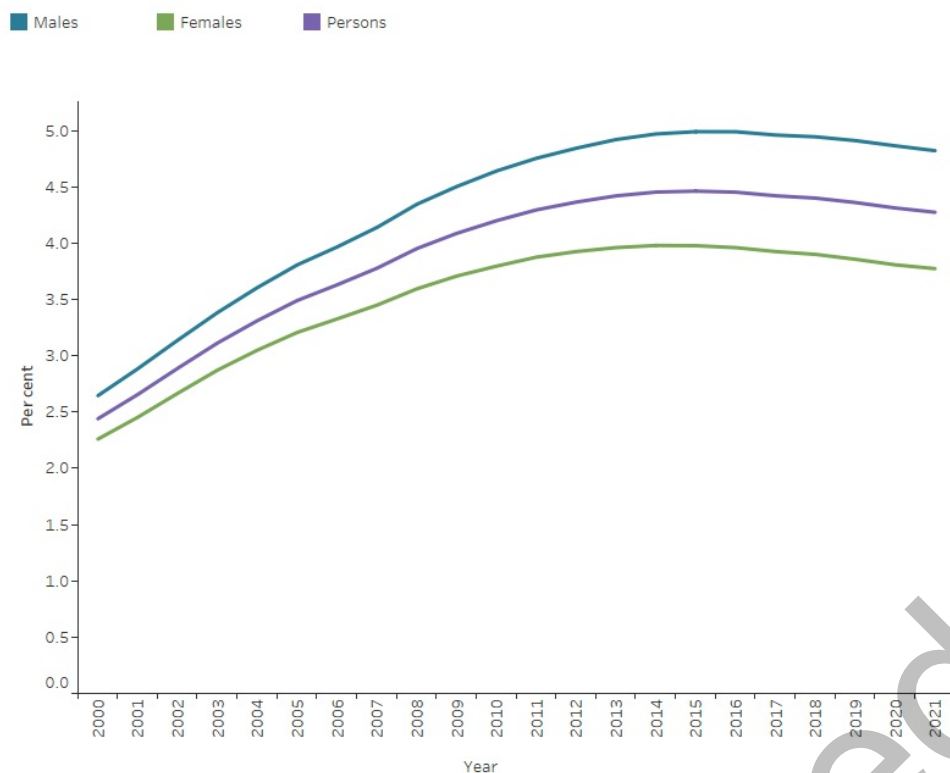

Figure 1: Prevalence of diabetes from linked NDSS and APEG data, 2000–2021

Notes:
1. Age-standardised to the 2001 Australian Standard Population.
2. Includes persons with missing or unassigned information on age and/or sex.

Source: AIHW analysis of linked National Diabetes Services Scheme and Australasian Paediatric Endocrine Group state-based registers.
https://www.aihw.gov.au

Type 1 diabetes

Around 58,600 people were newly diagnosed (incidence) with type 1 diabetes between 2000 and 2021 according to the National (insulin-treated) Diabetes Register (NDR).

In 2021, there were 3,000 people newly diagnosed with type 1 diabetes in Australia, equating to 12 diagnoses per 100,000 population.

The incidence of type 1 diabetes remained relatively stable across the last 2 decades, fluctuating between 11 and 13 new cases per 100,000 population.

See Type 1 diabetes for more information.

Type 2 diabetes

Just over 1.3 million people were newly diagnosed with type 2 diabetes between 2000 and 2021, according to linked NDSS and APEG data. This was an average of around 60,000 people each year.

However in 2021, the number of people newly diagnosed with type 2 diabetes in Australia was well below this average at 45,700, equating to 178 people diagnosed per 100,000 population.

There has been a steady decline in the age-standardised incidence rate for type 2 diabetes in Australia between 2000 and 2021, with an overall drop of 43%. Although evidence from the 2019 Global Burden of Disease study as reported in *The Lancet* (2020) shows an overall increase in incidence globally, the observed declining trend has also been reported in a number of other countries (Magliano et al. 2019; Magliano et al. 2021). The fall in incidence may be due to improved preventive measures such as screening, increased awareness and educational programs leading to behavioural changes and risk factor modification (Magliano et al. 2019; Shrapnel and Butcher, 2020).

See Type 2 diabetes for more information.

Gestational diabetes

More than 1 in 6 (17.9% or 53,900) females aged 15–49 who gave birth in hospital in 2020–21 had been diagnosed with gestational diabetes during their pregnancy, according to the National Hospital Morbidity Database (NHMD).

After adjusting for changes in the age structure of the population over time, the incidence of gestational diabetes more than doubled in Australia between 2012–13 and 2021–21 (Figure 2).

The rising incidence of gestational diabetes in the last decade is likely driven by several factors including increasing maternal age, higher rates of maternal overweight and obesity, and a growing proportion of higher risk ethnic groups in the population (Laurie and McIntyre 2020). The introduction of new diagnostic guidelines across all states and territories between 2011 and 2013 is also likely to have had an impact on rates.

See Incidence of gestational diabetes in Australia – Changing trends and Gestational diabetes for more information.

Figure 2: Incidence of gestational diabetes, 2000-01 to 2021-22

The chart shows the proportion of females diagnosed with gestational diabetes in Australia more than doubled from 9.3% in 2012–13 to 19.3% in 2021–22. Caution should be taken when comparing rates over time as many factors, including new diagnostic guidelines, are likely to have had an impact on the number of females diagnosed with gestational diabetes in recent years.
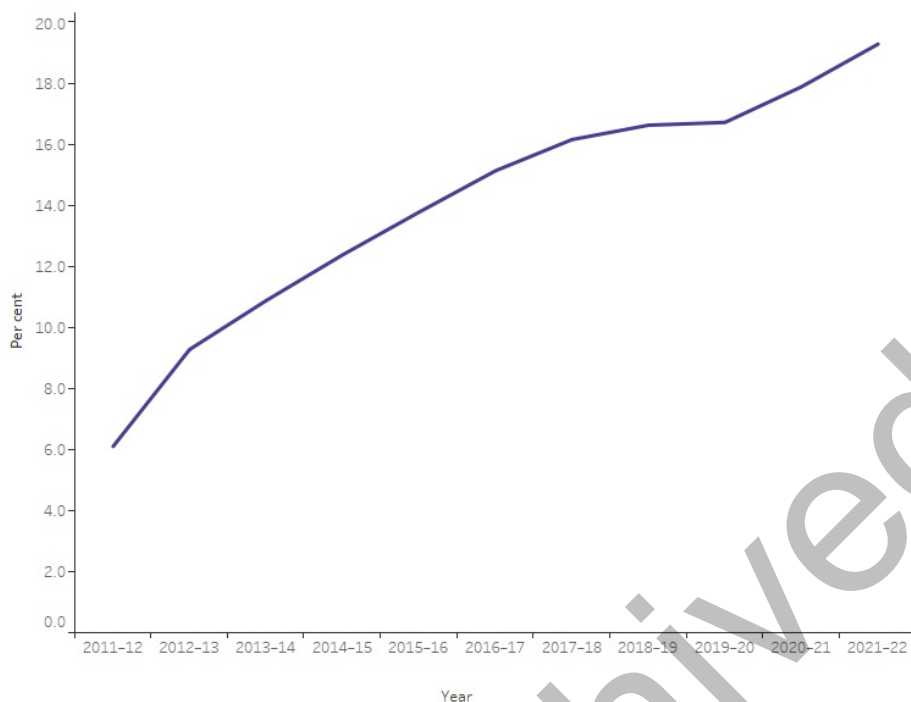

Figure 2: Incidence of gestational diabetes, 2011–12 to 2021–22

Notes
1. Age-standardised to the 2001 Australian Standard Population.
2. Population (women aged 15–49 giving birth in Australian hospitals) based on ICD-10-AM diagnosis codes.
3. Includes persons with missing or unassigned information on age and/or sex.
4. Caution should be taken when comparing rates over time as several factors, including new diagnostic guidelines are likely to have had an impact on incidence in recent years.
Chart: AIHW. Source: National Hospital Morbidity Database.
https://www.aihw.gov.au

Impact of diabetes

Burden of disease

Burden of disease refers to the quantified impact of living with and dying prematurely from a disease or injury and is measured using disability-adjusted life years (DALY). One DALY is equivalent to one year of healthy life lost.

In 2022, type 2 diabetes was responsible for 125,500 DALY in Australia – equating to 3.9 per 1,000 population. Type 2 diabetes contributed 2.3% of the total disease burden in Australia and was the 12th leading contributor. After accounting for differences in the age structure of a population, the overall burden from type 2 diabetes decreased slightly from 4.1 per 1,000 population in 2011 to 3.9 per 1,000 population in 2022. Type 1 diabetes was responsible for around 19,000 DALY, equating to 0.7 per 1,000 population (age-standardised rate). This rate is slightly higher than that recorded in 2015 and 2018, 0.6 and 0.7 per 1,000 population, respectively. Type 1 diabetes contributed to 0.3% of the total burden in Australia in 2022 (AIHW 2022b).

Additionally, in 2018, 4.3% of the total burden of disease could have been prevented by reducing exposure to the modifiable risk factor 'high blood plasma glucose levels' (including diabetes) (AIHW 2021b).

See Burden of diabetes.

Expenditure

In 2019-20, an estimated $3.1 billion of expenditure in the Australian health system was attributed to diabetes, representing 2.2% of total disease expenditure. Of the $3.1 billion in expenditure:

- type 2 diabetes represented 63%
- type 1 diabetes 10%
- gestational diabetes 2.0%

- other diabetes 24%* (AIHW 2022d).

*Note: numbers may not add to 100 due to rounding.

See Health system expenditure.

Adverse effects in pregnancy

Based on data from the NHMD for 2020–21, mothers with pre-existing diabetes (and to a lesser extent, gestational diabetes) were more prone to complications during pregnancy and intervention in childbirth with higher rates of caesarean section, induced labour, pre-existing and gestational hypertension, and pre-eclampsia compared with mothers with no diabetes in pregnancy.

Babies of mothers living with diabetes in pregnancy are also at an increased risk of childhood metabolic syndrome, obesity, impaired glucose tolerance, and type 2 diabetes in later life (Clausen et al. 2007; Kim et al. 2012; Zhao et al. 2016).

See Pregnancy complications.

Deaths

According to the AIHW National Mortality Database, in 2021, diabetes was the underlying cause of around 5,400 deaths. However, it contributed to around 19,300 deaths (11.2% of all deaths) when associated causes are also considered (AIHW 2021e).

See Life expectancy and causes of death.

Treatment and management of diabetes

What is HbA1c?

Glycated haemoglobin, haemoglobin A1c or HbA1c, is the main biomarker used to assess long-term glucose control in people living with diabetes. Haemoglobin is a protein in red blood cells which can bind with sugar to form HbA1c. It is directly related to blood glucose levels and strongly related with the development of long-term diabetes complications. Because red blood cells can live for up to 120 days, HbA1c gives an indication of blood glucose over a few months.

HbA1c was endorsed for the diagnosis of diabetes in 2010 by the Australian Medical Association. Diagnosis is confirmed using HbA1c levels ≥48 mmol/L or ≥6.5%. HbA1c targets for people living with diabetes depend on the type of diabetes, life expectancy, risk of hypoglycaemia and other comorbidities.

HbA1c testing

According to the National Prescribing Service (NPS) MedicineWise's MedicineInsight general practice insights report (NPS MedicineWise, 2022) in 2020–21, 70.5% of general practice patients with a diagnosis of diabetes (20 years and older) had at least one test result for HbA1c levels. Among MedicineInsight patients without a diagnosis of diabetes, 14.4% had received at least one test for HbA1c levels (up from 11% in 2019–20).

According to the Australian National Diabetes Audit-Australian Quality Clinical Audit (ANDA–AQCA) 2021, among all adult patients with recorded diabetes (n=4,262), the median HbA1c level was 63.0 mmol/mol. Median HbA1c was slightly higher among patients with type 1 diabetes (66.0 mmol/mol) and slightly lower in patients with type 2 diabetes (62.0 mmol/mol). Patients with gestational diabetes had significantly lower median HbA1c levels (34.0 mmol/mol) (ANDA 2021).

See Ongoing monitoring.

Medicines

In 2020–21, there were over 16.5 million prescriptions dispensed for diabetes medicines through Section 85 of the Pharmaceutical Benefits Scheme and Repatriation Pharmaceutical Benefits Scheme, representing 5.3% of total prescriptions. Metformin, a glucose-lowering medication for patients with type 2 diabetes, was the seventh most dispensed medicine in 2020–21 (Department of Health 2021b).

According to the NDR, 31,700 people began using insulin to treat their diabetes in 2021. Of the people with diabetes who began using insulin, 49% had type 2 diabetes, 39% had gestational diabetes, 10% were newly diagnosed with type 1 diabetes and 2% had other forms of diabetes.

See Medicine use.

Hospitalisations and procedures

Almost 1.3 million hospitalisations were associated with diabetes in 2020–21, with 4.7% recording diabetes as the principal diagnosis and around 95% recording diabetes as an additional diagnosis, according to the NHMD. This represents 11% of all hospitalisations in Australia.

Of these, around 1.1 million recorded type 2 diabetes as the principal and/or additional diagnosis and 64,600 hospitalisations recorded type 1 diabetes as the principal and/or additional diagnosis.

People with diabetes may require procedures to manage their diabetes or treat the complications of diabetes. According to the NHMD, there were 4,500 weight loss procedures and 5,300 lower limb amputations undertaken for people with type 2 diabetes in 2020–21 (18 and 21 per 100,000 population, respectively).

See <u>Hospitalisations</u>.

Variation between population groups

The impact of diabetes varies between population groups. To account for differences in the age structures of these groups, the data presented below is based on age-standardised rates.

In recent years, the impact of diabetes has been higher among Aboriginal and Torres Strait Islander people, those living in lower socioeconomic areas and those living in remote areas (Figure 3). The diabetes prevalence rate was 2.9 times as high among Indigenous Australians as non–Indigenous Australians based on age-standardised self–reported data from the 2018–19 National Aboriginal and Torres Strait Islander Health Survey (ABS 2019b).

Generally, the impact of diabetes increases with increasing remoteness and socioeconomic disadvantage. Deaths related to diabetes were 2.2 times as high in *Remote and very remote* areas compared with *Major cities*, and 2.4 times as high in the lowest compared with the highest socioeconomic areas (Figure 3).

Figure 3: Variation in the impact of diabetes between selected population groups

The table shows the age-standardised rate ratios for all diabetes by selected population group. Rate ratios are presented for prevalence, hospitalisations, deaths and burden of disease. Overall, rates increased for each measure by increasing remoteness and socioeconomic disadvantage while rates were also higher among Indigenous people compared with non-Indigenous people.

Hover on the numbers for more information on the impact of diabetes in each population group.

	Indigenous/ Non-Indigenous	Remote and very remote/Major cities	Most/Least disadvantaged areas
Having diabetes	2.9x	1.3x	1.8x
Hospitalised for diabetes	4.2x	2.6x	2.0x
Dying from diabetes	4.4x	2.2x	2.4x
Burden of diabetes	4.1x	1.8x	2.2x

Figure 3: Variation in the impact of diabetes between selected population groups

Note: This figure uses age-standardised rates to remove the impact of differences in age structures between these groups.
Sources: ABS 2019a,2019b; AIHW 2021a, AIHW 2022c, AIHW 2022e, AIHW 2023.
<u>https://www.aihw.gov.au/</u>

Impact of COVID-19

The onset of the COVID–19 pandemic has significantly impacted the Australian health system, including mortality, hospitalisations, health services, disease management and surveillance. Diabetes is one of many conditions correlated with greater health consequences throughout the COVID-19 pandemic including increased risk of complication and mortality (Peric and Stulnig 2020).

Diabetes incidence

There is growing evidence of an increased risk of new-onset diabetes following COVID-19 (Sathish et al. 2021, Zhang et al. 2022). In the 12-month periods to December 2021 and December 2022, the NDSS recorded around 121,000 and 117,000 new registrants, respectively. Registrations were higher in both periods than any previous 12 months recorded. These new registrations were an increase of 18% and 14%, respectively, compared with the equivalent 12-month period prior to the pandemic (to December 2019). The largest increase in registration was found among people with gestational diabetes, with an increase of 18% between December 2019 and December 2022 (Diabetes Australia 2022).

However, these new registrations may be due, at least in part, to people who were previously diagnosed with diabetes only registering with the NDSS during the pandemic. The increase in registrations may also be influenced by changes to the NDSS to simplify the usual processes to register (Andrikopoulos and Johnson 2020). Further monitoring is required to assess the influence on diabetes diagnoses as the COVID–19

pandemic continues to evolve.

Mortality

According to ABS COVID-19 Mortality data from January 2020 to March 2023, pre-existing chronic conditions were reported on death certificates for 10,850 (80.6%) of the 13,456 deaths due to COVID-19. Diabetes was a pre-existing condition in 15.7% of the doctor-certified deaths with a chronic condition listed on the death certificate (ABS 2023a).

According to ABS *Provisional Mortality Statistics*, in 2022, doctor-certified deaths due to diabetes (registered by 28 February 2023) were 19.2% above the baseline average. The age standardised diabetes death rate for 2022 was 10.5% higher than the baseline average comprising the years 2017–2019 and 2021 (ABS 2023b).

COVID-19 hospitalisations

In 2020–21, there were over 4,700 hospitalisations in Australia that involved a COVID-19 diagnosis. Around 42% of hospitalisations with a diagnosis of COVID-19 had one or more diagnosed comorbid conditions, such as type 2 diabetes or cardiovascular disease, an increase from 25% in 2019–20. Of the 4,700 hospitalisations involving a COVID-19 diagnosis, the most common comorbid conditions associated with COVID-19 hospitalisations over this period were type 2 diabetes (20%) and cardiovascular disease (which includes coronary heart disease and a range of other heart, stroke and vascular diseases) (20%) (AIHW 2022a).

Of those with a recorded comorbid diagnosis of type 2 diabetes:

- 12% of hospitalisations involved time spent in an intensive care unit, compared with 7.0% of all COVID-19 hospitalisations.
- 7.1% involved continuous ventilatory support, compared with 3.8% of all COVID-19 hospitalisations.
- 19% had a separation mode indicating the patient died in hospital, compared with 10.3% of all COVID-19 hospitalisations.

Monitoring

According to NPS MedicineWise analysis of MedicineInsight, the rate of HbA1c testing over the 6-months from 1 March 2020 to 31 August 2020 fell significantly among regularly attending patients with a record of type 2 diabetes compared with all regularly attending patients. The rate of type 2 diabetes encounters remained similar in both time periods. In the pre-COVID period, the average monthly rate of HbA1c testing among patients with a record of type 2 diabetes was 126.1 per 1000 clinical encounters, which fell to 109.0 tests per 1,000 clinical encounters in the early COVID period.

In April 2020, there was a significant decline in the rate of HbA1c tests performed. The rate of testing for patients with a record of type 2 diabetes fell from 120 tests per 1,000 clinical encounters in April 2019 to 77 tests per 1,000 clinical encounters in April 2020 (NPS MedicineWise 2020).

With the COVID–19 pandemic continuing to evolve, it is still too early to predict the long-term impacts on diabetes and other chronic conditions.

See Impact of COVID–19.

Where do I go for more information?

For more information on diabetes, see:

- Incidence of insulin–treated diabetes in Australia
- Indicators for the Australian National Diabetes Strategy 2016–2020: data update
- Incidence of gestational diabetes in Australia

Visit Diabetes for more on this topic.

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Introduction

Diabetes is a chronic condition characterised by high levels of blood glucose and is often associated with other chronic conditions, including cardiovascular disease and chronic kidney disease.

- The impact of diabetes can be reduced through diabetes prevention activities and better support for people living with diabetes, improving health outcomes and reducing long-term complications.
- Substantial progress has been made over many decades in improving the treatment and management of Australians living with diabetes and the prevention of new onset diabetes. Incidence and prevalence rates have been falling for type 2 diabetes, new treatments have improved outcomes for people living with diabetes and some risk factors for developing diabetes have improved. However, the continued large impact of diabetes on the health system makes it an important condition to target for continued monitoring and intervention.
- Progress on diabetes in Australia requires monitoring. This online report provides policy makers, health professionals, researchers and the broader community with a comprehensive summary of the latest available data describing diabetes in the Australian population.

The *Diabetes: Australian facts* report focuses on 4 main areas:

- diabetes risk factors
- diabetes prevalence (existing cases) and incidence (new cases)
- treatment and management
- impact, in terms of self-assessed health, burden of disease estimates, health expenditure and diabetes deaths.

Where possible, additional analysis by Aboriginal and Torres Strait Islander status, remoteness area, socioeconomic area and country of birth have been presented.

Need more information?

Please note: the information in this report does not contain medical advice. If you are concerned about your health, consult a qualified healthcare professional.

For health information and advice refer to healthdirect or call 1800 022 222.

For further information on diabetes including education and support programs refer to:

- Diabetes Australia website
- Juvenile diabetes research foundation website.

What is diabetes?

Diabetes is a chronic condition marked by high levels of glucose in the blood. It is caused either by the inability to produce insulin (a hormone made by the pancreas to keep blood glucose levels in range) or by the body not being able to use insulin effectively, or both.

Diabetes increases the risk of health complications, including heart disease, stroke, kidney disease, blindness and lower limb amputation. It is frequently associated with other chronic health conditions, such as cardiovascular disease and chronic kidney disease.

Type 1 diabetes

Type 1 diabetes is a lifelong autoimmune disease that can be diagnosed at any age but most commonly develops in people aged under 30. The exact cause is unknown, but it is believed to be the result of an interaction of genetic and environmental factors. A person with type 1 diabetes needs insulin replacement to survive and, except in cases where a pancreatic or islet cell transplant occurs, insulin will be required every day for the rest of their life. People with type 1 diabetes must also maintain a careful balance of diet, exercise, glucose management and insulin intake.

Type 2 diabetes

Type 2 diabetes is a condition in which the body becomes resistant to the normal effects of insulin and gradually loses the capacity to produce enough insulin in the pancreas. The condition has strong genetic and family-related (non-modifiable) risk factors and is also often associated with modifiable risk factors. The exact genetic causes of type 2 diabetes are unknown. People may be able to significantly slow or even halt the progression of the condition through changes to diet and increasing the amount of physical activity (Diabetes Australia 2022).

Gestational diabetes

Gestational diabetes occurs when higher than optimal blood glucose is diagnosed in pregnancy. This generally occurs in the second or third trimester of pregnancy, among women who have not previously been diagnosed with other forms of diabetes and can result in complications for mother and baby. While gestational diabetes may resolve after the baby is born, it can recur in later pregnancies and greatly increases the risk, both for the mother and the baby, of developing type 2 diabetes later in life. Some women can manage their gestational diabetes by changes to diet and physical activity, while others require oral hypoglycaemic (blood glucose lowering) medications, insulin therapy, or both.

Other diabetes

'Other' diabetes represents a name for less common forms of diabetes resulting from a range of different health conditions or circumstances. This includes conditions affecting the pancreas and endocrine system, viral infections, genetic syndromes and in some cases, diabetes triggered from medications needed to manage or treat another health condition. 'Other' diabetes may now also refer to new-onset diabetes associated with COVID-19 infection and treatment for the virus (Sathish et al. 2021).

Pre-diabetes

Pre-diabetes is a condition characterised by elevated blood glucose, but not meeting the diagnostic criteria for diabetes. It includes impaired fasting glucose (IFG) where blood glucose levels are higher during a fasted state, impaired glucose tolerance (IGT) where glucose levels are higher than normal, and elevated glycated haemoglobin (HbA1c) which indicates the average blood glucose levels over the past 2–3 months. People with pre-diabetes are at increased risk of developing diabetes and cardiovascular disease.

References

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Sathish T, Kapoor N, Cao Y, Tapp RJ and Zimmet P (2021) 'Proportion of newly diagnosed diabetes in COVID-19 patients: a systematic review and meta-analysis, *Diabetes, Obesity & Metabolism,* 23(3):870-4, doi:10.1111/dom.14269.

Australian stories about living with diabetes

Alex's story

Alex was diagnosed with type 1 diabetes in his late teens. Here he reflects on the importance of healthy eating, regular exercise and the use of technology to manage his condition and overall health and wellbeing.
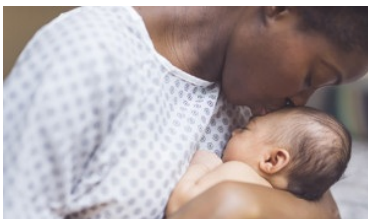
Lee's story

A routine eye examination led to a diagnosis of type 2 diabetes for Lee 6 years ago. Lifestyle changes have enabled Lee to control his blood glucose levels and have resulted in additional health benefits. These case studies are based on interviews with persons living with diabetes. These personal accounts are not necessarily representative of the circumstances of others, but offer insights into the diversity of people's experiences with diabetes.

Claire's story

Claire was diagnosed with gestational diabetes during both her second and third pregnancies. Careful monitoring of her condition resulted in healthy outcomes for both Claire and her babies.

Steve's story

Newly diagnosed with type 2 diabetes, Steve shares some of the challenges he has faced in managing his condition and the importance of not delaying getting medical treatment.

Names and identifying characteristics have been changed. Images are not representative of individuals in the story.

Australian stories about living with diabetes

Alex* is in his early 30s, works in information technology and is married with 2 young children. He has been living with type 1 diabetes for 15 years.

When he was 17, Alex's parents were concerned that he was drinking a lot of water, often felt lethargic and had lost weight. Alex went to see the family general practitioner and was sent straight to the emergency department at his local hospital. He was diagnosed with type 1 diabetes and spent the next week in the hospital's paediatric ward where he was visited by a paediatric endocrinologist and dietitian.

The diagnosis was not a complete shock to Alex, as one of his close family members was living with type 1 diabetes. However, he largely kept the diagnosis to himself – not wanting to be defined by the condition. Alex says that he probably did not take the diagnosis as seriously as he should have when he was in his teens and early 20s. Gradually, though, he has come to realise the importance of monitoring his blood glucose levels, healthy eating, and regular exercise, both for managing his type 1 diabetes and his overall health and wellbeing.

Alex's blood glucose levels have been steady for the last 4 years and he now self-manages his diabetes with a Flash Glucose Monitor (Flash GM) and visits to an endocrinologist every 6–8 months. The Flash GM enables him to monitor his blood glucose levels 24 hours a day without having to prick his finger to test his blood. The data are recorded on an app on his phone, and he receives notification warnings on his smart watch if the glucose levels change. Alex's job requires him to have a commercial driver's licence, so being able to monitor his blood glucose levels with such precision has been an important health and safety consideration to his employment. Alex appreciates the impact that new technologies have had for people with type 1 diabetes and looks forward to further developments in this area.

He says his awareness about his condition has improved greatly since his initial diagnosis. Alex's advice to others with type 1 diabetes is to exercise:

'Exercise is good for everyone; it can help your diabetes. If I exercise the night before, it helps bring my blood glucose levels down for the next day … it has a flow-on effect … it helps your mental space and is good for your life in general.'
This case study is based on an interview with a person who is living with type 1 diabetes. This personal account is not necessarily representative of the circumstances of other people with type 1 diabetes or the challenges they may face, but it is our hope that it will give readers a greater awareness and understanding of the diversity of people's experiences with diabetes.

The information provided does not contain medical advice – consult a qualified healthcare professional for guidance relating to your personal medical needs.

*Names and identifying characteristics have been changed. Images are not representative of individuals in the story.

How common is type 1 diabetes in Australia?

Australian stories about living with diabetes

Lee* is in his mid-50s. He was born in Singapore and is married with 2 grown children. Six years ago, after a routine eye examination, Lee's optometrist detected high pressure in one of his eyes. He was referred to an ophthalmologist for further tests and treatment, and went to his GP for additional testing. His GP diagnosed Lee with type 2 diabetes, based on his HbA1c results.

Lee was prescribed metformin to control his blood glucose levels and has regular HbA1c tests, eye checks, and blood pressure and blood lipid checks. He also sees a dietitian and a diabetes educator. He monitors his eyes closely with visits to the ophthalmologist, and takes eye drops to lower the pressure in his eyes.

Lee used to eat a diet high in carbohydrates. For a person with diabetes, carbohydrate intake is the most important part of the diet to consider when it comes to managing blood glucose levels. Lee says that, initially, it was a challenge to maintain his blood glucose levels within the target range.

It took a while for him to coordinate his meals and medication to avoid hypoglycaemia (low glucose levels) or hyperglycaemia (high glucose levels). He now follows a low carbohydrate diet that limits certain foods (such as rice) and has increased his intake of fruit and vegetables. He also takes long distance walks a couple of times a week.

Lifestyle changes have resulted in additional health benefits for Lee. His previously high cholesterol levels have improved with changes to his diet and increased physical activity.
As a result, over the last couple of years, Lee has been able to reduce the dose of metformin he needs to control his blood glucose levels.

This case study is based on an interview with a person who is living with type 2 diabetes. This personal account is not necessarily representative of the circumstances of other people with type 2 diabetes or the challenges they may face, but it is our hope that it will give readers a greater awareness and understanding of the diversity of people's experiences with diabetes.

The information provided does not contain medical advice – consult a qualified healthcare professional for guidance relating to your personal medical needs.

*Names and identifying characteristics have been changed. Images are not representative of individuals in the story.

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How common is type 2 diabetes in Australia?

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Australian stories about living with diabetes

Claire* is 35, has 3 children, and was diagnosed with gestational diabetes during both her second and third pregnancies.

Claire felt unwell 11 weeks into her second pregnancy. A fasting blood test detected low blood glucose levels and she was diagnosed with gestational diabetes. Given this history, she was tested early in her third pregnancy, and was again diagnosed with gestational diabetes.

Claire was referred to the gestational diabetes clinic at a local hospital for regular midwife and obstetrician appointments for both pregnancies. For her second pregnancy, she also attended an education appointment through a Maternal and Child Health program where she was provided with blood glucose testing equipment.

Claire was able to maintain her blood glucose levels within the target range throughout the day with a controlled diet but needed to take insulin overnight.

Her blood glucose levels were monitored at her regular appointments at the hospital, and her insulin was adjusted accordingly. These appointments were initially once a month but became fortnightly, then weekly as the pregnancies progressed.

Claire was alerted from as early as 16 weeks into her pregnancies that a caesarean or induction may be required and fortnightly scans from 32 weeks monitored the size of the babies. In both pregnancies, Claire was told that the babies were measuring large and that she should book in for a caesarean. Claire was determined to avoid a caesarean if possible and went into spontaneous labour at 38 weeks and had 2 successful natural births (after a caesarean with her first pregnancy) with both babies born within the healthy weight range.

After the babies were born, Claire and the babies' blood glucose levels were monitored in hospital for 24 hours. All were normal. Claire did another blood test 6 weeks after the births and this was also normal.

She will continue to monitor blood glucose levels with 6-monthly tests as she now has an increased risk of developing type 2 diabetes in later life.

This case study is based on an interview with a person who is living with gestational diabetes. This personal account is not necessarily representative of the circumstances of other people with gestational diabetes or the challenges they may face, but it is our hope that it will give readers a greater awareness and understanding of the diversity of people's experiences with diabetes.

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*Names and identifying characteristics have been changed. Images are not representative of individuals in the story.

How common is gestational diabetes in Australia?

Australian stories about living with diabetes

Steve* is 47. He is married with 2 kids, has a career in information technology and recently was diagnosed with type 2 diabetes.

An avid rugby union player in his youth, Steve loves the outdoors and camping with his family and friends. When he was in his early 30s, he was told during a medical check-up that he had potential longer-term health problems that he should be aware of. Within 10 years, he was diagnosed as pre-diabetic. He went to see a dietitian and was confident that he could manage his blood sugar (glucose) levels with a balanced diet and by using a blood glucose reader. However, sticking to a healthy eating plan was a challenge. His exercise regime was also hampered by an autoimmune condition and a lower back injury.

The lockdowns implemented during the COVID-19 pandemic also restricted his ability to exercise.

Steve was experiencing symptoms such as shakes and nerve sensations in his feet before he was diagnosed, but his general practitioner (GP) said that his 3-month average blood glucose level (his HBA1c) was within the target range. He sought a second opinion. This GP arranged an oral glucose tolerance test, which confirmed a diagnosis of type 2 diabetes. Steve currently manages his diabetes with the use of medication (metformin) which initially brought on symptoms of nausea and vomiting, but this subsided after his GP reassessed the dosage. Steve also feels he could be more consistent with a healthier eating plan.

Despite a family history of type 2 diabetes, Steve feels he has probably not taken his diagnosis seriously. He says, 'lack of knowledge is not the issue for me', and although he realises lifestyle change is important, he finds it hard to be consistent with new exercise and diet routines. 'Getting sick or the holiday season can be a distraction for healthier lifestyle routines,' he says. His advice to others who are concerned about type 2 diabetes:

'Don't hesitate to get a second professional opinion on your results. Listen to medical advice, see a dietitian and do a GP plan … talk with other people who have type 2 diabetes and … do not delay in getting medical treatment'.

This case study is based on an interview with a person who is living with type 2 diabetes. This personal account is not necessarily representative of the circumstances of other people with type 2 diabetes or the challenges they may face, but it is our hope that it will give readers a greater awareness and understanding of the diversity of people's experiences with diabetes.

The information provided does not contain medical advice – consult a qualified healthcare professional for guidance relating to your personal medical needs.

*Names and identifying characteristics have been changed. Images are not representative of individuals in the story.

How common is type 2 diabetes in Australia?

Diabetes risk factors

What is a risk factor?

Risk factors are attributes, characteristics or exposures that increase the likelihood of a person developing a condition or health disorder.

- Some risk factors are called modifiable, because a person can do something about them. For example, smoking is a modifiable risk factor because a person can stop smoking. Non-modifiable risk factors are those which you cannot change, for example, a family history of diabetes.
- Type 1 diabetes is strongly linked to family history with the condition, but the exact cause is unknown at this time. There are no modifiable factors which increase the risk for type 1 diabetes, although maintaining a healthy lifestyle is important for managing the symptoms and long-term complications associated with the condition.
- Both age and sex are key factors which can increase the risk of developing type 2 diabetes, as can family history and certain ethnic backgrounds–through inherited genes or through sharing an environment of risky health behaviours. Diabetes and mental health are also closely associated, where people with mental health conditions are at increased risk of developing diabetes (Lindekilde et al. 2021) and Australians with diabetes are more likely than other Australians to have poor mental health and wellbeing (AIHW 2011). These effects can arise directly, through biological pathways including the side effects of medications, and indirectly, through health behaviours.
- Some factors involved in developing type 2 and gestational diabetes are not linked to modifiable risk factors. However, both conditions are associated with modifiable behavioural and biomedical risk factors that increase the risk of diagnosis and related complications. Clustering of biomedical risk factors with a common underlying cause, as found in metabolic syndrome, also increases the risk of developing type 2 diabetes (Harris 2013).
- The Australian type 2 diabetes risk assessment tool (AUSDRISK) is a short list of questions assessing both modifiable and non-modifiable risk factors which can assess the risk of a person developing type 2 diabetes over the next 5 years. It evaluates both modifiable and non-modifiable risk factors for diabetes, including age, sex, ethnicity, parental history of diabetes, history of high blood glucose levels, use of antihypertensive medications, smoking, physical inactivity and sex/ethnicity-based waist circumference measures.
- **Biomedical risk factors** are bodily states that have an impact on a person's risk of disease. Some biomedical risk factors can be influenced by health behaviours. Biomedical risk factors for type 2 diabetes include:
  - impaired fasting glucose and impaired glucose tolerance
  - high blood pressure (also known as hypertension)
  - dyslipidaemia
  - overweight and obesity
  - abdominal obesity (measured by waist circumference).
- **Behavioural risk factors** are health-related behaviours that individuals have the most ability to modify. Behavioural risk factors for type 2 diabetes include:
  - unhealthy diet, such as inadequate fruit and vegetable intake
  - insufficient physical activity
  - smoking.
- For most risk factors there is no known threshold at which risk begins. The relationship between risk and disease is continuous – there is an increasing effect as exposure to the risk factor increases. Having multiple risk factors further escalates risk.
- Many chronic conditions, including diabetes, share behavioural and biomedical risk factors. Modifying these risk factors can reduce an individual's risk of developing type 2 diabetes prematurely and result in large health gains by reducing illness and rates of death.

This section presents statistics on a range of modifiable risk factors that influence the likelihood of a person developing type 2 diabetes.

View the risk factors for type 2 diabetes

- Impaired fasting glucose
- High blood pressure
- Dyslipidaemia
- Overweight and obesity
- Waist circumference
- Inadequate fruit and/or vegetable intake
- Insufficient physical activity
- Smoking

Further information

For more information on these and other diabetes risk factors, see:

- High blood pressure
- High blood plasma glucose
- Overweight and obesity: an interactive insight
- Waist circumference
- Insufficient physical activity
- Poor diet
- Smoking
- Health risk factors among Indigenous Australians
- Australian Burden of Disease Study 2018.

Visit Risk factors for more information on this topic.

References

Australian Institute of Health and Welfare (AIHW) (2011) *Diabetes and poor mental health and wellbeing: an exploratory analysis*, AIHW Australian Government, accessed 2 March 2022.

Harris MF (2013) *The metabolic syndrome*, Australian family physician 42(8): 524–527. PMID: 23971058.

Lindekilde N, Scheuer SH, Rutters F, Knudsen L, Lasgaard M, Rubin KH et al. (2021) *Prevalence of type 2 diabetes in psychiatric disorders: an umbrella review with meta-analysis of 245 observational studies from 32 systematic reviews*, Diabetologia 65:440–456.

Diabetes risk factors

Based on the latest available measured data from the Australian Bureau of Statistics (ABS) 2011–12 Australian Health Survey (AHS), an estimated 420,000 people aged 18 and over (3.1%) were living with Impaired Fasting Glucose (IFG) (AIHW analysis of ABS 2014).

In 2011–12:

- the proportion of adults with IFG generally increased with age and was highest in people aged 75 and over compared with those aged 35–44 (7.5% and 2.1%, respectively).
- men were almost twice as likely to be living with IFG than women (Figure 1).

What is impaired fasting glucose?

The initial stages of type 2 diabetes, also known as pre-diabetes, are characterised by impaired glucose regulation, including both impaired fasting glucose (IFG) and impaired glucose tolerance (IGT) (WHO and IDF 2006). IFG is characterised by higher than usual levels of glucose in the blood when fasting (in the range of 6.1 to 6.9 mmol/L) but less than diabetes levels (at least 7.0 mmol/L). People who have IFG or IGT are at risk of future development of diabetes. Without intervention, approximately 1 in 3 people living with pre-diabetes will develop type 2 diabetes within 10 years (Bell et al. 2020).

Early treatment and improved management of impaired glucose regulation may help to reduce the occurrence of type 2 diabetes. Interventions such as weight reduction, healthy eating, regular physical activity and reducing sedentary behaviour, stress management and smoking cessation, psychological support and appropriate pharmacotherapy can slow the progression of IFG and IGT to diabetes (Bell et al. 2020).

In the ABS 2011–12 AHS, a person who did not currently have diabetes but had an IFG result ranging from 6.1 to 6.9 mmol/L was considered to be at high risk of diabetes. The ABS 2011–12 AHS collected measured data on IFG. IGT was not measured (ABS 2013).

Figure 1: Impaired fasting glucose, persons aged 35 and over by age group and sex, 2011-12

The bar chart shows the proportion of adults living with impaired fasting glucose, by age and sex in 2011–12. A higher proportion of men (4.1%) than women (2.1%) were living with impaired fasting glucose.
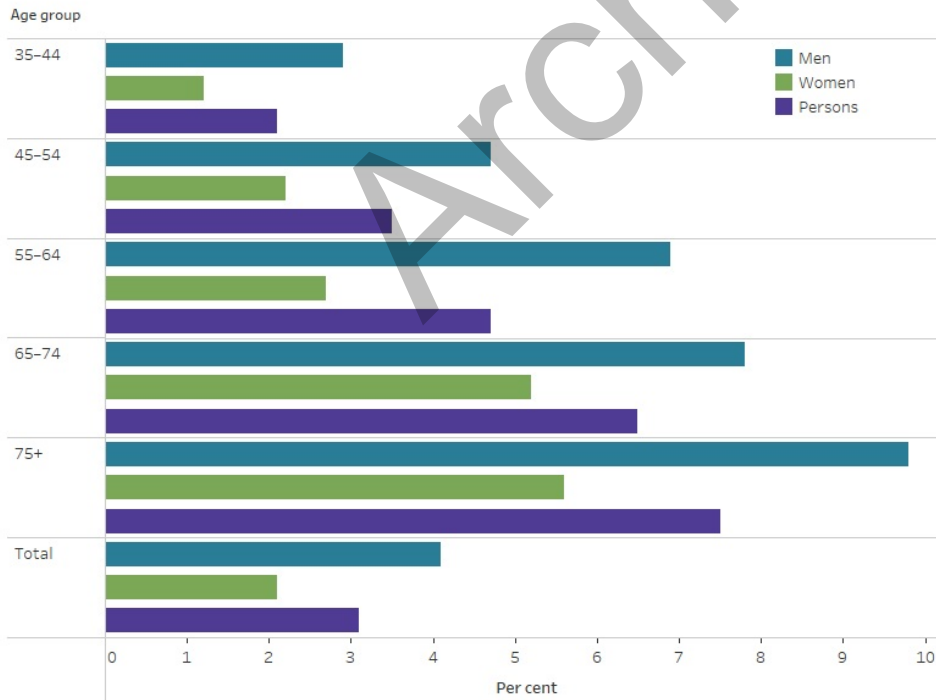

Figure 1: Impaired fasting glucose, persons aged 35 and over by age group and sex, 2011–12

Notes:
1. CI = A statistical term describing a range (interval) of values within which we can be 'confident' that the true value lies, usually because it has a 95% or higher chance of doing so.
2. Excludes persons with diabetes (i.e. with fasting blood glucose greater than or equal to 7.0 mmol/L), and persons who did not fast for 8 hours or more prior to their blood test.
3. Data for the 18–34 age groups not publishable due to small numbers, confidentiality or other concerns about data quality.
Chart: AIHW. Source: AIHW analysis of ABS 2014.
https://www.aihw.gov.au

Variation between population groups

In 2011–12, there were no statistically significant differences in the proportion of men and women living with IFG across geographic areas and socioeconomic areas (AIHW analysis of ABS 2014).

References

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WHO and IDF (World Health Organization and International Diabetes Federation) (2006) *Definition and diagnosis of diabetes mellitus and intermediate hyperglycaemia: report of a WHO/IDF consultation*, WHO, accessed 1 December 2021.

Diabetes risk factors

In 2017–18, based on measured data from the Australian Bureau of Statistics (ABS) National Health Survey (NHS):

- an estimated 34% of adults were living with high blood pressure. This included 23% living with uncontrolled high blood pressure and 11% whose blood pressure was controlled with medication.
- men were almost 1.3 times as likely to have uncontrolled high blood pressure compared with women.
- the proportion of adults with uncontrolled high blood pressure increased with age – from 7.5% among those aged 18–34 (10.2% men, 4.9% women) to a peak of 47% at age 85 and over (51% men, 48% women).

The proportion of Australian adults with high blood pressure has remained stable since 2011–12 (AIHW 2019).

Blood pressure is the force exerted by blood on the walls of the arteries, depending on whether the heart muscle is contracting (systolic blood pressure) or relaxing between contractions (diastolic blood pressure). High blood pressure, also known as raised blood pressure or hypertension, is where blood pressure is persistently higher than normal.

A person is considered to have high blood pressure if measured levels of systolic or diastolic blood pressure are high, regardless of the use of blood pressure medication.

Hypertension is commonly present among people with metabolic syndrome, including obesity, elevated blood glucose levels, insulin resistance and low high-density lipoprotein (HDL) cholesterol levels. These comorbidities, along with other risk factors, significantly increase the risk of developing diabetes (by over 2-fold) (Williams 2013).

In the ABS NHS 2017–18, persons aged 18 and over could consent to having a blood pressure measurement taken at the time of the interview. Participants who recorded a systolic blood pressure reading of 140mmHg or greater were counted as having a high blood pressure reading. Note that this only referred to the measurement at the time of the interview and does not necessarily indicate a chronic condition. For this survey, this is distinguished from 'Hypertension' which was self-reported as a long-term health condition.

Figure 1 and 1(a): Prevalence distribution of systolic and diastolic blood pressure measurements among adults, 2017–18

The two line charts show the distribution of systolic and diastolic blood pressure levels by sex in 2017–18.
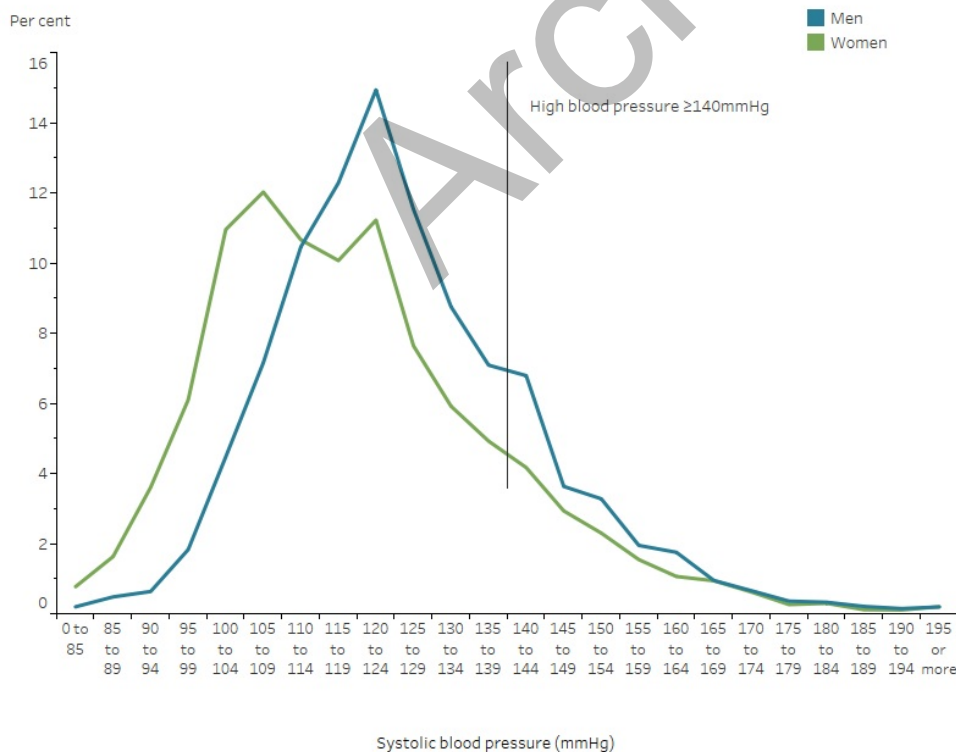

Figure 1: Prevalence distribution of systolic blood pressure measurements among adults, 2017-18

[Notes]

Chart: AIHW. Source: AIHW analysis of ABS 2019.
https://www.aihw.gov.au

Variation between population groups

After adjusting for different population age structures:

- The prevalence of uncontrolled high blood pressure was similar between remoteness areas in 2017–18.
- Uncontrolled high blood pressure was 1.3 times higher among those living in the lowest socioeconomic areas compared with the highest socioeconomic areas (AIHW 2019).
- Indigenous adults were 1.3 times more likely to have high blood pressure in 2018–19 than non-Indigenous adults (AIHW and NIAA 2020).

References

ABS (Australian Bureau of Statistics) (2019) *Microdata: National Health Survey, 2017–18*, AIHW analysis of detailed microdata, accessed 1 December 2021.

AIHW (Australian Institute of Health and Welfare) (2019) *High blood pressure*, AIHW, Australian Government, accessed 1 December 2021.

AIHW and NIAA (AIHW and National Indigenous Australians Agency) (2020) *Aboriginal and Torres Strait Islander Health Performance Framework 2020, Measure 1.07 High blood pressure*, AIHW, Australian Government, accessed 1 December 2021.

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Diabetes risk factors

According to the Australian Bureau of Statistics (ABS) 2011–12 Australian Health Survey (AHS):

- 63% of adults (8.5 million people) were living with dyslipidaemia. This included 57% with uncontrolled blood lipids and 6.6% with normal blood lipid levels who were taking lipid-modifying medication.
- 33% of adults had raised levels of LDL (bad) cholesterol, 23% had low levels of HDL (good) cholesterol and 14% had raised levels of triglycerides. In addition, 33% had a total cholesterol level that was considered high (AIHW 2015).
- men and women had similar levels of dyslipidaemia in 2011–12.
- The proportion of adults with dyslipidaemia increased with age, from 34% among those aged 18–24 (31% men, 36% women) to a peak of 81% at age 65–74 (78% men, 84% women) (Figure 1).

Blood lipids are fats in the blood and include cholesterol and triglycerides. Cholesterol is a fatty substance produced by the liver and carried by the blood to supply material for cell walls and hormones. Triglycerides play an important role in metabolism as an energy source and in helping to transfer dietary fat throughout the body.

Dyslipidaemia (abnormal blood lipids) can contribute to the development of atherosclerosis, a build-up of fatty deposits in the blood vessels which may lead to the development of cardiovascular diseases. Dyslipidaemia is a risk factor for chronic diseases such as coronary heart disease and stroke (AIHW 2017).

In the most recent large-scale biomedical survey of the Australian population, the Australian Bureau of Statistics (ABS) 2011–12 Australian Health Survey (AHS), a person was considered to be living with dyslipidaemia if they had one or more of the following:

- total cholesterol ≥ 5.5 mmol/L
- LDL cholesterol ≥ 3.5 mmol/L
- HDL cholesterol < 1.0 mmol/L for men and < 1.3 mmol/L for women
- triglycerides ≥ 2.0 mmol/L
- taking lipid-modifying medication (ABS 2013).

Sufficient physical activity and a healthy diet help maintain healthy blood cholesterol levels. People with dyslipidaemia may also be treated with lipid-modifying medicines such as statins.

Figure 1: Adults living with dyslipidaemia by age and sex, 2011-12

The bar chart shows the proportion of adults living with dyslipidaemia, by age and sex in 2011-12. The proportion of adults with dyslipidaemia increased with age, from 34% among those aged 18-24 (31% men, 36% women) to a peak of 81% at age 65-74 (78% men, 84% women).
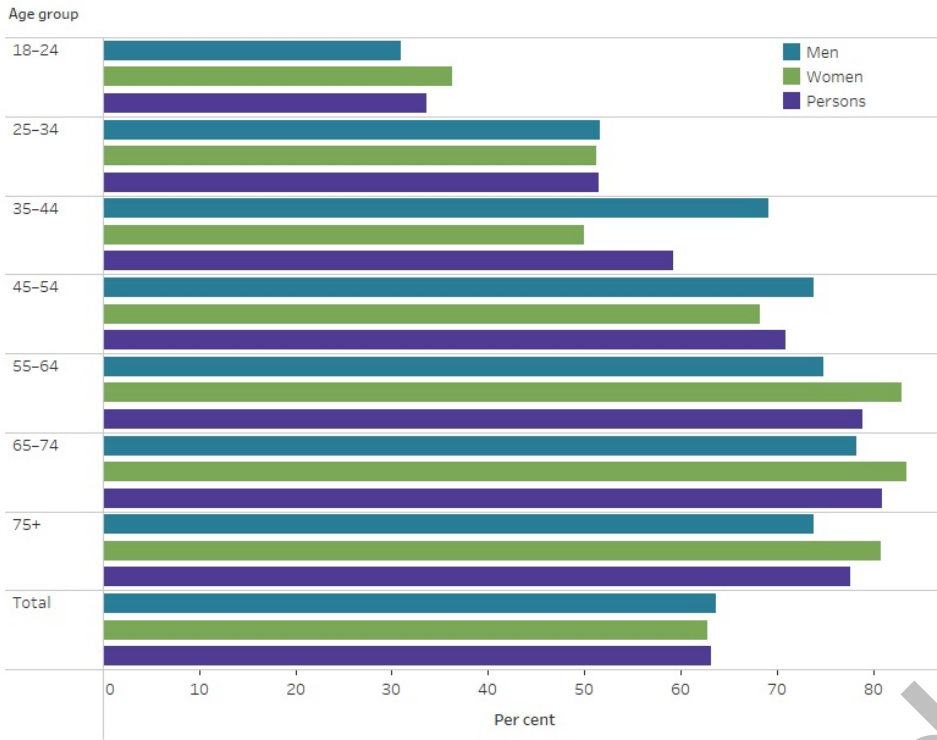
Figure 1: Adults living with dyslipidaemia by age and sex, 2011–12

Notes:
1. CI = A statistical term describing a range (interval) of values within which we can be 'confident' that the true value lies, usually because it has a 95% or higher chance of doing so.
2. Excludes persons who did not fast for 8 hours or more prior to their blood test.
Chart: AIHW. Source: AIHW analysis of ABS 2013.
https://www.aihw.gov.au

Variation between population groups

There were no statistically significant differences in the proportion of adults with dyslipidaemia across remoteness areas or socioeconomic groups in 2011–12 (AIHW 2015).

References

ABS (Australian Bureau of Statistics) (2013) *Australian Health Survey: user's guide, 2011-13*, ABS website, accessed 9 March 2022.

AIHW (2015) *Cardiovascular disease, diabetes and chronic kidney disease—Australian facts: Risk factors*, AIHW, Australian Government, accessed 9 March 2022.

AIHW (2017) *Risk factors to health*, AIHW, Australian Government, accessed 25 May 2022.

Diabetes risk factors

In 2017–18, based on the latest available measured data from the 2017–18 Australian Bureau of Statistics (ABS) National Health Survey (NHS):

- An estimated 25% of children and adolescents aged 2–17 were overweight or obese, with 17% overweight but not obese, and 8.2% obese. Rates varied across age groups, but were similar for males and females.
- An estimated 67% of Australians aged 18 and over were overweight or obese (36% overweight but not obese and 31% obese).
- Both overweight and obesity and obesity rates were higher among men than women (1.3 and 1.1 times as likely, respectively).
- Obesity was more common in older age groups – 6% of adults aged 18-24 were obese, compared with 41% of adults aged 65-74 (AIHW 2020).

> **Overweight and obesity** increase the risk of chronic diseases, including heart attack and stroke, and are associated with increased morbidity and mortality. Excess body fat can contribute to the development of biomedical risk factors, raising levels of blood pressure and abnormal blood lipids, and increasing the risk of type 2 diabetes.
>
> Overweight and obesity usually occur because of an imbalance between energy intake from the diet and energy expenditure through physical activities and bodily functions. This energy imbalance is influenced by a complex interplay of individual, environmental and societal determinants (AIHW 2017).
>
> Adults with a body mass index (BMI) (kg/m^2) of 25-29 are considered to be overweight, but not obese, while a BMI of 30 or over is classified as obese. A separate classification of overweight and obesity based on age and sex is used for children and adolescents.

After adjusting for different population age structures over time, the prevalence of overweight and obesity among Australians aged 18 and over increased by 16.5% between 1995 and 2017–18 (AIHW 2020) – driven by a 63% increase in obesity rates during this period (Figure 1).

Figure 1: Distribution of BMI among adults, 1995 and 2017-18

The line chart compares the distribution of body mass index in 1995 and 2017–18, and shows that a greater proportion were overweight or obese in 2017–18.
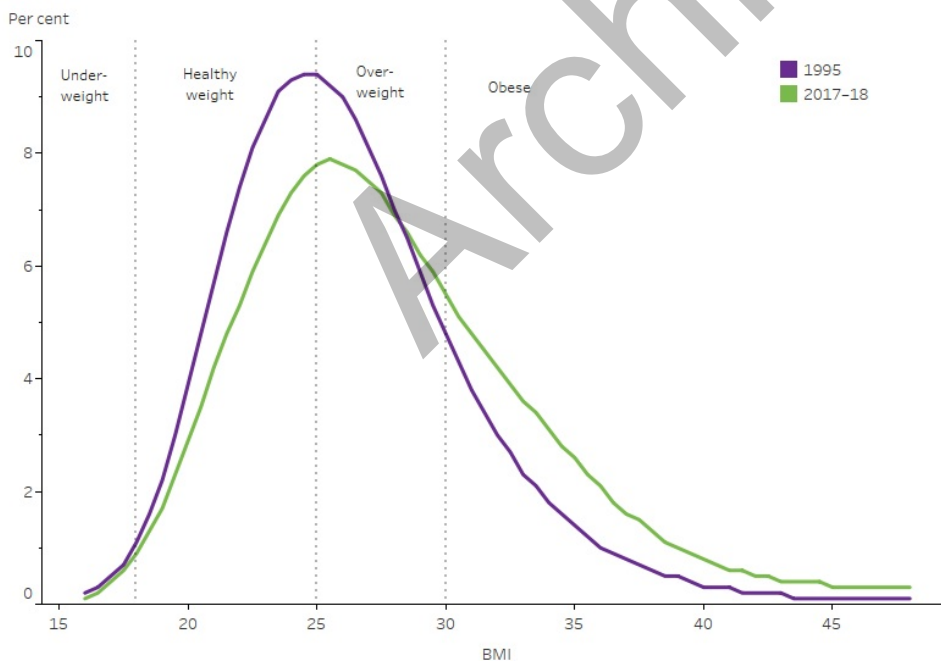
Figure 1: Distribution of BMI among adults, 1995 and 2017–18

Notes:
1. The distributions have been smoothed, including the minimum and maximum values which are based on aggregates of 16 or less and 48 or more.
2. Overweight and obesity classification is based on measured height and weight.
3. In 2017–18, imputation was used to obtain BMI for respondents aged 18 and over who did not have a measured BMI (34% of respondents).

Chart: AIHW. Source: AIHW 2020.
https://www.aihw.gov.au

Variation between population groups

After adjusting for different population age structures:

- Adults living in *Outer regional and remote* areas and in *Inner regional* areas were 1.1 times more likely to be overweight or obese in 2017–18, compared with people living in *Major cities*.
- Adults living in the lowest socioeconomic areas were 1.2 times more likely to be overweight or obese than those in the highest socioeconomic areas (AIHW 2020).
- Indigenous Australians aged 15 and over were less likely than non-Indigenous Australians to be overweight but 1.5 times as likely to be obese (AIHW and NIAA 2020).

References

AIHW (Australian Institute of Health and Welfare) (2017) *A picture of overweight and obesity in Australia*, AIHW, Australian Government, accessed 15 December 2021.

AIHW (2020), *Overweight and obesity: an interactive insight*, AIHW, Australian Government, accessed 15 December 2021.

AIHW and NIAA (National Indigenous Australians Agency) (2020) *Aboriginal and Torres Strait Islander Health Performance Framework 2020, Measure 2.22 Overweight and obesity,* AIHW, Australian Government, accessed 1 December 2021.

Diabetes risk factors

Based on the latest available measured data from the Australian Bureau of Statistics (ABS) 2017–18 National Health Survey (NHS):

- An estimated 63% of Australian adults had a waist circumference that put them at an increased risk of chronic disease, including type 2 diabetes.
- The proportion of men and women with an at-risk waist circumference generally increased with age, with 81% of men aged 65–74 and 84% of women aged 75 and over (Figure 1).

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

- Women were 1.1 times more likely to have a waist circumference that put them at increased risk of chronic disease than men
- The proportion of people with an at-risk waist circumference has remained steady since 2011–12 (AIHW analysis of ABS 2013, ABS 2016 and ABS 2019a).

Waist circumference for adults is a good indicator of total body fat and is a better predictor than body mass index (BMI) for certain chronic conditions such as cardiovascular risk and type 2 diabetes (NHMRC 2013). A waist circumference above 80 cm for women and 94 cm for men is associated with an increased risk of chronic conditions. A waist circumference above 88 cm for women and 102 cm for men is associated with a substantially increased risk of chronic conditions (WHO 2000).

Figure 1: Increased risk of developing chronic diseases based on waist circumference, adults, by age and sex, 2017–18

The bar chart shows the proportion of adults with increased risk of developing chronic diseases based on waist circumference, by age and sex in 2017–18. The proportion of men and women with an at-risk waist circumference generally increased with age, with 81% of men aged 65–74 and 84% of women aged 75 and over.
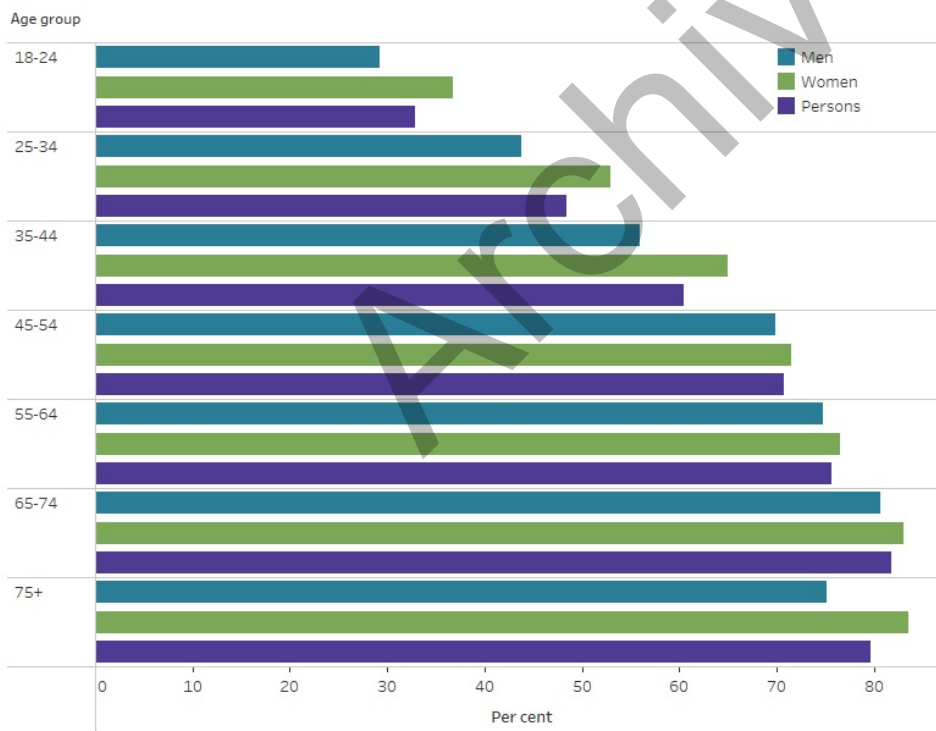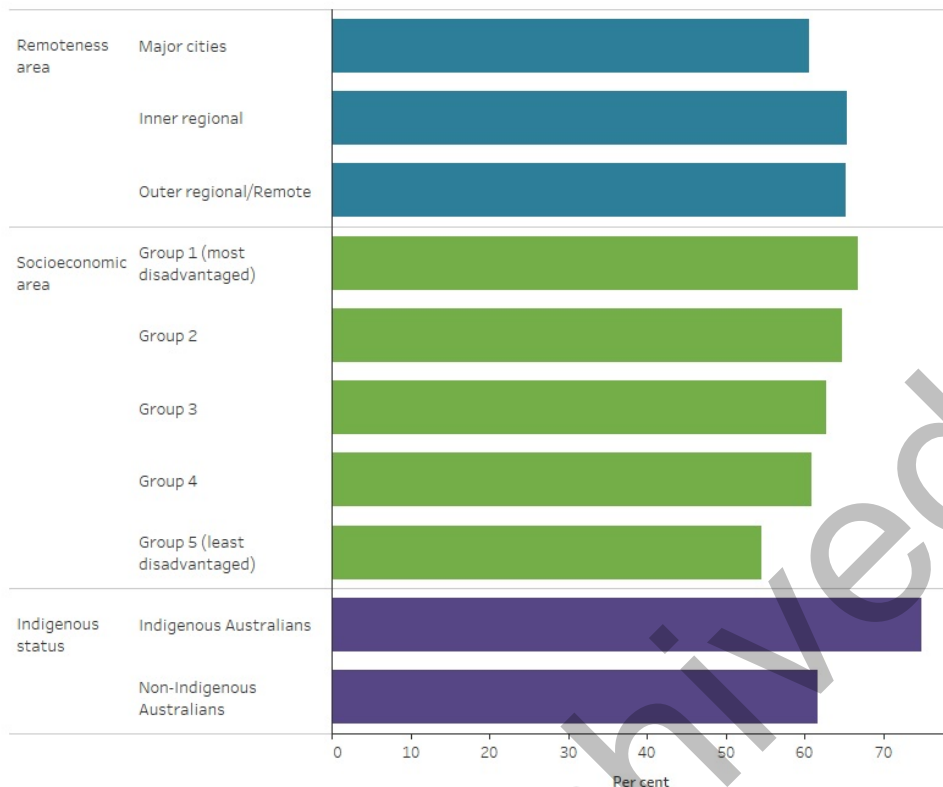

Figure 1: Increased risk of developing chronic diseases based on waist circumference, adults, by age and sex, 2017–18

Notes:
1. Based on measured waist circumference. A waist circumference of ≥ 94 cm for men and ≥ 80 cm for women indicates that they are at increased risk of developing chronic disease.
2. CI = A statistical term describing a range (interval) of values within which we can be 'confident' that the true value lies, usually because it has a 95% or higher chance of doing so.
Chart: AIHW. Source: AIHW analysis of ABS 2019a.
https://www.aihw.gov.au

Variation between population groups

After adjusting for different population age structures, the proportion of people with an at-risk waist circumference:

- was 1.2 times higher among those living in the lowest socioeconomic areas compared with those in the highest socioeconomic areas

- was 1.1 times higher among people living in both *Inner regional* and *Outer regional and remote areas* compared with those living in *Major cities*
- was 1.2 times higher for Indigenous adults compared with non-Indigenous adults based on data from the 2018–19 National Aboriginal and Torres Strait Islander Health Survey (NATSIHS) and 2017–18 NHS (Figure 2).

Figure 2: Increased risk of developing chronic diseases based on waist circumference, adults, by selected population groups, 2017-18

The bar chart shows the proportion of adults with increased risk of developing chronic diseases based on waist circumference, by selected populations groups in 2017-18. The proportion of people with an at-risk waist circumference was higher among Indigenous Australians, people living in inner regional and outer regional and remotes areas, and people living in the lowest socioeconomic areas.

Figure 2: Increased risk of developing chronic diseases based on waist circumference, adults, by selected population groups, 2017–18

[Notes]

Chart: AIHW. Sources: ABS 2013, 2016, 2019a, 2019b.
https://www.aihw.gov.au

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Diabetes risk factors

In 2017–18, most Australians aged 2 and over (95%) failed to meet the 2013 _Australian Dietary Guidelines_ for adequate fruit and vegetable intake, based on self-reported data from the Australian Bureau of Statistics (ABS) National Health Survey (NHS). The proportion of Australians meeting the guidelines for adequate fruit and/or vegetable intake was similar across age groups (Figure 1).

The age-standardised proportion of Australians with inadequate fruit and/or vegetable intake:

- was slightly higher for males compared with females in all age groups with the exception of those aged 75 and over (Figure 1)
- remained unchanged between 2014–15 and 2017–18 (AIHW analysis of ABS 2016 and ABS 2019a).

> The 2013 _Australian Dietary Guidelines_ recommend a minimum number of daily serves of fruit (1–2 for children and 2 for adults) and vegetables (2.5–5.5 for children; 5–6 or more for men depending on age and 5 or more for women) (NHMRC 2013). For more information on the dietary guidelines for different age groups, see the Australian Dietary Guidelines.

Figure 1: Inadequate fruit and/or vegetable consumption, by age (2+) and sex, 2017–18

The bar chart shows the proportion of Australians aged 2 and over with inadequate fruit and/or vegetable intake, by age and sex in 2017–18. The proportion of Australians with inadequate fruit and/or vegetable intake was significantly higher for males than females (97% and 93%, respectively) and remained unchanged between 2014–15 and 2017–18.
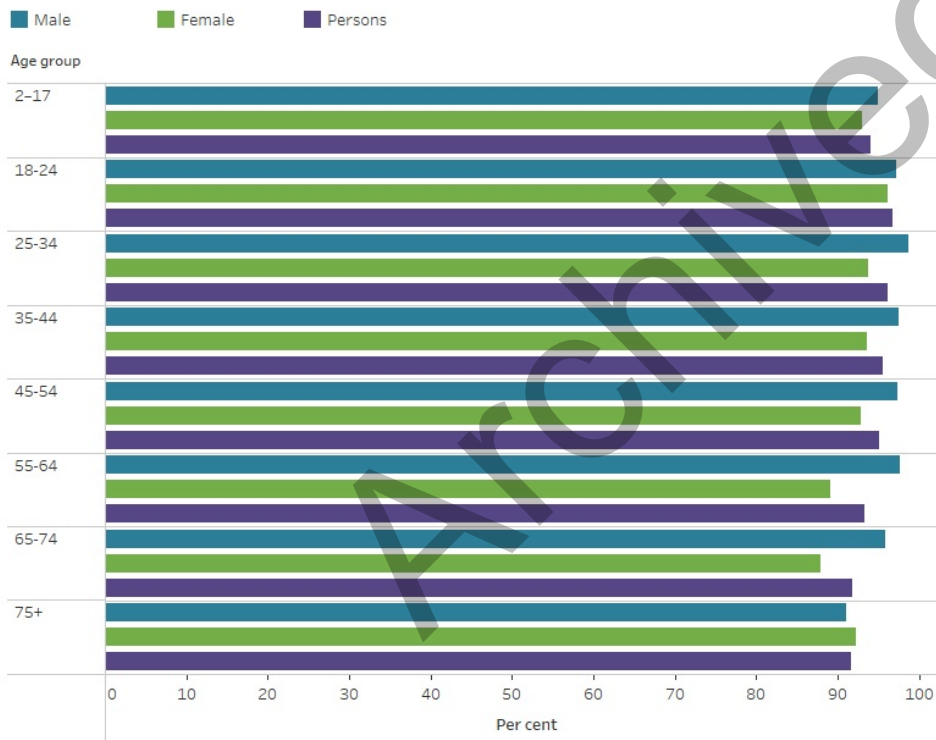

Figure 1: Inadequate fruit and/or vegetable consumption, by age (2+) and sex, 2017–18

Notes:
1. Did not meet the adequate fruit (1–2 for children and 2 for adults) and vegetable (2.5–5.5 for children; 5–6 or more for men depending on age, and 5 or more for women) serves per day. Estimates based on self-reported data.
2. CI = A statistical term describing a range (interval) of values within which we can be 'confident' that the true value lies, usually because it has a 95% or higher chance of doing so.
Chart: AIHW. Source: AIHW analysis of ABS 2019a.
https://www.aihw.gov.au

Variation between population groups

After adjusting for different population age structures, inadequate fruit and vegetable consumption:

- was slightly higher in the lowest socioeconomic areas compared with the highest socioeconomic areas
- was similar for all remoteness areas
- was slightly higher among Indigenous Australians compared with non-Indigenous Australians, based on estimates from the 2017–18 NHS and 2018–19 National Aboriginal and Torres Strait Islander Health Survey (NATSIHS) (Figure 2).

Figure 2: Inadequate fruit and/or vegetable consumption, 2+ year olds, by selected population groups, 2017–18

The bar chart shows the proportion of Australians aged 2 and over with inadequate fruit and/or vegetable intake, by selected population groups in 2017–18. The proportion of Australians with inadequate fruit and/or vegetable intake was slightly higher in the lowest socioeconomic areas, was similar for all remoteness areas and was slightly higher among Indigenous Australians.
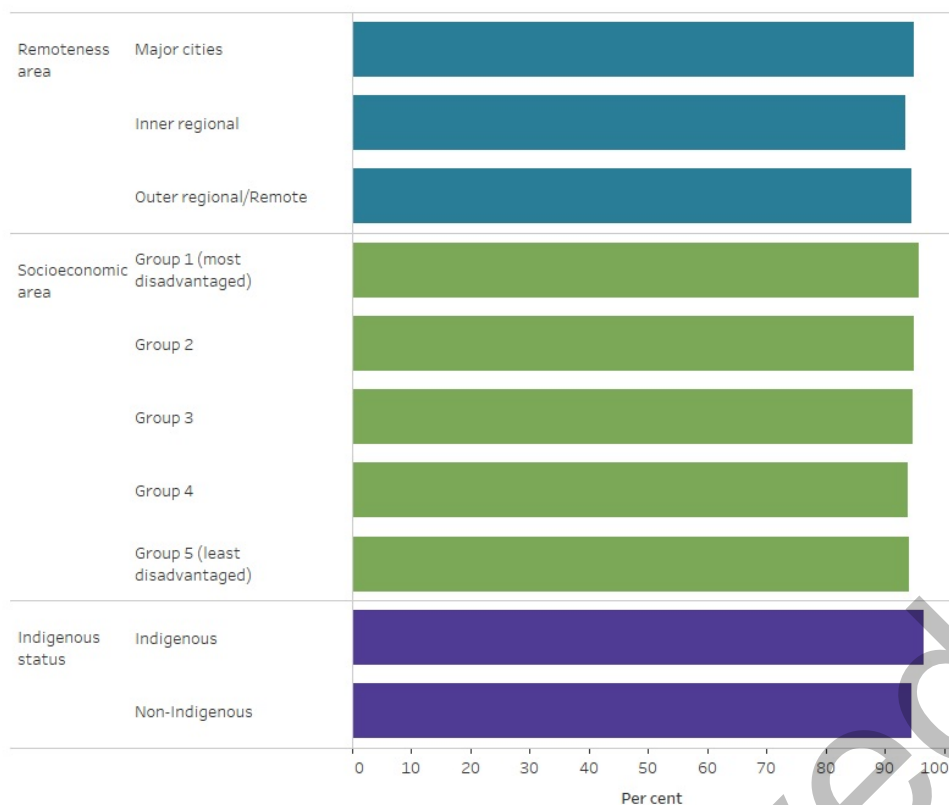

Figure 2: Inadequate fruit and/or vegetable intake, 2+ years, by selected population characteristics, 2017–18..

[Notes]

Chart: AIHW. Sources: AIHW analysis of ABS 2019a, 2019b.

References

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ABS (2019a) *Microdata: National Health Survey, 2017-18*, AIHW analysis of detailed microdata, accessed 1 December 2021.

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Diabetes risk factors

Based on self-reported data from the 2017–18 Australian Bureau of Statistics (ABS) National Health Survey (NHS):

- 55% of Australian adults aged 18 and over were insufficiently active.
- 51% of Australian adults aged 18–64 were insufficiently active and 72% of adults aged 65 and over were insufficiently active.
- Women were 18% more likely to be insufficiently active than men after adjusting for age (Figure 1).

After adjusting for different population age structures over time, there was a 5.8% decrease in the proportion of adults who were insufficiently active between 2007–08 and 2017–18. However, rates have not changed since 2011–12 (AIHW 2019).

> Australia's Physical Activity and Sedentary Behaviour Guidelines provide recommendations on the amount and type of physical activity required for health benefits (Department of Health 2019). Based on the guidelines, insufficient physical activity is defined here as:
>
> - adults aged 18–64 who did not complete 150 minutes of moderate to vigorous physical activity across 5 or more days in the last week
> - adults aged 65 and over who did not complete at least 30 minutes of physical activity per day on 5 or more days in the last week.
>
> In 2017–18, the ABS NHS collected information for the first time on physical activity at work. Therefore, results for 2017–18 include physical activity at work. For comparability across the different NHSs, data for trends exclude physical activity at work.

Figure 1: Insufficient physical activity, by age and sex, adults, 2017-18

The bar chart shows the proportion of adults who were insufficiently active, by age and sex in 2017-18. Women were more likely to be insufficiently active than men (59% compared with 50%).
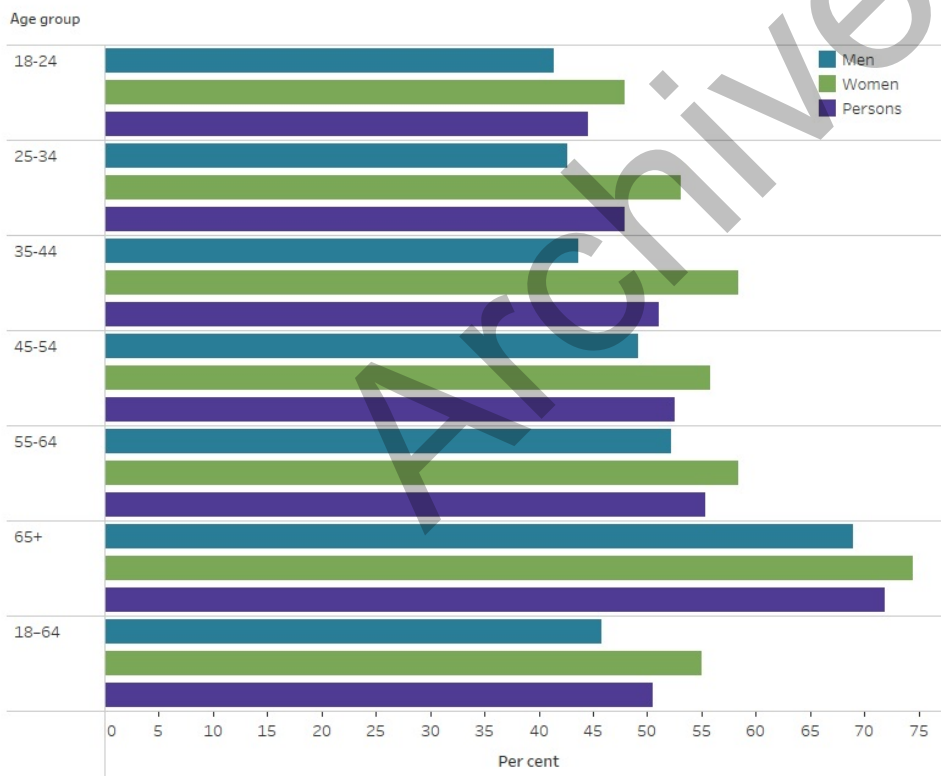

Figure 1: Insufficient physical activity, adults by age and sex, 2017–18

[Notes]

Chart: AIHW. Source: AIHW 2019.
https://www.aihw.gov.au

Variation between population groups

In 2017–18, after adjusting for different population age structures:

- Australian adults living in the lowest socioeconomic areas were 1.3 times more likely to be insufficiently active compared with those living in the highest socioeconomic areas.
- There were similar levels of insufficient physical activity across remoteness areas.

- The proportion of Indigenous adults who were insufficiently active was similar to that of non-Indigenous adults, based on estimates from the 2018–19 National Aboriginal and Torres Strait Islander Health Survey (NATSIHS) and 2017–18 NHS (Figure 2).

Comparable data on physical activity from the 2018-19 NATSIHS were only collected for non-remote areas and exclude physical activity at work. Results presented for non-Indigenous adults from the NATSIHS exclude remote areas and physical activity at work.

Figure 2: Insufficient physical activity among adults, by selected population groups, 2017–18

The bar chart shows the proportion of adults who were insufficiently active, by selected population groups in 2017–18. The proportion of Australians with insufficient physical activity was higher in the lowest socioeconomic areas, was similar for all remoteness areas and was similar for Indigenous Australians and non-Indigenous Australians.
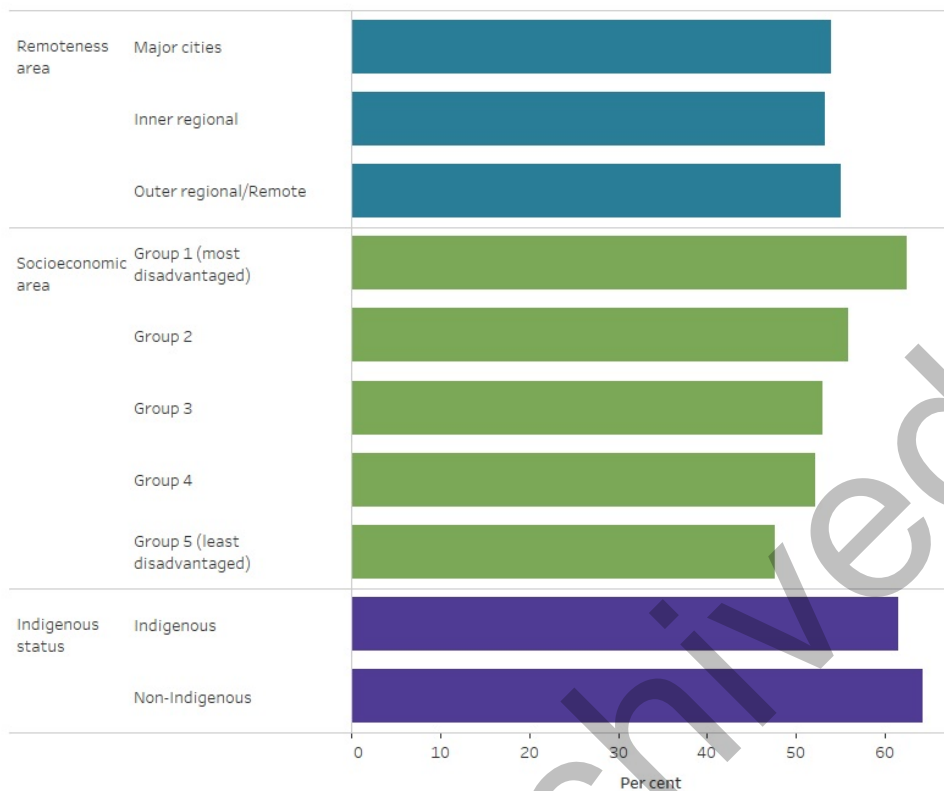
Figure 2: Insufficient physical activity among adults, by selected population groups, 2017–18

[Notes]

Chart: AIHW. Sources: ABS 2019a, 2019b; AIHW 2019.

References

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Department of Health (2019) *Australia's Physical Activity and Sedentary Behaviour Guidelines and the Australian 24-Hour Movement Guidelines*. Canberra: Australian Government Department of Health, accessed 13 July 2020.

Diabetes risk factors

In 2019, based on results from the National Drug Strategy Household Survey:

- 11.0% of people aged 14 and over smoked daily
- males were 1.2 times as likely to smoke daily as females, after controlling for age
- between 2001 and 2019, the proportion of males aged 14 and over who smoked daily decreased by 42% and females by 45% (Figure 1).
- men aged 40-49 had the highest proportion of current daily smokers (18.4%), while the highest proportion among women were aged 50-59 (15.2%).
- daily smoking rates among males and females aged 15-24 decreased between 2001 and 2019 by 59% and 69%, respectively (AIHW 2020).

Tobacco smoking is the leading cause of preventable disease and death in Australia today (AIHW 2021). While the exact mechanism for how smoking impacts diabetes risk is unclear, research has shown that smoking increases insulin resistance and is associated with an increased risk of type 2 diabetes in men and women (Chang 2012). Prenatal smoking is also associated with an increased risk of gestational diabetes (Bar-Zeev et al. 2020).

People with diabetes who smoke also further increase their risk of cardiovascular disease, peripheral vascular disease and neuropathy (Chang 2012). There is also emerging evidence in relation to the health effects of second-hand smoke and the increased risk of developing type 2 diabetes (Campbell et al. 2017) and gestational diabetes (Morales-Suárez-Varela et al. 2022). Smoking cessation benefits people at any age with evidence that doing so reduces the relative risk of some diabetes-related complications (CDC 2020).

Though long-term data on the safety of e-cigarettes is scarce, recent research has found using e-cigarettes could influence glucose levels and the development of pre-diabetes (Gorna et al. 2020). The potential toxic effects of e-liquid and nicotine together with the risk of vaping as a driver to future tobacco smoking among youth is concerning (WHO 2020).

Figure 1: Tobacco smoking status, people aged 14 and over, 2001 to 2019

The line chart shows the proportion of people smoking, by sex and smoking status between 2001 and 2019. Daily smokers fell from 19.4% in 2001 to 11.0% in 2019.
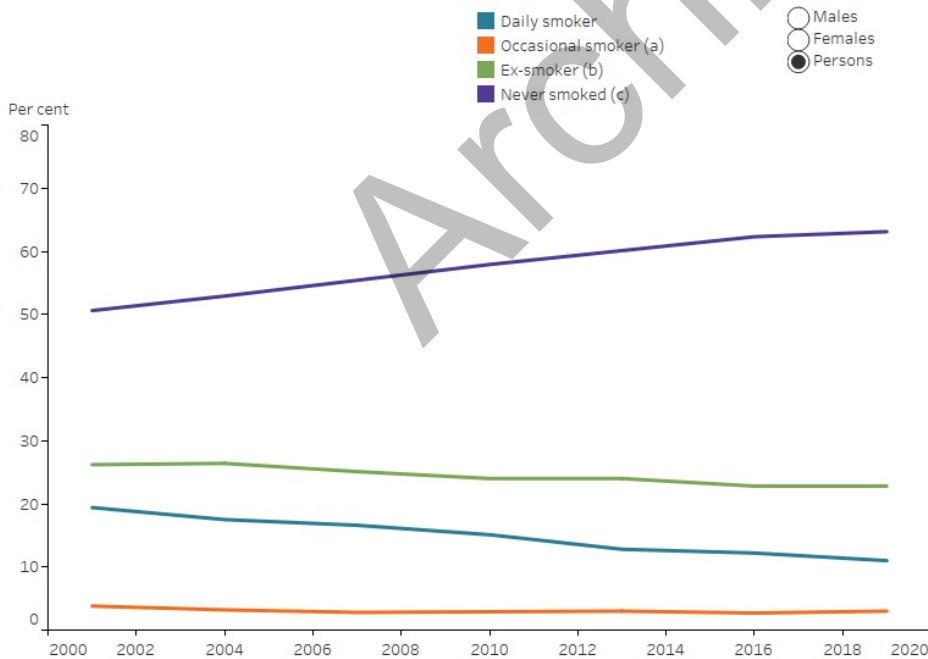

Figure 1: Tobacco smoking status, people aged 14 and over, 2001 to 2019

(a) Includes people who reported smoking weekly or less than weekly.
(b) Smoked at least 100 cigarettes (manufactured and/or roll-your-own) or the equivalent amount of tobacco in their life, and reported no longer smoking.
(c) Never smoked 100 cigarettes (manufactured and/or roll-your-own) or the equivalent amount of tobacco.

Note: Smoking status in 2010 has been revised. Trend data may not match previously published results.
Chart: AIHW. Source: AIHW 2020.
https://www.aihw.gov.au

Variation between population groups

After adjusting for different population age structures:

- People aged 14 and over living in *Remote and very remote* areas were twice as likely to smoke daily in 2019 compared with people living in *Major cities* (AIHW 2020).
- People aged 14 and over living in the lowest socioeconomic areas were 3.6 times more likely to smoke daily in 2019 compared with those living in the highest socioeconomic areas.
- Indigenous people aged 15 and over were 3 times more likely to smoke daily in 2018–19, compared with non-Indigenous people in 2017–18 (AIHW and NIAA 2020).

Use of e-cigarettes

While the proportion of Australians who smoke tobacco may be declining, the use of e-cigarettes is becoming more common, particularly among young adults. According to the National Drug Strategy Household Survey 2019:

- The proportion of people who had ever used e-cigarettes increased from 8.8% to 11.3% between 2016 and 2019.
- Of those aged 18–24, 64% of current smokers and 20% of non-smokers reported having tried e-cigarettes (AIHW 2020).

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Gorna I, Napierala M and Florek E (2020), 'Electronic Cigarette Use and Metabolic Syndrome Development: A Critical Review', *Toxics*, 8(4), doi:10.3390/toxics8040105.

Morales-Suárez-Varela M, Peraita-Costa I, Perales-Marín A, Llopis-Morales A and Llopis-González A (2022) 'Risk of Gestational Diabetes Due to Maternal and Partner Smoking', *International Journal of Environmental Research and Public Health*, 19(2):925, doi:10.3390/ijerph19020925.

WHO (World Health Organization) (2020) '*E-cigarettes are harmful to health*', WHO, accessed 6 December 2021.

How common is diabetes?

Explore diabetes prevalence (existing cases) and incidence (new cases) by key subtypes:

- All diabetes
- Type 1 diabetes
- Type 2 diabetes
- Gestational diabetes

![Australian Government - Australian Institute of Health and Welfare](logo)

How common is diabetes?

Page highlights:

How many people are living with diabetes in Australia?

- More than 1.3 million (1 in 20) Australians were living with diabetes in 2021.
- Diabetes was more common among older Australians with almost 1 in 5 aged 80–84 living with diabetes.
- Males were 1.3 times as likely to be living with diabetes compared with females.
- 7.9% of Aboriginal and Torres Strait Islander people were living with diabetes in 2018–19.

How many people are newly diagnosed with diabetes in Australia?

- 49,900 people were newly diagnosed (incidence) with diabetes in 2021.
- The incidence of diabetes increased with increasing age, peaking in the 65-69 age group for both males and females.
- Since 2000, there has been a 43% decline in the age-standardised incidence rate for diabetes.
- There were around 2,200 new cases of diabetes among Aboriginal and Torres Strait Islander people in 2021.

Limitations of estimating diabetes prevalence

Data presented from the linked National Diabetes Services Scheme (NDSS) and Australasian Paediatric Endocrine Group (APEG) data (Figure 2) and Australian Bureau of Statistics (ABS) National Health Survey (NHS) (Figure 3) are likely to underestimate the true prevalence of diabetes in the Australian population. This is because:

- Both data sources are based on people who have received a formal medical diagnosis of diabetes. However, Australian studies have shown that many people are living with undiagnosed type 2 diabetes. For example, in the 1999–2000 AusDiab Study, half of all diabetes were undiagnosed (Dunstan et al. 2001). In the 2011–12 Australian Bureau of Statistics (ABS) Australian Health Survey (AHS), which collected blood glucose data, 20% of participating adults aged 18 and over had undiagnosed type 2 diabetes prior to the survey (ABS 2013a).
- Registration with the NDSS is voluntary and eligible people with type 2 diabetes are more likely to register if they access subsidised diabetes consumables to monitor their diabetes at home or require insulin. Some people may be diagnosed with diabetes and choose not to register with the scheme.
- Indigenous Australians are under-represented on the NDSS (see Using the NDSS for reporting on Indigenous Australians).

Despite these limitations, these data sources provide the best picture into the number of people living with diabetes in Australia to monitor changes in populations at risk, and trends over time. Further research is required to examine whether the proportion of people with undiagnosed type 2 diabetes in Australia has changed over time and the impact of this on the prevalence of disease in Australia.

How many people are living with diabetes in Australia?

More than 1.3 million (1 in 20) Australians were living with diabetes and currently registered with the linked National Diabetes Services Scheme (NDSS) and Australasian Paediatric Endocrine Group (APEG) state-based registers in 2021. This includes people with type 1 diabetes, type 2 diabetes and other diabetes, but excludes gestational diabetes.

Variation by age and sex

In 2021, the prevalence of diabetes, according to linked NDSS and APEG data, increased with increasing age:

- Almost 1 in 5 (19.5%) Australians aged 80–84 (22.1% males and 17.2% of females) (Figure 1) were living with diabetes in 2021, which was almost 30 times as high as those aged under 40 (0.7%).
- Diabetes was 1.3 times as common among males as females, after controlling for age.

Figure 1: Prevalence of diabetes, by age and sex, 2021

The chart shows the increasing prevalence of diabetes in 2021 by 5-year age groups, peaking in the 80–84 age group for both males and females (22.1% and 17.2%, respectively). The prevalence of diabetes is consistently higher among males than females from age 35 and over.

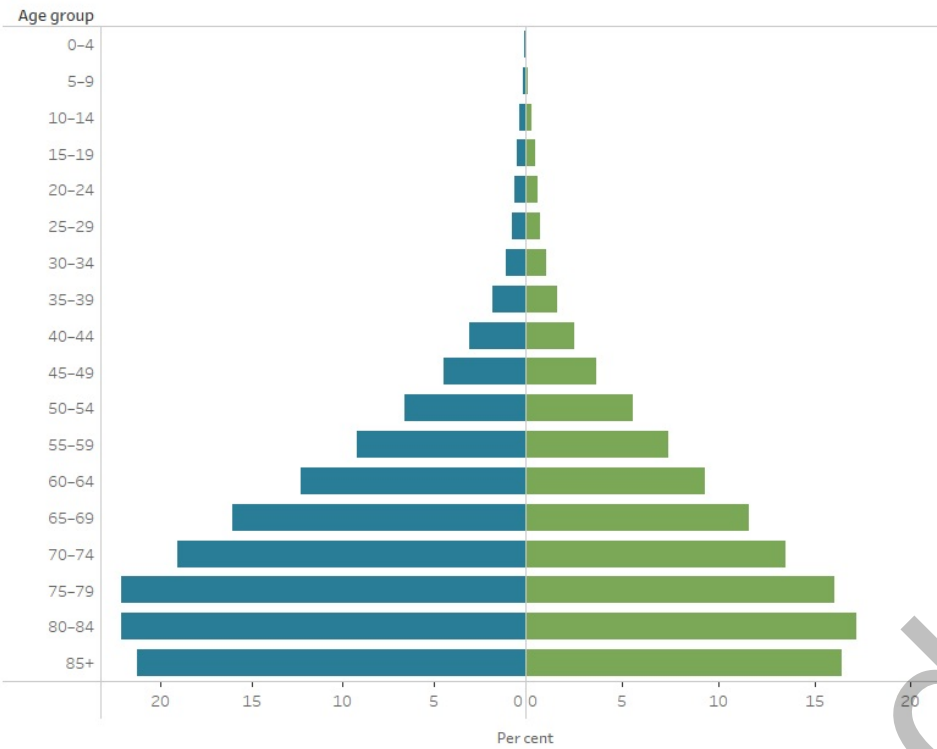Figure 1: Prevalence of diabetes, by age and sex, 2021

Trends over time

The number of people living with diabetes in Australia increased almost 2.8-fold between 2000 and 2021, from 460,000 to 1.3 million.

Based on linked NDSS and APEG data, the age-standardised prevalence rate increased by almost 80% between 2000 and 2021, however, rates have remained relatively stable since 2011 for both males and females (Figure 2).

Figure 2: Prevalence of diabetes from linked NDSS and APEG data, by sex, 2000-2021

This chart shows the estimated age–standardised proportion of people with diabetes based on data from the linked National Diabetes Services Scheme and Australasian Paediatric Endocrine Group between 2000 and 2021. The proportion increased from 2.4% in 2000 to 4.3% in 2021 and has remained relatively stable since 2014.
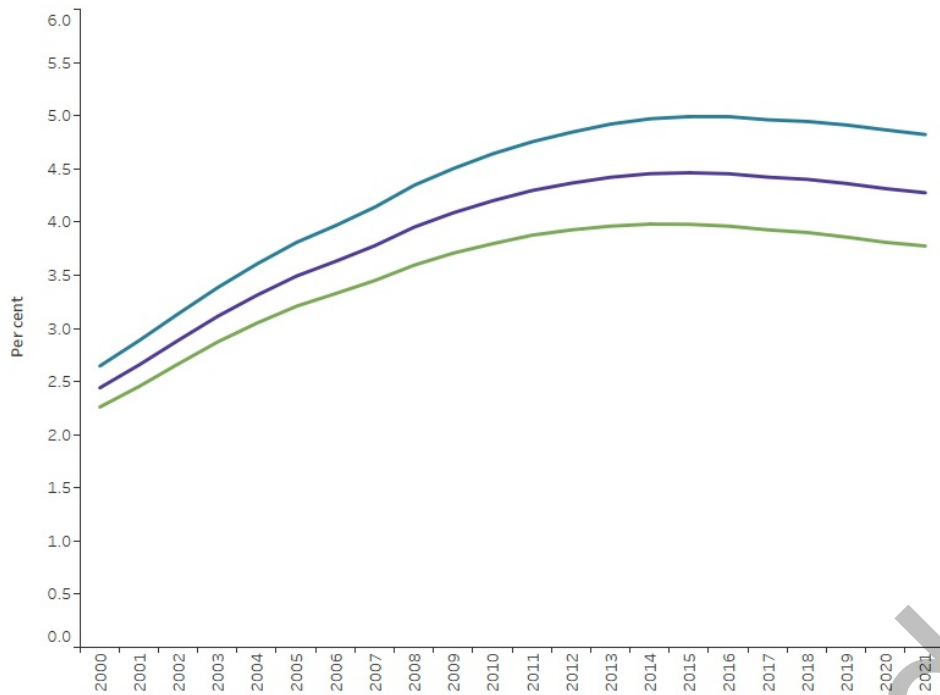
Figure 2: Prevalence of diabetes from linked NDSS and APEG data, 2000–2021

Note: Age-standardised to the 2001 Australian Standard Population.
Chart: AIHW. Source: AIHW analysis of linked National Diabetes Services Scheme and Australasian Paediatric Endocrine Group state-based registers.

https://www.aihw.gov.au

Similar patterns were found in the ABS NHS. The age-standardised prevalence rate of diabetes increased by 33% between 2001 and 2017–18. The rate of self-reported diabetes remained stable between 2014–15 and 2017–18 (Figure 3).

> **Note:** Although the most recent NHS was conducted in 2020–21, the survey was collected during the COVID-19 pandemic, via an online, self-report format, which significantly changed the data collection and survey estimates. It is advised that the 2020–21 NHS data are considered a break in time series from previous NHS collections and should be used for point-in-time national analysis only.

Figure 3: Prevalence of self-reported diabetes from the National Health Survey, by sex, 2001 to 2017-18

The chart shows the prevalence of self-reported diabetes, by sex from 2001 to 2017–18 based on data from the ABS National Health Surveys. After adjusting for differences in the age structure of the populations, the prevalence of diabetes increased from 3.3% in 2001 to 4.7% in 2014–15 while dropping slightly to 4.4% in 2017–18. While the overall trend is similar among males and females, the prevalence of diabetes is consistently around 1.3 times higher among males than females.
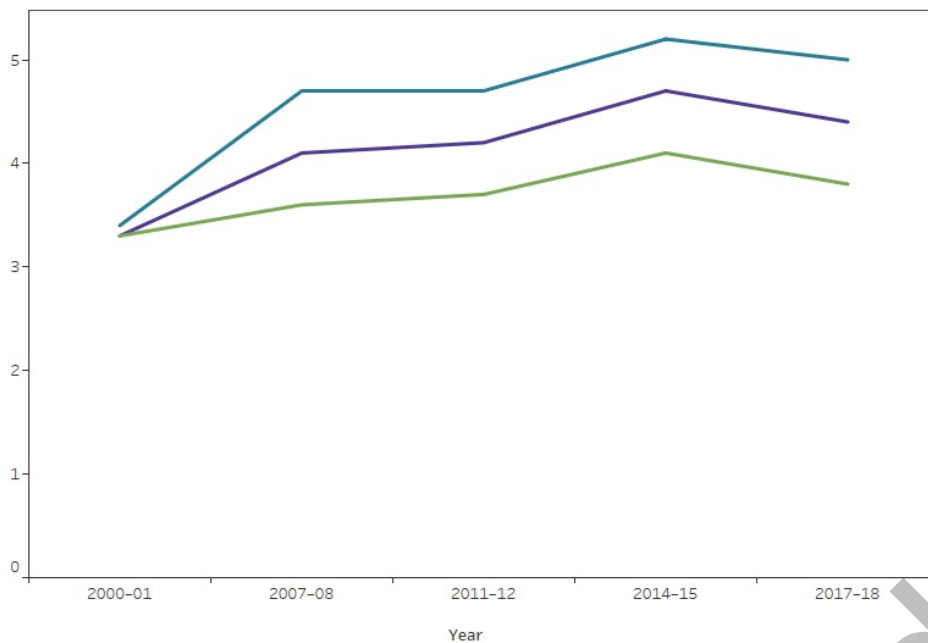
Figure 3: Prevalence of self-reported diabetes, by sex, 2001 to 2017–18

Notes
1. Respondent ever told by a doctor or a nurse that they had diabetes. Includes diabetes type 1, type 2 and type unknown. Data for 2004–05 are not available using this definition.
2. The estimates also include persons who reported they had diabetes but that it was not current at the time of interview.
3. Per cent age-standardised to the 2001 Australian population.
Chart: AIHW. Sources: AIHW analysis of ABS 2003; ABS 2009; ABS 2013b; ABS 2016; ABS 2019.
https://www.aihw.gov.au/

Variation between population groups

Aboriginal and Torres Strait Islander people

Around 7.9% of Aboriginal and Torres Strait Islander people (64,100) were living with diabetes according to self-reported data from the ABS 2018–19 National Aboriginal and Torres Strait Islander Health Survey (NATSIHS) (ABS 2019b). This is similar to the 7.7% reported in the equivalent survey in 2012–13 (ABS 2014).

After controlling for differences in the age structure of the populations, based on self-reported and measured results, Indigenous Australians were almost 3 times as likely to be living with diabetes as their non-Indigenous counterparts.

Using the NDSS for reporting on Indigenous Australians

The representation and accuracy of data relating to Aboriginal and Torres Strait Islander people on the NDSS is influenced by a range of factors, which may reduce the accuracy of reporting on these communities and prevent the use of the NDSS for reporting on prevalence by Indigenous status.

- Before 2005, data entry for the NDSS registration form for Indigenous status coded all 'unknown' or 'not stated' responses to the Indigenous status question as 'non-Indigenous'. In 2005, the NDSS database was amended to add an extra value to the Indigenous status variable to indicate 'inadequate/not stated' where Indigenous status was not known. As a result of this issue, Indigenous status cannot be determined for 98% of people registered on the NDSS prior to 2005.
- Indigenous Australians may not register with the NDSS at all. Where Indigenous people live in rural, remote and very remote locations, NDSS Access Points may be limited, or consumables may be obtained through bulk supplies provided to health services through the NDSS. Diabetes-related products can also be accessed through other programs. These issues may result in lower registration rates for the NDSS among Aboriginal and Torres Strait Islander people. For example, programs operating under Section 100 of the National Health Act 1953 – such as Aboriginal Medical Services and the National Aboriginal Community Controlled Health Organisation – provide Indigenous Australians access to free and subsidised products that people with insulin-treated diabetes need.

Remoteness area

In 2021, the age-standardised prevalence rate of diabetes was highest in *Remote and very remote* areas where people were 1.3 times as likely to be living with diabetes as those in *Major cities*. The disparity in *Remote and very remote* areas was more pronounced among females than males (1.6 and 1.1 times as high, respectively) (Figure 4).

Socioeconomic area

In 2021, the age-standardised prevalence rate of diabetes was around 1.8 times as high among those living in the lowest socioeconomic areas as in the highest socioeconomic areas. The variation in prevalence rates between the lowest and highest socioeconomic areas was slightly higher among females than males (2.0 and 1.7 times as high, respectively) (Figure 4).

Figure 4: Prevalence of diabetes, by selected population groups and sex, 2021

The chart shows the prevalence of diabetes by selected population groups and sex in 2021. After controlling for differences in the age structures of the population, diabetes prevalence increased with increasing remoteness and socioeconomic disadvantage. Those living in Remote and very remote areas were 1.3 times as likely to have diabetes than those living in Major cities. People living in the most disadvantaged areas were 1.8 times as likely to have diabetes as those living in the least disadvantaged areas.
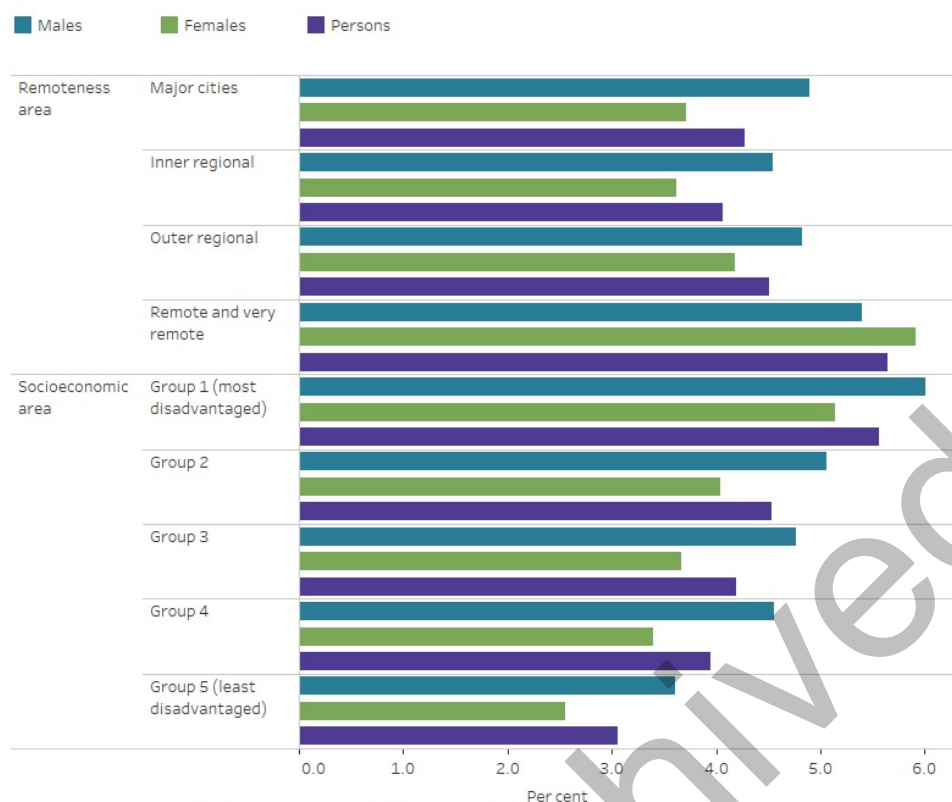

Figure 4: Prevalence of diabetes by selected popultion group and sex, 2021

[Notes]

Chart: AIHW. Source: AIHW analysis of National Diabetes Services Scheme and Australasian Paediatric Endocrine Group state-based registers.
https://www.aihw.gov.au

How many people are newly diagnosed with diabetes in Australia?

Between 2000 and 2021, over 1.4 million people newly diagnosed with diabetes (incidence) were registered on the NDSS and APEG state-based registries, including type 1 diabetes, type 2 diabetes and other diabetes but excluding gestational diabetes. This is about 64,000 people each year – an average of about 175 diagnosed individuals per day. In 2021, 49,900 people were newly diagnosed with diabetes in Australia (137 per day), equating to 194 per 100,000 population.

Variation by age and sex

In 2021, the incidence of diabetes:

- increased with increasing age, peaking in the 65–69 age group for both males and females (532 and 392 per 100,000 population, respectively) (Figure 5)
- was 1.4 times as common among males as females overall, after controlling for age.

Figure 5: Incidence of diabetes, by age and sex, 2021

The chart shows the number of new diabetes cases (per 100,000 population) (incidence) of diabetes by 5-year age group and sex in 2021. The incidence of diabetes increased with increasing age, peaking in the 65–69 age group among both males and females (532 and 392 per 100,000 population, respectively).
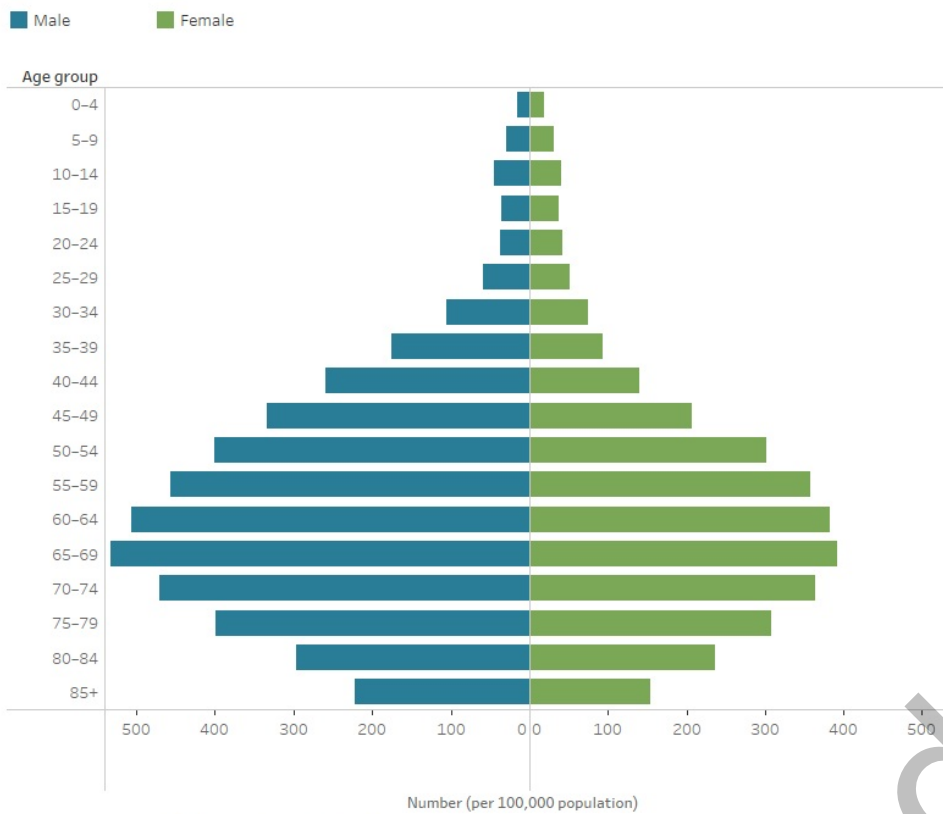
Figure 5: Incidence of diabetes, by age and sex, 2021

Trends over time

There has been a steady decline in the age-standardised diabetes incidence rate in Australia (largely driven by type 2 diabetes) between 2000 and 2021, with an overall drop of 43% (Figure 6). Although evidence from the 2019 Global Burden of Disease study as reported in *The Lancet* (2020) shows an overall increase in diabetes incidence globally, the observed declining trend has also been reported in several other countries (Magliano et al. 2019; Magliano et al. 2021). The fall in incidence may be due to improved preventive measures such as screening, increased awareness and educational programs leading to behavioural changes and risk factor modification (Magliano et al. 2019; Shrapnel and Butcher 2020).

Note: Some caution should be used when interpreting these trends. The NDSS is estimated to capture 80–90% of all people with diagnosed diabetes in Australia (AIHW 2009). It is uncertain how many people with diagnosed diabetes are not registering with the NDSS and how many people are living with undiagnosed diabetes. Indigenous Australians are also known to be under-represented on the NDSS.

Figure 6: Incidence of diabetes, by sex, 2000-2021

The chart shows the decreasing trend in the incidence of diabetes between 2000 and 2021, for both males and females. Overall, incidence rates fell from 307 to 176 per 100,000 population between 2000 and 2021.
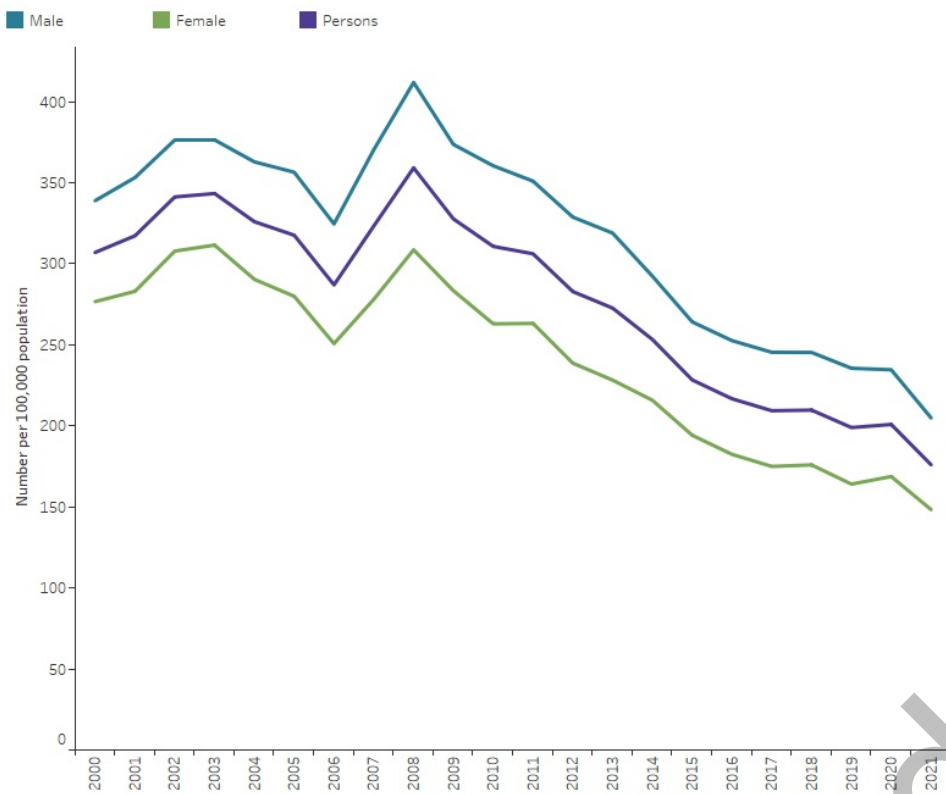
Figure 6: Incidence of diabetes, by sex, 2000–2021

Note: Age-standardised to the 2001 Australian Standard population.
Chart: AIHW. Source: AIHW analysis of linked National Diabetes Services Scheme and Australasian Paediatric Endocrine Group state-based registers.
https://www.aihw.gov.au

Variation between population groups

Aboriginal and Torres Strait Islander people

In 2021:

- there were around 2,200 new cases of diabetes among Aboriginal and Torres Strait Islander people – a rate of 256 per 100,000 population.
- incidence rates increased with increasing age and peaked among those aged 65–69 (788 per 100,000 population).
- incidence rates were 1.2 times as high among Indigenous males compared with Indigenous females, after controlling for age.
- incidence rates were highest in the 65–69 age group in Indigenous males but in the 60–64 age group among Indigenous females (925 and 712 per 100,000 population, respectively) (Figure 7).
- after adjusting for differences in the age structure of the populations, the incidence of diabetes was 2.0 times as high among Indigenous males and 2.4 times as high among Indigenous females compared with their non-Indigenous counterparts (Figure 8).

Figure 7: Incidence of diabetes for Aboriginal and Torres Strait Islander people, by age and sex, 2021

The chart shows the incidence of diabetes for Aboriginal and Torres Strait Islander people by 5-year age group and sex in 2021. The number of new diabetes diagnoses (incidence) per 100,000 population was highest among males aged 65–69 and females aged 60–64 (1,416 and 1,069 per 100,000 population, respectively).
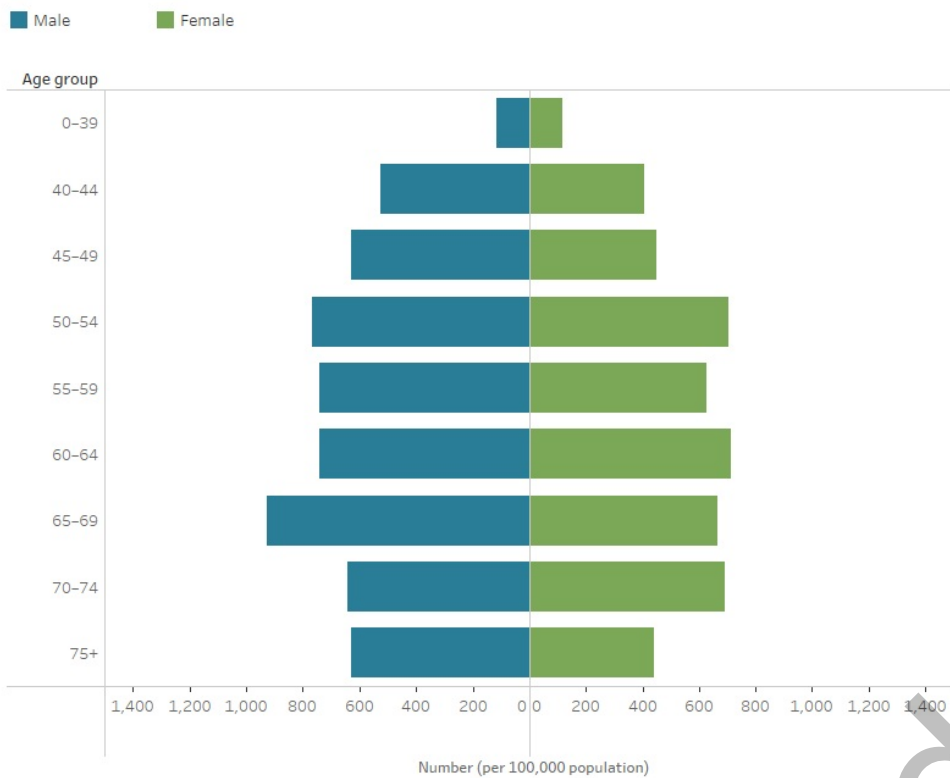
Figure 7: Incidence of diabetes, Aboriginal and Torres Strait Islander people, by age and sex, 2021

Chart: AIHW. Source: AIHW analysis of linked National Diabetes Services Scheme and Australasian Paediatric Endocrine Group state-based registers.
https://www.aihw.gov.au

Remoteness area

In 2021, age-standardised diabetes incidence rates were around 1.1 times as high in *Outer regional areas* compared with *Major cities* and *Inner regional* areas and 1.2 times as high as *Remote and very remote* areas (Figure 8).

Socioeconomic area

In 2021, age-standardised diabetes incidence rates increased with increasing levels of socioeconomic disadvantage. People living in the lowest socioeconomic areas were 1.9 times as likely to be diagnosed with diabetes as those living in the highest socioeconomic areas (Figure 8).

Figure 8: Incidence of diabetes, by selected population group and sex, 2021

The chart shows the incidence of diabetes by selected population group and sex in 2021. Age-standardised diabetes incidence rates were 1.9 as high among those living in the most disadvantaged areas as those living in the most advantaged areas and were slightly higher among people living in Outer regional areas compared with Major cities, Inner regional and Remote and very remote areas. Incidence rates were 2.1 times higher among Indigenous Australians compared with non-Indigenous Australians.
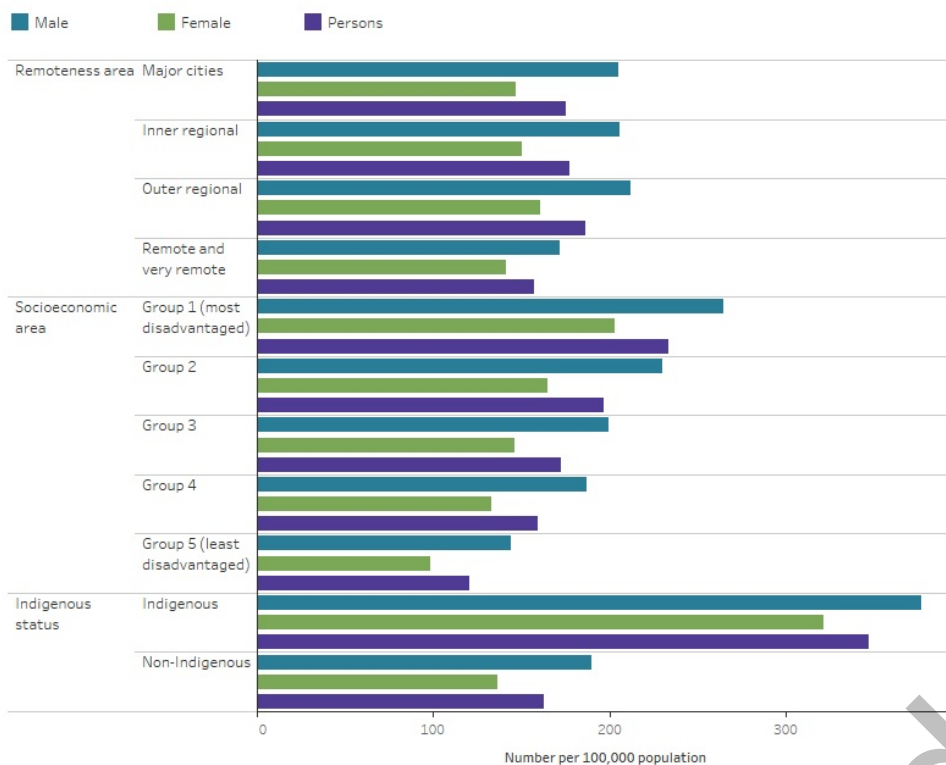
Figure 8: Incidence of diabetes, by selected population group and sex, 2021

[Notes]

Chart: AIHW. Source: AIHW analysis of National Diabetes Services Scheme and Australasian Paediatric Endocrine Group state-based registers.
https://www.aihw.gov.au

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How common is diabetes?

Page highlights:

How many people are living with type 1 diabetes in Australia?

- Around 13,200 children and young adults aged 0–19 were living with type 1 diabetes in 2021.
- The prevalence of type 1 diabetes in 2021 was similar among males and females.
- Type 1 diabetes prevalence rates remained stable between 2014 and 2021.

How many people are newly diagnosed with type 1 diabetes in Australia?

- Males were 1.3 times as likely to be newly diagnosed (incidence) with type 1 diabetes as females in 2021.
- Type 1 diabetes incidence rates were highest in the 10–14 age group, for both males and females.
- Type 1 diabetes incidence rates remained relatively stable between 2000 and 2021.

How many people are living with type 1 diabetes in Australia?

There are currently no accurate national data on the total number of cases (prevalence) of type 1 diabetes at all ages (see Why is prevalence only reported for children and young adults with type 1 diabetes?) However, the National (insulin-treated) Diabetes Register (NDR) can provide reliable estimates for children and young adults. According to the NDR, around 13,200 children and young adults aged 0–19 were living with type 1 diabetes in 2021 (211 per 100,000 population).

Variation by age and sex

In 2021:

- the prevalence of type 1 diabetes was similar among males and females
- the majority (81%) of children and young adults with type 1 diabetes were aged 10–19
- the type 1 diabetes prevalence rate was around 15 times as high in children and young adults aged 15–19 as those aged 0–4 (416 and 27 per 100,000 population, respectively) (Figure 1).

Figure 1: Prevalence of type 1 diabetes in children and young adults, by age and sex, 2021

The bar chart shows the prevalence of type 1 diabetes in children and young adults by sex in 2021. Rates were highest among males and females aged 15–19 (412 and 404 per 100,000 population, respectively).
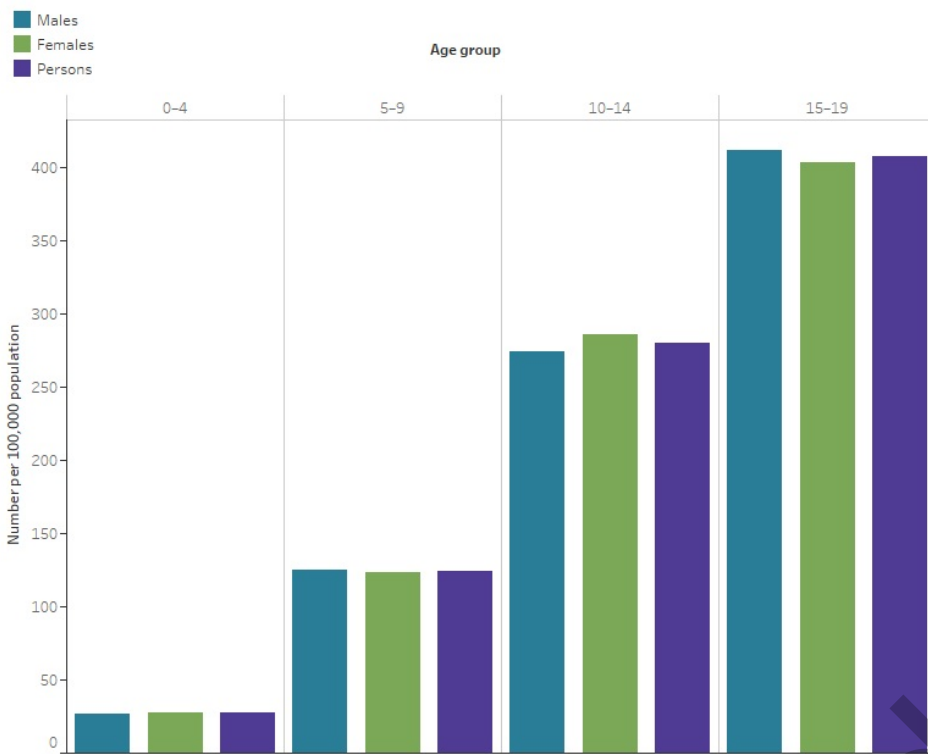
Figure 1: Prevalence of type 1 diabetes in children and young adults, by age group and sex, 2021

Notes:
1. Includes persons with missing or unassigned information on age and/or sex.
2. Age at first insulin use is used as a proxy for age of diagnosis.

Chart: AIHW. Source: AIHW National (insulin-treated) Diabetes Register.
https://www.aihw.gov.au

Trends over time

The age-standardised prevalence rates for type 1 diabetes among children and young adults remained relatively unchanged between 2014 and 2021 (Figure 2).

Figure 2: Prevalence of type 1 diabetes in children and young adults, by sex, 2014-2021

The chart shows the age-standardised rates of young males and females living with type 1 diabetes, which have remained largely unchanged between 2014 to 2021.
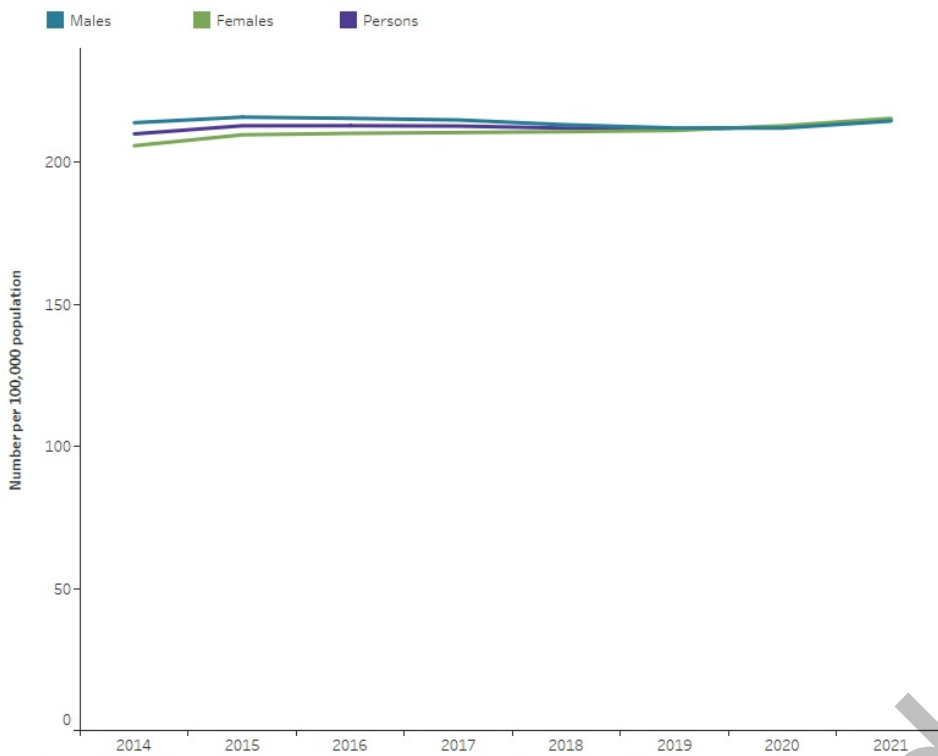
Figure 2: Prevalence of type 1 diabetes in children and young adults, by sex, 2014–2021

Notes:
1. Age-standardised to the 2001 Australian Standard Population.
2. Includes persons with missing or unassigned information on age and/or sex.
3. Age at first insulin use is used as a proxy for age of diagnosis.

Chart: AIHW. Source: AIHW National (insulin-treated) Diabetes Register.
https://www.aihw.gov.au

Variation between population groups

Aboriginal and Torres Strait Islander people

In 2021, there were 587 Aboriginal and Torres Strait Islander children and young adults aged 0–19 living with type 1 diabetes (158 per 100,000 population).

After adjusting for differences in the age structure of the populations, Indigenous children and young adults were around 21% less likely to be living with type 1 diabetes as their non-Indigenous counterparts (Figure 3).

Remoteness area

There was no clear pattern between the prevalence of type 1 diabetes among children and young adults and remoteness area in 2021. Overall, rates were highest in *Inner regional* and lowest in *Remote and very remote* areas (Figure 3).

Socioeconomic area

The prevalence of type 1 diabetes among children and young adults varied across socioeconomic areas in 2021, with rates being 1.2 times as high among the most disadvantaged areas compared with the least disadvantaged areas (Figure 3).

Figure 3: Prevalence of type 1 diabetes in children and young adults (0-19 years), by selected population group and sex, 2021

The horizontal bar chart shows that male and female type 1 diabetes prevalence rates in 2021, were lower among younger Indigenous Australians, younger people living in Remote and very remote areas, and younger people living in the least disadvantaged socioeconomic areas.
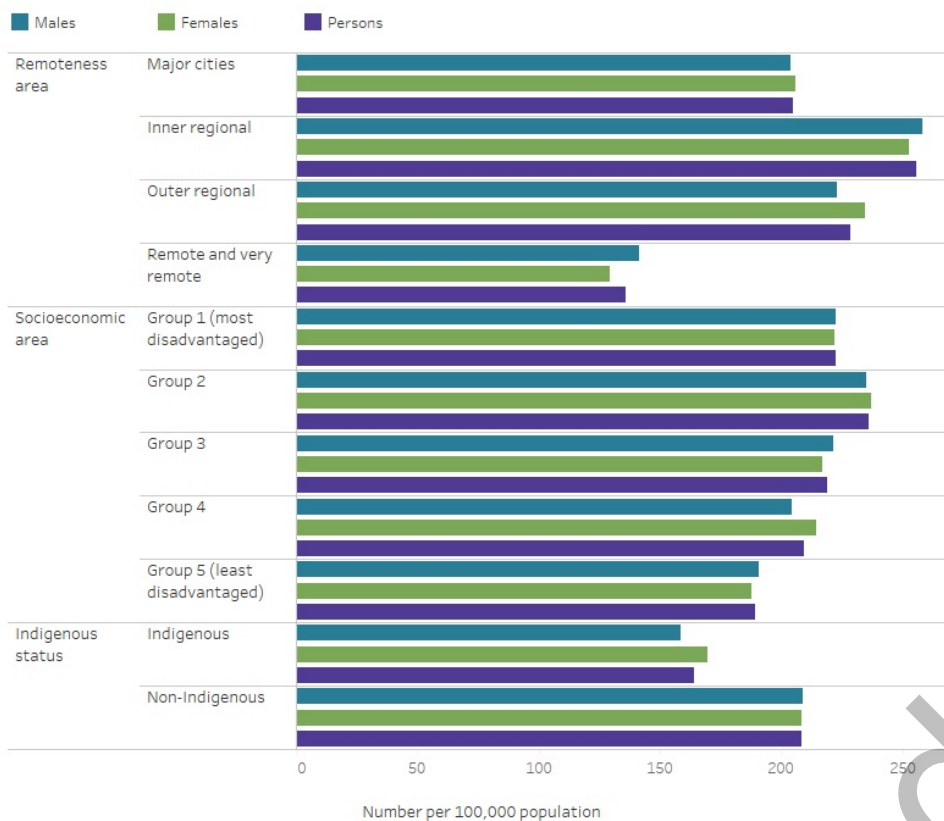
Figure 3: Prevalence of type 1 diabetes in children and young adults, by selected population group and sex, 2021
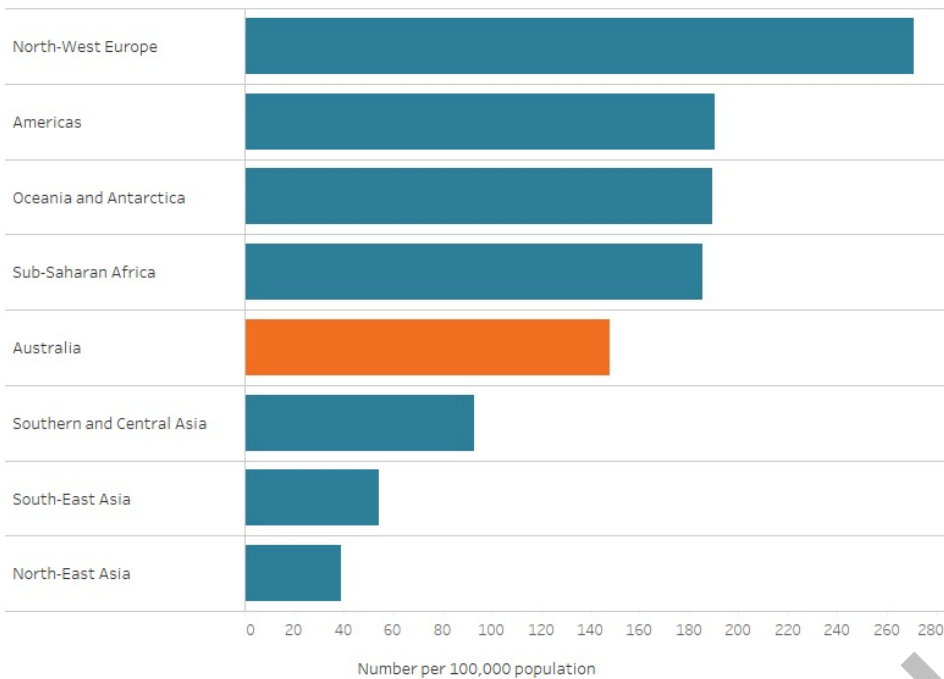
[Notes]

Country of birth

Type 1 diabetes prevalence rates varied by country of birth. In 2021, age-standardised rates were 1.8 times as high among children and young adults born in North–West Europe as those born in Australia (Figure 4). Caution should be used when interpreting these data due to a high level of missing country of birth information for people on the linked NDSS and APEG data.

Figure 4: Prevalence of type 1 diabetes in children and young adults (0-19 years), by country of birth, 2021

The horizontal bar chart shows type 1 diabetes prevalence rates were highest among children and young adults born in North-West Europe with prevalence rates 1.8 times as high as those among children and young people born in Australia (271 and 148 per 100,000 population).

Country of birth

Number per 100,000 population

Notes:
1. Age-standardised to the 2001 Australian Standard Population.
2. Age at first insulin use is used as a proxy for age of diagnosis.
3. Includes persons with missing or unassigned information on age and/or sex.
4. Excludes persons whose birth country was not stated or inadequately described.
5. Country of birth is classified using major groupings from the Standard Australian Classification of Countries (SACC) 2nd edition.

Chart: AIHW. Source: AIHW National (insulin-treated) Diabetes Register (NDR).
https://www.aihw.gov.au

Why is prevalence only reported for children and young adults with type 1 diabetes?

The NDSS registration forms and database have changed over time.

- Information recorded for older registrants is frequently incomplete for important variables, including diagnosis date and the date of first insulin use.
- The largest change occurred progressively between 2 December 2002 and 28 February 2003. At this time, the clinical terminology used to describe diabetes type was updated from juvenile-onset diabetes, Insulin Dependent Diabetes Mellitus (IDDM) and Non-Insulin Dependent Diabetes Mellitus (NIDDM), to type 1 and type 2 diabetes. Prior to this, people registering with the NDSS with insulin-treated type 2 diabetes may have been incorrectly recorded as type 1 so that their insulin using needs could be met. This occurred because the NDSS registration form did not have an option for insulin-treated type 2 diabetes, reflecting diabetes classification at that time. All registrants that were classified as IDDM were reclassified as type 1 diabetes as there was no effective way to differentiate between diabetes types, resulting in misclassification for some people with insulin-treated type 2 diabetes.
- In 2015, Diabetes Australia commissioned the Australian Healthcare Associates (AHA) to conduct an audit to test the reliability of the NDSS database and determine whether diabetes type is correctly recorded. Almost 1 in 5 (17.9%) of people surveyed with reported type 1 diabetes were found to have type 2 diabetes (25 of 140), with 80% of these people initially registered prior to 2003 (20 of 25) (AHA 2015). Small numbers of individuals with reported type 2 diabetes were also found to be misclassified (23 of 695).
- The NDR uses NDSS data linked with the Australasian Paediatric Endocrine Group (APEG) state-based registries which is used as a secondary ascertainment dataset and a rigorous algorithm is applied to confirm diabetes type. The algorithm checks age at diagnosis and the period between diagnosis and first insulin use. These factors are important for confirming type 1 diabetes status due to younger diagnosis age and immediate requirement for insulin therapy for survival in type 1 diabetes. The validation undertaken for the NDR, as well as the use of a secondary ascertainment data source, provide confidence in the accuracy of diabetes type for younger Australians.
- The Australian Bureau of Statistics National Health Survey also provides national estimates for type 1 diabetes. However, small numbers for younger age groups results in high variability and limits the reporting that is possible on people living with type 1 diabetes. Further, survey questions relating to diabetes include 'Diabetes – type 1 – (insulin dependent)' as the type 1 diabetes option, which may result in incorrect selection for people with type 2 diabetes using insulin.

How many people are newly diagnosed with type 1 diabetes in Australia?

Around **58,600** people were newly diagnosed with type 1 diabetes between 2000 and 2021 according to the National (insulin-treated) Diabetes Register (NDR). This was around 2,700 new cases of type 1 diabetes each year – an average of 7 newly diagnosed people a day.

There were **3,000** people newly diagnosed (incidence) with type 1 diabetes in Australia in 2021, equating to 12 diagnoses per 100,000 population.

Variation by age and sex

In 2021:

- nearly 2 in 3 people newly diagnosed with type 1 diabetes were aged under 30
- incidence rates were highest in the 10-14 age group for both males and females, 36 and 31 per 100,000, respectively (Figure 5)
- after adjusting for differences in the age structure of the populations, type 1 diabetes incidence rates were 1.3 times as high among males as females.

Figure 5: Incidence of type 1 diabetes, by age and sex, 2021

The butterfly chart shows the incidence rates of type 1 diabetes by age group in 2021. Rates were highest among males and females aged 10-14 years (36 and 31 per 100,000 population).
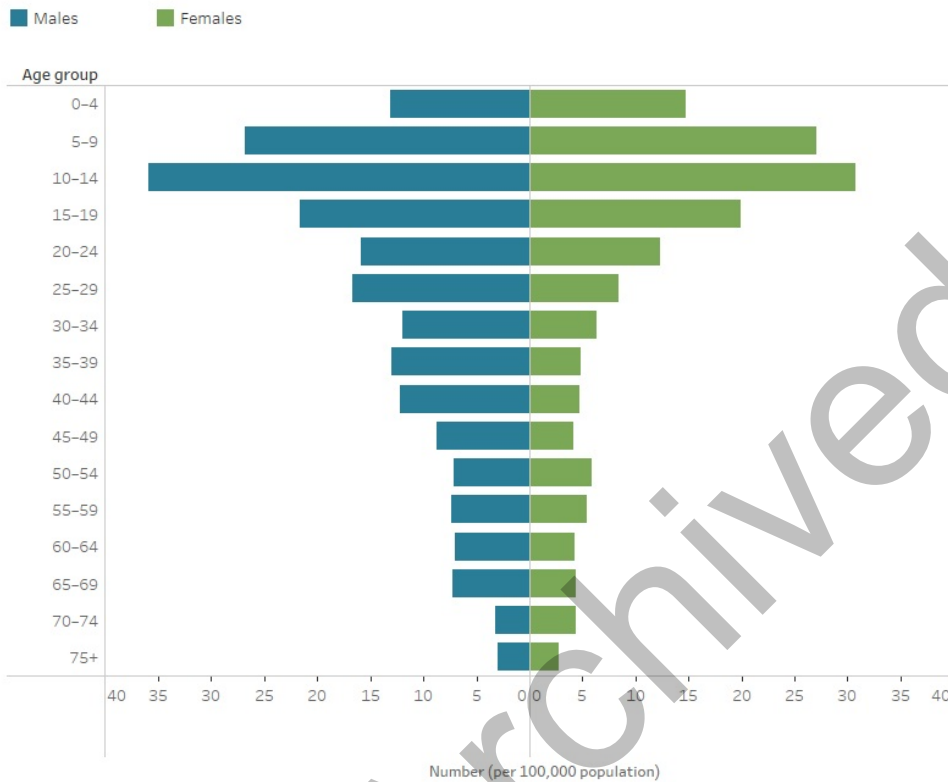

Figure 5: Incidence of type 1 diabetes, by age and sex, 2021

Notes:
1. Includes persons with missing or unassigned information on age and/or sex.
2. Age at first insulin use is used as a proxy for age of diagnosis.
Chart: AIHW. Source: AIHW National (insulin-treated) Diabetes Register.
https://www.aihw.gov.au

Trends over time

Type 1 diabetes age-standardised incidence rates remained relatively stable between 2000 and 2021 with new diagnoses among males consistently being around 1.3 times as likely as females during the period (Figure 6).

Figure 6: Incidence of type 1 diabetes, by sex, 2000-2021

The chart shows the age-standardised incidence rates for males and females newly diagnosed with type 1 diabetes between 2000 to 2021. Over the last two decades, incidence rates have remained relatively stable, fluctuating between 13 and 15 new cases per 100,000 population for males and 10 to 12 new cases for females.
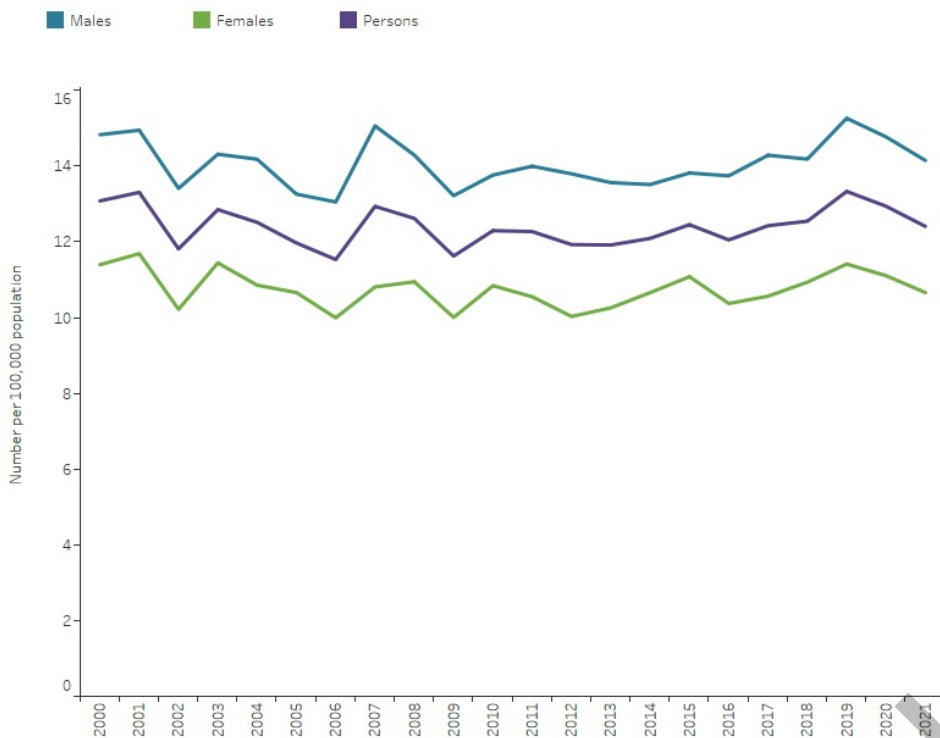
Figure 6: Incidence of type 1 diabetes, by sex, 2000–2021

Notes:
1. Age-standardised to the 2001 Australian Standard Population.
2. Age at first insulin use is used as a proxy for age of diagnosis.
3. Includes persons with missing or unassigned information on age and/or sex.

Chart: AIHW. Source: AIHW analysis of National (insulin-treated) Diabetes Register.
https://www.aihw.gov.au

Variation between population groups

Aboriginal and Torres Strait Islander people

There were 151 Aboriginal and Torres Strait Islander people newly diagnosed with type 1 diabetes in 2021 (17 per 100,000 population). Age-standardised incidence rates were 1.3 times as high among Indigenous males compared with Indigenous females.

After adjusting for differences in the age structure of the populations, the type 1 diabetes incidence rate was 1.2 times as high among Indigenous Australians compared with non-Indigenous Australians (Figure 7).

Remoteness area

In 2021, type 1 diabetes incidence rates were lowest in *Remote and very remote* areas and highest in *Inner regional* areas (Figure 7).

Socioeconomic area

The incidence of type 1 diabetes in 2021 was slightly lower in the least disadvantaged socioeconomic areas, but similar across the other areas (Figure 7).

Figure 7: Incidence of type 1 diabetes, by selected population groups and sex, 2021

The chart shows that male and female type 1 diabetes prevalence rates in 2021, were higher among Indigenous Australians, people living in Inner and Outer regional areas, and people living in the lowest socioeconomic areas.
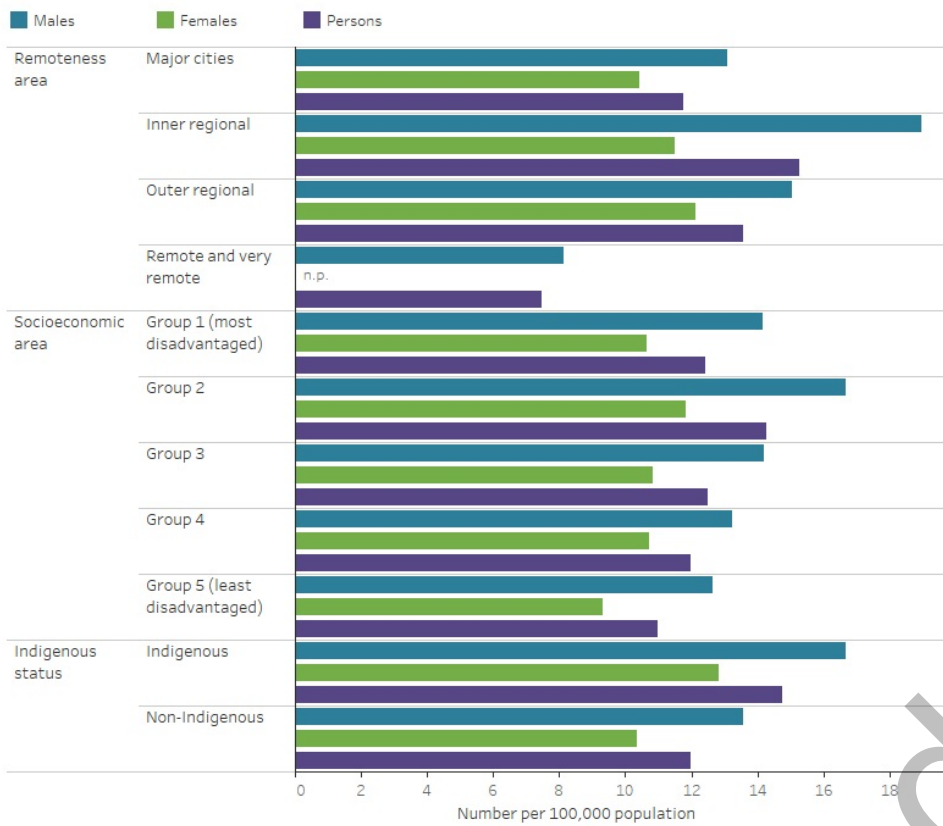
Figure 7: Incidence of type 1 diabetes, by selected population group and sex, 2021

[Notes]

Chart: AIHW. Source: AIHW analysis of National (insulin-treated) Diabetes Register (NDR).
https://www.aihw.gov.au

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How common is diabetes?

Page highlights:

How many people are living with type 2 diabetes in Australia?

- Almost 1.2 million (4.6%) people were living with type 2 diabetes in Australia in 2021.
- Overall, males were 1.3 times as likely to be living with type 2 diabetes as females.
- In 2018–19, an estimated 10.7% (51,900) Aboriginal and Torres Strait Islander people were living with type 2 diabetes.
- Type 2 diabetes prevalence increased with both the level of remoteness and socioeconomic disadvantage.

How many people are newly diagnosed with type 2 diabetes in Australia?

- Around 45,700 people were newly diagnosed (incidence) with type 2 diabetes in Australia in 2021, around 125 people a day.
- Males were 1.4 times as likely to be newly diagnosed with type 2 diabetes as females.
- Type 2 diabetes incidence rates have almost halved since 2008.

How many people are living with type 2 diabetes in Australia?

Almost **1.2 million (4.6%)** Australians were living with type 2 diabetes and registered with the National Diabetes Services Scheme (NDSS) and Australasian Paediatric Endocrine Group (APEG) state-based registers in 2021.

Variation by age and sex

In 2021, the prevalence of type 2 diabetes, based on linked NDSS and APEG data, increased with increasing age. Of the almost 1.2 million Australians living with type 2 diabetes, 3.1% were aged less than 40 while 59% were aged 65 or over. Type 2 diabetes prevalence peaked in the 80–84 age group (22% and 17% for males and females, respectively) (Figure 1).

Overall, age-standardised type 2 diabetes prevalence rates were 1.3 times as high in males compared with females.

Figure 1: Prevalence of type 2 diabetes, by age and sex, 2021

The butterfly chart shows the prevalence of type 2 diabetes by age groups in 2021. Rates were highest among males and females aged 80–84 (22% and 17%).
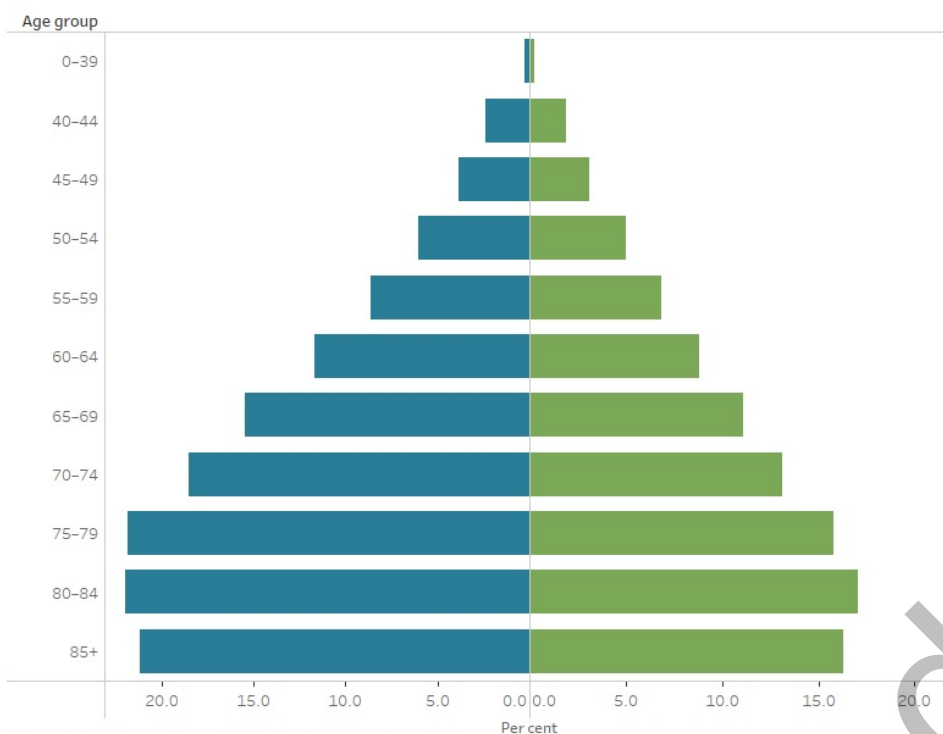
Figure 1: Prevalence of type 2 diabetes, by age and sex, 2021

Note: Includes persons with missing or unassigned information on age and/or sex.
Chart: AIHW. Source: AIHW analysis of linked National Diabetes Services Scheme and Australasian Paediatric Endocrine Group state-based registers.
https://www.aihw.gov.au

Trends over time

The number of people living with type 2 diabetes in Australia increased almost 3-fold between 2000 and 2021, from around 400,000 to almost 1.2 million.

After adjusting for differences in the age structure of the population, the proportion of people living with type 2 diabetes almost doubled between 2000 and 2013, and has remained relatively stable in the last decade (Figure 2). Since 2008, the age-standardised prevalence of type 2 diabetes has consistently been 1.3 times as high among males as females.

Similar patterns were found in the National Health Survey (NHS). The age-standardised prevalence rate of type 2 diabetes increased by 37% overall between 2001 and 2017–18 (Figure 3).

Note: The true prevalence of diabetes (including type 2 diabetes) is likely to be underestimated in the Australian population. Refer to Limitations of estimating diabetes prevalence data for more information.

Figure 2: Prevalence of type 2 diabetes from the linked NDSS and APEG data, by sex, 2000–2021

The chart shows the increase in the age-standardised rates of males and females living with type 2 diabetes between 2000 to 2021, from 2.3% to 4.3% for males, and from 2.0% to 3.3% for females.
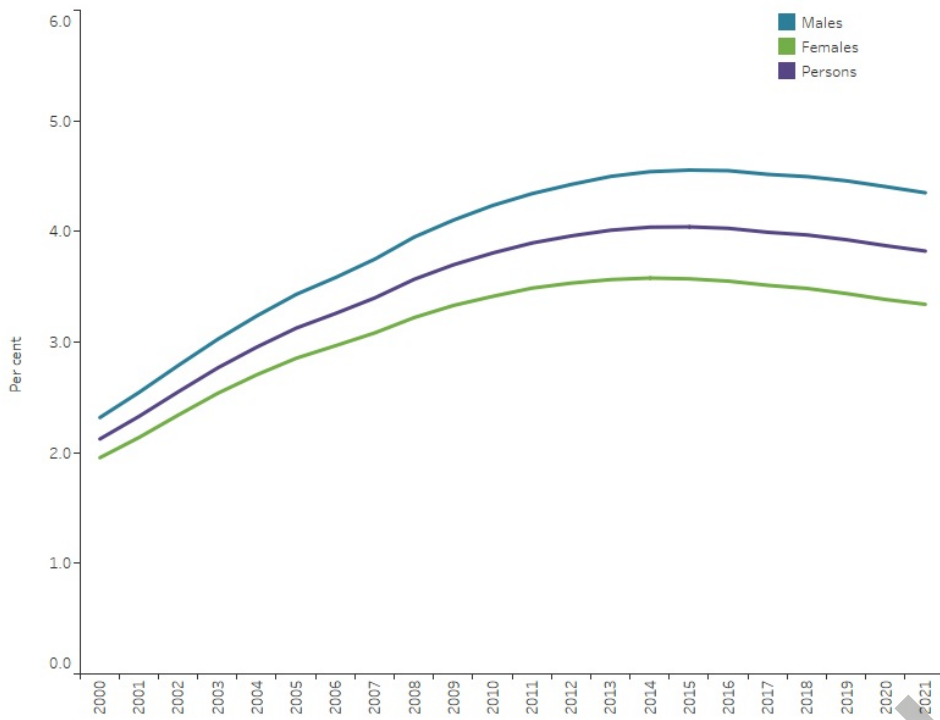
Figure 2: Prevalence of type 2 diabetes from the linked NDSS and APEG data, by sex, 2000–2021

Notes:
1. Age-standardised to the 2001 Australian Standard Population.
2. Includes persons with missing or unassigned information on age and/or sex.

Chart: AIHW. Source: AIHW analysis of National Diabetes Services Scheme and Australasian Paediatric Endocrine Group state-based registers.
https://www.aihw.gov.au

Figure 3: Prevalence of self-reported type 2 diabetes among adults 18+, by sex, 2001 to 2017-18 (National Health Survey data)

The line chart shows the increase in the age-standardised rates of males and females living with type 2 diabetes between 2001 to 2017-18, from 3.5% to 5.5% for males, and from 3.4% to 4.1% for females.
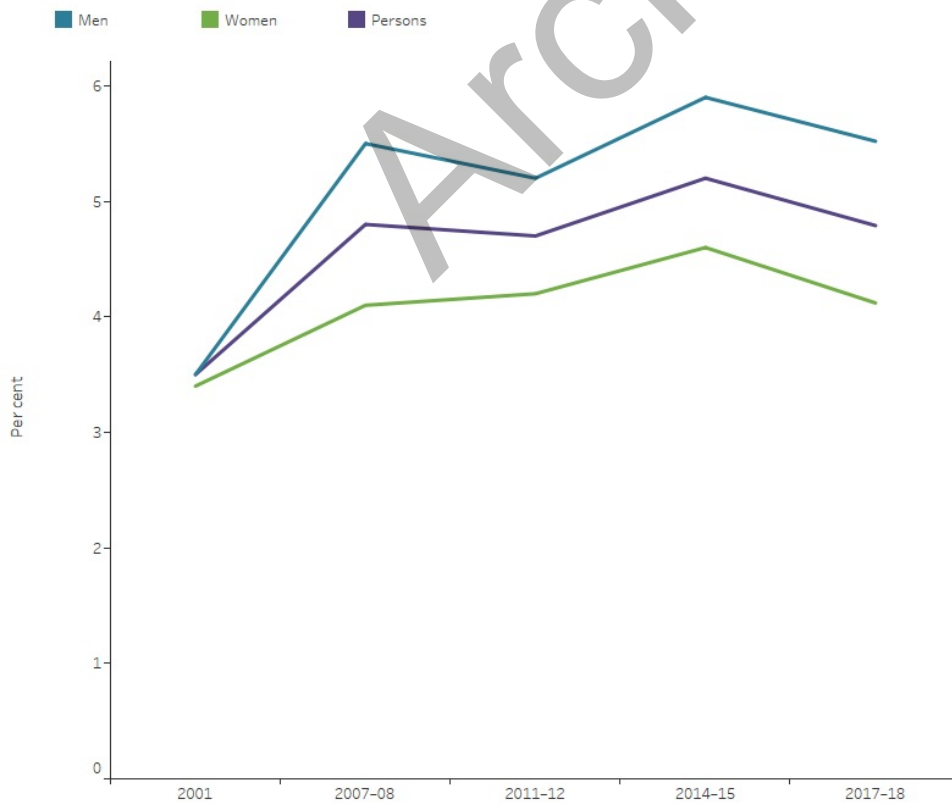

Figure 3: Prevalence of self-reported type 2 diabetes among adults, by sex, 2001 to 2017–18 (National Health Survey data)

Notes:
1. Based on self-reported data.
2. Age-standardised to the 2001 Australian Standard Population.
Chart: AIHW. Sources: AIHW analysis of ABS 2003, 2009, 2013, 2016, 2019.
https://www.aihw.gov.au

Variation between population groups

Aboriginal and Torres Strait Islander people

Among Aboriginal and Torres Strait Islander adults (aged 18+) in 2018–19, an estimated 10.7% (51,900 people) were living with type 2 diabetes, based on self-reported data from the ABS National Aboriginal and Torres Strait Islander Health Survey (NATSIHS). The age-standardised prevalence of type 2 diabetes was similar among Indigenous men and women.

Based on estimates from the 2018–19 NATSIHS and 2017–18 NHS, after adjusting for differences in the age structure of the populations, Indigenous adults were 2.9 times as likely to be living with type 2 diabetes as non-Indigenous adults.

For more information about issues with reporting Indigenous type 2 diabetes prevalence data from the linked NDSS and APEG data refer to Using the NDSS for reporting on Indigenous Australians.

Remoteness area

In 2021, the prevalence of type 2 diabetes (based on linked NDSS and APEG data) generally increased with increasing remoteness area. Age-standardised rates among people living in *Remote and very remote* areas were 1.4 and 1.5 times as high as those living in *Major Cities* and *Inner regional* areas, respectively. This disparity was more pronounced among females than males (Figure 4).

See *Geographical variation in disease: diabetes, cardiovascular and chronic kidney disease* for more information on the prevalence of type 2 diabetes by state/territory, Population Health Network and Population Health Area.

Socioeconomic area

In 2021, the prevalence of type 2 diabetes (based on linked NDSS and APEG data) increased with the level of socioeconomic disadvantage. Age-standardised rates were almost twice as high among those living in the lowest socioeconomic areas as in the highest socioeconomic areas. This disparity was more evident among females than males (2.1 and 1.7 times as high, respectively) (Figure 4).

Figure 4: Prevalence of type 2 diabetes, by selected population group and sex, 2021

The chart shows that male and female type 2 diabetes prevalence rates in 2021, were higher among people living in remote and very remote areas, and people living in the lowest socioeconomic areas.
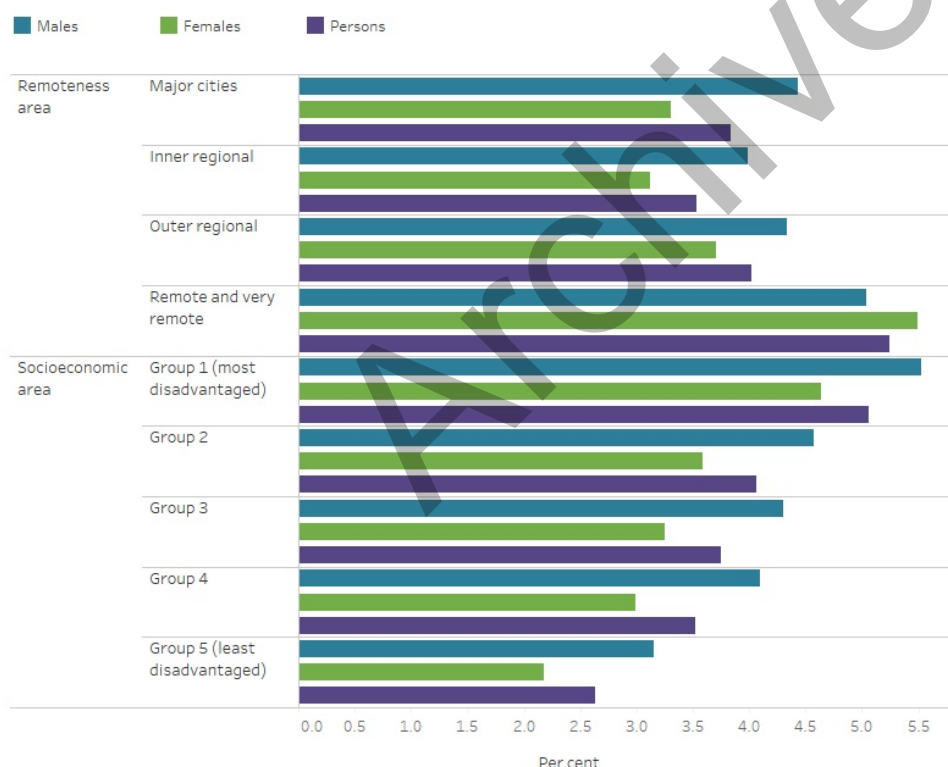

Figure 4: Prevalence of type 2 diabetes, by selected population group and sex, 2021

[Notes]

Chart: AIHW. Source: AIHW analysis of National Diabetes Services Scheme and Australasian Paediatric Endocrine Group state-based registers.
https://www.aihw.gov.au

How many people are newly diagnosed with type 2 diabetes in Australia?

According to linked NDSS and APEG data, over **1.3 million** people were newly diagnosed (incidence) with type 2 diabetes between 2000 and 2021. This is approximately 60,400 people each year – an average of 165 newly diagnosed people a day.

There were just over **45,700** people newly diagnosed with type 2 diabetes in Australia in 2021, around 125 people a day.

Variation by age and sex

In 2021, type 2 diabetes incidence rates were highest among males and females aged 65–69 according to linked NDSS and APEG data (515 and 383 per 100,000 population, respectively) (Figure 5).

After adjusting for the different age structures of the populations, type 2 diabetes incidence rates were 1.4 times as high among males as females.

Figure 5: Incidence of type 2 diabetes, by age and sex, 2021

The chart shows the type 2 diabetes incidence rates by age group and sex in 2021. Rates were highest among males and females aged 65–69 (515 and 383 per 100,000 population).
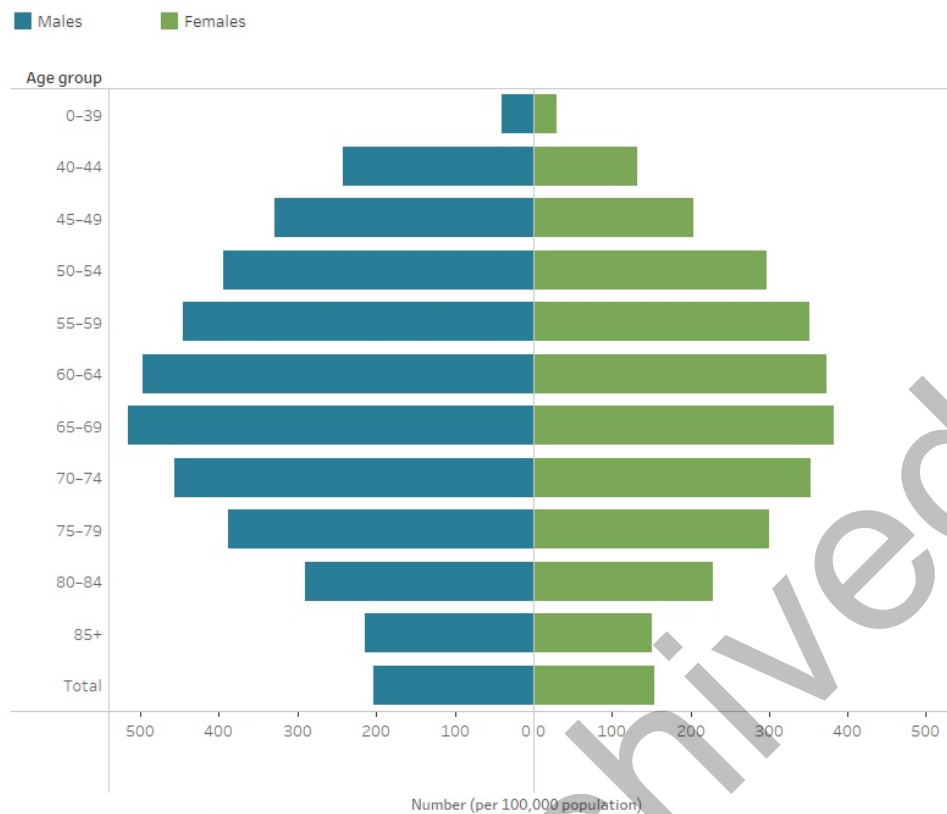

Figure 5: Incidence of type 2 diabetes, by age and sex, 2021

Note: Includes persons with missing or unassigned information on age and/or sex.
Chart: AIHW. Source: AIHW analysis of linked National Diabetes Services Scheme and Australasian Paediatric Endocrine Group state-based registers.
https://www.aihw.gov.au

Trends over time

There has been a steady decline in the age-standardised incidence rate for type 2 diabetes in Australia between 2000 and 2021, with an overall drop of 43% (Figure 6). Although evidence from the 2019 Global Burden of Disease study as reported in *The Lancet* (2020), shows an overall increase in incidence globally, the observed declining trend has also been reported in a number of other countries (Magliano et al. 2019; Magliano et al. 2021). The fall in incidence may be due to improved preventive measures such as screening, increased awareness and educational programs leading to behavioural changes and risk factor modification (Magliano et al. 2019; Shrapnel and Butcher 2020).

> **Note:** Some caution should be used when interpreting these trends. The NDSS is estimated to capture 80–90% of all people with diagnosed diabetes in Australia (AIHW 2009). It is uncertain how many people with diagnosed diabetes have not registered with the NDSS and how many people are living with undiagnosed diabetes. The under-representation of Indigenous Australians on the NDSS is a further factor for consideration.

Figure 6: Incidence of type 2 diabetes, by age and sex, 2000–2021

The chart shows declines in the age-standardised incidence rates of males and females newly diagnosed with type 2 diabetes between 2000 to 2021, from 292 to 159 per 100,000 population, overall.
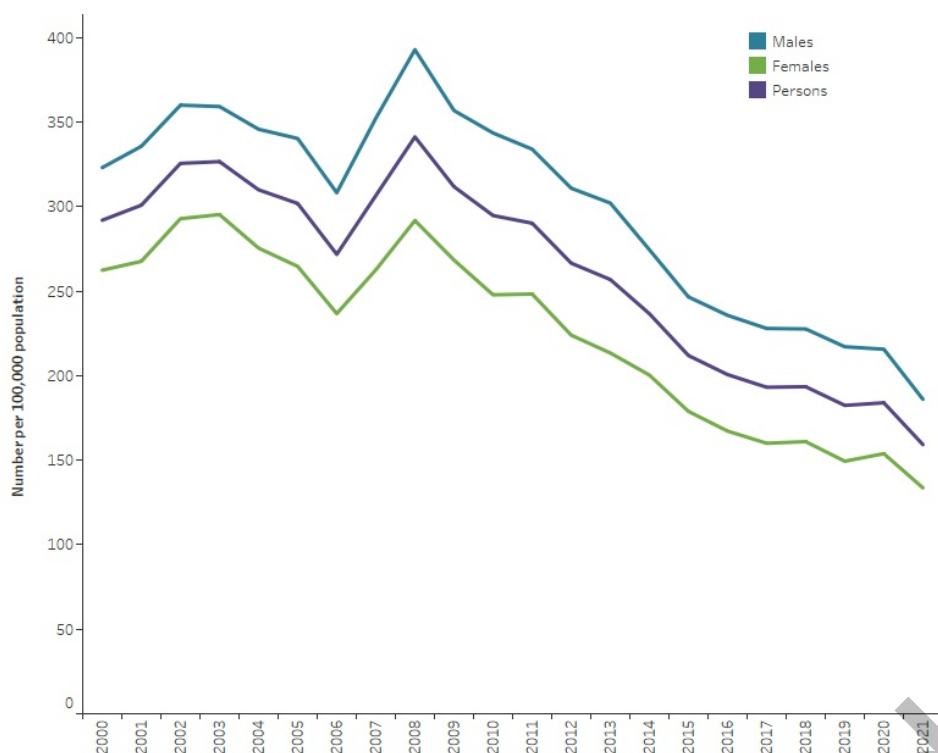
Figure 6: Incidence of type 2 diabetes, by age and sex, 2000–2021

Notes:
1. Age-standardised to the 2001 Australian Standard Population.
2. Includes persons with missing or unassigned information on age and/or sex.
Chart: AIHW. Source: AIHW analysis of linked National Diabetes Services Scheme and Australasian Paediatric Endocrine Group state-based registers.
https://www.aihw.gov.au

Variation between population groups

Aboriginal and Torres Strait Islander

Around 2,000 Aboriginal and Torres Strait Islander people were newly diagnosed with type 2 diabetes in 2021 (based on linked NDSS and APEG data), equating to 225 diagnoses per 100,00 population. Age-standardised incidence rates were 1.2 times as high among Indigenous males as females. Rates were highest among Indigenous males aged 65–69 and Indigenous females aged 60–64 (914 and 699 per 100,000, respectively) (Figure 7).

After controlling for age, type 2 diabetes incidence rates were 2.2 times as high among Indigenous Australians as non-Indigenous Australians (Figure 8).

Figure 7: Incidence of type 2 diabetes, Aboriginal and Torres Strait Islander people, by age and sex, 2021

The chart shows the incidence of type 2 diabetes among Aboriginal and Torres Strait Islander people by age group in 2021. Rates were highest among Indigenous males aged 65–69 and females aged 60–64 (1,391 and 1,048 per 100,000 population).
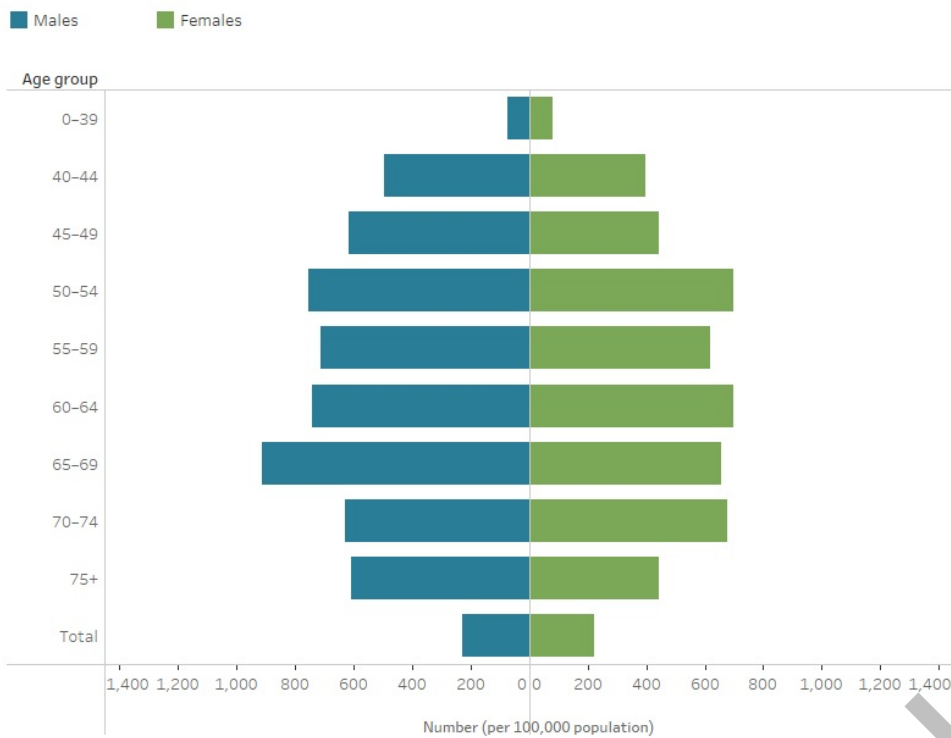
Figure 7: Incidence of type 2 diabetes, Aboriginal and Torres Strait Islander people, by age and sex, 2021

Notes:
1. Includes persons with missing or unassigned information on age and/or sex.
2. Rates may be influenced by the lower capture of Indigenous Australians and people living in *Remote and very remote* areas or across states and territories with large remote communities on the National Diabetes Services Scheme.
Chart: AIHW. Source: AIHW analysis of linked National Diabetes Services Scheme and Australasian Paediatric Endocrine Group state-based registers.
https://www.aihw.gov.au

Remoteness area

Based on linked NDSS and APEG data, the incidence of type 2 diabetes in 2021 was slightly higher among those living in *Outer regional* areas, that is 1.1 and 1.2 times as high as those living in *Major cities* and *Remote and very remote* areas, respectively (Figure 8).

Socioeconomic area

In 2021, the incidence of type 2 diabetes (based on linked NDSS and APEG data) increased with increasing levels of socioeconomic disadvantage. Rates were around 2.0 times as high among those living in the lowest socioeconomic areas as in the highest socioeconomic areas (Figure 8).

Figure 8: Incidence of type 2 diabetes, by selected population groups and sex, 2021

The chart shows that male and female type 2 diabetes prevalence rates in 2021, were higher among Indigenous Australians, people living in outer regional areas, and people living in the lowest socioeconomic areas.
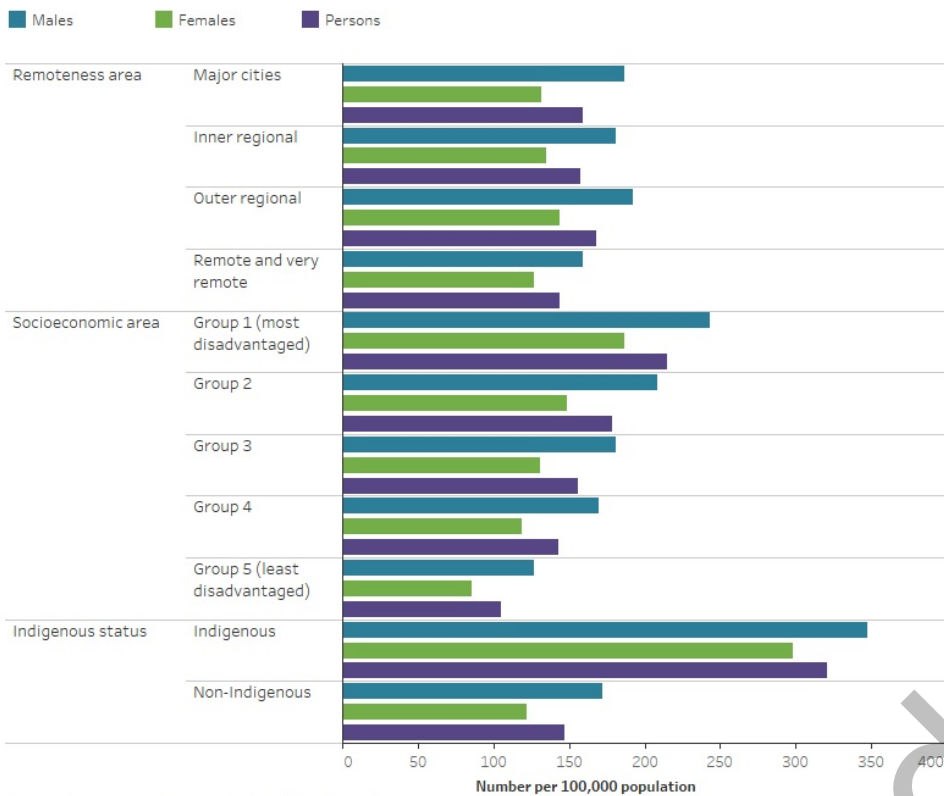
Figure 8: Incidence of type 2 diabetes, by selected population group and sex, 2021

[Notes]

Chart: AIHW. Source:AIHW analysis of linked National Diabetes Services Scheme and Australasian Paediatric Endocrine Group state based registers.
https://www.aihw.gov.au

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How common is diabetes?

Page highlights:

Diagnostic criteria

- Testing for gestational diabetes is recommended for all pregnant women at 24-28 weeks' gestation with re-testing at 6-12 weeks' post-partum recommended for women diagnosed with gestational diabetes.

How common is gestational diabetes in Australia?

- More than 1 in 6 women (17.9%) who gave birth in 2020-21 was diagnosed with gestational diabetes (53,900 women).

Measuring diabetes in pregnancy

- Find out more about the data sources available for measuring diabetes in pregnancy.

Risk factors

The following factors (Nankervis et al. 2014) increase a woman's risk of developing gestational diabetes:

- ethnicity: Asian, Indian subcontinent, Aboriginal, Torres Strait Islander, Pacific Islander, Māori, Middle Eastern, non-white African
- pre-pregnancy body mass index (BMI) >30 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 >4500g or >90th percentile)
- polycystic ovary syndrome
- medications: corticosteroids, antipsychotics.

Diagnostic criteria

The Australasian Diabetes in Pregnancy Society guidelines recommend the 75g oral glucose tolerance test (OGTT) for all pregnant women at 24-28 weeks' gestation and re-testing with the 75g OGTT at 6-12 weeks post-partum for women diagnosed with gestational diabetes. The post-partum test is to identify ongoing glucose issues which may indicate other forms of diabetes first detected in pregnancy. Regular, ongoing monitoring is also recommended due to the high risk of recurrence in subsequent pregnancies and of developing type 2 diabetes in the future.

A diagnosis for gestational diabetes (using the International Association of Diabetes and Pregnancy Study Groups criteria) is made based on the 75g OGTT with one or more of the following values (Nankervis et al. 2014):

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

How common is gestational diabetes in Australia?

In 2021–22, more than 1 in 6 women (17.9%) aged 15-49 who gave birth in an Australian hospital were diagnosed with gestational diabetes (53,900 females), based on the National Hospital Morbidity Database.

Variation by age

In 2021-22, the incidence of gestational diabetes increased with increasing maternal age, ranging from 8.4% to 31.7% in the 15-19 and 45-49 age groups, respectively. Compared with women aged 15-19, those aged 35-39 were 2.6 times as likely to be diagnosed with gestational diabetes while women aged 40-44 and 45-49 were 3.3 and 3.8 times as likely, respectively (Figure 1).

Figure 1: Incidence of gestational diabetes, by age, 2021-22

The chart shows the incidence of gestational diabetes by age group in 2021-22. Rates increased with increasing age, peaking in the 45-49 age group. Women in the 45-49 age group were 3.8 times as likely to be diagnosed with diabetes as women aged 15-19.
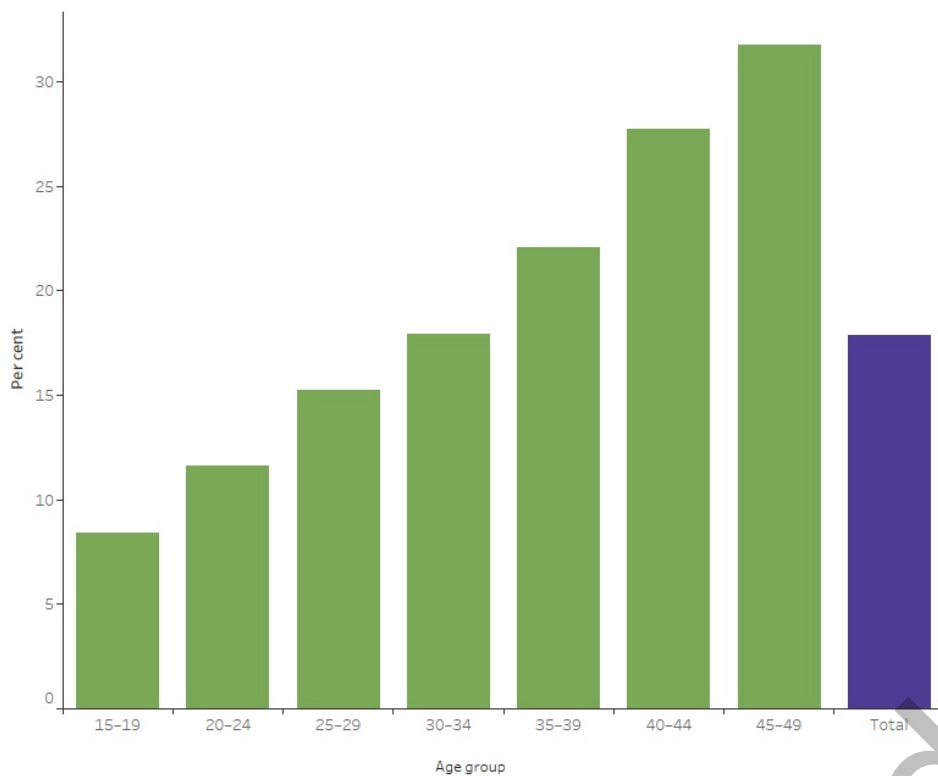
Figure 1: Incidence of gestational diabetes, by age, 2021–22

Notes:
1. Population (women aged 15–49 giving birth in Australian hospitals) based on ICD-10-AM diagnosis codes.
2. Includes persons with missing or unassigned information on age and/or sex.
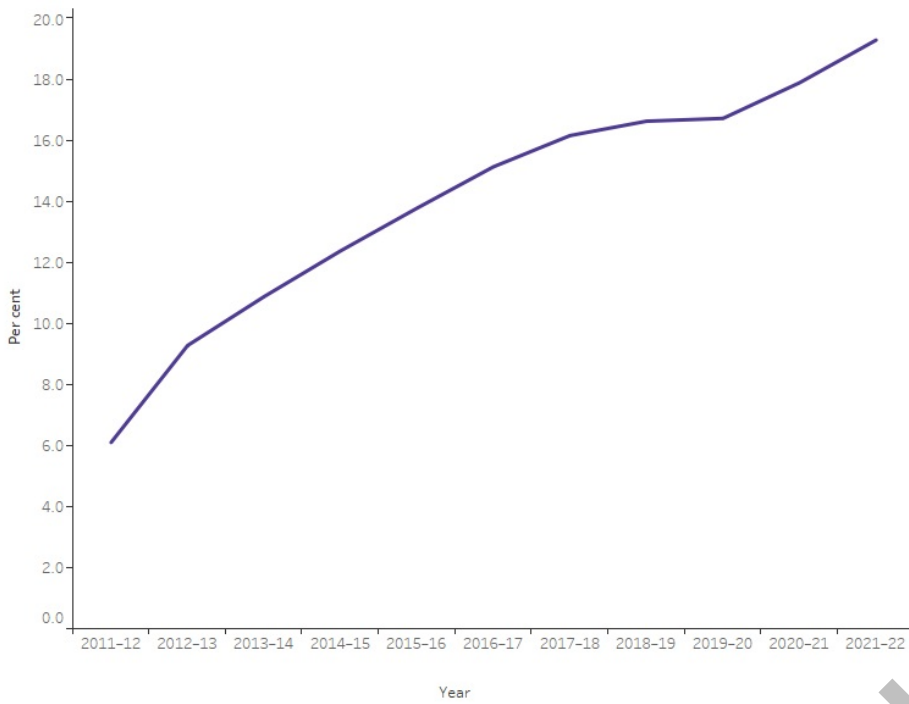Chart: AIHW. Source: National Hospital Morbidity Database.
https://www.aihw.gov.au

Trends over time

After adjusting for changes in the age structure of the population over time, the incidence of gestational diabetes more than doubled in Australia between 2012–13 and 2021–22. The most notable increases were recorded between 2012–13 and 2017–18 with a further upward spike in 2020–21 and 2021–22 (Figure 2).

Note: The rising incidence of gestational diabetes in the last decade is likely driven by several factors including increasing maternal age, higher rates of maternal overweight and obesity, and a growing proportion of higher risk ethnic groups in the population (Laurie and McIntyre 2020). The introduction of new diagnostic guidelines across all states and territories between 2011 and 2013 and the establishment of the National Gestational Diabetes Register (NGDR) in 2011 may also have had an impact on rates. Refer to Incidence of gestational diabetes in Australia – Changing trends for further information.

Figure 2: Incidence of gestational diabetes, 2011-12 to 2021-22

The chart shows the proportion of females diagnosed with gestational diabetes in Australia more than doubled from 9.3% in 2012–13 to 19.3% in 2021–22. Caution should be taken when comparing rates over time as many factors, including new diagnostic guidelines, are likely to have had an impact on the number of females diagnosed with gestational diabetes in recent years.

Figure 2: Incidence of gestational diabetes, 2011–12 to 2021–22

Notes
1. Age-standardised to the 2001 Australian Standard Population.
2. Population (women aged 15–49 giving birth in Australian hospitals) based on ICD-10-AM diagnosis codes.
3. Includes persons with missing or unassigned information on age and/or sex.
4. Caution should be taken when comparing rates over time as several factors, including new diagnostic guidelines are likely to have had an impact on incidence in recent years.
Chart: AIHW. Source: National Hospital Morbidity Database.
https://www.aihw.gov.au

Variation between population groups

Aboriginal and Torres Strait Islander women

In 2020–21:

- there were around 2,400 new cases of gestational diabetes among Aboriginal and Torres Strait Islander women, equating to 16% of Indigenous women who gave birth in hospital.
- the incidence of gestational diabetes increased with increasing age, peaking in the 40–49 age group at 30% which is about 2.6 times that of those aged 15–24 (11.3%) (Figure 3).
- After adjusting for differences in the age structure of the populations, Indigenous women were 1.2 times as likely to be diagnosed with gestational diabetes as non-Indigenous women (Figure 4).

Figure 3: Incidence of gestational diabetes among Indigenous women by age, 2020–21

The chart shows the incidence of gestational diabetes among Indigenous women by age group in 2020–21. Rates increased with increasing age, peaking in the 40–49 age group. Women in the 40–44 age group were 2.6 times more likely to be diagnosed with diabetes than those aged 15–24.
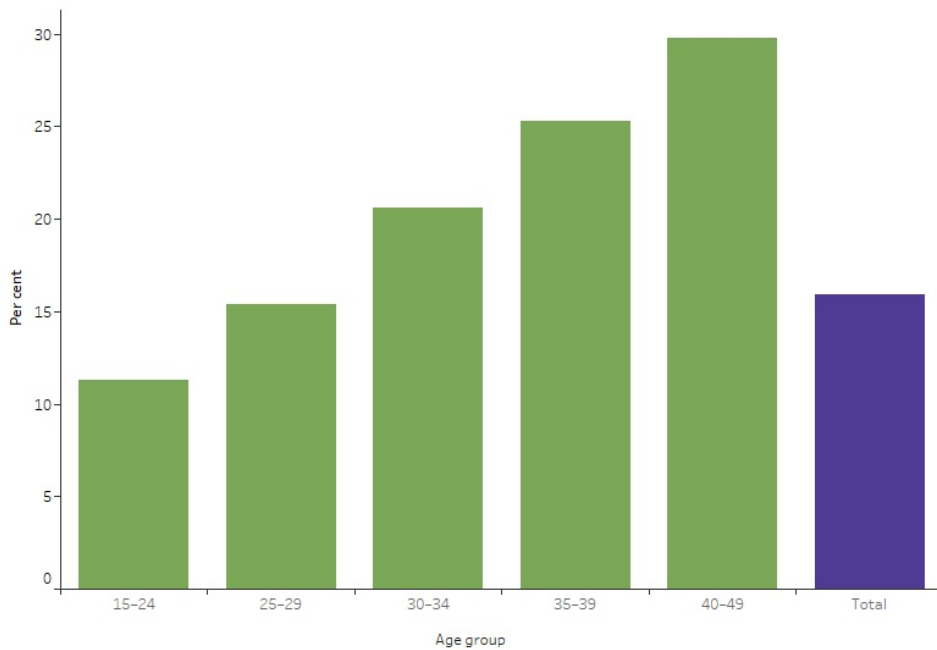
Figure 3: Incidence of gestational diabetes among Indigenous women by age, 2020–21

Notes
1. Population (women aged 15–49 giving birth in Australian hospitals) based on ICD-10-AM diagnosis codes.
2. Excludes persons whose Indigenous status was not stated or inadequately described.
Chart: AIHW. Source: AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

Remoteness area

In 2020–21, the incidence of gestational diabetes was slightly higher among those living in *Remote and very remote areas* (1.1 and 1.2 times as high as those living in *Major cities* and *Inner regional* areas, respectively) (Figure 4).

Socioeconomic area

In 2020–21, the incidence of gestational diabetes increased with increasing levels of socioeconomic disadvantage. After adjusting for differences in the age structure of the populations, women living in the lowest socioeconomic areas were 1.6 times as likely to be diagnosed with gestational diabetes as those living in the highest socioeconomic areas (Figure 4).

Figure 4: Incidence of gestational diabetes, by selected population groups, 2020-21

The chart shows the incidence of gestational diabetes by selected population groups in 2020–21. Incidence rates increased with increasing socioeconomic disadvantage with women living in the most disadvantaged areas being 1.6 times as likely to be diagnosed with gestational diabetes as those living in the least disadvantaged areas. Incidence rates were slightly higher among those living in Remote and very remote areas.
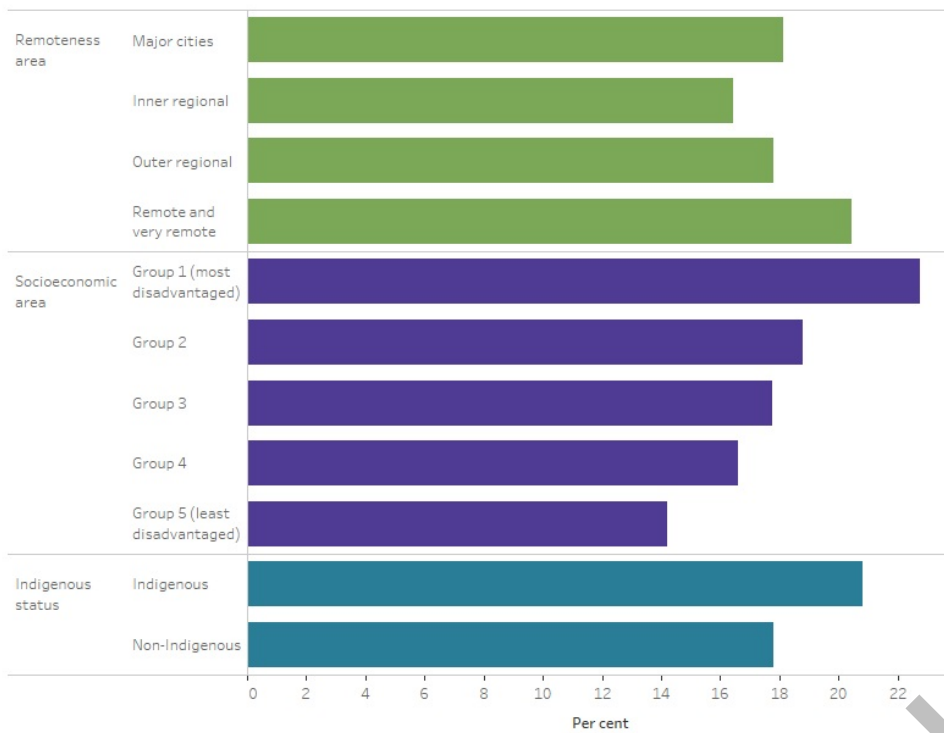
Figure 4: Incidence of gestational diabetes, by selected population group, 2020–21

Notes
1. Population (women aged 15–49 giving birth in Australian hospitals) based on ICD-10-AM diagnosis codes.
2. Age-standardised to the 2001 Australian Standard Population.
3. Excludes persons whose Indigenous status, remoteness area and/or socioeconomic area was missing or unassigned.

Chart: AIHW. Source: AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

Country of birth

In 2020–21, after adjusting for differences in the age structure of the populations, compared with women born in Australia:

- women born in Southern and Central Asia, South-east Asia, North Africa and the Middle East and North-East Asia were between 1.6 and 2.3 times as likely to be diagnosed with gestational diabetes
- women born in North-West Europe and the Americas were slightly less likely (0.8 and 0.9 times) to be diagnosed with gestational diabetes, respectively (Figure 5).

Figure 5: Incidence of gestational diabetes, by country of birth, 2020-21

The chart shows the age-standardised incidence of gestational diabetes by country of birth in 2020-21. Compared with women born in Australia, those born in Southern and Central Asia and South-East Asia were 2.3 and 1.6 times as likely to be diagnosed with gestational diabetes while women born in the Americas and North-West Europe were both 0.8 and 0.9 times as likely, respectively.
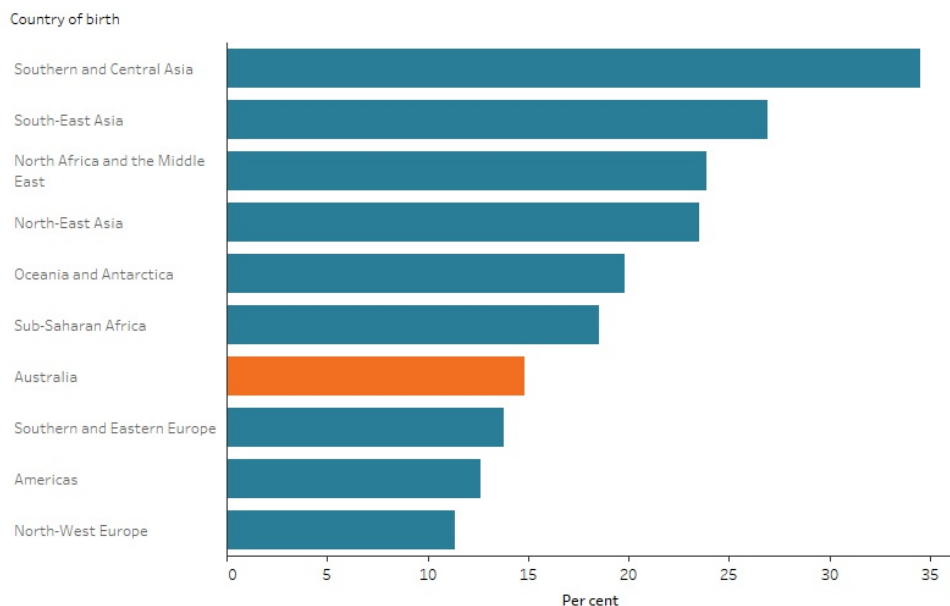
Country of birth

Figure 5: Incidence of gestational diabetes, by country of birth, 2020–21

Notes
1. Population (women aged 15–49 giving birth in Australian hospitals) based on ICD-10-AM diagnosis codes.
2. Age-standardised to the 2001 Australian Standard Population.
3. Excludes persons whose birth country was not stated or inadequately described.

Chart: AIHW. Source: AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

Measuring diabetes in pregnancy

Measuring the number of women living with gestational diabetes or pre-existing diabetes during pregnancy at a given time (prevalence) is not as useful as measuring the total number of diabetes-impacted pregnancies (incidence).

The 3 primary sources of data available to report on diabetes in pregnancy at the national level are:

- National Perinatal Data Collection (NPDC)
- National Hospital Morbidity Database (NHMD)
- National Diabetes Services Scheme (NDSS).

These data sources are administrative data sets designed to collect information primarily for administrative purposes, so might not always be suitable for monitoring complex health issues and research.

National Hospital Morbidity Database (NHMD)

In this report, the NHMD is the primary data source used to report gestational diabetes incidence and complications associated with both gestational diabetes and pre-existing diabetes in pregnancy. The NHMD contains episode-level records from admitted patient data collection systems in Australian public and private hospitals and includes administrative, demographic and clinical data. The NHMD captures virtually all births in Australia, with 97% of babies born in a hospital (AIHW 2021) and allows the calculation of a national estimate of gestational diabetes incidence. The NHMD provides national data on pregnancies affected by diabetes, and some complications and interventions. Data from the NHMD enable new cases of gestational diabetes in Australia over time to be identified. While the NHMD allows for the differentiation between pre-existing diabetes types using ICD-10-AM codes, changes to the ICD-10-AM coding, and the accuracy of recording diabetes type have an impact on the ability to report complications by diabetes type from the NHMD (AIHW 2014; Knight et al. 2011).

National Perinatal Data Collection (NPDC)

Compared with the other data sources (NHMD and NDSS), the NPDC provides comprehensive data for assessing the short-term impact of diabetes in pregnancy on the health of mothers and babies. But national data for all pregnancies affected by diabetes are not available for reporting, as data on diabetes status in Victoria are not currently collected in a format comparable with the specifications for the NPDC, so are excluded when reporting on the impact of diabetes in pregnancy. Data are also not currently of sufficient quality to assess diabetes type at the national level, as some jurisdictions are unable to distinguish between pre-existing diabetes types. Before 2014, information for diabetes type was provided, but varied across jurisdictions, so data cannot be compared with data collected after 2014.

National Diabetes Services Scheme (NDSS)

The NDSS allows the number of women with gestational diabetes to be identified at the national level, including the number of women having a repeat diagnosis of gestational diabetes, and provides information about the number of women who are using insulin therapy as the method of treatment for their condition. But the NDSS cannot be used to assess pre-existing diabetes in pregnancy or be used to assess pregnancy-related complications or outcomes.

> **Note:** A definitive diagnosis of gestational diabetes 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).

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Comorbidity of diabetes

Page highlights:

How many people are living with CKD, HSVD and diabetes?

- In 2011–12, an estimated 2.8 million Australian adults (18%) were living with diabetes, CKD and/or HSVD

Hospitalisations with CKD, CVD and diabetes

- Of the 1.2 million hospitalisations for diabetes in 2020–21, CVD was the most common comorbidity (8.1%), with CKD present in 6.3% of diabetes hospitalisations.

Deaths from CKD, CVD and diabetes

- 84% of diabetes deaths in 2021 also had CKD and or CVD recorded on the death certificate.

Diseases commonly associated with diabetes deaths

- Associated causes commonly listed where diabetes was the underlying cause of death in 2021 include coronary heart disease, kidney failure and hypertensive diseases.

What are multimorbidity and comorbidity?

1 in 5 (4.9 million) Australians were estimated to be living with multimorbidity in 2017-18 (ABS 2019). The terms multimorbidity and comorbidity are often used interchangeably within chronic condition and health-care reporting.

Comorbidity is defined as the occurrence of more than 1 condition or disorder concurrently. Possible combinations can consist of both physical conditions and/or mental disorders. Whereas **multimorbidity** is the presence of 2 or more chronic conditions in a person at the same time. These concepts are important for the way different parts of the health system view patients. The concept of comorbidity is useful for the secondary and tertiary-care settings, for example, an endocrinologist might treat a patient with type 2 diabetes as having comorbidity with other diseases. Multimorbidity is a more useful concept in the primary care setting where holistic care is provided that is not determined by the presence of any specific condition (Harrison et al. 2021).

The health effect of multimorbidity can be greater than the combined effect of individual conditions, leading to more severe illness, a poorer prognosis and premature death. People living with multimorbidity generally use more health services, including increased contact with primary healthcare services, with more complex hospitalisations and poorer outcomes than those living with a single condition.

How many people are living with diabetes, chronic kidney disease and heart, stroke and vascular disease?

Reliable estimates of the comorbidity of diabetes, chronic kidney disease (CKD) and heart, stroke and vascular disease (HSVD) in the Australian population can be derived from large-scale biomedical health surveys. The most recent of these was the National Health Measures Survey, the biomedical component of the 2011–12 Australian Health Survey (ABS 2013).

In 2011–12, an estimated 2.8 million Australian adults (18%) were living with diabetes, CKD and/or HSVD. Of these, 860,000 had diabetes, of which:

- 480,000 (3.1% of adults) had diabetes only.
- 201,000 (1.3% of adults) had diabetes and CKD.
- 103,000 (0.7% of adults) had diabetes and HSVD.
- 76,700 (0.5% of adults) had diabetes, CKD and HSVD (Figure 1).

Men were 2.3 times as likely as women to be living with all 3 conditions, after adjusting for age.

The prevalence of comorbidity of diabetes with CKD and/or HSVD increased with age, from 2.5% of adults aged 55–64 to 9.0% of adults aged 65 and over.

Figure 1: Prevalence of diabetes, CKD and HSVD, and their comorbidity, persons aged 18 and over, 2011–12

The Venn diagram shows the overlapping proportion of adults who had diabetes, chronic kidney disease or heart, stroke and vascular disease in 2011–12. Among adults with these conditions, an estimated 17% had diabetes only and 2.7% were living with all 3 conditions.
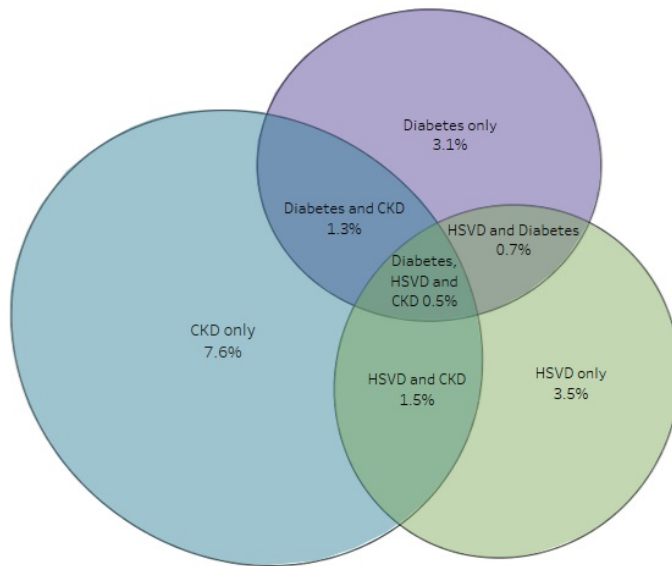
Figure 1: Prevalence of diabetes, CKD and HSVD and their comorbidity, persons aged 18 and over, 2011-12

Note: Diabetes prevalence is based on HbA1c and self-reported data, CKD prevalence is based on eGFR and ACR test results and HSVD prevalence is based on self-reported data of people who participated in the measured component of the 2011–12 Australian Health Survey.

Chart: AIHW. Source: AIHW analysis of ABS 2013.
https://www.aihw.gov.au

Hospitalisations with diabetes, chronic kidney disease and cardiovascular disease

Hospital comorbidity

Where a person has 2 or more of CKD, CVD or diabetes recorded in their episode of hospitalisation, this is referred to as comorbidity. Dialysis hospitalisations have been excluded because they are often performed as routine treatments on a same-day basis and have no other comorbid diagnoses recorded. Note also, the coding rule for diabetes – if present, diabetes is universally coded on a person's hospital record. This is unlike CVD and CKD, which are coded only if they affected the care and treatment provided during the hospitalisation. This may under-report hospital comorbidity of these diseases.

In 2020–21, there were around 2.2 million hospitalisations in people aged 18 or over in which diabetes, CKD or CVD was present as the principal and/or an additional diagnosis. This equates to 23% of all non-dialysis hospitalisations for people 18 and older.

Of these, more than half (around 1.2 million) included a diabetes diagnosis, either alone (802,000 or 36%), or in combination with CVD and/or CKD (428,000 or 19%). The most common comorbidity including diabetes was CVD and diabetes (179,000 or 8.1%), with diabetes and CKD present in 139,000 hospitalisations (6.3%). There were a further 110,000 hospitalisations (5.0%) where all 3 conditions were present (Figure 2).

Figure 2: Hospitalisations with diabetes, CKD (excluding dialysis) or CVD, persons aged 18 and over, 2020-21

The Venn diagram shows the overlapping proportion of hospitalisations among adults in 2020-21 with diabetes, chronic kidney disease or cardiovascular disease as the principal and/or additional diagnosis. Among the hospitalisations for these conditions 36% were for diabetes only, and 5.0% of hospitalisations were for all 3 conditions.
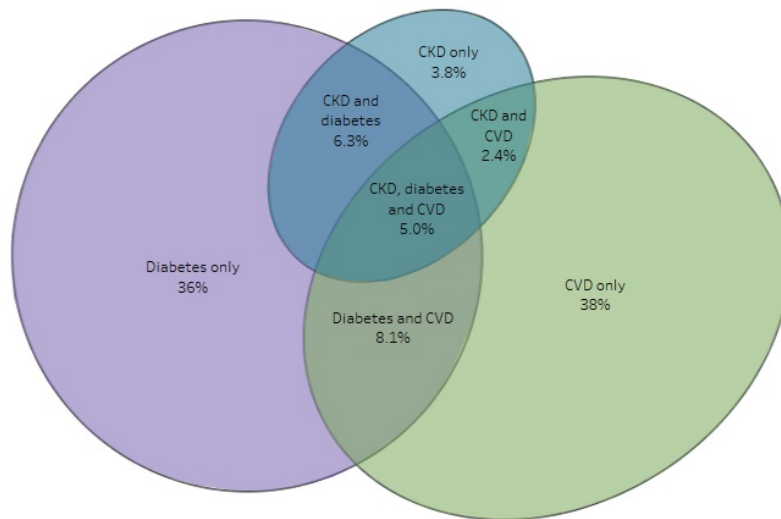
Figure 2: Hospitalisations with diabetes, CKD or CVD, persons aged 18 and over, 2020–21

Note: CKD excludes dialysis as a principal diagnosis.

Chart: AIHW. Source: AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

Variation by age and sex

The rate of hospitalisations with comorbidity of CKD, CVD and/or diabetes increases with age.

In 2020–21, for example, people aged 45–64 were 7.0 times as likely to have a combination of diabetes and CVD recorded on their hospital record as people aged 18–44 (690 and 99 per 100,000 population, respectively). For those aged 65 and over, this difference increased to 30 times the rate of those aged 18–44 (3,000 and 99 per 100,000 population, respectively).

Men were more likely to be hospitalised with comorbidity than women. After adjusting for age, the rate of hospitalisation where all 3 conditions were recorded was 1.7 times as high for men as for women.

Hospital comorbidity in the Aboriginal and Torres Strait Islander population

In 2020–21, there were 96,600 non-dialysis hospitalisations of Indigenous people aged 18 and over where CKD, CVD or diabetes was present as a principal and/or additional diagnoses.

Of these hospitalisations, 34,800 (36%) recorded 2 or 3 of the conditions – 8,400 (8.7%) recorded diabetes and CVD together, 1,800 (1.8%) recorded CVD and CKD, 15,700 (16.2%) recorded CKD and diabetes, and 8,900 (9.2%) recorded all 3 conditions (Figure 3).

After adjusting for age differences in the populations, the rate of hospitalisation of Indigenous people recording all 3 conditions was 5.8 times as high as the rate of non-Indigenous people.

Figure 3: Hospitalisations with diabetes, CKD or CVD, Aboriginal and Torres Strait Islander persons aged 18 and over, 2020-21

The Venn diagram shows the overlapping proportion of hospitalisations among Indigenous adults in 2020-21 with diabetes, chronic kidney disease or cardiovascular disease as the principal and/or additional diagnosis. Among the hospitalisations for these conditions 40% were for diabetes only, and 9.2% of hospitalisations were for all 3 conditions.
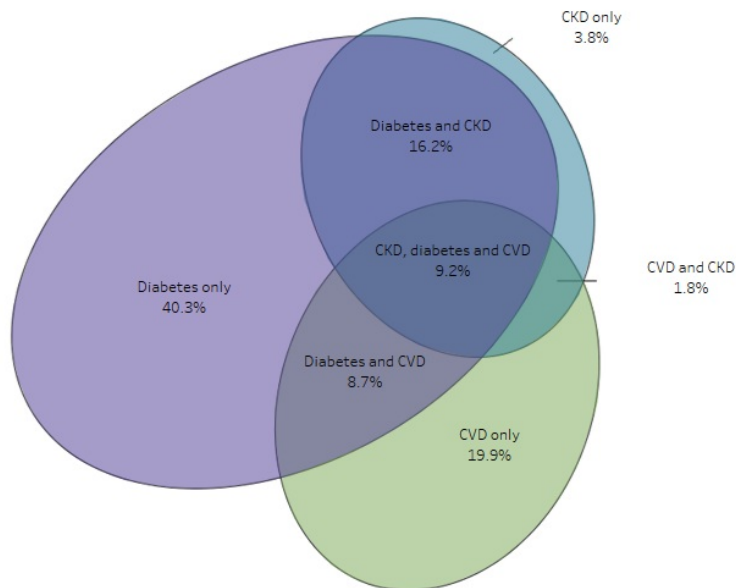
Figure 3: Hospitalisations with diabetes, CKD or CVD, Aboriginal and Torres Strait Islander persons aged 18 and over, 2020–21

Note: CKD excludes dialysis as a principal diagnosis.

Chart: AIHW. Source: AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

Deaths from diabetes, chronic kidney disease and cardiovascular disease

Often, more than one disease or condition contributes to a death. Along with the underlying cause of death, a medical practitioner or coroner will also record associated causes on a death certificate. The most complete representation of cause of death will consider the contribution of both underlying and associated causes (Harding et al. 2014).

Whereas CVD is a common underlying cause of death, diabetes and CKD are more likely to be recorded as associated causes of death. Both diabetes and CKD are known to be under-reported in national mortality statistics and can be omitted from death certificates as contributory causes of death (McEwen et al. 2011; Sypek et al. 2018).

Association of diabetes, CKD and CVD

Of the 169,800 deaths registered among persons aged 18 and over in Australia in 2021, diabetes, CKD and CVD were listed as an underlying or associated cause in 99,100 deaths. In total, 58% of adult deaths had at least 1 of these 3 conditions recorded.

Diabetes was recorded as an underlying or associated cause in 19,300 deaths (11% of adult deaths) with 84% of these having CVD and/or CKD also recorded on the death certificate.

Of all deaths among adults in 2021:

- 26,800 (16%) had at least 2 of diabetes, CKD and diabetes recorded on the death certificate
- 3,100 (1.8%) had diabetes only recorded
- 11,100 (6.5%) had diabetes and CVD recorded
- 889 (0.5%) had diabetes and CKD recorded
- 4,200 (2.4%) had all 3 conditions recorded (Figure 4).

Figure 4: Diabetes, CKD and CVD listed as any cause of death (% of total adult deaths), 2021

The Venn diagram shows the proportion of deaths among adults in 2021 with diabetes, chronic kidney disease or cardiovascular disease as any cause of death. Among deaths from these conditions, diabetes was recorded as the only cause in 3.1% of deaths, and all 3 diseases were recorded as the underlying or associated cause in 4.2% of deaths.
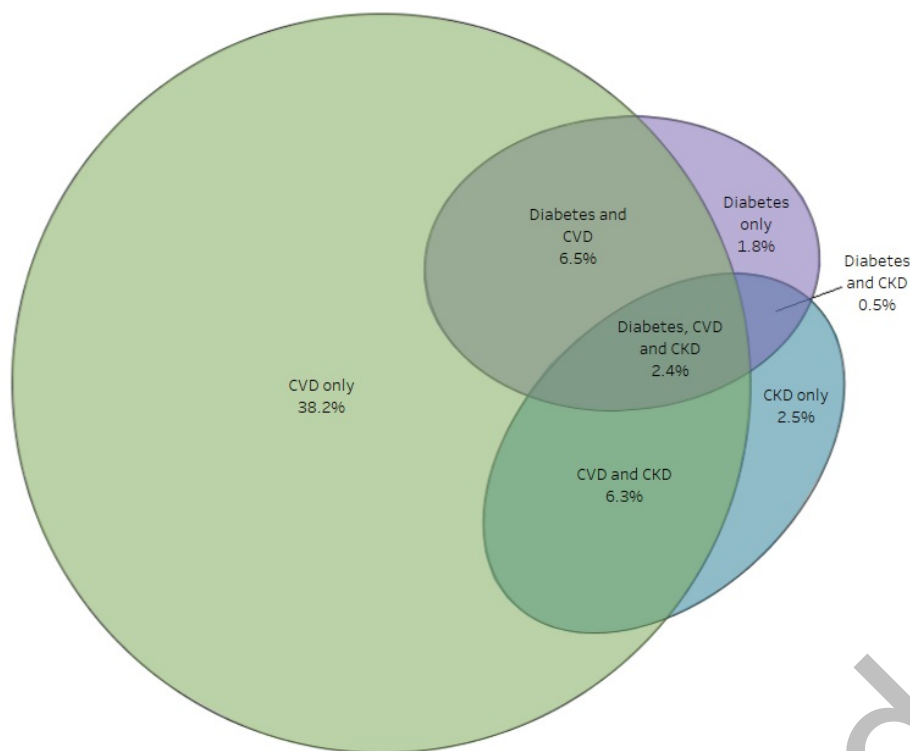
Figure 4: Diabetes, CKD and CVD listed as any cause of death (% of all adult deaths), 2021

Note: Due to rounding, percentages may not add up to 100.
Chart: AIHW. Source: National Mortality Database
https://www.aihw.gov.au

Diseases commonly associated with diabetes deaths

Where diabetes was listed as the underlying cause of death in 2021, common associated causes of death include coronary heart disease (I20-I25), kidney failure (N17-N19) and hypertensive diseases (I10-I15) (Table 1).

Table 1: Common associated causes where diabetes is the underlying cause of death, 2021

Associated cause of death	Per cent
Coronary heart disease (I20-I25)	41.2
Kidney failure (N17-N19)	41.2
Hypertensive disease (I10-I15)	33.8
Other ill-defined causes (R00-R94, R96-R99, I46.9, I95.9, I99, J96.0, J96.9, P28.5)	29.8
Heart failure and complications and ill-defined heart disease (I50-I51)	21.4
Dementia including Alzheimer's disease (F01, F03, G30)	15.9
Cerebrovascular disease (I60-I69)	15.7
Cardiac arrhythmias (I47-I49)	12.9
Diseases of arteries, arterioles and capillaries excl. atherosclerosis, aortic aneurysm and dissection (I72-I79)	9.7
Selected metabolic disorders excl. dehydration (E70-E89 excl. E86, E87)	9.3

Source: National Mortality Database

Diabetes associated with other causes of death

The most common underlying cause of death where diabetes is listed as the associated cause in 2021 include coronary heart disease (I20-I25), dementia (F01, F03, G30), cerebrovascular disease (I60-I69) and chronic obstructive pulmonary disease (J40-J44) (Table 2).

Table 2: Common underlying causes where diabetes is the associated cause of death, 2021

Underlying cause of death	Per cent

Coronary heart disease (I20–I25)	19.2
Dementia including Alzheimer's disease (F01, F03, G30)	9.9
Cerebrovascular disease (I60–I69)	6.6
Chronic obstructive pulmonary disease (COPD) (J40–J44)	4.6
Lung cancer (C33, C34)	4.0
Accidental falls (W00–W19)	3.4
Colorectal cancer (C18–C20, C26.0)	2.5
Pancreatic cancer (C25)	2.3
Hypertensive disease (I10–I15)	2.1
Prostate cancer (C61)	2.0

Source: National Mortality Database

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Treatment and management

What is the treatment and management of diabetes?

The treatment and management of diabetes can be regarded as having 3 broad phases – prevention, acute care and secondary prevention and monitoring.

Prevention

Type 1 diabetes is strongly linked to family history with the condition, but there is no known way to prevent the condition. Maintaining a healthy lifestyle is important for managing the symptoms and long-term complications associated with the condition.

Prevention activities can help people at risk of type 2 diabetes before symptoms appear. Healthy eating and physical activity in everyday life (such as workplaces, schools, communities and active travel), not smoking and the use of medicines can help manage levels of biomedical risk factors such as high blood glucose (Royal Australian College of General Practitioners 2020).

Prevention may also come from interventions that target wider social determinants of health, including income, education, housing, early childhood development and access to affordable health services (Marmot et al. 2008).

Prevention services are commonly delivered by general practitioners (GPs), alongside midwives, nurses, pharmacists, Indigenous health workers and allied health professionals.

The Australian Government has prioritised preventative health action through the National Preventive Health Strategy 2021–2030 which aims to create a stronger and more effective preventative health system, to enhance the health and wellbeing of Australians. More information on the National Preventive Health Strategy 2021–2030 can be found on the Department of Health website.

Acute care

Acute care is treatment given during and immediately after an acute diabetes complication, such as ketoacidosis. It includes emergency care provided before a person reaches hospital, as well as care given in the emergency department and in hospital.

Secondary prevention and monitoring

Secondary prevention is the treatment of diabetes once detected. Treatment can be based on lifestyle modification alone (diet and exercise), lifestyle modification and anti-diabetic drugs or lifestyle modification and insulin. Routine screening for blood glucose and key risk areas including eyes and feet should be done to effectively reduce complications.

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Treatment and management

Page highlights:

- MedicineInsight is a database managed by NPS MedicineWise containing de-identified electronic health records from over 700 Australian general practices.
- There were 14.3 million clinical encounters with General Practitioners recorded in the MedicineInsight database in 2020–21. Patients with type 2 diabetes ever recorded accounted for 12% of encounters despite representing 5.6% of the total MedicineInsight patients.

Primary health care:

- is the entry level to the health system and, as such, is usually a person's first encounter with the health system.
- includes a broad range of activities and services, from health promotion and prevention to treatment and management of acute and chronic conditions.
- can refer to a broad range of healthcare services including General Practitioners (GPs), midwives, nurses, pharmacists, and allied health including dietitians, physiotherapists, optometrists and podiatrists.

There were 14.3 million clinical encounters with GPs recorded in the MedicineInsight database in 2020–21. Patients with type 2 diabetes ever recorded accounted for 12% of encounters despite representing 5.6% of the total MedicineInsight patients.

According to the 2020–21 MedicineInsight General Practice Insights report (NPS MedicineWise, 2022):

- Patients with type 2 diabetes ever recorded accounted for 5.6% of total MedicineInsight patients.
- Patients with type 1 diabetes ever recorded accounted for 0.5% of total MedicineInsight patients.
- Patients with gestational diabetes ever recorded accounted for 0.7% of total MedicineInsight patients.

Of the 14.3 million clinical encounters with GPs recorded in the 2020–20 report, patients with type 2 diabetes ever recorded accounted for 11.8% of encounters. Patients with type 1 diabetes ever recorded represented only 0.9% of clinical encounters, and patients with gestational diabetes ever recorded represented only 0.8% of encounters.

Patients with type 2 diabetes had an age- and sex-adjusted average of 9.6 encounters per person, per year. Patients with recorded type 1 diabetes had a slightly lower rate of 8.7 encounters per person per year. There was no published average for patients with gestational diabetes recorded.

References

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Treatment and management

Page highlights:

All diabetes hospitalisations

- There were almost 1.3 million hospitalisations associated with diabetes in 2020–21 (11% of all hospitalisations in Australia).
- Most (72%) diabetes hospitalisations occurred in those aged 60 and over.

Type 1 diabetes hospitalisations

- There were around 64,600 hospitalisations where type 1 diabetes was recorded as the principal and/or additional diagnosis.
- Type 1 diabetes hospitalisation rates as the principal diagnosis were highest among people aged 15-19.

Type 2 diabetes hospitalisations

- There were around 1.1 million hospitalisations with type 2 diabetes recorded as the principal and/or additional diagnosis in 2020–21 with 96% as the additional diagnosis.
- Type 2 diabetes hospitalisations were 1.4 times as high among males as females, overall.

All diabetes hospitalisations

There were almost **1.3 million** hospitalisations associated with diabetes in 2020–21. This represents **11%** of all hospitalisations in Australia.

Of the almost 1.3 million hospitalisations associated with diabetes in 2020–21, 4.7% were recorded as the principal diagnosis (the diagnosis largely responsible for hospitalisation) and around 95% were recorded as an additional diagnosis (a coexisting condition with the principal diagnosis or a condition arising during hospitalisation that affects patient management), according to the AIHW National Hospital Morbidity Database (NHMD).

In 2020–21, there were around:

- 59,400 hospitalisations with diabetes as the principal diagnosis. Over two-thirds were due to type 2 diabetes (69%) followed by type 1 diabetes (26%), gestational diabetes (4.2%) and diabetes 'other or unspecified' (1.8%).
- 1.2 million hospitalisations with diabetes as an additional diagnosis. Most were due to type 2 diabetes (89%) followed by gestational diabetes (5.5%), type 1 diabetes (4.2%) and diabetes 'other or unspecified' (1.1%).

What does a diabetes hospitalisation mean?

- Hospitalisation data presented here are based on admitted patient episodes of care from the National Hospital Morbidity Database (NHMD), including multiple admissions experienced by the same individual within a period of time.
- For a person living with diabetes, being admitted to hospital may be due to a range of things, including the initial diagnosis of diabetes, treatment for the management of diabetes or complications from diabetes, or an issue unrelated to diabetes itself.
- The health classification used for morbidity reporting in Australia is the International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) which is used alongside the Australian Classification of Health Interventions (ACHI) which classifies procedures and interventions (refer to Data sources, methods and classifications).
- The Australian Coding Standards (ACS) are rules that direct the assignment of ICD-10-AM and ACHI codes to each record. Changes in the classification and coding standards over time impact the ability to monitor and report hospitalisation trends. Current coding standards require diabetes to be coded whenever documented in the medical record, even where diabetes may not be directly related to the hospitalisation. These standards mean that diabetes is more likely to appear in hospitals data compared to some other chronic conditions.

Variation by age and sex

In 2020–21, diabetes hospitalisation rates (principal and/or additional diagnosis):

- were 1.2 times higher among males than females overall. Age-specific rates were higher among females than males in the younger groups (5 to 44 years) and higher among males from age 45 and over (Figure 1).
- generally increased with increasing age, with 72% of diabetes hospitalisations occurring in those aged 60 and over, peaking for both males and females in the 80–84 age group (31,700 and 20,500 per 100,000 population, respectively) (Figure 1).

Figure 1: Diabetes hospitalisation rates, by diagnosis type, age and sex, 2020-21

The chart shows hospitalisation rates with diabetes as the principal and/or additional diagnosis peaked in the 80-84 age group with 31,670 and 20,451 hospitalisations for males and females, respectively, per 100,000 population. With diabetes as the principal diagnosis, rates peaked among males aged 80-84 and females aged 85 and over (1,160 and 570 per 100,000 population, respectively). Rates with diabetes as an additional diagnosis peaked in the 80-84 age group with 30,510 and 19,881 per 100,000 population, respectively.
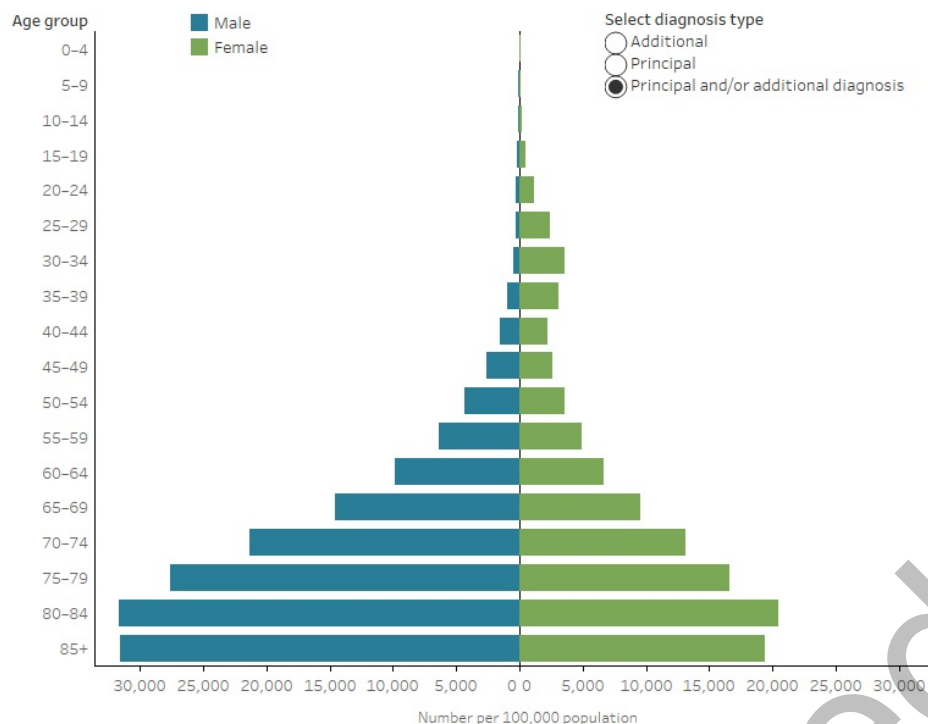

Figure 1: Diabetes hospitalisation rates, by diagnosis type, age group and sex, 2020-21

Chart: AIHW: Source: AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

Trends over time

The number of hospitalisations with diabetes as the principal and/or additional diagnosis increased by 49% between 2012-13 and 2020-21, from 837,000 to almost 1.3 million.

Between 2012-13 and 2018-19, there was a 29% increase in the age-standardised diabetes hospitalisation rate, followed by an 8.0% drop in 2019-20. The decline in 2019-20 may be associated with aspects of the early COVID-19 pandemic which had a profound impact on the provision of healthcare services and hospital activity generally (AIHW 2022). See Impact of COVID-19, Hospitalisations for more information. The diabetes hospitalisation rate increased slightly in 2020-21, yet remains 4.8% lower than the pre-pandemic peak of 2018-19.

The overall trend has displayed a similar pattern among both sexes, with diabetes hospitalisation rates consistently around 1.2 times higher among males compared with females (Figure 2).

Figure 2: Diabetes hospitalisations rates, by diagnosis type and sex, 2012-13 to 2020-21

The chart shows the increasing trend in the rate of hospitalisations with diabetes as the principal and/or additional diagnosis, by sex from 2012-13 to 2019-20, for both males and females. Rates among males have consistently been around 1.2 times higher than among females. Hospitalisation rates peaked in 2018-19 at 4,268 per 100,000 population per year and declined slightly to 3,924 per 100,000 population in 2019-20. Hospitalisation rates with diabetes as a principal diagnosis have increased more gradually since 2012-13, and continued to record an increase in 2019-20 for males only.
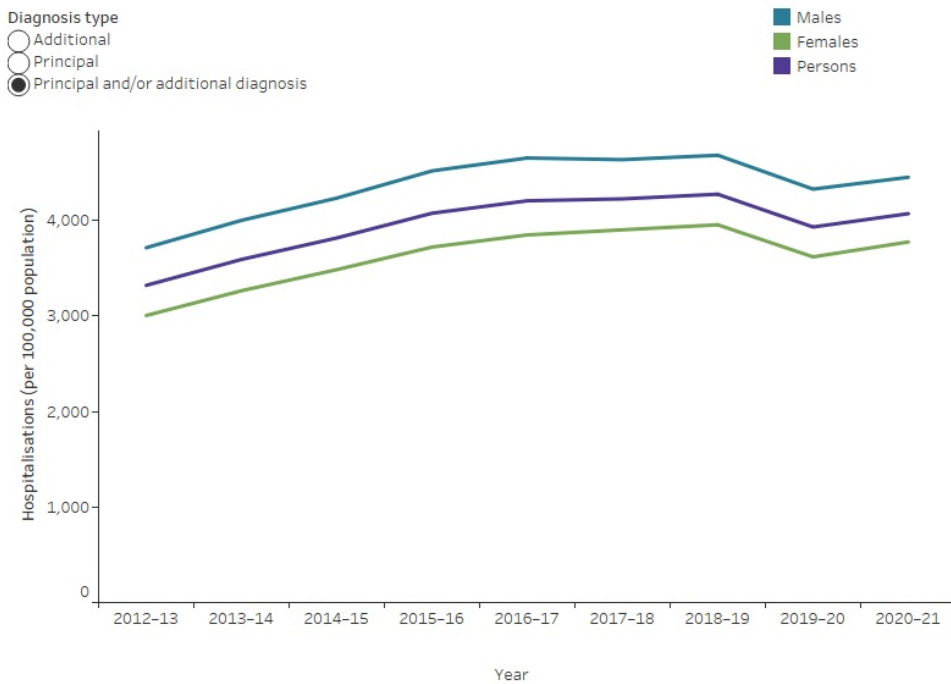
Figure 2: Diabetes hospitalisation rates, by diagnosis type and sex, 2012–13 to 2020-21

Note: Age-standardised to the 2001 Australian Standard Population.
Chart: AIHW. Source: AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

Impact of changes in coding over time

The International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification (ICD-10-AM) code changes in Chapter IV Endocrine, nutritional and metabolic disease and Australian Coding Standards (ACS) 0401 *Diabetes mellitus and intermediate hyperglycaemia* have affected the ability to monitor trends for diabetes hospitalisations. Transition between ICD-10-AM/Australian Classification of Health Interventions (ACHI)/ACS classification editions has resulted in differences in how diabetes was recorded, when it had a direct relationship with the principal reason for the episode of care, or when it might be recorded as an additional diagnosis in any hospitalisation.

The coding practice for classifying diabetes under ICD-10-AM 6th edition (used 1 July 2008 to 30 June 2010) was largely consistent with previous editions of ICD-10-AM. However, clarification of how the coding standard for additional diagnoses should be applied (ACS 0002) meant that conditions would only be coded as an additional diagnosis if they were 'significant in terms of treatment required, investigations needed, and resources used in each episode of care'. While this clarification resulted in a decrease in the number of conditions being coded as additional diagnoses for all hospitalisations, it had a particularly significant impact on the reporting of diabetes as an additional diagnosis.

The coding practice for classifying diabetes under ICD-10-AM 7th edition (used from 1 July 2010) changed again due to changes made to ACS 0401. The changes resulted in a further decrease between 2009-10 and 2010-11 in the reporting of diabetes-related conditions, due to the condition not meeting the criteria for being assigned as either the principal or additional diagnosis.

Following investigation into the effect of these changes to diabetes coding, an additional change to ACS 0401 that 'when documented, diabetes mellitus should always be coded' was implemented in July 2012.

The impact on reported diabetes hospitalisations:

- Between 2009-10 and 2010-11, the number of hospitalisations reported for diabetes decreased by 41% from around 442,000 in 2009-10 to 263,000 in 2010-11.
- Between 2010-11 and 2011-12, there were increases in the number of hospitalisations reported for diabetes that may be unrelated to coding changes.
- Between 2011-12 and 2012-13, the number of hospitalisations for which diabetes was recorded as either the principal and/or additional diagnoses increased – 8% increase where diabetes was recorded as the principal diagnosis, and a 250% increase where it was recorded as an additional diagnosis (Figure 3).

Figure 3: Diabetes hospitalisation rates, by diagnosis type, 2000-01 to 2020-21

The chart shows the rate of hospitalisations for diabetes, by diagnosis type from 2000-01 to 2019-20. Hospitalisation rates with a principal diagnosis of diabetes remained steady between 2000-01 to 2009-10 followed by a drop from 424 to 176 per 100,000 population in 2010-11 and have remained steady to 2019-20. Hospitalisation rates with an additional diagnosis of diabetes increased from 1,671 per 100,000 population in 2000-01 to 2,584 per 100,000 population in 2007-08 then declined to 766 per 100,000 population in 2010-11 before showing an increasing trend between 2011-12 and 2019-20 peaking at 4,055 per 100,000 population in 2018-19.
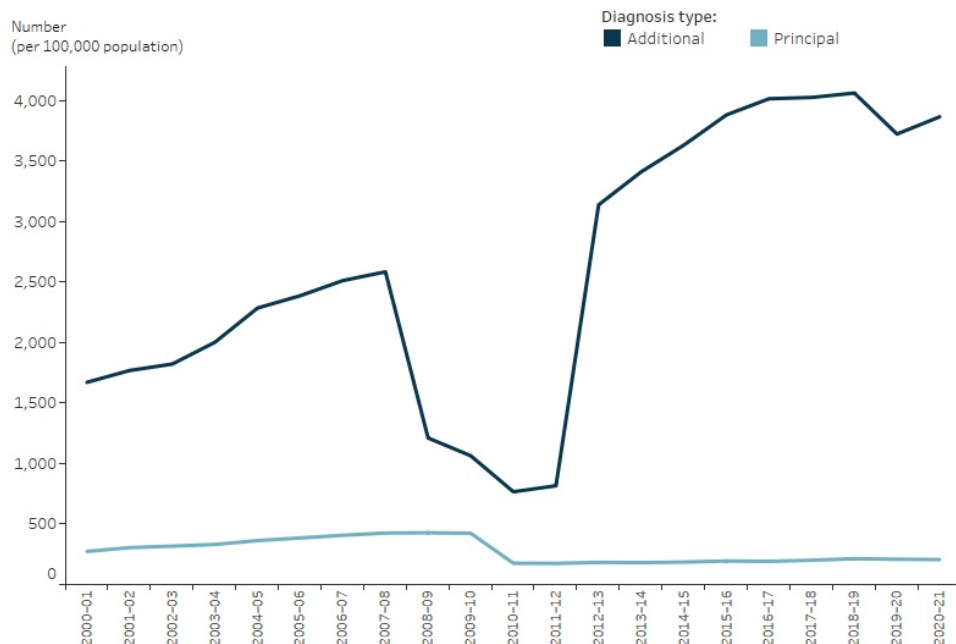
Figure 3: Diabetes hospitalisation rates, by diagnosis type, 2000–01 to 2020–21

Note: Age-standardised to the 2001 Australian Standard Population.
Chart: AIHW. Source: AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

Variation between population groups

Aboriginal and Torres Strait Islander people

In 2020–21, there were around 85,500 hospitalisations associated with diabetes (as the principal and/or additional diagnosis) among Aboriginal and Torres Strait Islander people – a rate of 9,800 per 100,000 population. The rate generally increased with increasing age, peaking among Indigenous Australians aged 85 and over. Age-standardised rates were 1.2 times higher among Indigenous females as males, overall (Figure 4).

After adjusting for differences in the age structure of the populations, the rate of hospitalisation associated with diabetes among Indigenous Australians was 4.2 times as high as for non-Indigenous Australians (Figure 5).

Figure 4: Diabetes hospitalisation rates for Aboriginal and Torres Strait Islander people, principal and/or additional diagnosis, by age and sex, 2020-21

The bar chart shows hospitalisations with diabetes as the principal and/or additional diagnosis for Aboriginal and Torres Strait Islander people, by sex for 2020-21. Rates peaked for males in the 85+ year age group with 66,800 hospitalisations per 100,000 population and for females in the 70–74-year age group with 53,800 hospitalisations per 100,000 population.
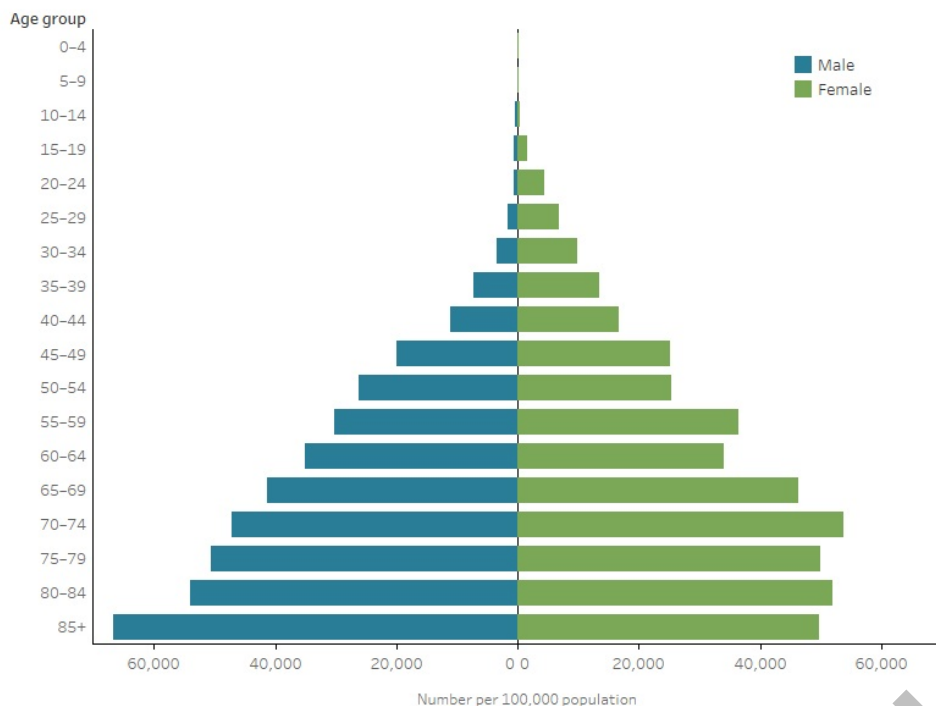
Figure 4: Diabetes hospitalisation rates for Aboriginal and Torres Strait Islander people, principal and/or additional diagnosis, by age group and sex, 2020–21

Chart: AIHW: Source: AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

Socioeconomic area

In 2020–21, after adjusting for differences in the age structure of the population, diabetes hospitalisation rates (as the principal and/or additional diagnosis) were 1.7 times as high among those living in the lowest socioeconomic areas compared with those living in the highest socioeconomic areas (Figure 5).

Remoteness area

In 2020–21, after adjusting for differences in the age structure of the population, diabetes hospitalisation rates (as the principal and/or additional diagnosis) were 2.6 times as high among those living in *Remote and very remote* areas as those living in *Major cities* (Figure 5).

Figure 5: Diabetes hospitalisation rates, principal and/or additional diagnosis, by population group and sex, 2020–21

The bar chart shows hospitalisations with diabetes as the principal and/or additional diagnosis, by population group and sex for 2019–20. Rates increased with increasing remoteness and were highest among people living in Remote and very remote areas at 9,980 per 100,000 population compared to 3,720 per 100,000 population living in Major cities. Hospitalisation rates also increased gradually with increasing socioeconomic disadvantage. Those living in the most disadvantaged areas had the highest hospitalisation rates with 4,870 per 100,000 population compared with those living in the least disadvantaged areas with 2,777 per 100,000 population. Diabetes hospitalisation rates were 4.3 times higher among Aboriginal and Torres Strait Islander people compared with non-Indigenous people.
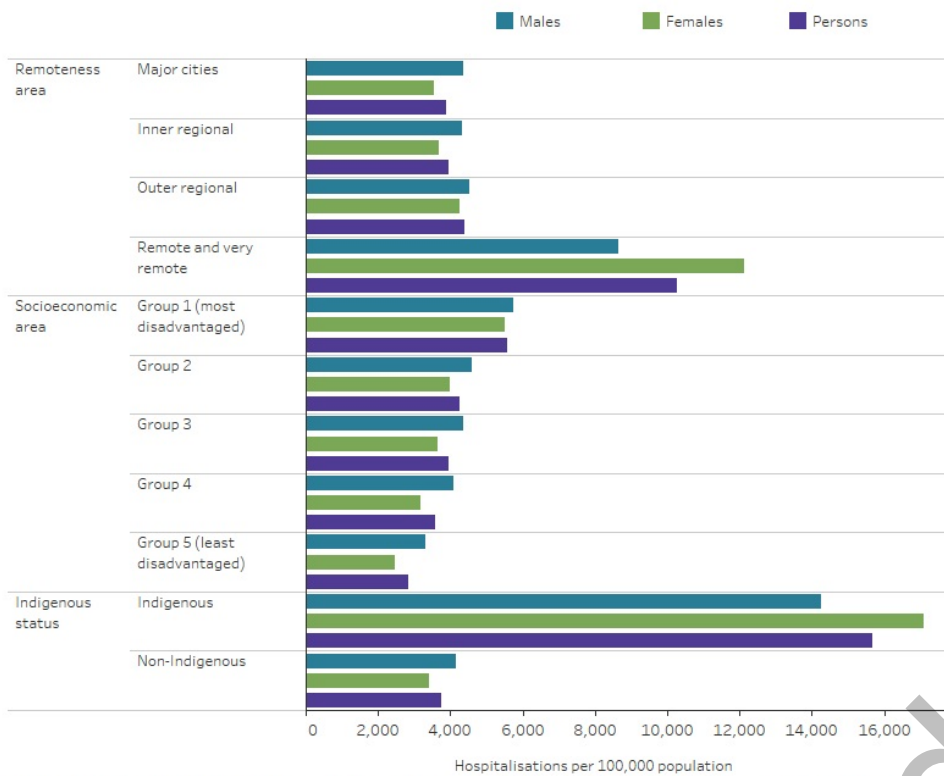
Figure 5: Diabetes hospitalisation rates, principal and/or additional diagnosis, by population group and sex, 2020-21

Notes
1. Age-standardised to the 2001 Australian Standard Population.
2. Excludes persons whose Indigenous status, remoteness area and/or socioeconomic area was missing or unassigned.

Chart: AIHW. Source: AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

Country of birth

In 2020–21, diabetes hospitalisation rates (as the principal and/or additional diagnosis) varied by country of birth. Almost two-thirds (64%) of diabetes hospitalisations were for people born in Australia – a rate of 3,800 per 100,000 population.

Of all diabetes hospitalisations among patients not born in Australia, the most common regions/countries of birth include North–West Europe (9.8%) and Southern and Eastern Europe (8.5%).

After adjusting for differences in the age structure of the populations, diabetes hospitalisation rates were 1.5 times as high among those born in North Africa and the Middle East compared with those born in Australia (Figure 6).

Figure 6: Diabetes hospitalisation rates, principal and/or additional diagnosis, by country of birth, 2020-21

The chart shows the age-standardised hospitalisation rates with diabetes as the principal and/or additional diagnosis, by country of birth for 2019-20. Diabetes hospitalisation rates were 1.5 times as high among those born in North Africa and The Middle East as those born in Australia.
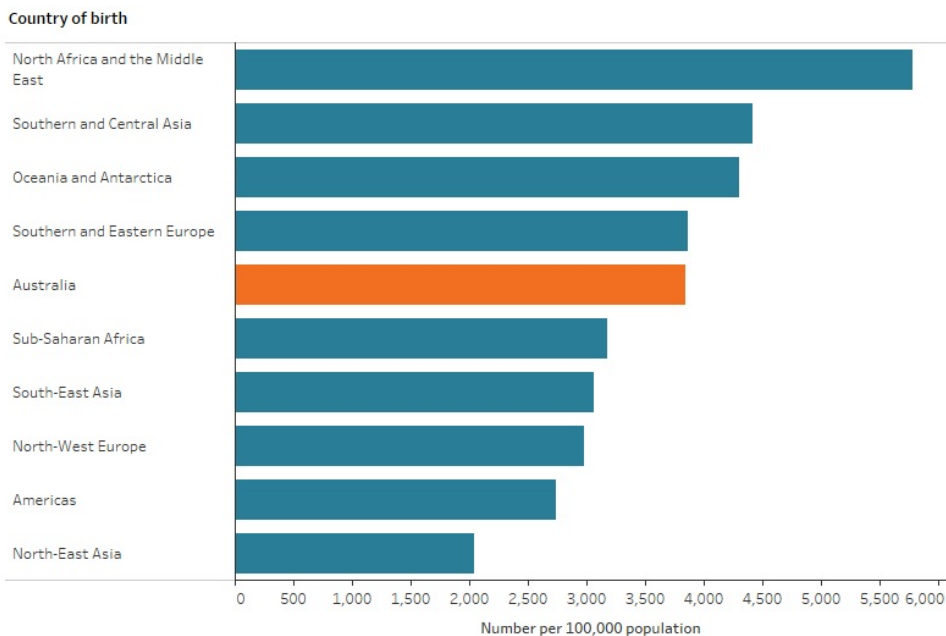
Country of birth

Figure 6: Diabetes hospitalisation rates, principal and/or additional diagnosis, by country of birth, 2020-21

Notes
1. Age-standardised to the 2001 Australian Standard Population.
2. Excludes persons whose birth country was not stated or inadequately described.

Chart: AIHW. Source: AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

Type 1 diabetes hospitalisations

There were around **64,600 hospitalisations** where type 1 diabetes was recorded as the principal and/or additional diagnosis in 2020–21, with 15,200 (24%) as a principal diagnosis and 49,500 (76%) as an additional diagnosis.

Variation by age and sex

In 2020–21, type 1 diabetes hospitalisation rates (as the principal and/or additional diagnosis):

- increased with increasing age, with 62% of type 1 diabetes hospitalisations occurring in those aged 40 and over
- were highest among those aged 70–74 (470 and 342 per 100,000 population for males and females, respectively) (Figure 7)
- were slightly higher among females than males overall, after controlling for differences in the age structures of the populations (Figure 8).

Where type 1 diabetes was the main reason for the hospitalisation (principal diagnosis), type 1 diabetes hospitalisation rates were:

- highest among those aged 15–19 (83 and 114 per 100,000 population for males and females, respectively) (Figure 7)
- similar among males and females after controlling for the age structures of the populations (Figure 8).

Figure 7: Type 1 diabetes hospitalisation rates by diagnosis type, age and sex, 2020-21

The bar chart shows hospitalisations with type 1 diabetes as the principal and/or additional diagnosis peaked in the 70–74-year age group with 470 and 342 hospitalisations for males and females, respectively, per 100,000 population.
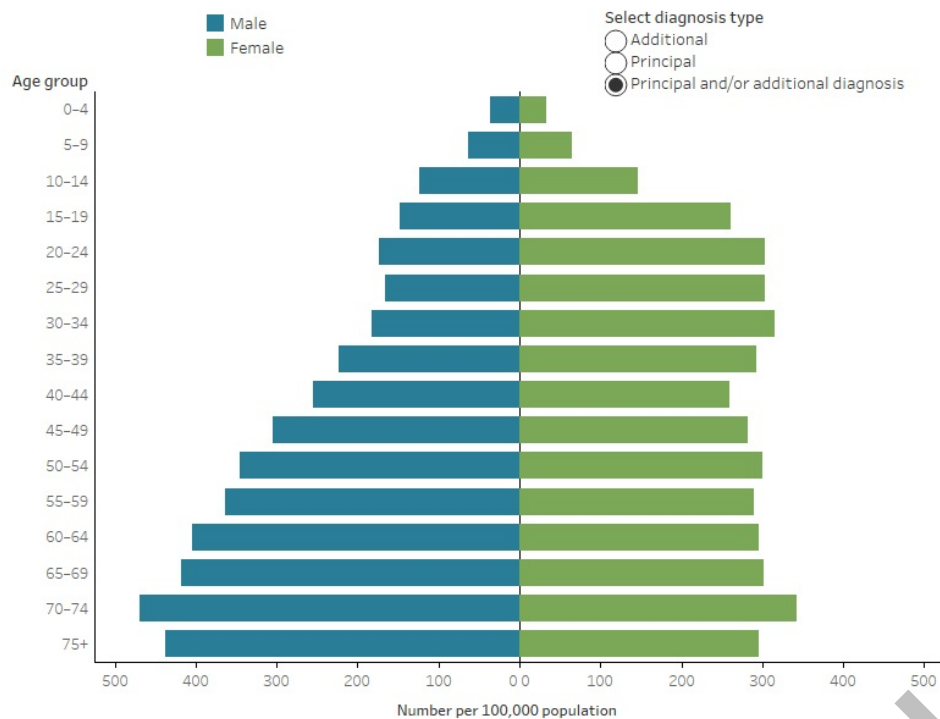
Figure 7: Type 1 diabetes hospitalisation rates by diagnosis type, age group and sex, 2020–21

Chart: AIHW: Source: AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

Trends over time

Between 2012–13 and 2020–21, there was a 20% increase in the number of hospitalisations for patients with a principal and/or additional diagnosis of type 1 diabetes (from 53,900 to 64,600 hospitalisations).

After adjusting for age, type 1 diabetes hospitalisation rates (principal and/or additional diagnosis) increased steadily by around 6% between 2012–13 and 2020–21 (Figure 8).

Figure 8: Type 1 diabetes hospitalisation rates, by diagnosis type and sex, 2012–13 to 2020–21

The chart shows hospitalisations rates for type 1 diabetes as the principal and/or additional diagnosis increased by 5.7% between 2012–13 and 2020–21 with the rates consistently slightly higher among females than males over this period.
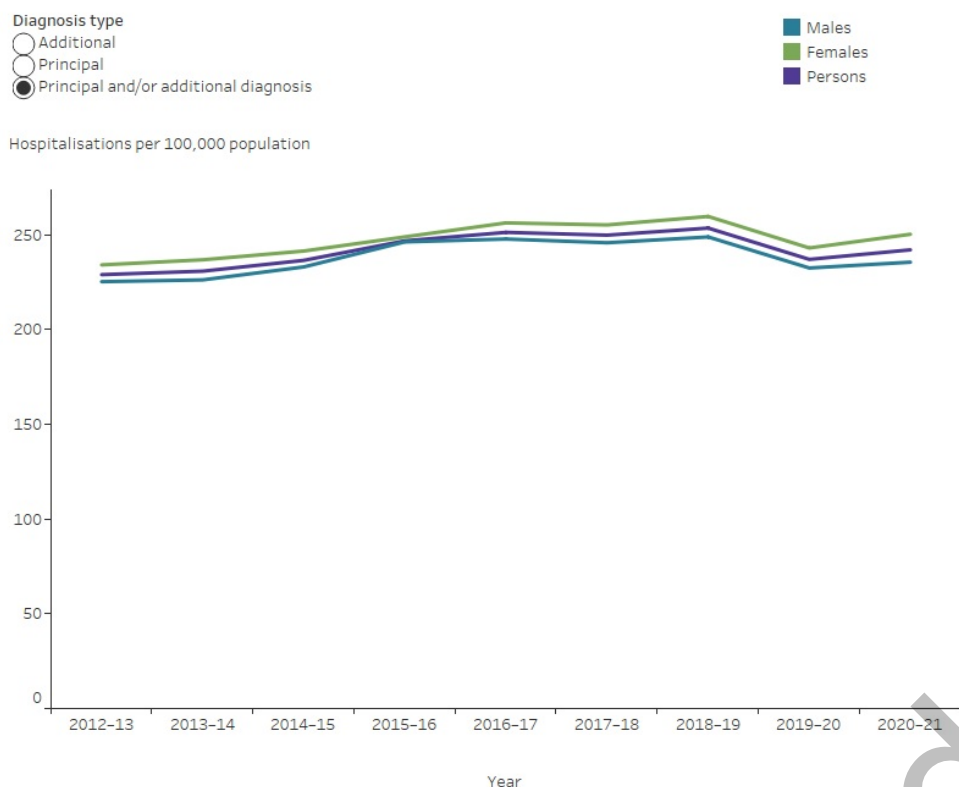
Figure 8: Type 1 diabetes hospitalisation rates, by diagnosis type and sex, 2012–13 to 2020–21

Note: Age-standardised to the 2001 Australian Standard Population.
Chart: AIHW. Source: AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

Variation among population groups

Aboriginal and Torres Strait Islander people

In 2020–21, there were around 3,000 hospitalisations for type 1 diabetes (as the principal and/or additional diagnosis) among Aboriginal and Torres Strait Islander people (341 per 100,000 population), with 55% of these hospitalisations being among Indigenous females.

Among Indigenous Australians, type 1 diabetes hospitalisation rates (as the principal and/or additional diagnosis) were highest among males aged 70–74 and females aged 25–29 (803 and 771 per 100,000 population, respectively) (Figure 9).

After adjusting for differences in the age structure of the populations, the type 1 diabetes hospitalisation rate among Indigenous Australians was 1.7 times as high as the rate for non-Indigenous Australians (Figure 10).

Figure 9: Type 1 diabetes hospitalisation rates for Aboriginal and Torres Strait Islander people, principal and/or additional diagnosis, by age and sex, 2020-21

The chart shows hospitalisations with type 1 diabetes as the principal and/or additional diagnosis for Aboriginal and Torres Strait Islander people, by sex for 2020-21. Rates peaked for males in the 70-74 age group with 803 hospitalisations per 100,000 population and for females in the 25-29 age group with 771 hospitalisations per 100,000 population.
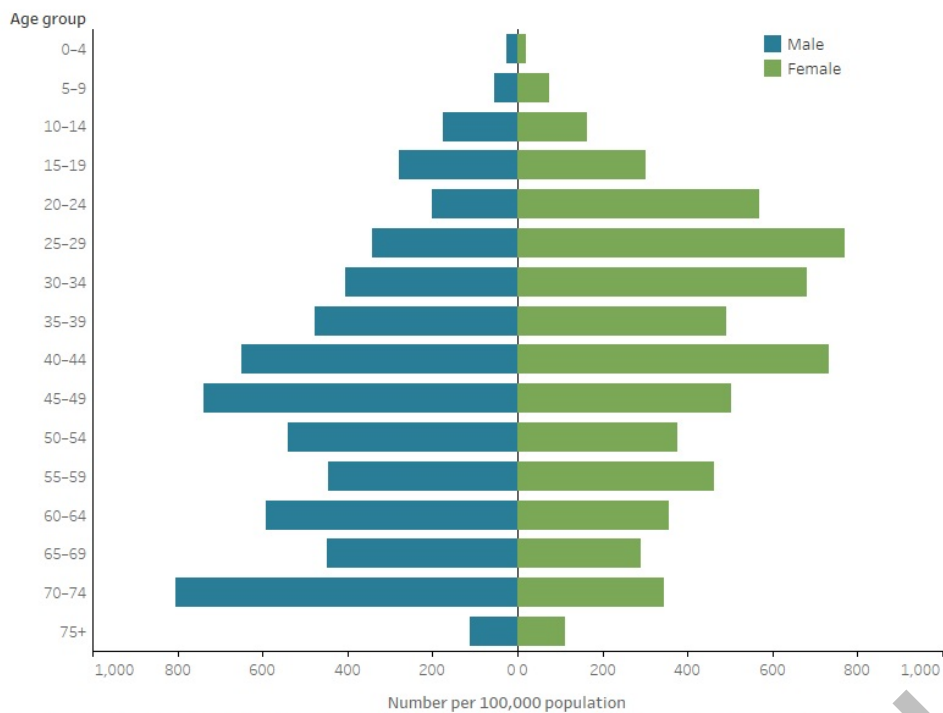
Figure 9: Type 1 diabetes hospitalisation rates for Aboriginal and Torres Strait Islander people, principal and/or additional diagnosis, by age group and sex, 2020–21

Chart: AIHW: Source: AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

Socioeconomic area

In 2020–21, type 1 diabetes hospitalisation rates (as the principal and/or additional diagnosis) increased with increasing levels of socioeconomic disadvantage. Age-standardised rates were 1.5 times as high among those living in the lowest socioeconomic areas as those living in the highest socioeconomic areas (Figure 10). This difference was similar for males and females.

Remoteness area

In 2020–21, type 1 diabetes hospitalisation rates (as the principal and/or additional diagnosis) varied by remoteness area. Age-standardised rates were between 1.2 and 1.4 times higher in *Inner regional* and *Outer regional* areas compared with *Major cities* and *Remote and very remote* areas (Figure 10).

Figure 10: Type 1 diabetes hospitalisation rates, principal and/or additional diagnosis, by population group and sex, 2020-21

The chart shows hospitalisations with type 1 diabetes as the principal and/or additional diagnosis, by population group and sex for 2020-21. Rates among remoteness areas were highest in Inner regional areas with 307 per 100,000 population compared to 214 per 100,000 population in Remote and very remote areas. Age-standardised rates were 1.5 times as high among those living in the lowest socioeconomic areas as those living in the highest socioeconomic areas and 1.7 times higher among Indigenous as non-Indigenous Australians.
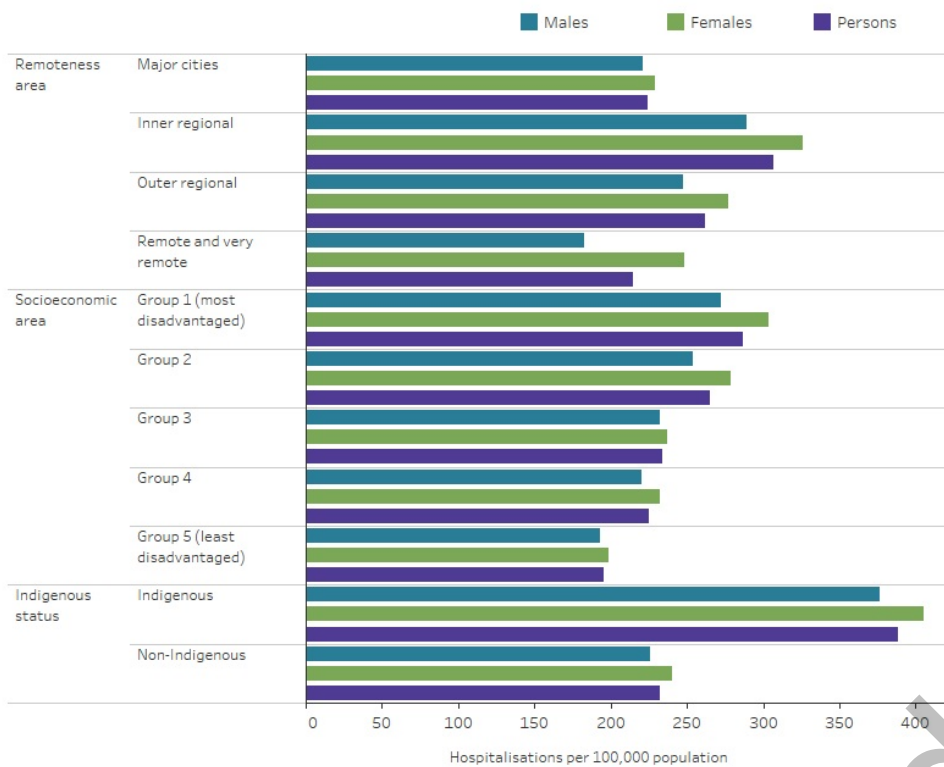
Figure 10: Type 1 diabetes hospitalisation rates, principal and/or additional diagnosis, by population group and sex, 2020–21

Notes
1. Age-standardised to the 2001 Australian Standard Population.
2. Excludes persons whose Indigenous status, remoteness area and/or socioeconomic area was missing or unassigned.

Chart: AIHW. Source: AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

Country of birth

A person's country of birth commonly affects the risk of developing type 1 diabetes – this can often be attributed to the interaction of genetic, environmental and cultural factors (Hjern and Söderström 2008).

In 2020–21, type 1 diabetes hospitalisation rates (as the principal and/or additional diagnosis) varied by country of birth. Most (81%) patients admitted to hospital for type 1 diabetes were born in Australia. Of those patients not born in Australia, the most common regions/countries of birth include North–West Europe (7.6%) and Oceania and Antarctica (3.2%).

After adjusting for differences in the age structure of the populations, type 1 diabetes hospitalisation rates were highest for people born in Australia and lowest for those born in North–East Asia (Figure 11).

Figure 11: Type 1 diabetes hospitalisation rates, principal and/or additional diagnosis, by country of birth, 2020–21

The chart shows the age-standardised hospitalisations for type 1 diabetes as the principal and/or additional diagnosis, by country of birth for 2020–21. Type 1 diabetes hospitalisation rates were highest among people born in Australia (276 per 100,000 population) and lowest among those born in North-East Asia (29 per 100,000 population).
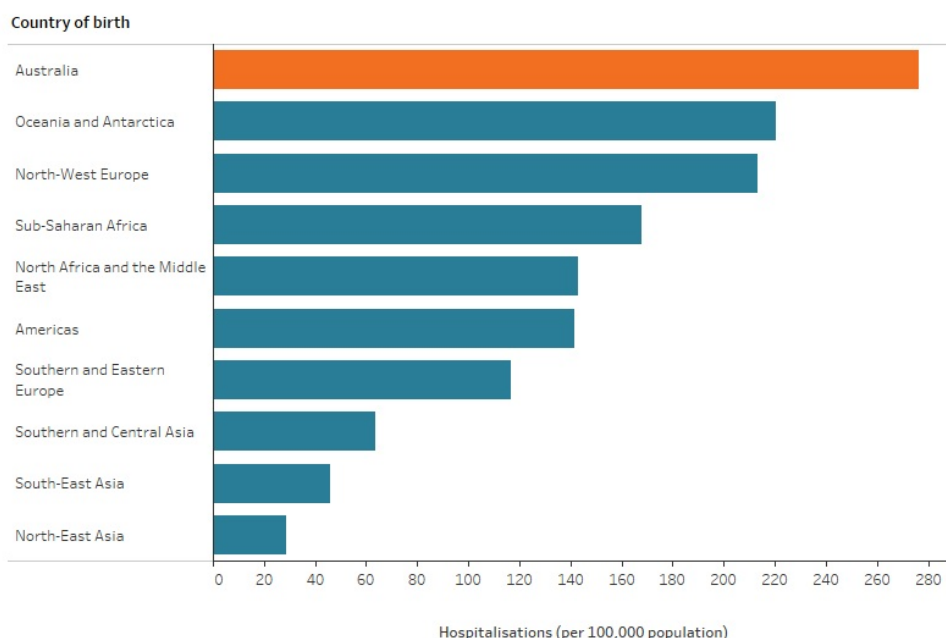
Figure 11: Type 1 diabetes hospitalisation rates, principal and/or additional diagnosis, by country of birth, 2020-21

Notes
1. Age-standardised to the 2001 Australian Standard Population.
2. Excludes persons whose birth country was not stated or inadequately described.

Chart: AIHW. Source: AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

Type 1 diabetes hospitalisations with diabetes complications

In 2020-21, there were around **36,300 hospitalisations** with one or more acute or chronic **diabetes complications** associated with the hospitalisation for people with type 1 diabetes (56% of all type 1 diabetes hospitalisations). Suboptimal diabetic control, kidney, eye and neurological complications, and ketoacidosis were the most common hospital complications found for people with type 1 diabetes.

Issues with diabetes complications

Diabetes complications which are detected in the hospital setting are considered material to the hospitalisation and do not represent all complications a patient may have or the number of people with diabetes affected by these complications (prevalence). People who are hospitalised with diabetes are more likely to represent complex cases and are more likely to suffer from one or more diabetes complications than people who are not hospitalised.

Further research is required to fully understand the prevalence of these complications in the broader diabetes community at the national level. The accuracy of diagnosis of some complications may also be an issue. In recent research by Davis and Davis (2019) assessing the incidence of diabetic ketoacidosis in the Fremantle Diabetes Study, incorrect coding rates of 39% were found for initial episodes and 41.7% for recurrent episodes.

In 2020-21, there were:

- 11,700 hospitalisations with kidney complications (45 per 100,000 population).
- 10,800 hospitalisations with eye complications (42 per 100,000 population).
- 10,700 hospitalisations with suboptimal diabetic control (42 per 100,000 population).
- 9,600 hospitalisations with neurological complications (38 per 100,000 population).
- 9,200 hospitalisations with ketoacidosis (36 per 100,000 population).

Age and sex

In 2020-21:

- Hospitalisations with associated diabetes complication were generally higher in Australians aged 50 and over (Figure 12).
- Females aged 0-24 were 1.4 times as likely to be hospitalised with ketoacidosis compared with males aged 0-24.

Figure 12: Hospitalisations with associated diabetes complications for type 1 diabetes, by age, 2020-21

The bar chart shows hospitalisations with associated diabetes complications for type 1 diabetes, by age group for 2020-21. The most common complication associated with hospitalisations for type 1 diabetes were kidney and eye complications. The rate of kidney complications peaked among those aged 75+ at 92 per 100,00 population and eye complications peaked among people aged 50-74 with 78 per 100,000 population. The only complication where rates reduced with increasing age was ketoacidosis which peaked among people aged 0-24 at 45 per 100,000 population.
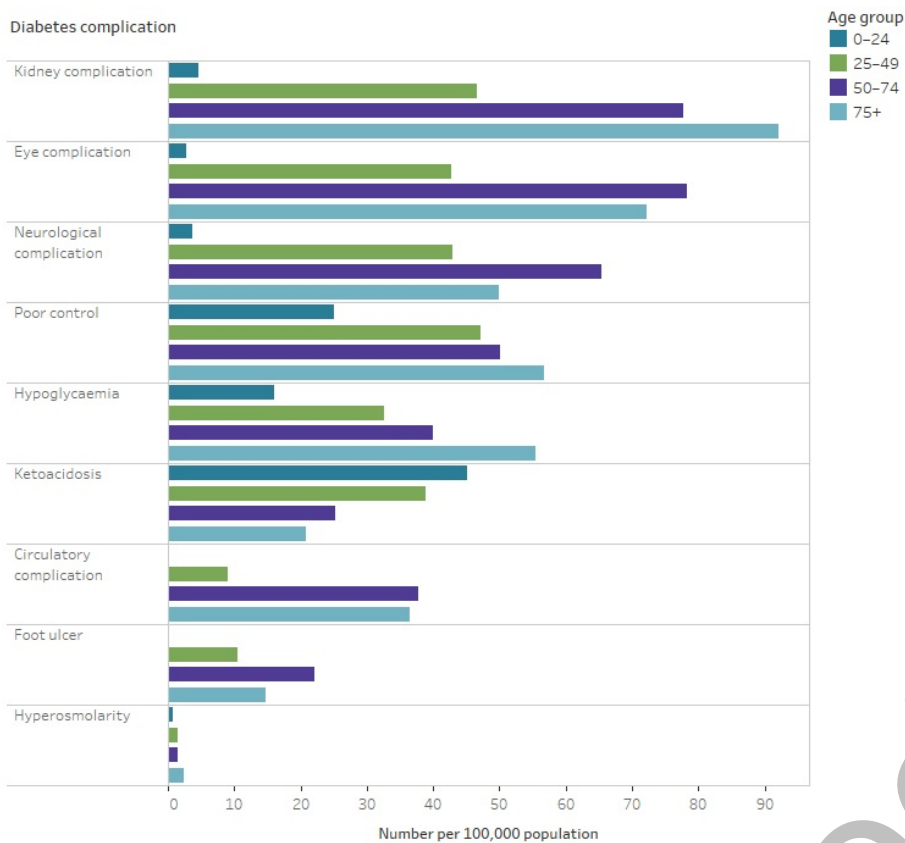
Figure: 12 Hospitalisations with associated complication for type 1 diabetes, by age, 2020–21

Chart: AIHW. Source: AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

After adjusting for different population age structures:

- Males were more likely to have hospitalisations associated with chronic diabetes complications including foot ulcer, kidney, eye, neurological and circulatory complications.
- Circulatory complications and foot ulcer were 2.2 and 1.9 times as high, respectively, in males compared with females.
- Females were slightly more likely to have hospitalisations associated with acute complications including ketoacidosis (Figure 13).

Figure 13: Hospitalisations with associated diabetes complications for type 1 diabetes, by sex, 2020-21

The bar chart shows hospitalisations with associated diabetes complications for type 1 diabetes, by sex for 2020–21. Males were more likely than females to have hospitalisations associated with type 1 diabetes complications including foot ulcer, kidney, eye, neurological and circulatory complications. Ketoacidosis was the only complication where rates were notably higher among females than males (1.2 times higher).
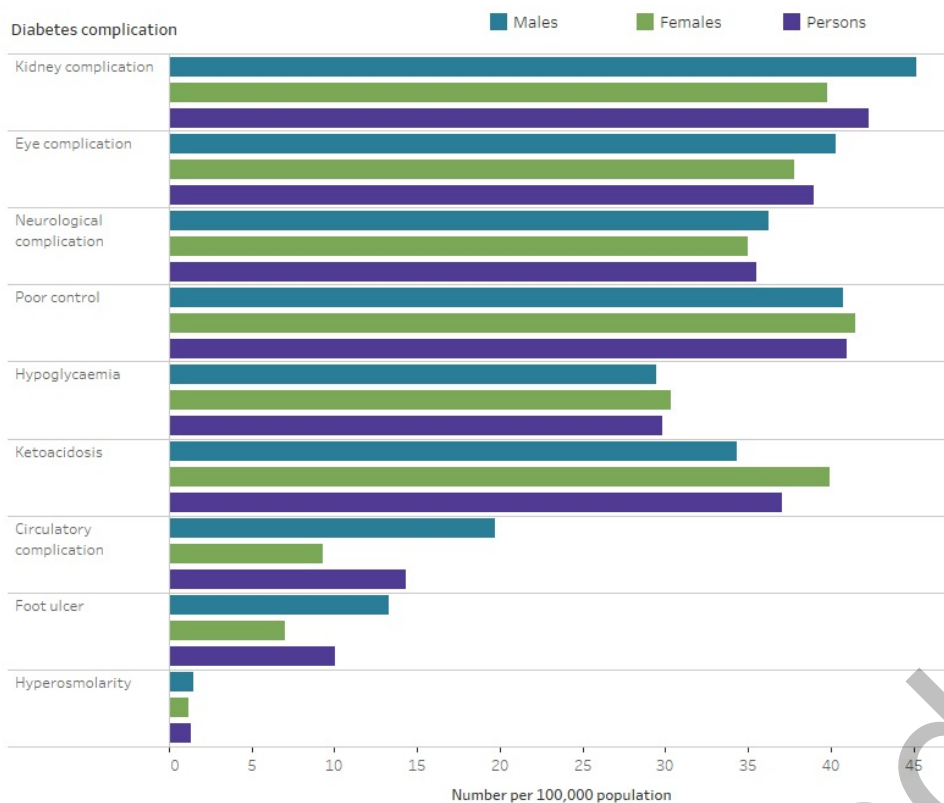
Figure: 13 Hospitalisations with associated complication for type 1 diabetes, by sex, 2020–21

Note: Aged-standardised to the 2001 Australian Standard Population.
Chart: AIHW. Source: AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

Type 2 diabetes hospitalisations

There were around **1.1 million hospitalisations** with type 2 diabetes recorded as the principal and/or additional diagnosis in 2020–21, with 40,700 (3.7% of type 2 diabetes hospitalisations) as the principal diagnosis and 1,060,000 (96% of type 2 diabetes hospitalisations) as an additional diagnosis.

Variation by age and sex

In 2020–21, type 2 diabetes hospitalisations (as the principal and/or additional diagnosis):

- generally increased with increasing age, with most (87%) occurring in those aged 55 and over. Type 2 diabetes hospitalisation rates were highest among those aged 80–84 (31,000 and 20,000 per 100,000 population for males and females, respectively).
- were higher among males than females from age 50 onwards (Figure 14).
- were 1.4 times as high for males as females, after controlling for the age structure of the population (Figure 15).

Where type 2 diabetes was the main reason for the hospitalisation (principal diagnosis), the age-standardised hospitalisation rate was 2.0 times as high among males compared with females (Figure 15).

Figure 14: Type 2 diabetes hospitalisation rates by diagnosis type, age and sex, 2020-21

The bar chart shows hospitalisations with type 2 diabetes as the principal and/or additional diagnosis peaked in the 80–84 age group with 31,069 and 20,030 hospitalisations for males and females, respectively, per 100,000 population. Hospitalisations with type 2 diabetes as a principal diagnosis were around twice as high among males as females peaking the 80–84 age group with 1,106 and 534 hospitalisations per 100,000 for males and females, respectively.
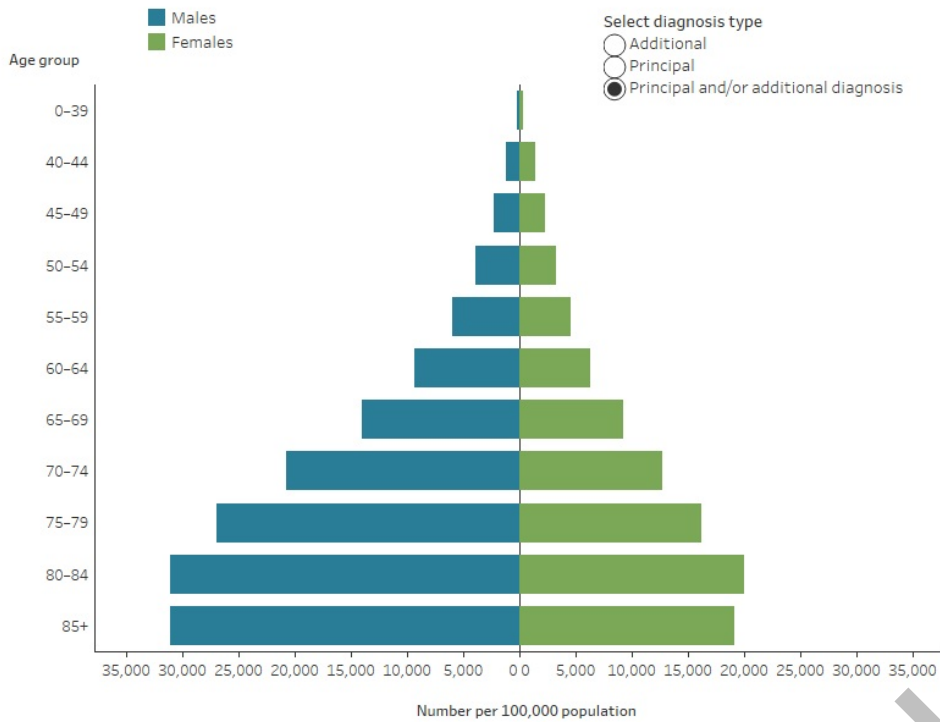
Figure 14: Type 2 diabetes hospitalisation rates, by diagnosis type, age and sex, 2020–21

Chart: AIHW. Source: AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

Trends over time

After adjusting for age, type 2 diabetes hospitalisation rates (principal and/or additional diagnosis) increased steadily by around 21% overall between 2012–13 and 2020-21. With a peak in 2018-19, the trend was similar among both sexes, with rates among males consistently around 1.4 times as high compared with females (Figure 15).

Figure 15: Type 2 diabetes hospitalisation rates by diagnosis type and sex, 2012-13 to 2020-21

The chart shows the rate of hospitalisations with type 2 diabetes as the principal and/or additional diagnosis increased 21% overall between 2012-13 to 2020–21, for both males and females. A slight dip in rates in 2019-20 was followed by an increase again in 2020-21. Throughout this period, rates have remained around 1.4 times higher among males than females.

Figure 15: Type 2 diabetes hospitalisation rates by diagnosis type and sex, 2012–13 to 2020-21

Note: Age-standardised to the 2001 Australian Standard Population.
Chart: AIHW. Source: AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

Variation between population groups

Aboriginal and Torres Strait Islander people

In 2020–21, there were around 77,500 hospitalisations for type 2 diabetes (as the principal and/or additional diagnosis) among Aboriginal and Torres Strait Islander people – a rate of 8,900 per 100,000 population. The hospitalisation rates were highest among Indigenous females aged 70–74 and Indigenous males aged 85 or higher (53,300 and 66,400 per 100,000 population, respectively) (Figure 16). Indigenous women were 1.1 times as likely to be hospitalised with type 2 diabetes when compared with Indigenous males after controlling for age.

After adjusting for differences in the age structure of the populations, the hospitalisation rate for type 2 diabetes among Indigenous Australians was 4.6 times the rate for non-Indigenous Australians (Figure 17).

Figure 16: Type 2 diabetes hospitalisation rates for Aboriginal and Torres Strait Islander people, principal and/or additional diagnosis, by age and sex, 2020-21

The bar chart shows hospitalisations with type 2 diabetes as the principal and/or additional diagnosis for Aboriginal and Torres Strait Islander people, by sex for 2020–21. Rates peaked for males in the 85+ year age group with 66,402 hospitalisations per 100,000 population and for females in the 70–74-year age group with 53,316 hospitalisations per 100,000 population.

Figure 16: Type 2 diabetes hospitalisations rates for Aboriginal and Torres Strait Islander people, principal and/or additional diagnosis, by age and sex, 2020–21
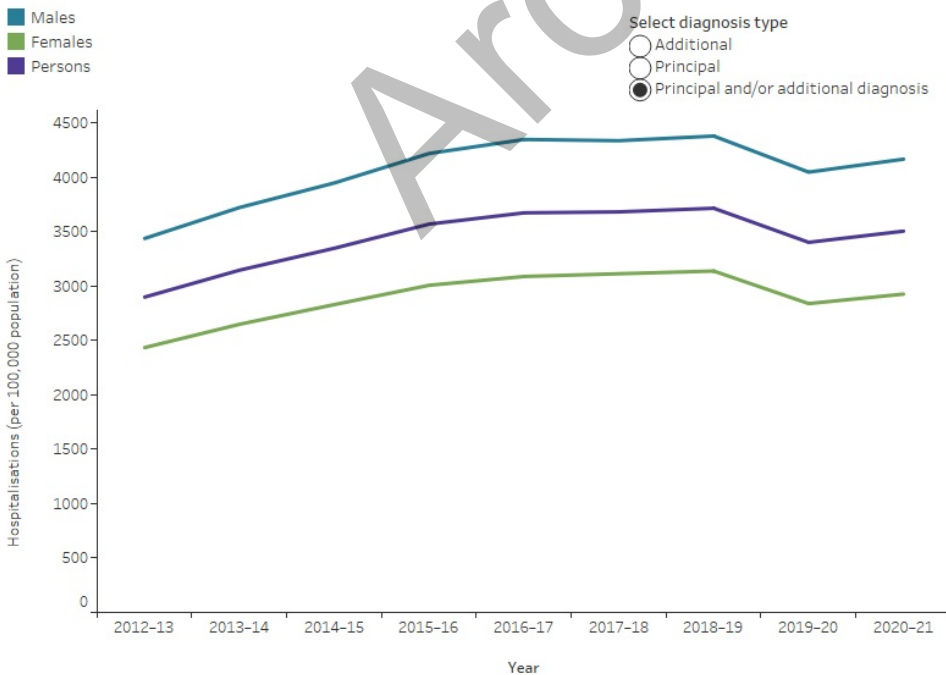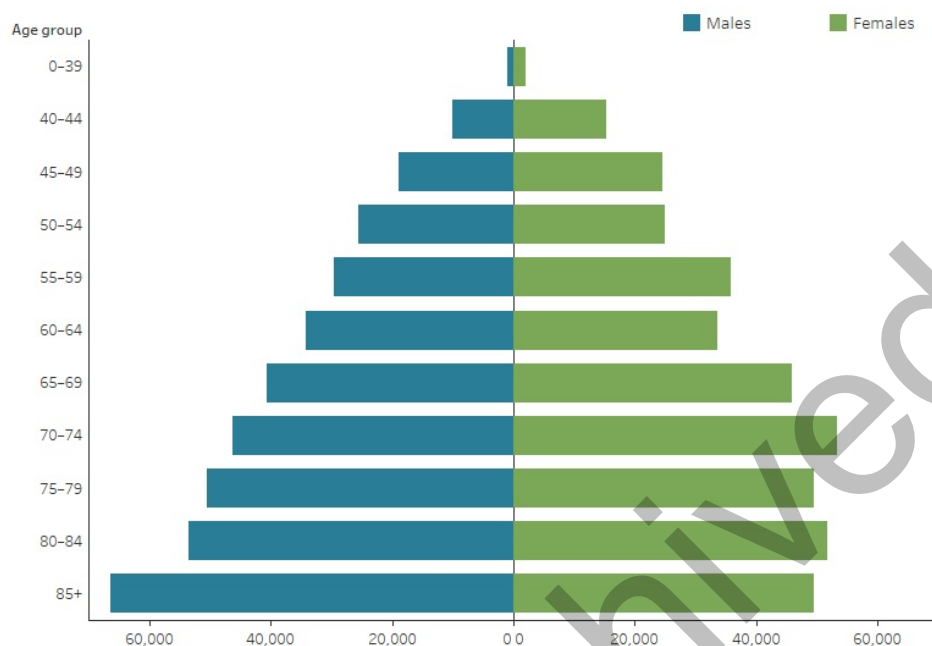
Chart: AIHW. Source: AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

Socioeconomic area

In 2020–21, age-standardised type 2 diabetes hospitalisation rates (as the principal and/or additional diagnosis) increased with increasing levels of socioeconomic disadvantage. People living in the lowest socioeconomic areas were 2.0 times as likely to be diagnosed with type 2 diabetes as those living in the highest socioeconomic areas (Figure 17).

Remoteness area

In 2020–21, age-standardised type 2 diabetes hospitalisation rates (as the principal and/or additional diagnosis) were 2.6 to 2.9 times as high in *Remote and very remote* areas, compared with *Major cities, Inner regional* and *Outer regional* areas (Figure 17).

See *Geographical variation in disease: diabetes, cardiovascular and chronic kidney disease* for more information on type 2 diabetes hospitalisations by state/territory, Population Health Network and Population Health Area.

Figure 17: Type 2 diabetes hospitalisation rates, principal and/or additional diagnosis, by population group and sex, 2020-21

The bar chart shows the age-standardised hospitalisation rate with type 2 diabetes as the principal and/or additional diagnosis, by population group and sex for 2020–21. Rates increased with increasing remoteness and were 2.9 times higher among those living in Remote and very remote areas compared with those living in Major cities. Type 2 diabetes hospitalisation rates increased with increased socioeconomic disadvantage being 2.0 times higher among those living in the most disadvantaged areas compared with those living in the least disadvantaged areas. Type 2 diabetes hospitalisation rates among Indigenous Australians were 4.6 times higher than for non-Indigenous Australians.
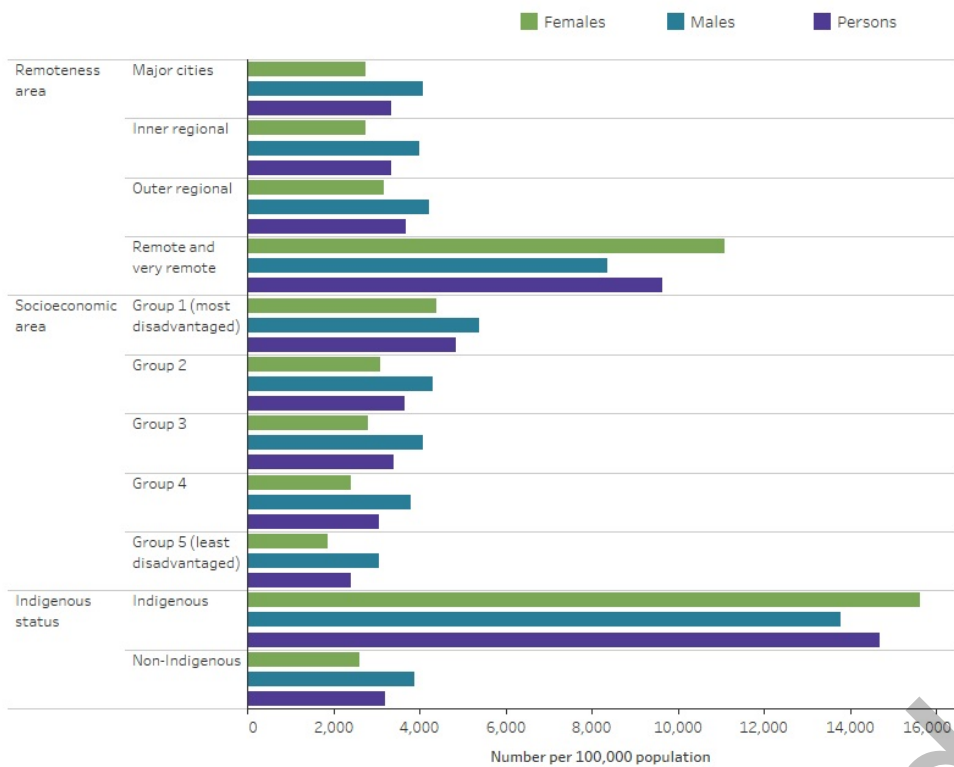
Figure 17: Type 2 diabetes hospitalisation rates, principal and/or additional diagnosis, by population group and sex, 2020–21

Notes
1. Age-standardised to the 2001 Australian Standard Population.
2. Excludes persons whose Indigenous status, remoteness area and/or socioeconomic area was missing or unassigned.

Chart: AIHW. Source: AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

Country of birth

A person's country of birth commonly affects their risk of developing type 2 diabetes, however, the degree to which this is influenced by migration or ethnicity is unclear. Potential reasons may include genetic predisposition, potential exposure to risk factors in the country of origin, factors related to the migration process and/or changes in lifestyle behaviours following migration (Zhang et al. 2020).

In 2020–21, 64% of hospitalisations with type 2 diabetes as the principal and/or additional diagnosis were for people born in Australia (653,000 hospitalisations). Type 2 diabetes hospitalisation rates varied by country of birth, with age-standardised rates for people born in Northern Africa and the Middle East being 1.6 times as high compared with those born in Australia. Hospitalisation rates were lowest among those born in North–East Asia (Figure 18).

Figure 18: Type 2 diabetes hospitalisation rates, principal and/or additional diagnosis, by country of birth, 2020-21

The chart shows the age-standardised hospitalisation rate for type 2 diabetes as the principal and/or additional diagnosis, by country of birth for 2020–21. Type 2 diabetes hospitalisation rates for people born in Northern Africa and the Middle East were 1.6 times as high compared with those born in Australia.
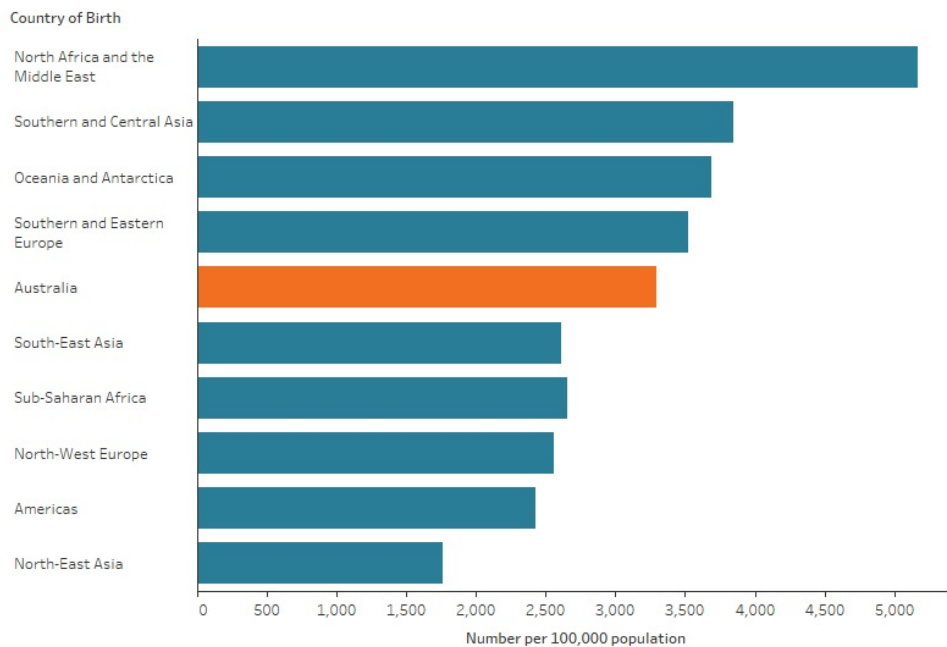
Figure 18: Type 2 diabetes hospitalisation rates, principal and/or additional diagnosis, by country of birth, 2020–21

Notes:
1. Age-standardised to the 2001 Australian Standard Population.
2. Excludes persons whose birth country was not stated or inadequately described.

Chart: AIHW. Source: AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

Type 2 diabetes hospital procedures

According to the National Hospital Morbidity Database (NHMD), there were around **4,500 weight loss procedures** and **6,100 lower limb amputations** undertaken for people with type 2 diabetes in 2020–21 (18 and 24 per 100,000 population, respectively).

People with diabetes may require surgery to help manage their diabetes or treat the complications of diabetes.

Weight loss reduces the risk of developing type 2 diabetes and reduces long-term complications associated with type 2 diabetes and obesity. Lifestyle interventions are the primary method for reducing weight, but in some people weight loss (bariatric) surgery is an effective intervention for long-term weight loss and maintenance (Lee and Dixon 2017).

Diabetes can cause damage to the nerves in the feet which reduces blood circulation and increases risk of infection and foot ulcers. Diabetic foot ulcers can lead to hospitalisation and require lower limb amputation (Reardon et al. 2020).

Variation by age and sex

In 2020–21, rates for obesity surgery among people living with type 2 diabetes were:

- 1.9 times as high in females compared with males after controlling for age (Figure 19)
- highest in people aged 50–54 (49 per 100,000), over 8 times as high as those aged 0–39 and 245 times as high as people 85 and over (Figure 20).

Rates of lower limb amputation among people living with type 2 diabetes:

- were 3.6 times as high in males compared with females after controlling for age (Figure 19)
- generally increased with increasing age, with 74% of lower limb amputations undertaken in people aged 60 or above (Figure 21)
- were highest among people aged 80–84 (112 per 100,000 population), which was 124 times as high as for those aged 0–39 (0.9 per 100,000 population) (Figure 21).

Counting hospital procedures

The number and rate of procedures reported in this section should be interpreted with caution. Hospital procedures reported using the NHMD may represent many individuals undergoing these procedures, or in some cases, a single individual undergoing multiple procedures over time as they require further follow-up and treatment. In 2011, it was estimated that only 1.7% (12,300) of people living with diabetes had experienced one or more lower limb amputation procedures despite 4,200 lower limb procedures being undertaken in that year and similar numbers in the years prior (AIHW 2017). This implies that there are high number of people who have multiple amputations to treat the complications from diabetes. Further research is required to understand the differences between the number of separations for these procedures and the number of individuals who have undergone the procedures.

Figure 19: Procedures for managing type 2 diabetes, by sex, 2020–21

The bar chart shows age-standardised rates of procedures for managing type 2 diabetes, by sex for 2020-21. Rates for lower limb amputation were higher for males than females with 32 and 9 hospitalisations respectively, per 100,000 population. Hospitalisations for obesity surgery were higher among females than males with 23 and 12 hospitalisations per 100,000, respectively.
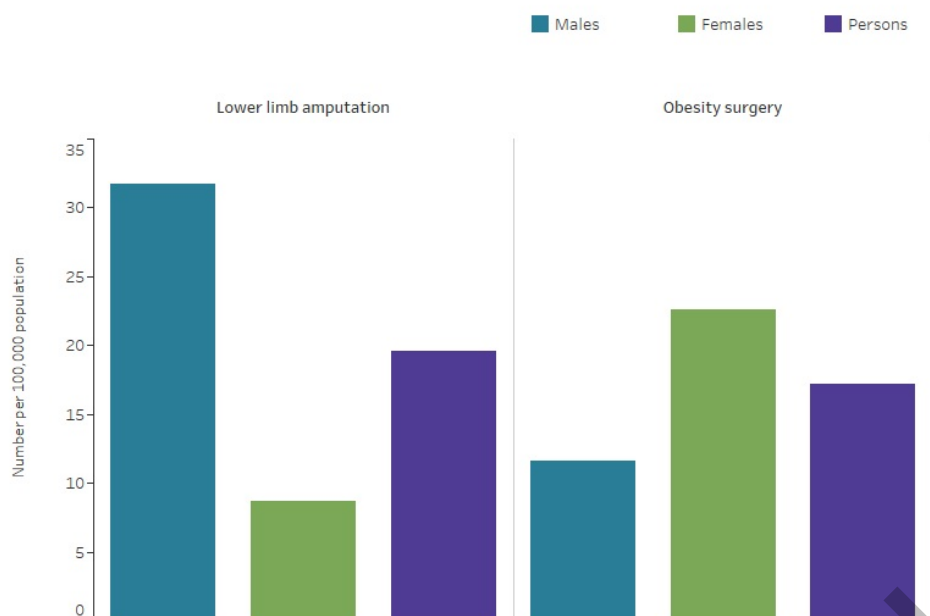
Figure 19: Procedures for managing type 2 diabetes, by sex, 2020-21

Notes
1. Age-standardised to the 2001 Australian Standard Population.
2. Obesity surgery includes primary or initial procedures for weight loss surgery and procedures that are described as adjustments, revisions, removals and other procedures.

Chart: AIHW. Source: AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

Figure 20: Obesity surgery for managing type 2 diabetes, by age and sex, 2020-21

The chart shows rates of obesity surgery for managing type 2 diabetes, by sex and age for 2020-21. Rates peaked for both males and females in the 50-54-year age group with 33 and 64 procedures for males and females, respectively, per 100,000 population.
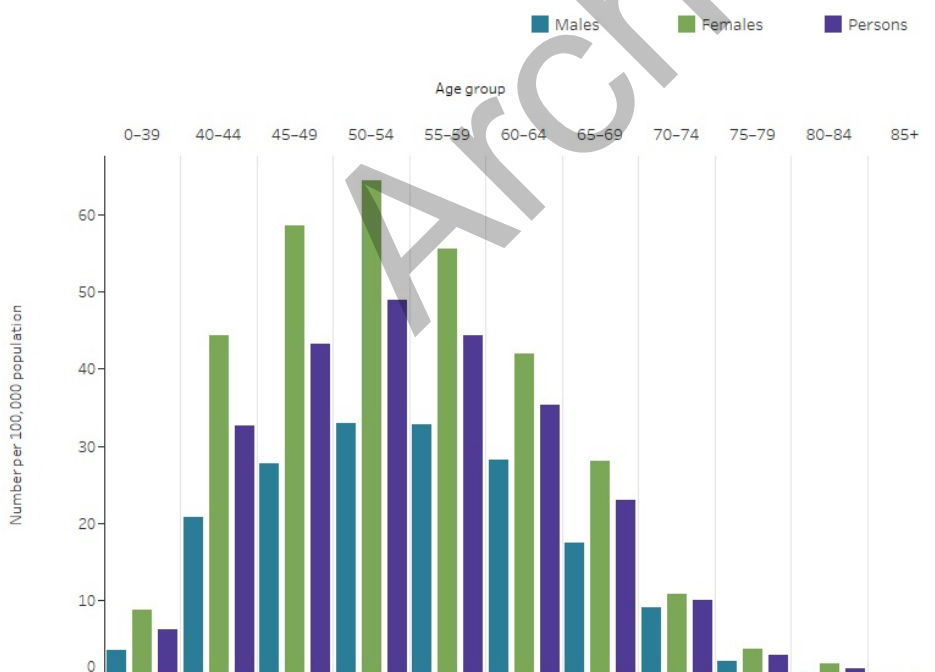
Figure 20: Obesity surgery for managing type 2 diabetes, by sex, 2020-21

Note: Obesity surgery includes primary or initial procedures for weight loss surgery and procedures that are described as adjustments, revisions, removals and other procedures.

Chart: AIHW. Source: AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

Figure 21: Lower limb amputation for managing type 2 diabetes, by age and sex, 2020-21

The chart shows rates of lower limb amputations for managing type 2 diabetes, by sex and age for 2020-21. Rates peaked among males in the 85 and over age group and females in the 80-84 age group with 187 and 55 procedures for males and females, respectively, per 100,000 population.

Figure 21: Lower limb amputation for managing type 2 diabetes, by age and sex, 2020–21

Chart: AIHW.   Source: AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

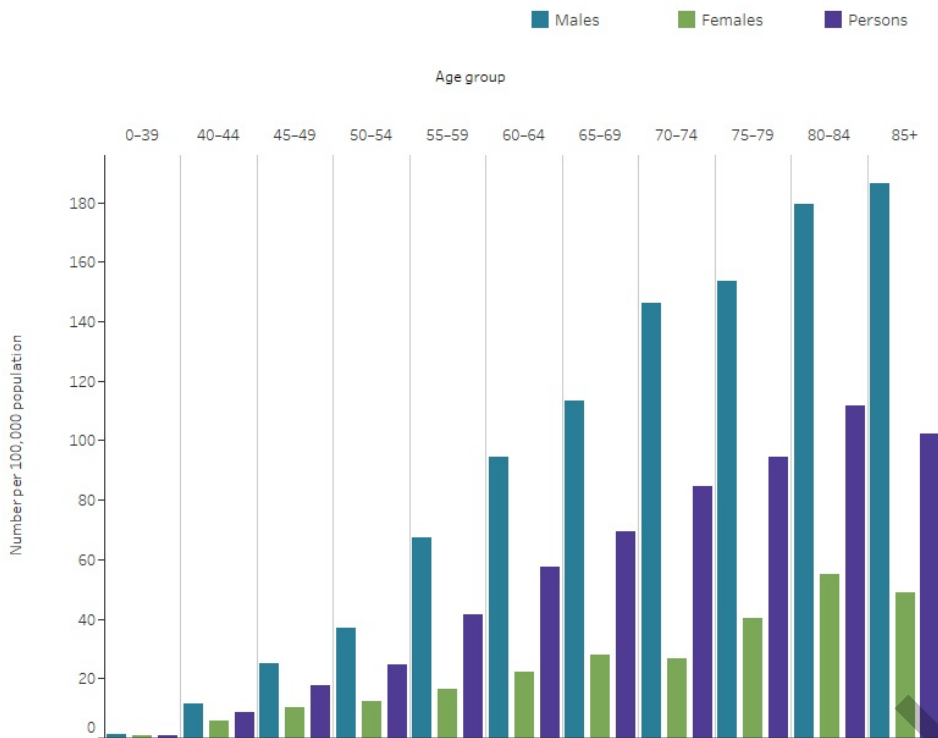## Type 2 diabetes hospitalisations with diabetes complications

In 2020-21, there were over **560,000** hospitalisations with acute or chronic **diabetes complications** associated with the hospitalisation for people living with type 2 diabetes (51% of all type 2 diabetes hospitalisations). This was down from 608,000 in 2019-20 (52% of all type 2 diabetes hospitalisations). Kidney, eye, neurological, circulatory and poor diabetes control were the most common hospital complications found for people living with type 2 diabetes.

In 2020-21, there were:

- 244,900 hospitalisations with kidney complications (955 per 100,000 population).
- 103,200 hospitalisations with eye complications (402 per 100,000 population).
- 84,000 hospitalisations with neurological complications (328 per 100,000 population).
- 69,200 hospitalisations with circulatory complications (270 per 100,000 population).
- 61,100 hospitalisations with poor diabetes control (238 per 100,000 population).

Variation by age and sex

In 2020-21:

- kidney complications were the most reported complication in both males and females with type 2 diabetes
- the rate of hospitalisation with associated complication for type 2 diabetes increased with increasing age and was highest among people aged 80 and over for all complications (Figure 22)
- type 2 diabetes complications were reported 1.3 times more frequently among males than females, after controlling for age (Figure 23).

Figure 22: Hospitalisations with associated diabetes complications for type 2 diabetes, by age, 2020-21
The chart shows hospitalisations for type 2 diabetes with associated diabetes complications, by age for 2020-21. Type 2 diabetes hospitalisation rates were highest in the 80+ age group across all complications with kidney complications having the highest rate at 7,941 hospitalisations per 100,000 population.
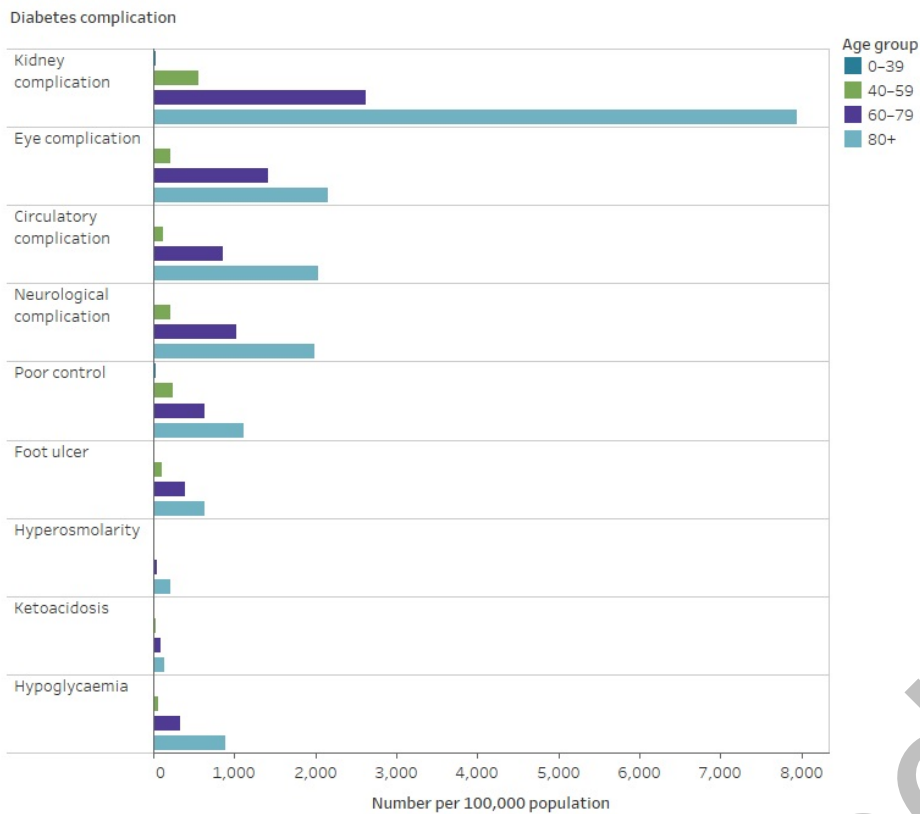
Diabetes complication

Figure 22: Hospitalisations with associated complication for type 2 diabetes, by age, 2020-21

After adjusting for different population age structures:

- males had higher rates for all complications compared with females
- rates were 3.1 times as high for males compared with females for foot ulcer, 3.0 times as high for circulatory complications, 1.9 times as high for neurological complications, and 1.5 times as high for kidney complications and ketoacidosis (Figure 23).

Figure 23: Hospitalisations with associated diabetes complications for type 2 diabetes, by sex, 2020-21

The chart shows age-standardised hospitalisation rates for type 2 diabetes with associated diabetes complications, by sex for 2020–21. Type 2 diabetes hospitalisation rates were highest for males across all complications with Kidney complications having the highest rate for both males and females with 943 and 611 hospitalisations for males and females, respectively, per 100,000 population.
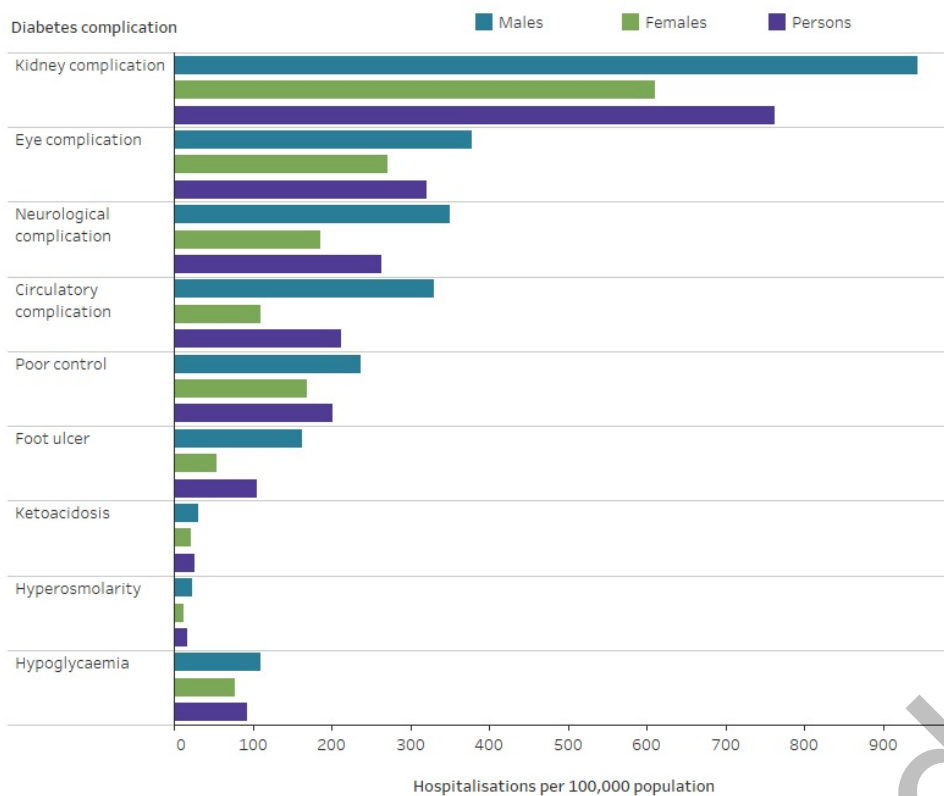
Figure 23: Hospitalisations with associated complication for type 2 diabetes, by sex, 2020–21

Note: Age-standardised to the 2001 Australian Standard Population.

Chart: AIHW.   Source: AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

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Zhang H, Rogers K, Sukkar L, Jun M, Kang A, Young T et al. (2020), 'Prevalence, incidence and risk factors of diabetes in Australian adults aged ≥45 years: A cohort study using linked routinely-collected data', *Journal of Clinical & Translational Endocrinology*, volume 22, doi:10.1016/j.jcte.2020.100240.

Treatment and management

Page highlights:

Variation by age and sex

- In 2020–21, there were 19,100 emergency department (ED) presentations with a principal diagnosis of diabetes with males being 1.3 times as likely to present as females.
- The rate of diabetes-related ED presentations was highest in the 15–19 age group for females and the 80–84 age group for males.

Diabetes types

- Almost two-thirds (65%) of ED presentations with a principal diagnosis of diabetes were for 'other/unknown diabetes'; 21% were for type 1 diabetes and about 13% were for type 2 diabetes.

Reasons for presentation

- Ketoacidosis was recorded as the reason for presentation in about 40% of all ED presentations with a principal diagnosis of diabetes.

Triage category

- Of all diabetes-related ED presentations in 2020–21, 38% were categorised as 'emergency' and 39% as 'urgent'.

End status

- More than three-quarters of patients (76%) presenting to the ED with a principal diagnosis of diabetes in 2020–21 were subsequently admitted to hospital; 70% were admitted to the same hospital and 6% were referred to another hospital for admission.

Emergency departments (EDs) are an essential component of Australia's health-care system. Many of Australia's public hospitals have purpose-built EDs, staffed 24 hours a day, providing care for people living with diabetes who require urgent medical, surgical or other attention.

Variation by age and sex

In 2020–21:

- there were 19,100 ED presentations with a principal diagnosis of diabetes (type 1 diabetes, type 2 diabetes or other diabetes)
- after adjusting for age, the overall rate of presentation for males was 1.3 times as high as the female rate
- the rate of diabetes-related ED presentations for females was highest in the 15–19 age group and for males it was highest in the 80–84 age group. Between the ages of 5 and 24, females had a higher rate of presentation but in all other age groups, the rate for males was higher (Figure 1).

Figure 1: Emergency department presentations with a principal diagnosis of diabetes, by age and sex, 2020-21

The chart shows the number of emergency department presentations with a principal diagnosis of diabetes per 100,000 population, by age group and sex in 2020–21. Between the ages of 5 and 24, females had a higher rate of presentation but in all other age groups, the rate for males was higher.
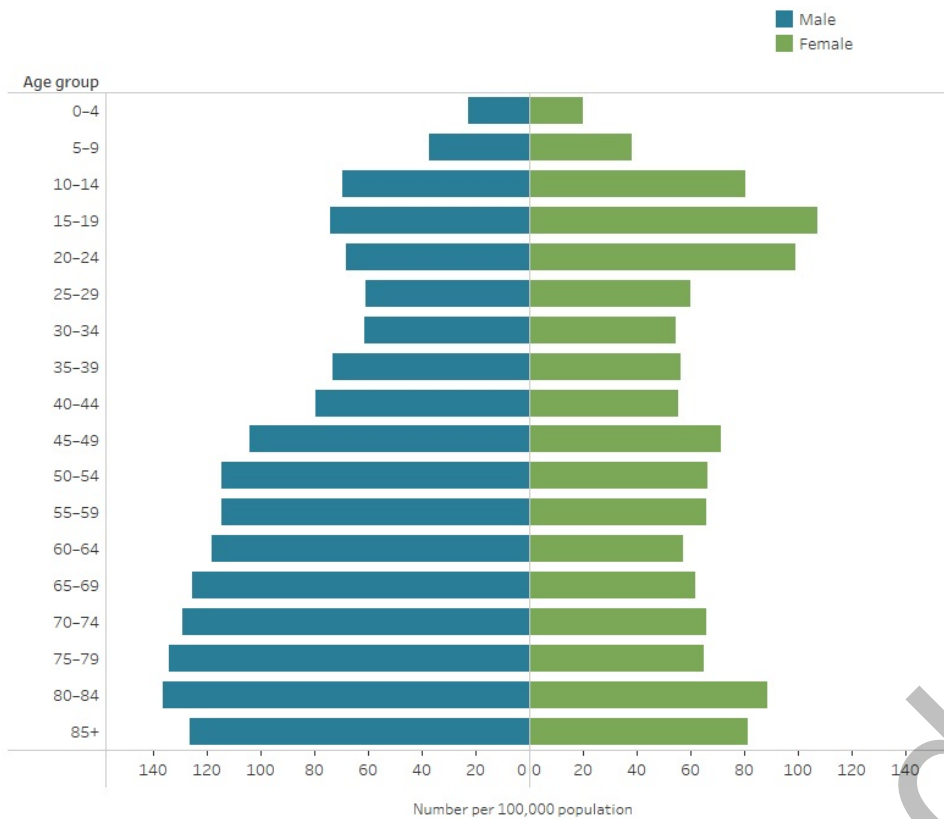
Figure 1: Emergency department presentations, diabetes as a principal diagnosis, by age and sex, 2020-21

Chart: AIHW. Source: AIHW National Hospital Morbidity Database (NHMD).
https://www.aihw.gov.au

Diabetes types

In 2020–21:

- There were 12,500 ED presentations with a principal diagnosis of 'other/unknown diabetes', accounting for almost two thirds (65%) of diabetes‑related ED presentations.
- Around one-fifth (21%) of diabetes-related ED presentations had a principal diagnosis of type 1 diabetes (4,000 presentations) and about 13% had a principal diagnosis of type 2 diabetes (2,600 presentations).

After adjusting for age differences in the populations:

- Males were 1.4 times as likely to present to the ED with a principal diagnosis of type 2 diabetes when compared to females.
- Males were 1.1 times as likely to present to the ED with a principal diagnosis of type 1 diabetes when compared to females (Figure 2).

Figure 2: Emergency department presentations with a principal diagnosis of diabetes, by diabetes type and sex, 2020-21

The chart shows the number of emergency department presentations with a principal diagnosis of diabetes per 100,000 population by sex and diabetes type in 2020–21. Presentations were similar by sex for type 1 diabetes and 1.4 times higher among males than females for both other diabetes and type 2 diabetes.

Figure 2: Emergency department presentations, diabetes as a principal diagnosis, by diabetes type and sex, 2020-21

Note: Age-standardised to the 2001 Australian Standard Population.

Chart: AIHW. Source: AIHW National Hospital Morbidity Database (NHMD).
https://www.aihw.gov.au

Variation between population groups

In 2020–21, after controlling for age:

- Aboriginal and Torres Strait Islander people presented to the ED with a principal diagnosis of diabetes at 5.7 times the rate of non-Indigenous people
- rates of ED presentation increased with increasing levels of socioeconomic disadvantage. People in the lowest socioeconomic area presented to the ED at 3.2 times the rate of people in the highest socioeconomic area
- presentation rates also increased with increasing remoteness. In *Remote and very remote* areas, the rate was 3.9 times as high when compared to *Major cities* (Figure 3).

Figure 3: Emergency department presentations with a principal diagnosis of diabetes, by population group and sex, 2020-21

The chart shows the number of emergency department presentations with a principal diagnosis of diabetes per 100,000 population by selected population group and sex in 2020-21. Presentation rates increased both with increasing levels of socioeconomic disadvantage and remoteness while rates among Indigenous Australians were almost 6 times higher than non-Indigenous Australians.
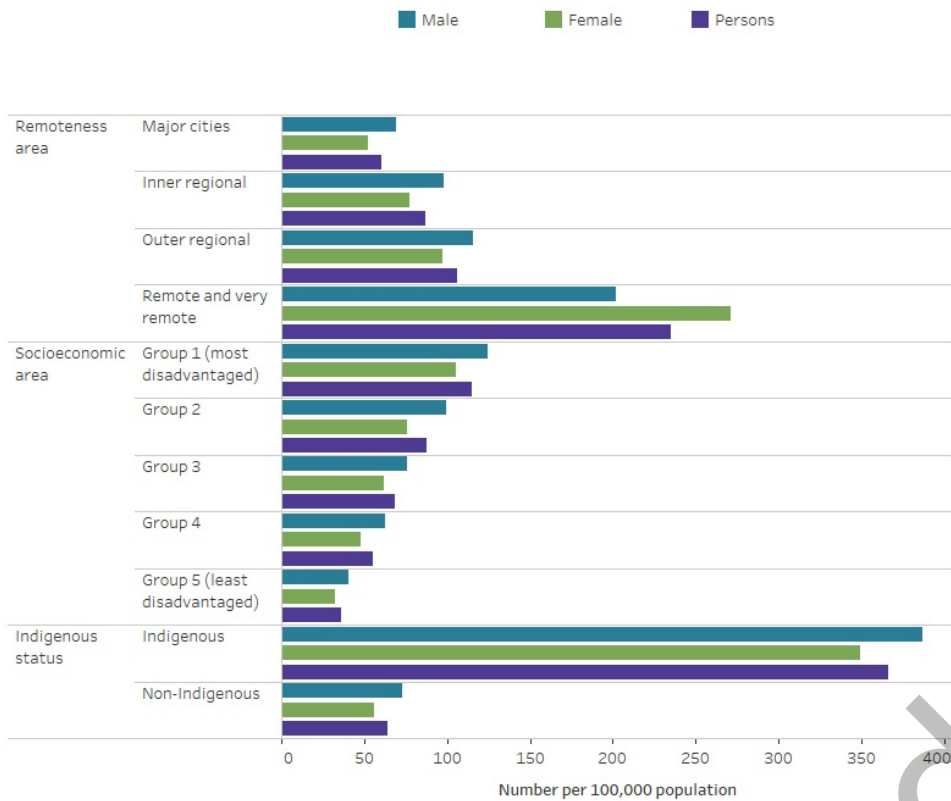
Figure 3: Emergency departement presentations, diabetes as a principal diagnosis, by population group 2020–21

[Notes]

Chart: AIHW. Source: AIHW National Hospital Morbidity Database (NHMD).
https://www.aihw.gov.au

Reasons for presentation

In 2020–21:

- There were 7,500 ED presentations with a principal diagnosis of diabetes with ketoacidosis, accounting for about 40% of all diabetes related ED presentations. After adjusting for age, males and females presented to the ED with ketoacidosis at a similar rate.
- Just over one-third (34%) of ED presentations had a principal diagnosis of diabetes with an unspecified complication. Males were 1.7 times as likely to present to the ED with this principal diagnosis compared to females, after adjusting for age.
- 9.1% of ED presentations had a principal diagnosis of diabetes with poor blood gluocose control. Males were 1.3 times as likely to present to the ED with this principal diagnosis compared to females after adjusting for age.
- 18% of ED presentations had a principal diagnosis of diabetes without complication. Males were 1.3 times as likely to present to the ED with this principal diagnosis compared to females after adjusting for age (Figure 4).

Figure 4: Emergency department presentations with a principal diagnosis of diabetes, by reason for presentation and sex, 2020-21

The chart shows the number of emergency department presentations with a principal diagnosis of diabetes per 100,000 population by reason for presentation and sex in 2020-21. Ketoacidosis was the main reason for presentation among both males and females while Poor (glucose) control was the least provided reason (30 and 7 per 100,000 population, respectively).
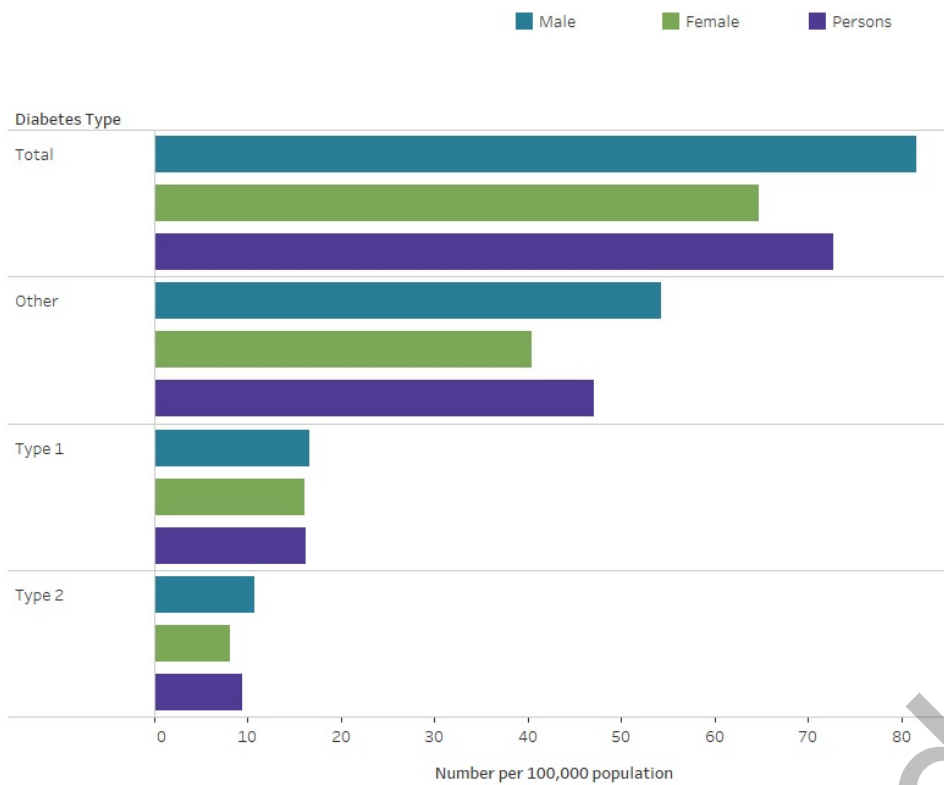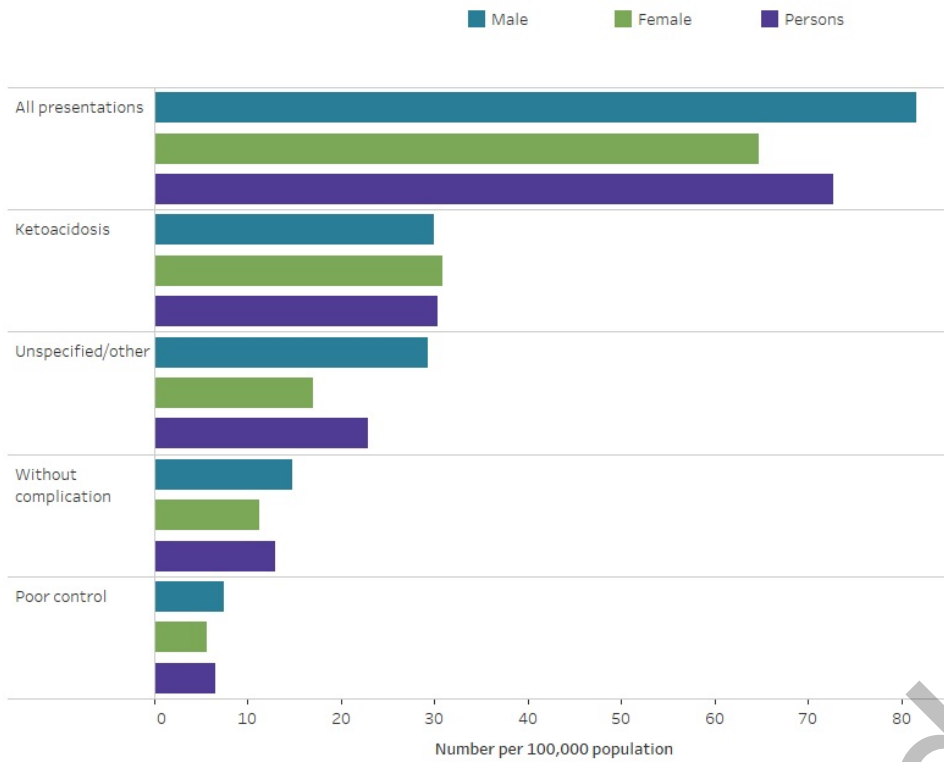
Figure 4: Emergency department presentations, diabetes as a principal diagnosis, reason for presentation by sex, 2020-21

Note: Age-standardised to the 2001 Australian Standard Population.

Chart: AIHW. Source: AIHW National Hospital Morbidity Database (NHMD).
http://www.aihw.gov.au

Triage category

Triage category is used to indicate the level of urgency of a patient's need for care. Of all diabetes-related ED presentations in 2020–21:

- 409 (2.1%) were triaged as 'resuscitation' indicating a need for immediate care.
- 7,300 (38%) were categorised as 'emergency' (within 10 minutes).
- 7,500 (39%) as 'urgent' (within 30 minutes).
- 3,300 (17%) as 'semi-urgent' (within 60 minutes).
- 586 (3.1%) as 'non-urgent' (within 120 minutes).

End status

Around 70% of patients presenting to the ED with a principal diagnosis of diabetes in 2020–21 were subsequently admitted to the same hospital, with an additional 6% being referred to another hospital for admission. Almost a quarter (23%) departed without being admitted or referred to another hospital.

Treatment and management

Page highlights:

Pathology service usage

- The HbA1c test, as the standard, remains the most utilised Medicare Benefits Schedule (MBS) service for diabetes diagnostic testing and the ongoing management of established diabetes.

Diagnosing diabetes

- In 2020, 542,000 people (2,100 per 100,000 population) screened as asymptomatic though high-risk, accessed an MBS-subsidised HbA1c test to determine a diagnosis of diabetes

Monitoring established diabetes

- In 2020, 769,000 people (3,000 per 100,000 population) received a HbA1c check for the management of established diabetes.

Screening for gestational diabetes

- In 2020, 163,500 women (2,700 per 100,000 population) received a diagnostic test for gestational diabetes with most (98%) accessing the oral glucose tolerance test (OGTT) and a further 2% accessing the oral glucose challenge test (OGCT).

Ongoing monitoring

- In 2019-20, 66.6% of general practice patients with a diagnosis of diabetes (20 years and older) had at least one test result for HbA1c levels – of these 52.2% had at least one result that was above the optimum goal for the management of diabetes.

Commonly used pathology checks for diabetes:

Glycated haemoglobin, haemoglobin A1c or HbA1c, is the main biomarker used to assess long-term glucose control in people living with diabetes. Haemoglobin is a protein in red blood cells which can bind with sugar to form HbA1c. It is directly related to blood glucose levels and strongly related with the development of long-term diabetes complications. Because red blood cells can live for up to 120 days, HbA1c gives an indication of blood glucose over a few months.

- The **HbA1c test** was endorsed for the diagnosis of diabetes in 2010 by the Australian Medical Association. Diagnosis is confirmed using HbA1c levels ≥48 mmol/L or ≥6.5%. HbA1c targets for people living with diabetes depend on the type of diabetes, life expectancy, risk of hypoglycaemia and other comorbidities. Regular monitoring for HbA1c forms an important part of diabetes management and preventing long-term complications (Wang and Hng 2021).
- The **oral glucose tolerance test (OGTT)** assesses venous plasma (blood) glucose before and 2 hours after a 75g oral glucose load. The OGTT is considered the gold standard for the diagnosis of gestational diabetes but may also be used in the non-pregnant population. A diagnosis of gestational diabetes is confirmed using blood glucose level – fasting (≥5.1 mmol/L); after 1 hour (≥10.0 mmol/L); after 2 hours (≥8.5 mmol/L). A diagnosis of diabetes in the non-pregnant population is confirmed using blood glucose level – fasting (≥7.0 mmol/L); after 2 hours (≥11.1 mmol/L) (RCPA 2019a).
- The **oral glucose challenge test (OGCT)** is a shorter version of the OGTT with (non-fasting) blood glucose measured 1 hour after a 50g or 75g oral glucose load. A level of 7.8 mmol/L for 50g (or ≥8.0 mmol/L for 75g) is the suggested cut-off for a diabetes diagnosis. Patients exceeding these cut-offs are recommended to undergo an OGTT (RCPA 2019b).
- Although not included in the analysis for this report, the Medicare Benefits Schedule (MBS) provides rebates for a range of additional services for the management of established diabetes including the quantitation of fructosamine, quantitation of urinary albumin/creatine ratio in urine, measurement of total cholesterol, triglycerides and high-density lipoprotein (HDL) cholesterol and assessment for microalbuminuria (RACGP 2020).
- From November 2021, greater emphasis has also been placed on the role of primary care in the management of established diabetes, with the introduction of routine HbA1c point-of-care services on the MBS (Department of Health 2021).

Pathology service usage

The MBS data collection contains information on services that qualify for a benefit under the *Health Insurance Act 1973* and for which a claim has been processed. These data provide insight into the usage of pathology services for diabetes diagnostic testing and the ongoing management of established diabetes, both for which the HbA1c test, as the standard, remains the most utilised MBS service (Figure 1).

Figure 1: Number of people who received MBS-subsidised services for diabetes diagnostic testing and/or management of established diabetes, 2014-2020

The chart shows the number of people who received MBS-subsidised services for the diagnosis of diabetes and/or the management of established diabetes between 2014 and 2020. The HbA1c test has remained the most utilised service for diagnosing diabetes since 2014 with around 770,000 people receiving this service in 2020. The number of people receiving the HbA1c service for the management of their

diabetes has increased steadily since 2014 with around 542,000 people accessing this service in 2020.

Pathology item
- Diagnostic HbA1c (66841)
- Diagnostic HbA1c Indigenous (73839)
- Diagnostic OGCT GDM (66545)
- Diagnostic OGTT (66542)
- Diagnostic OGTT GDM (66548)
- Management HbA1c (66551)
- Management HbA1c Indigenous (73840)
- Management HbA1c pregnancy (66554)

Select measure
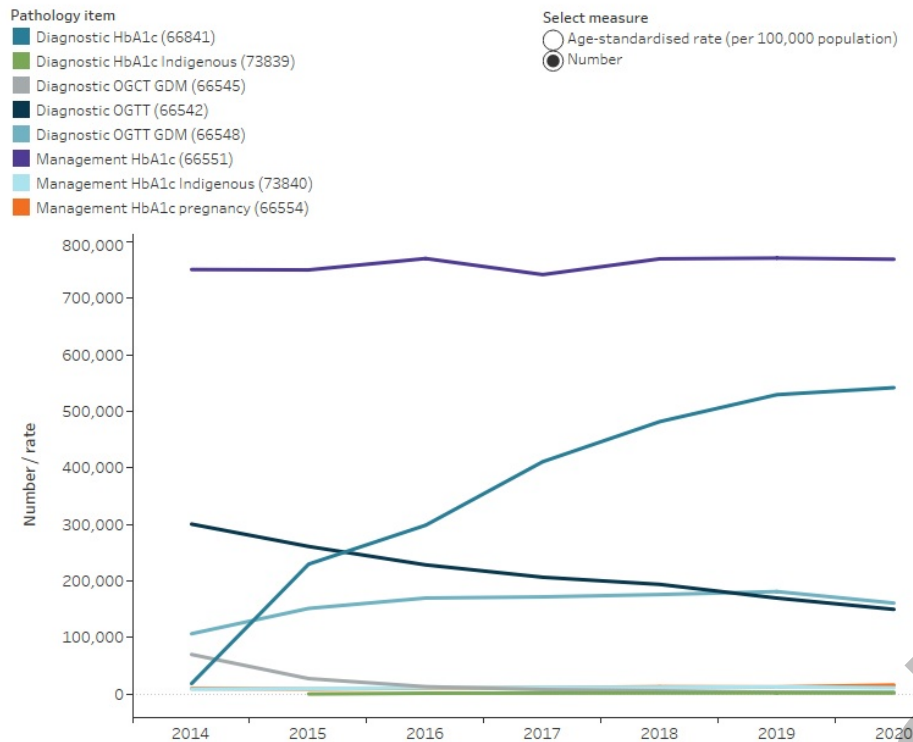- ○ Age-standardised rate (per 100,000 population)
- ● Number

Figure 1: Number of people who received MBS-subsidised services for diabetes diagnostic testing and/or management of established diabetes, 2014–2020

[Notes]

Chart: AIHW. Source: AIHW analysis of Medicare Benefits Schedule data.

https://www.aihw.gov.au

Diagnosing diabetes

In 2020, 542,000 people (2,100 per 100,000 population) screened as asymptomatic though high-risk, received a MBS-subsidised HbA1c test to determine a diagnosis of diabetes. Overall, the number of people accessing this service generally increased with increasing age, peaking among those aged 75-79 (8,900 per 100,000 population). Rates per 100,000 population were slightly higher among females than males overall, largely driven by a spike in numbers among females in the 15-49 age group, possibly due to the use of HbA1c in pregnancy-related diabetes screening.

The introduction of the HbA1c item on the MBS for diagnostic purposes in November 2014 enabled general practitioners (GPs) to detect diabetes in people considered to be high-risk according to elevated HbA1c only rather than the more formal oral glucose tolerance test (OGTT). This shift contributed to an almost 30-fold increase in people accessing diagnostic HbA1c services through the MBS between 2014 and 2020 and a halving in the number of people accessing the MBS-subsidised OGTT (Figure 1).

Monitoring established diabetes

In 2020, 769,000 people (3,000 per 100,000 population) received a HbA1c test for the management of established diabetes. The number of people accessing this item has remained steady since 2014 and, notably through the first waves of the COVID-19 pandemic throughout 2020 and early 2021 (Figure 2). Overall numbers for the HbA1c item to monitor established diabetes were 1.4 times higher among males than females in 2020 and rates increased with increasing age, peaking among both males and females in the 75-79 age group.

While people are eligible to access MBS-subsidised HbA1c tests for the management of established diabetes up to 4 times per year, on average people received this service only 1.5 times per year between 2014 and 2020 with a similar pattern between males and females.

Figure 2: Number of people who received a MBS-subsidised HbA1c test for the management of established diabetes by sex, April 2014 to August 2021

The chart shows the number of people who received a MBS-subsidised HbA1c test for the management of established diabetes, by sex and month between January 2014 and August 2021. Overall, the number of people receiving this service remained steady over the period ranging between 74,000 and 110,000 per month.
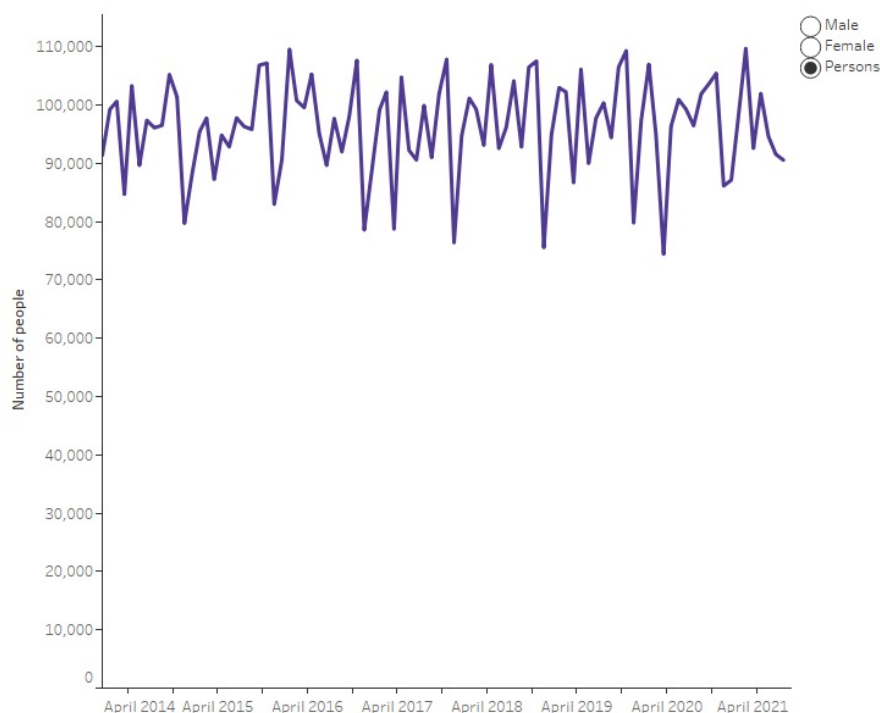
Figure 2: Number of people who received a MBS-subsidised HbA1c test for the management of established diabetes by sex, April 2014 to August 2021

Notes:
1. MBS item 66551 Quantitation of glycated haemoglobin performed in the management of established diabetes.
2. Date of processing up to 23/11/2021.
Chart: AIHW. Source: AIHW analysis of Medicare Benefits Schedule data.

https://www.aihw.gov.au

The management of pre-existing diabetes during pregnancy is important for the wellbeing of the mother and baby. In 2020, 15,900 women (261 per 100,000 population) received a HbA1c test for the management of pre-existing diabetes in pregnancy. The number of women accessing this item has increased steadily since 2014 with a spike in April and May 2020 (Figure 3), likely impacted by temporarily revised guidelines for gestational diabetes screening in response to the COVID-19 pandemic – refer to the Impact of COVID-19: Gestational diabetes screening for further information. By early 2021, demand for this item had returned to pre-COVID levels.

Screening for gestational diabetes

Screening for gestational diabetes is universally recommended for pregnant women between 24–28 weeks' gestation (Nankervis et al. 2014). In 2020, around 163,000 women (2,700 per 100,000 population) received a diagnostic test for gestational diabetes with most (98%) accessing the OGTT and a further 2% accessing the oral glucose challenge test (OGCT).

Gestational diabetes screening rates remained steady between 2014 and 2019, followed by an 11% drop in 2020 (down from 184,000 to 163,000 tests). Numbers in 2020 were likely impacted by temporarily revised guidelines for gestational diabetes screening in response to the COVID-19 pandemic – refer to the Impact of COVID-19: Gestational diabetes screening for further information. The number of women accessing these MBS subsidised services (processed to 1 August 2021), indicate the use of the OGTT and OGCT had returned to pre-COVID levels (Figure 3).

The use of MBS data and birth records data provide a proxy measure for the proportion of pregnant women being tested for gestational diabetes. Based on the number of women accessing the OGTT and/or OGCT, this proportion has increased steadily in recent years from 55% in 2014 to 62% in 2019. Note these figures likely underestimate the total proportion of pregnant women tested for gestational diabetes as women consistently represent around 60% of all people who receive a HbA1c test for the diagnosis of diabetes among the 15–49 age group – an indication that HbA1c may also be used for gestational diabetes screening.

Figure 3: Number of women who received MBS-subsidised services for the diagnosis of gestational diabetes and management of pre-existing diabetes in pregnancy, by month, January 2014 to August 2021

The chart shows the number of women who received MBS-subsidised services for the diagnosis of gestational diabetes and management of pre-existing diabetes in pregnancy, by month between January 2014 and August 2021. The chart reflects the impact of COVID-19 resulting in a dramatic drop in the number of women receiving the oral glucose tolerance test between April and June 2020 with a slight increase in the number of women receiving the HbA1c during this period. By October 2020, numbers had returned to pre-COVID levels.
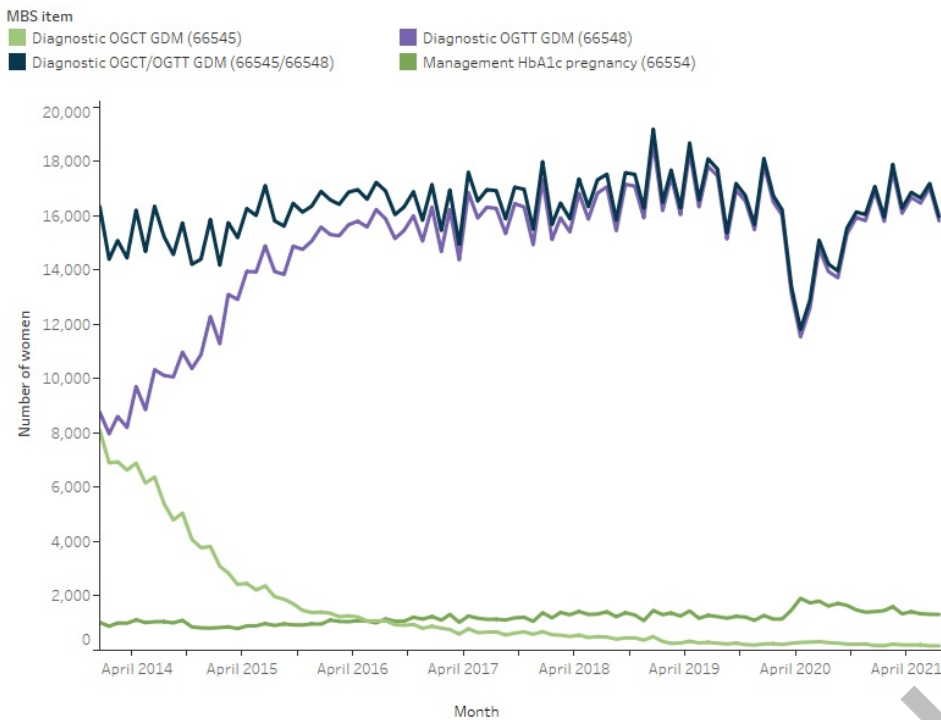
Figure 3: Number of women who received MBS-subsidised services for the diagnosis of gestational diabetes and management of pre-existing diabetes in pregnancy, by month

Notes:
1. GDM (gestational diabetes mellitus); OGCT (oral glucose challenge test); OGTT (oral glucose tolerance test); HbA1c (quantitation of glycated haemoglobin). Date of processing – up to 23/11/2021.
2. Only data for females aged 15–49 are reported for these items.
Chart: AIHW. Source: AIHW analysis of Medicare Benefits Schedule Data.

https://www.aihw.gov.au

Ongoing monitoring

Monitoring of key biomedical targets aims to reduce and manage diabetes complications. Two key monitoring targets are:

1. keep blood glucose levels within a specified target range
2. maintain blood pressure within acceptable levels.

Blood glucose monitoring helps health professionals determine the best management strategy for people living with diabetes. Keeping blood glucose levels within a target range can help reduce a person's risk of developing a range of diabetes-related complications.

HbA1c testing rates

According to the NPS MedicineInsight *General practice insights report* (NPS MedicineWise, 2021), in 2019–20, more than two-thirds (67%) of general practice patients with a diagnosis of diabetes (20 years and older) had at least one test result for HbA1c levels. More than half of these patients (52%) had at least one result that was above the optimum goal for the management of diabetes, that being ≤ 53 mmol/mol.

Amongst MedicineInsight patients without a diagnosis of diabetes, only 11% had received at least one test for HbA1c levels. Around 3% of the general practice patients tested without diabetes had a result ≥ 48 mmol/mmol (0.3% of all patients with no recorded diagnosis of diabetes).

Median HbA1c

The Australian National Diabetes Audit – Australian Quality Clinical Audit (ANDA – AQCA) provides biennial updates on diabetes practice processes and outcome data for participating diabetes services across all states and territories in Australia (Department of Health 2021). Among all adult patients with diagnosed diabetes recording a blood glucose result (n=4,262), the median HbA1c level was 63.0 mmol/mol. Median HbA1c was slightly higher among patients with type 1 diabetes (66.0 mmol/mol) and slightly lower in patients with type 2 diabetes (62.0 mmol/mol). Patients with gestational diabetes recording a blood glucose result (n = 49) had notably lower median HbA1c levels (34.0 mmol/mol).

Diabetes with an HbA1c result

The Practice Incentives Program (PIP) Quality Improvement Measures (QI) Quality Improvement Measure 1 (QIM 1) reports on the proportion of regular clients with a recorded diagnosis of type 1, type 2 or undefined diabetes and who had a HbA1c result in their GP record from the previous 12 months. Regular clients are defined as individuals who had visited a practice 3 or more times in the previous 2 years and data are collected from over 5,700 general practices across Australia (AIHW 2021).

As of July 2021, 59% of regular clients with a record of type 1 diabetes had an HbA1c result recorded in their GP record in the previous 12 months. This proportion was higher in regular clients with a record of type 2 diabetes (73%) and undefined diabetes (66%). The proportion of regular clients with an HbA1c result in the previous 12 months increased with increasing age and was highest in the 65 and over age group

for type 1, type 2 and undefined diabetes.

Diabetes with blood pressure recorded

The PIP QI Quality Improvement Measure 10 (QIM 10) provides information on the proportion of regular clients with a diagnosis of diabetes (type 1, type 2 or undefined) and a recorded blood pressure in their GP record in the previous 6 months (AIHW 2021).

As of July 2021, 59% of regular clients with diabetes had blood pressure recorded in their GP record in the previous 6 months. This proportion was 7% higher than in October 2020 (52%) and increased with increasing age. It was highest in the 65 and over age group (64% in males and 64% in females) and lowest in the 0-14 age group (6% in males and 8% in females).

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Treatment and management

Page highlights:

Diabetes medicines

- In 2020–21, over <u>16.5</u> million prescriptions were dispensed for diabetes medicines through the Pharmaceutical Benefits Scheme (PBS) and Repatriation Pharmaceutical Benefits Scheme (RPBS), representing 5.3% of total prescriptions.

Supply of diabetes medicines

- Prescriptions dispensed through the PBS for diabetes medicines increased by <u>24%</u> between 2017–18 and 2020–21, from 13.4 million to 16.5 million.

Insulin use

- In 2021, 31,700 people began using insulin to treat their diabetes. Around <u>15,600</u> people living with type 2 diabetes initiated insulin therapy (1,700 per 100,000 population).
- The incidence of insulin therapy in people living with type 2 diabetes was highest for both males and females aged 10–39 and was <u>1.6 times</u> as high for females compared with males, overall.

Management of gestational diabetes

- Of all females (aged 15–49) diagnosed with gestational diabetes in 2020–21, at the time of giving birth, <u>49%</u> were recorded as having managed their condition without medication using diet, exercise and/or lifestyle management; <u>39%</u> had been treated with insulin therapy and <u>8.4%</u> had been treated with oral hypoglycaemic medications.

Diabetes medicines

Diabetes medicines are key elements in preventing and treating diabetes and its risk factors. They are most commonly used to help manage blood glucose levels.

Types of diabetes medicines

People living with diabetes may require medications including insulin to help manage their blood glucose levels. All people with type 1 diabetes will require insulin. There are a variety of diabetes medicines used in Australia:

Insulin: This is a hormone made by beta cells in the pancreas. Insulin is released into the blood stream where it helps to move glucose from food that is eaten into the body's cells to be used as energy. Injectable insulin is provided to people living with diabetes to supplement or replace insulin produced by the body to help reduce the level of glucose in the blood.

Biguanides: Also known as metformin, these are tablets which lower blood glucose levels by reducing the amount of stored glucose released by the liver, slowing the absorption of glucose from the intestine, and helping the body to become more sensitive to insulin so that its own insulin works better.

Sulphonylureas: This group of tablets lower blood glucose levels by stimulating the pancreas to release more insulin.

Thiazolidinediones: These medicines help to lower blood glucose levels by increasing the effect of the body's own insulin, especially on muscle and fat cells.

Alpha Glucosidase Inhibitors: These help to slow down the digestion and absorption of certain dietary carbohydrates.

Dipeptidyl peptidase 4 (DPP-4) inhibitors: These inhibit the enzyme DPP-4 which enhances the levels of active incretin hormones and act to lower blood glucose levels by increasing insulin secretion and decreasing secretion of glucagon (a hormone that has the opposite effect of insulin, that is, by increasing blood glucose levels).

Glucagon-like peptide-1 receptor agonists (GLP-1a): GLP-1 is a hormone that is produced in the body when you eat which stimulates the pancreas to secrete insulin to reduce blood glucose levels. Medicines belonging to the GLP-1 receptor agonist (GLP-1a) class mimic the effects of GLP-1 to reduce blood glucose level and are normally given as an injection.

Sodium-glucose transporter (SGLT2) inhibitors: These are a class of tablet which lower plasma glucose concentrations by increasing renal excretion of glucose (Diabetes Australia 2021).

In 2020–21, there were **over 16.5 million prescriptions** dispensed for diabetes medicines through Section 85 of the Pharmaceutical Benefits Scheme (PBS) and Repatriation Pharmaceutical Benefits Scheme (RPBS), representing 5.3% of total prescriptions. Over one third of those claims (5.4 million) were for metformin which was the seventh highest dispensed medicine, costing over $50 million from out-of-pocket payments and government subsidies.

Supply of diabetes medicines

The PBS and RPBS are Australian Government programs that subsidise approved prescriptions for medicines to make them more affordable. Medicines may be discounted through this subsidy and require a co-payment from the patient to reach the gap between the subsidy and the cost of the medicines. Some medicines are subsidised enough to be under the co-payment threshold and not require any further out-of-pocket costs to the person.

Prescriptions dispensed through the PBS for diabetes medicines increased by 24% between 2017–18 and 2020-21, from 13.4 million to 16.5 million (Figure 1). The increase across this period was due to PBS subsidised prescriptions which included an out-of-pocket expense for the person.

Prescriptions dispensed for diabetes medicines made up 5.3% of the total number of prescriptions dispensed in 2020–21, an increase of 18% from 2017–18 (4.5%).

Figure 1: Prescriptions dispensed for diabetes medicines, by co-payment status, 2017-18 to 2020-21

The chart shows the number of prescriptions dispensed for diabetes medicines, by co-payment status between 2017–18 and 2020–21. Over the period, diabetes medicines increased from 13.4 million to 16.5 million. The increase across this period was due to PBS subsidised prescriptions which included an out-of-pocket expense for the person.
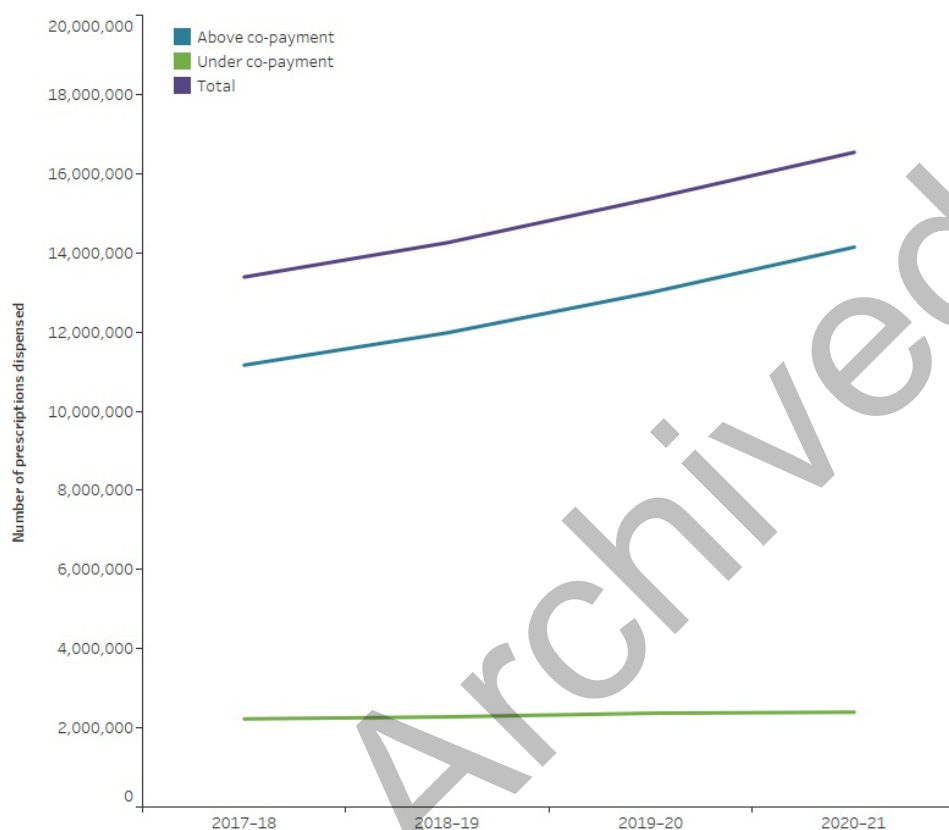
Figure 1: Prescriptions dispensed for diabetes medicines, by co-payment status, 2017–18 to 2020–21

Note:Includes PBS and RPBS Section 85 prescriptions supplied in Australia.
Chart: AIHW. Source:AIHW analysis of PBS and RPBS Section 85 Supply Data maintained by the Department of Health.
http://www.aihw.gov.au

Overall, prescriptions dispensed for thiazolidinediones and alpha glucosidase inhibitors have been decreasing over time, and there was a small decrease in the number dispensed for insulin in 2020–21. All other diabetes medicines have recorded increasing prescriptions dispensed over time. Combination therapies and other blood glucose lowering medications such as I GLP-1a recorded the largest increases from 2017–18 to 2020–21 (36% and 136%, respectively) (Figure 2).

Figure 2: Supply of diabetes medicines, by type, 2017-18 to 2020-21

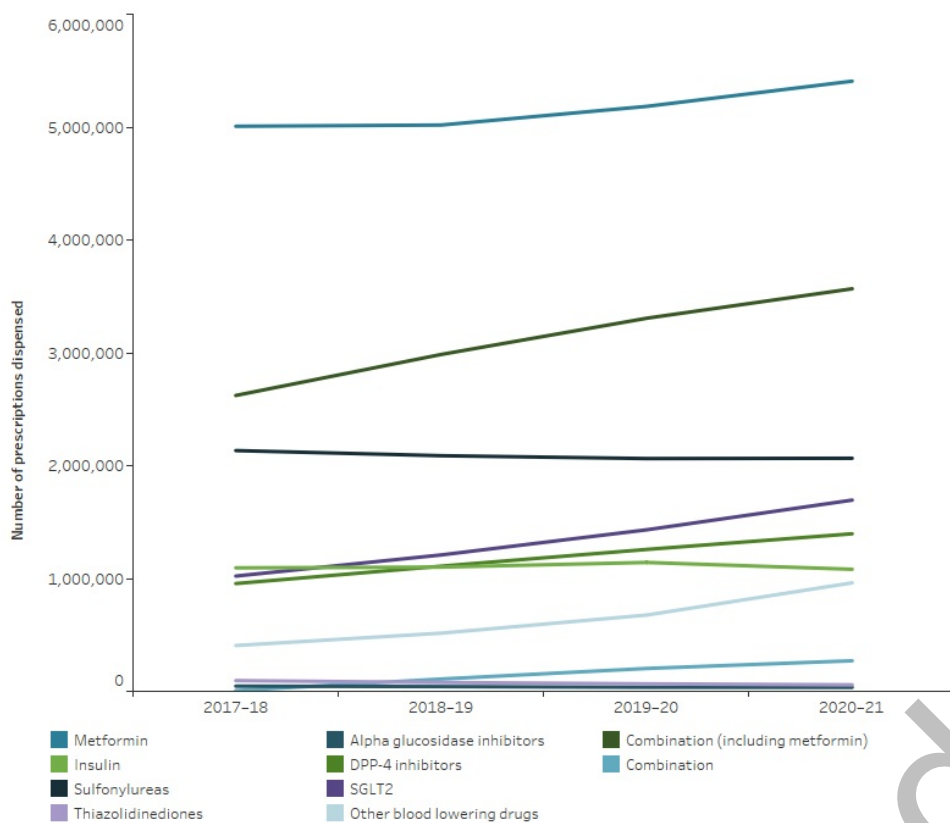**Figure 2: Supply of diabetes medicines, by type, 2017–18 to 2020–21**

Note: Includes PBS and RPBS Section 85 prescriptions supplied in Australia.
Chart: AIHW. Source:AIHW analysis of PBS and RPBS Section 85 Supply Data maintained by the Department of Health.
https://www.aihw.gov.au

Insulin use

Insulin is a hormone made by beta cells in the pancreas. For people living with type 1 diabetes, the body does not produce insulin and daily insulin injections or infusion via an insulin pump are required to survive. Not all people living with type 2 diabetes require insulin therapy initially, but most will require some form of insulin treatment to maintain blood glucose levels over time. For people with type 2 diabetes, insulin is now considered a second-line therapy after initial treatment with metformin, depending on the clinical context, and early intervention with insulin can be beneficial for long-term outcomes in some patients (Wong and Tabet 2015).

All diabetes

In 2021, 31,700 people registered on the National (insulin-treated) Diabetes Register (NDR) began using insulin to treat their diabetes. Of these:

- around 3,000 (9.5%) people were diagnosed with type 1 diabetes
- 15,600 (49%) people began using insulin to treat type 2 diabetes
- 12,300 (39%) females began using insulin to treat gestational diabetes
- 589 (1.9%) people began using insulin to treat other forms of diabetes.
- 253 (0.8%) people began using insulin for whom diabetes type was unknown.

Due to rounding, percentages do not sum to 100.

Type 2 diabetes

In 2021, around 15,600 people living with type 2 diabetes initiated insulin therapy according to the National (insulin-treated) Diabetes Register (1,700 per 100,000 population).

Age and sex

In 2021, the incidence of insulin therapy in people living with type 2 diabetes was:

- highest for both males and females aged 10–39 (3,900 and 7,500 per 100,000 population, respectively) and decreased with age (Figure 3)
- 4.2 times as high in people aged 10–39 as those aged 85 and higher (5,500 and 1,300 per 100,000 respectively)
- higher for males compared with females from age 45 onwards (Figure 3)
- overall, 1.6 times as high for females compared with males after adjusting for the different age structures of the population.

Figure 3: Incidence of insulin therapy for type 2 diabetes, by age and sex, 2021

The chart shows the incidence of insulin therapy for type 2 diabetes by age group in 2021. Rates were highest in males and females aged 10–39 (3,900 and 7,500 per 100,000 population, respectively).
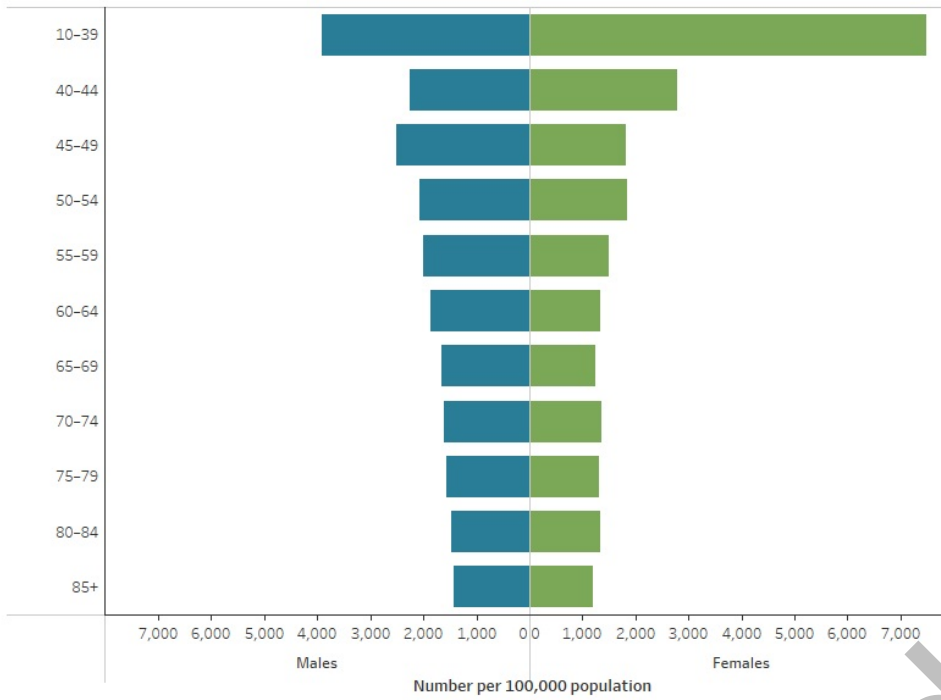
Figure 3: Incidence of insulin therapy for type 2 diabetes, by age and sex, 2021

Notes:
1.The prevalent population including all registrants with type 2 diabetes who have never used insulin were used as the denominator population to derive the incidence rates.
2. Due to small numbers and concerns about the data quality, data for 0–9 years were excluded from analysis.
3. Includes persons with missing or unassigned information on age and/or sex.
Chart: AIHW. Source: AIHW National (insulin-treated) Diabetes Register.
https://www.aihw.gov.au

Trends over time

After controlling for the age structure of the population, the incidence of insulin therapy for people living with type 2 diabetes decreased overall between 2000 and 2021 (down 8.5%) (Figure 4).

Figure 4: Incidence of insulin therapy for type 2 diabetes, by sex, 2000-2021

The chart shows a decline in the incidence rate of insulin therapy for people living with type 2 diabetes between 2000 and 2021 from around 4,000 to 3,700 per 100,000 population.
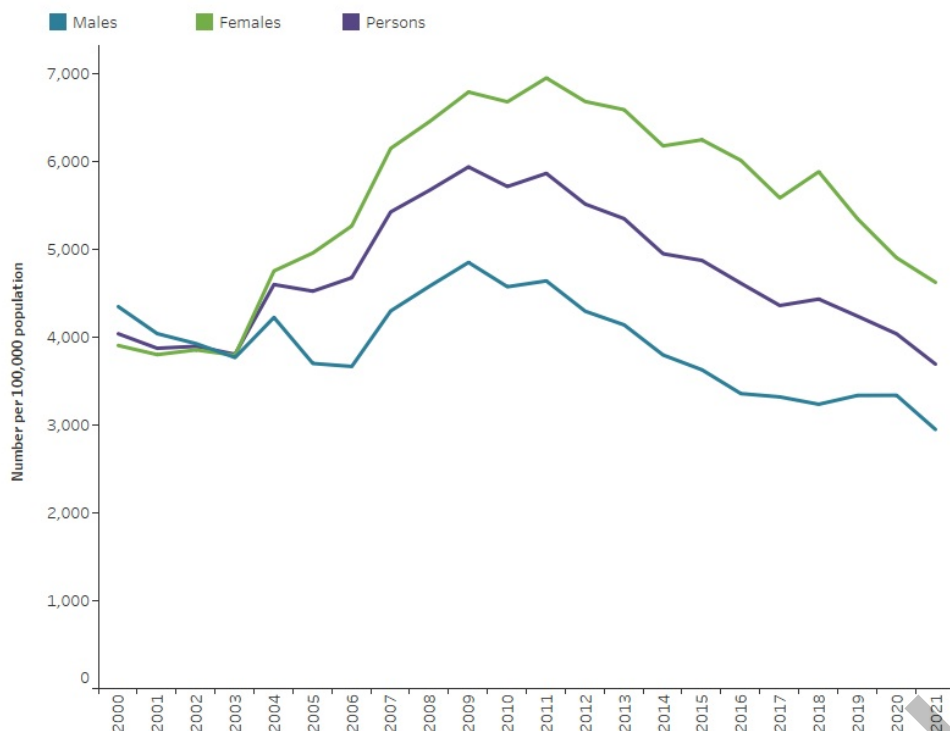
Figure 4: Incidence of insulin therapy for type 2 diabetes, by sex, 2000–2021

Notes:
1. Age-standardised to the 2001 Australian Standard Population.
2. The prevalent population including all registrants with type 2 diabetes who have never used insulin were used as the denominator population to derive the incidence rates.
3. Due to small numbers and concerns about the data quality, data for 0–9 years were excluded from analysis.
4. Includes persons with missing or unassigned information on age and/or sex.
Chart: AIHW. Source: AIHW National (insulin-treated) Diabetes Register.
https://www.aihw.gov.au

Variation between population groups

In 2021, the age-standardised incidence of insulin therapy for people living with type 2 diabetes:

- was higher among those living in *Major cities* and *Inner regional* areas compared with *Outer regional* and *Remote and very remote* areas
- was similar among socioeconomic areas (Figure 5).

Figure 5: Incidence of insulin therapy for type 2 diabetes, by selected population groups and sex, 2021

The chart shows that for males and females the incidence of insulin therapy in people living with type 2 diabetes in 2021, was lower among people living in remote and very remote areas, and similar among socioeconomic areas.

Figure 5: Incidence of insulin therapy for type 2 diabetes, by selected population group and sex, 2021

[Notes]

Chart: AIHW. Source: National (insulin-treated) Diabetes Register.
https://www.aihw.gov.au

Note: Incidence rates of insulin-treated type 2 diabetes for Indigenous Australians have been excluded from this report, as the NDR may underestimate the number of Aboriginal and Torres Strait Islander people with diabetes regis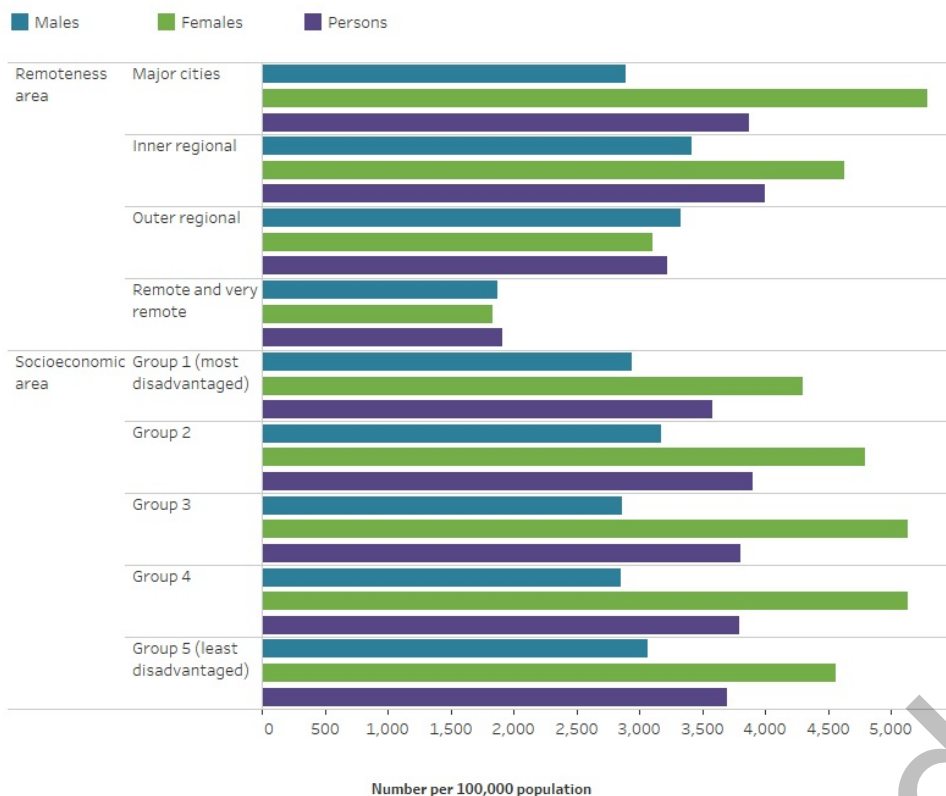tered. For more information see the 'Methods and classifications' section of the Australian Institute of Health and Welfare's *Incidence of insulin-treated diabetes in Australia* report.

Management of gestational diabetes

Of all females (aged 15–49) diagnosed with gestational diabetes in 2020–21, at the time of giving birth in hospital:

- 49% were recorded as having managed their condition without medication using diet, exercise and/or lifestyle management.
- 39% had been treated with insulin therapy.
- 8.4% had been treated with oral hypoglycaemic (blood glucose lowering) medications.
- The treatment type for 3.5% was unspecified.

Variation by age

In 2020–21, females who managed their gestational diabetes:

- without the use of medication were more likely to be younger, with those aged 15–19 being 1.4 times as likely to manage their condition using diet, exercise and/or lifestyle modifications compared with those aged 45 and over
- with the use of oral hypoglycaemic medications were more likely to be younger, with those aged 15–19 being 2.1 times as likely as those aged 45 and over to use this treatment type
- with the use of insulin (an indication of increasing gestational diabetes severity) were more likely to be older with those aged 45 and over being 2.5 times as likely to require this treatment type than those aged 15–19.

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Impact of diabetes

Impact of diabetes

Quality of life of people with diabetes

Quality of life has no agreed definition, but it reflects the perceived level of physical and social functioning as well as mental health and is recognised as an important component of health (Department of Health 2021). Diabetes is not only associated with increased morbidity and mortality, but also decreased quality of life. Diabetes-related complications further reduce quality of life compared to people without complications and the degree of impairment is related to the number and severity of complications (Tapp et al. 2006).

Self-assessed health was assessed using pooled self-reported data on long-term health conditions from the ABS 2014–15 and 2017–18 National Health Surveys to obtain populations living with and without diabetes (AIHW analysis of ABS 2016 and ABS 2019).

Adults aged 18 and over living with diabetes in the 2014–15 and 2017–18 National Health Surveys were more likely to rate their health as fair/poor compared with adults without diabetes (37% and 13%, respectively).

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Impact of diabetes

Page highlights:

Complications in primary care

- The most common <u>diabetic complications</u> present among adults living with diabetes attending services for diabetes care in 2021 were sexual dysfunction (12%), congestive cardiac failure (4.0%) and end-stage kidney disease (4.0%).

Pregnancy complications

- In 2020–21, compared to mothers without diabetes, mothers living with pre-existing diabetes (and to a lesser extent, gestational diabetes), were <u>more prone to complications</u> during pregnancy and intervention in childbirth.

Diabetes-related complications are significant factors contributing to morbidity and mortality in Australia and are associated with increases in the costs associated with the treatment and management of diabetes (Lee et al. 2013; Twigg and Wong 2015). Diabetes is associated with both microvascular and macrovascular complications, especially in those with out-of-range diabetes management and higher long-term blood glucose levels (Stratton et al. 2000).

Diabetes complications may include:

- microvascular complications to the eye (retinopathy), kidney (nephropathy), and nerves (neuropathy)
- macrovascular complications affecting the circulatory system including ischemic heart disease, peripheral vascular disease and cerebrovascular disease
- an increased risk of other complications developing including foot ulcers (Reardon et al. 2020).

High blood glucose levels can also cause acute hyperglycaemic emergencies (Deed et al. 2018). These emergencies include:

- Ketoacidosis which is a life-threatening complication characterised by hyperglycaemia and high levels of blood acids (ketones) which is mostly found in people with type 1 diabetes.
- Hyperosmolarity which draws water from the body's organs and is characterised by persistent hyperglycaemia without ketoacidosis, and is accompanied by profound dehydration.

Complications in primary care

The 2021 <u>Australian Quality Clinical Audit 2021 Annual Report</u> includes data collected for around 4,500 adults living with diabetes attending services for diabetes care. Many of these patients recorded complications related to diabetes.

In the last 12 months, the most common diabetic complications present in the cohort were:

- sexual dysfunction (12%)
- congestive cardiac failure (4.0%)
- end-stage kidney disease (4.0%)
- myocardial infarction (2.9%)
- CABG/angioplasty/stent (2.7%)
- blindness (1.9%)
- cerebral stroke (1.3%).

Prior to the last 12 months, the most common diabetic complications present in the cohort were:

- sexual dysfunction (12%)
- CABG/angioplasty/stent (10%)
- myocardial infarction (10%)
- cerebral stroke (5.0%)
- congestive cardiac failure (5.0%)
- end-stage kidney disease (5.0%)
- blindness (1.6%).

The most common foot complication reported in the cohort was peripheral neuropathy, which was recorded for 22% of patients in the last 12 months. Other diabetic foot complications in the last 12 months included foot ulceration (5.8%), peripheral vascular disease (7.6%) and lower limb amputation (1.7%).

Almost two-fifths of the cohort exhibited a form of proteinuria, either microalbuminuria (28%) or macroalbuminuria (10%) and more than a third of patients (33%) had chronic kidney disease (CKD). 56% of diabetes patients with CKD had middle-stage CKD (stage 3 or 4) (Australian National Diabetes Audit 2021).

Pregnancy complications

Diabetes in pregnancy, whether pre-existing (that is, type 1, type 2 or other diabetes type) or arising as a result of the pregnancy (gestational diabetes), is associated with an increased risk of adverse outcomes for the mother and child both during pregnancy, labour and delivery and in the longer term.

> **Note:** The National Hospital Morbidity Database provides national data on pregnancies affected by diabetes, but International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification (ICD-10-AM) coding changes and the accuracy of recording diabetes type affect the ability to report on the number of pregnancies affected by and complications from pre-existing diabetes type. Further, in some cases, 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).

Short-term outcomes

The complications and adverse outcomes experienced by mothers and their babies during pregnancy and delivery, vary between the types of diabetes (whether pre-existing or gestational diabetes), most likely due to the causes and effects of each diabetes type (AIHW 2019).

In 2020–21, compared to mothers without diabetes, mothers living with pre-existing diabetes (and to a lesser extent, gestational diabetes), were more prone to complications during pregnancy and intervention in childbirth. Having controlled for differences in the age structure of the populations, such complications include caesarean section, induced labour, maternal care for excessive fetal growth, pre-eclampsia and preterm birth (Figure 1).

Figure 1: Selected birth and pregnancy outcomes, by diabetes status, 2020–21

The horizontal bar chart shows selected birth and pregnancy outcomes for females by birth status in 2020–21. Compared to mothers without diabetes, mothers living with pre-existing diabetes (and to a lesser extent, gestational diabetes), were more prone to complications during pregnancy and childbirth such as caesarean section, induced labour, maternal care for excessive fetal growth, pre-eclampsia and preterm birth.
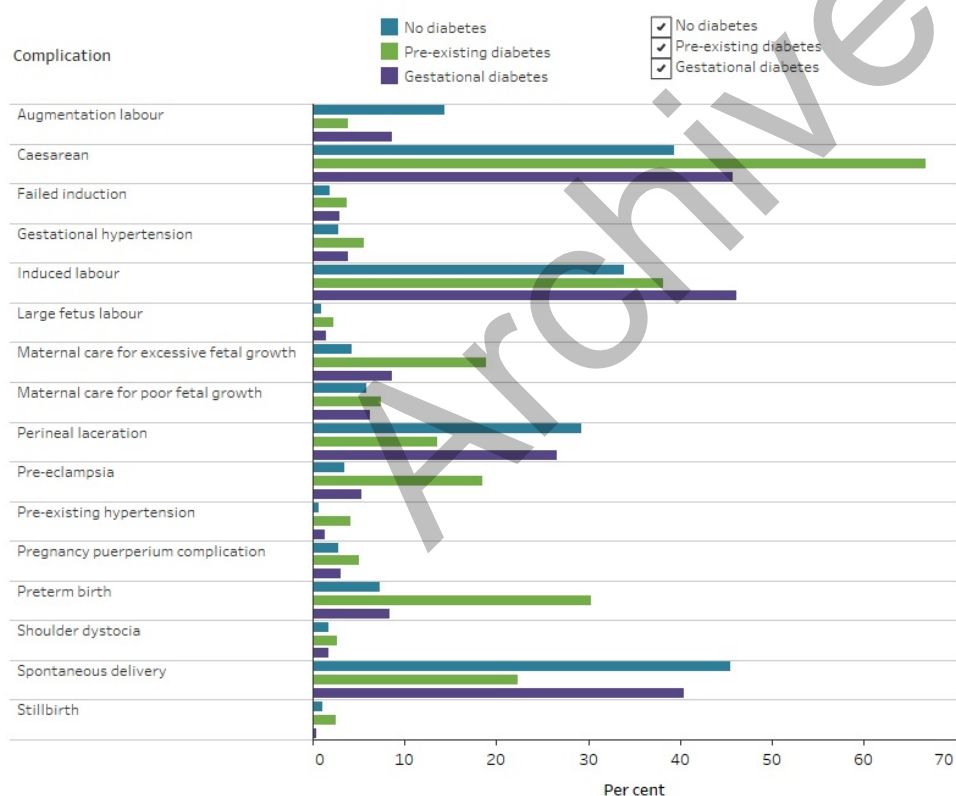
Figure 1: Selected birth and pregnancy outcomes, by diabetes status, 2020–21
Notes
1. Age-standardised to the 2001 Australian Standard Population.
2. Pre-existing diabetes includes type 1, type 2 and other diabetes.
Chart: AIHW. Source:AIHW National Hospital Morbidity Database.
https://www.aihw.gov.au

Longer-term outcomes

Diabetes in pregnancy is also associated with longer-term adverse outcomes for both mother and baby. For women diagnosed with gestational diabetes this includes an increased risk of recurrence of the condition in subsequent pregnancies with studies showing recurrence rates to vary between 30% and 84% (Kim et al. 2007). They also experience an increased risk for the development of type 2 diabetes, metabolic syndrome and cardiovascular disease.

Babies of mothers living with diabetes in pregnancy are also at an increased risk of childhood metabolic syndrome, obesity, impaired glucose tolerance and type 2 diabetes in later life (Clausen et al. 2007; Kim et al. 2012; Zhao et al. 2016).

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Impact of diabetes

Page highlights:

Type 1 diabetes burden

- In 2022, type 1 diabetes was responsible for around 19,000 DALY in Australia – equating to 0.7 DALY per 1,000 population.
- The proportion of fatal and non-fatal burden was similar (49% and 51%, respectively).

Type 2 diabetes burden

- In 2022, type 2 diabetes was the 12th highest disease-specific cause of DALY at 3.9 per 1,000 population.
- 61% of the burden attributed to type 2 diabetes was non-fatal.

Risk factors for diabetes burden

- In 2018, the 3 leading risk factors contributing to type 2 diabetes total burden were overweight and obesity, diet and physcial inactivity.

What is burden of disease?

Burden of disease is a measure of the years of healthy life lost from living with or dying from disease and injury. The measure used is the 'disability-adjusted life year' (DALY). This combines health loss from living with illness and injury (non-fatal burden, or YLD) and dying prematurely (fatal burden, or YLL) to estimate total health loss (total burden, or DALY). Burden of disease estimates seek to capture both the quantity and health-related quality of life, and to reflect the magnitude, severity and impact of disease and injury within a population. Burden of disease does not quantify the social or financial consequences of disease and injury. Further information can be found in _Australian Burden of Disease Study 2022_ (ABDS).

Note: The ABDS 2022 does not include estimates by Remoteness areas, Socioeconomic groups or risk factors. The most recent estimates are presented in the _Australian Burden of Disease Study: Impact and causes of illness and death in Australia 2018_ and _Australian Burden of Disease Study 2018: Interactive data on risk factor burden_ reports.

Type 1 diabetes burden

In 2022, type 1 diabetes was responsible for around 19,000 DALY in Australia – equating to 0.7 DALY per 1,000 population.

The proportion of fatal and non-fatal burden was similar with 49% (9,400 YLL) attributed to fatal burden and 51% (9,600 YLD) attributed to non-fatal burden.

Variation by age and sex

In 2022:

- Overall DALY rates were highest among people aged 50–54 (1.1 per 1,000 population)
- DALY were highest among males aged 50–54 and females aged 30–34 (1,121 and 815 DALY, respectively) (Figure 1)
- Age-standardised DALY rates were 1.5 times as high among males as females.

Figure 1: Type 1 diabetes total burden (DALY), by age group and sex, 2022

The chart shows the burden of type 1 diabetes in 2022 was higher among males than females and older Australians. DALY were highest among males aged 50–54 and females aged 30–34 (1,121 and 815 DALY, respectively).

Figure 1: Type 1 diabetes total burden (DALY), by age group and sex, 2022

Chart: AIHW. Source: Australian Burden of Disease Database.
https://www.aihw.gov.au

Trends over time

Between 2003 and 2022, there was a 27% increase in non-fatal burden (YLD) attributed to type 1 diabetes. This further coincides with a 27% decrease in the fatal burden from years of lost life (YLL).

Variation between population groups

The overall burden of type 1 diabetes was higher among people living in lower socioeconomic areas and in *Inner regional* areas compared with other socioeconomic areas and remoteness areas. In 2018, after adjusting for different population age structures:

- rates were 1.5 times as high among those living in *Inner regional* areas compared with those living in *Major cities*.
- rates were over 2 times as high amongst those living in the lowest socioeconomic area (highest disadvantage) compared with those living in the highest socioeconomic area (Figure 2).

Figure 2: Type 1 diabetes total burden (DALY), by select population groups, 2018

The horizontal bar chart shows that the burden of type 1 diabetes for males and females were highest among people living in inner regional areas, and people living in the lowest socioeconomic areas.

Figure 2: Type 1 diabetes total burden (DALY), by select population groups, 2018

Notes:
1. Age-standardised to the 2001 Australian Standard Population.
2. Prevalence estimates and deaths with insufficient geographic detail to align to a remoteness area are excluded from the analysis.
Chart: AIHW. Source: Australian Burden of Disease Database.
https://www.aihw.gov.au

Aboriginal and Torres Strait Islander people

In 2018, type 1 diabetes was responsible for 596 DALY among Aboriginal and Torres Strait Islander people in Australia – equating to 0.7 DALY per 1,000 population.

The proportion attributed to fatal burden was higher (58%, or 343 YLL) than that attributed to non-fatal burden (42% or 253 YLD).

Between 2003 and 2018, there was a 57% decrease in the age-standardised DALY per 1,000 population, attributed to type 1 diabetes among Aboriginal and Torres Strait Islander people (AIHW 2022a).

Type 2 diabetes burden

In 2022, type 2 diabetes was the 12th highest disease-specific cause of DALY at 3.9 per 1,000 population (AIHW 2022).

Sixty-one per cent (76,400 YLD) of burden attributed to type 2 diabetes was non-fatal, with the remaining 39% (49,100 YLL) of the total burden being fatal.

Variation by age and sex

The overall burden attributed to type 2 diabetes was higher in males and older Australians.

In 2022:

- the overall disease burden attributed to type 2 diabetes was 1.5 times as high among males as females
- 52% (65,500 DALY) of DALY attributed to type 2 diabetes occurred in persons aged 65–84
- in the 65–69 year age group, DALY in males were over 1.6 times those in females (11,200 and 6,800, respectively)
- in females aged 90–94, DALY attributed to type 2 diabetes were 1.2 times as high as their male counterparts (2,200 and 1,800, respectively) (Figure 3).

Figure 3: Type 2 diabetes total burden (DALY), by age group and sex, 2022

The chart shows the burden of type 2 diabetes in 2022 was higher among males and older Australians. DALY were highest among males aged 65–69 and females aged 70–74 (11,189 and 7,092 DALY, respectively).
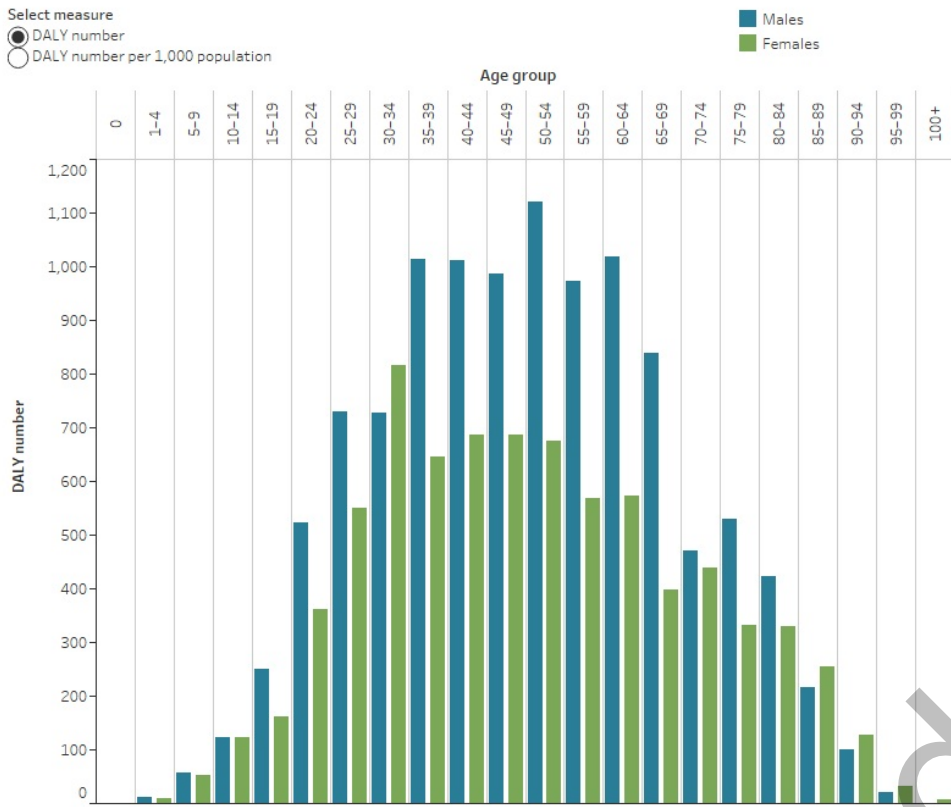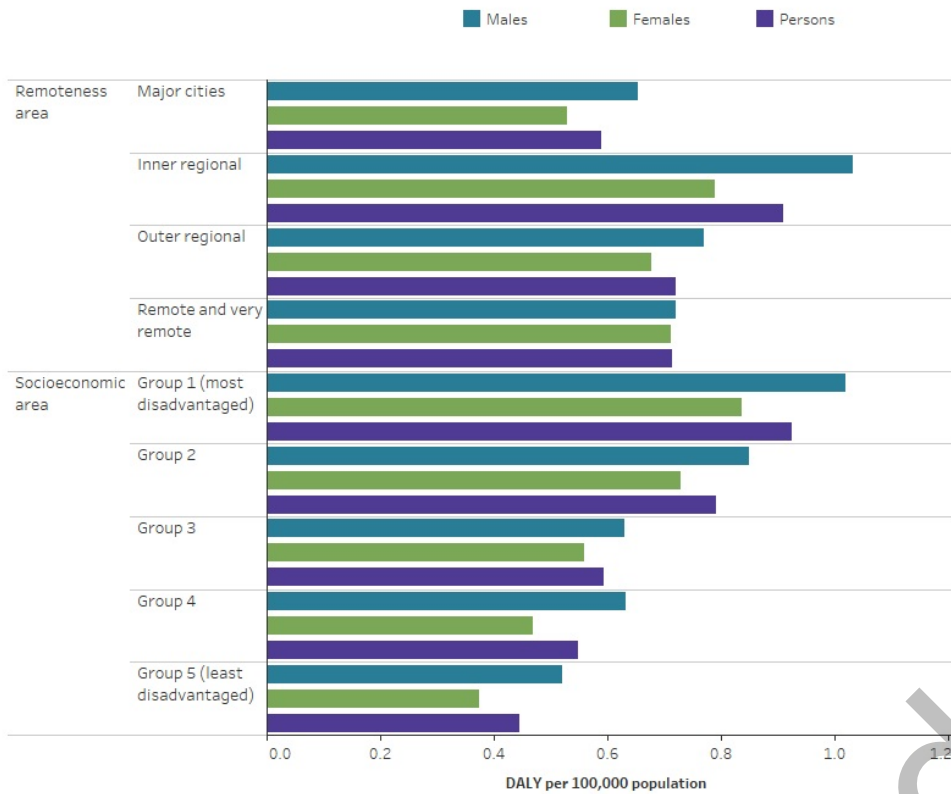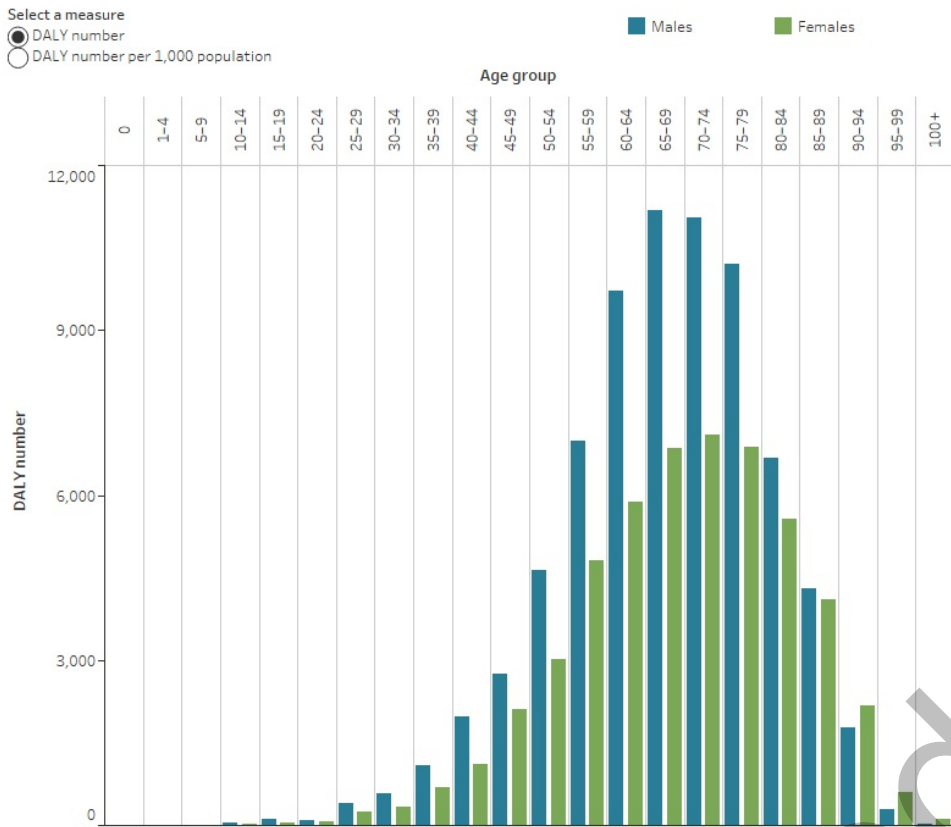
Figure 3: Type 2 diabetes total burden (DALY), by age group and sex, 2022

Chart: AIHW. Source: Australian Burden of Disease Database.
https://www.aihw.gov.au

Trends over time

Between 2003 and 2022, there was a 21% increase in non-fatal burden of type 2 diabetes, from 1.9 to 2.4 YLD per 1,000 population. However, there was a 25% decrease in the rate of fatal burden for the same time period, from 2.0 to 1.5 YLL per 1,000 population.

Variation between population groups

The overall burden of type 2 diabetes varied by socioeconomic areas and remoteness areas. In 2018, after adjusting for different population age structures:

- rates in *Remote and very remote* areas were 2 times as high as *Major cities*.
- rates were 2.4 times as high in those living in the lowest socioeconomic group compared with those living in the highest socioeconomic area (Figure 4).

Aboriginal and Torres Strait Islander people

In 2018, type 2 diabetes was responsible for around 7,000 DALY among Aboriginal and Torres Strait Islander people in Australia – equating to 8.4 per 1,000 population.

The proportion attributed to fatal burden (46% or 3,000 YLL) was slightly lower than that attributed to non-fatal burden (57% or 4,000 YLD).

Between 2003 and 2018, there was a 42% decrease in the age-standardised DALY per 1,000 attributed to type 2 diabetes among Aboriginal and Torres Strait Islander people (AIHW 2022a).

Figure 4: Type 2 diabetes total burden (DALY), by selected population groups, 2018

The horizontal bar chart shows that the burden of type 1 diabetes for males and females were highest among people living in remote and very remote areas, and people living in the lowest socioeconomic areas.
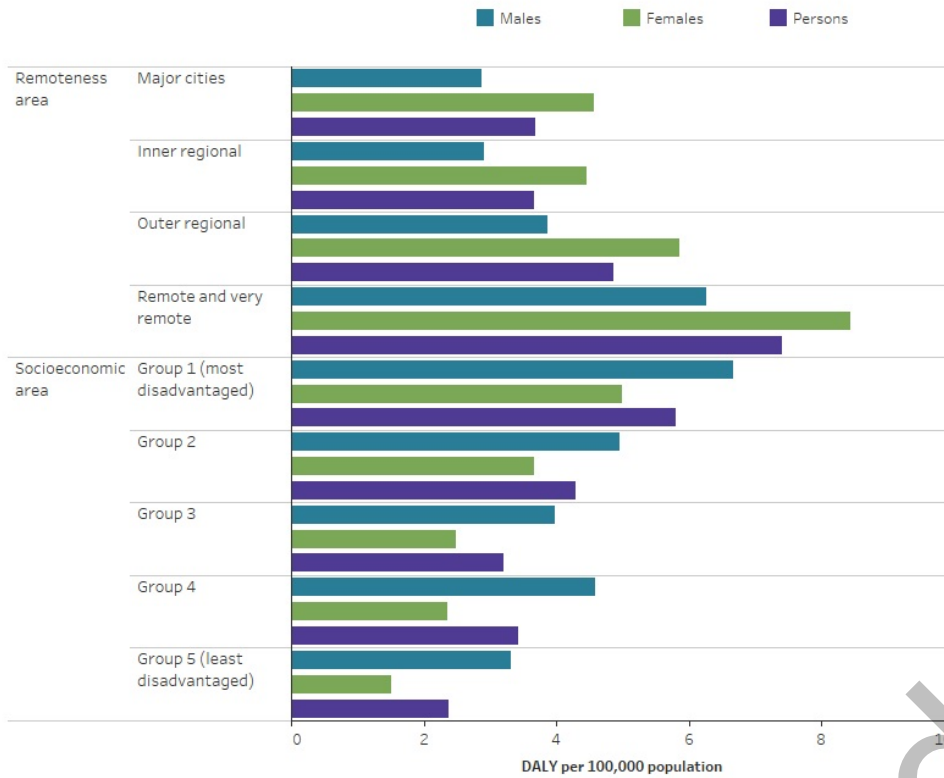
Figure 4: Type 2 diabetes total burden (DALY), by selected population groups, 2018

Notes:
1. Age-standardised to the 2001 Australian Standard Population.
2. Prevalence estimates and deaths with insufficient geographic detail to align to a remoteness area are excluded from the analysis.
Chart: AIHW. Source: Australian Burden of Disease Database.
http://www.aihw.gov.au

Risk factors for type 2 diabetes burden

Behavioural, environmental and biomedical risk factors commonly impact an individual's health and increase the risk of disability, injury or death. In 2018:

- Over one-third of type 2 diabetes total burden was attributable to overweight and obesity (37% in males and 35% in females).
- Around 19% of type 2 diabetes total burden was attributable to dietary risk factors for both males and females.
- Physical inactivity attributed a larger proportion of total burden for type 2 diabetes in females than males (14.8% and 12.8%, respectively).
- Tobacco use attributed a larger proportion of total burden for type 2 diabetes in males than females (3.7% and 1.0%, respectively) (AIHW 2021).

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Impact of diabetes

Page highlights:

How many deaths are associated with diabetes in Australia?

- Diabetes contributed to around 19,300 deaths in 2021 (11.2% of all deaths) and was among the 10 leading causes of death in Australia.

- Males were 1.7 times as likely to die from diabetes as females.
- Age-standardised mortality rates for diabetes (underlying and/or associated cause) increased by 3.7% between 2020 and 2021.
- There were 833 deaths associated with diabetes among Aboriginal and Torres Strait Islander people in 2021.

How many deaths are associated with diabetes in Australia?

Diabetes was among the 10 leading causes of death of Australians in 2021 (ABS 2021), contributing to around 19,300 deaths (11.2% of all deaths) according to the National Mortality Database. Diabetes was the underlying cause of death in around 5,400 deaths (28% of diabetes deaths). It was an associated cause of death in a further 13,900 deaths (72% of diabetes deaths).

Where diabetes was listed as the underlying and/or associated cause of death:

- 4.2% were due to type 1 diabetes
- 58% were due to type 2 diabetes
- 38% were due to other or unspecified diabetes.

Note:

- Examining only the underlying cause of death can underestimate the impact of diabetes on mortality (Harding et al. 2014). This is because it is often not diabetes itself that leads directly to death, but one of its complications that will be listed as the underlying cause on the death certificate. See Diseases commonly associated with diabetes deaths for further information.
- Further, deaths from diabetes are known to be under-reported in national mortality statistics, as diabetes is often omitted from death certificates as a cause of death (McEwen et al. 2011; Whittall et al. 1990).

Variation by age and sex

In 2021, mortality rates for diabetes (as the underlying and/or associated cause):

- increased with increasing age, with rates 2.2 times as high in those aged 85 and over compared with those aged 80–84 and 4.1 times as high as those aged 75–79 (Figure 1)
- were 1.7 times as high in males compared with females, after controlling for age
- were highest in those aged 85 and over for both males and females at 1,600 and 1,200 per 100,000 population, respectively.

Figure 1: Diabetes death rates, by cause of death type, age and sex, 2021

The chart shows the diabetes death rates by cause of death type, age and sex in 2020. Diabetes death rates (as any cause of death) were highest among males in each age group from 50 and over and increased with increasing age, peaking among those aged 85 and over.

Figure 1: Diabetes death rates, by cause of death type, age and sex, 2021

Note: Includes persons with missing or unassigned information on age and/or sex.
Chart: AIHW. Source: National Mortality Database.
https://www.aihw.gov.au

Trends over time

Age-standardised mortality rates for diabetes (as the underlying and/or associated cause) have remained relatively stable since 2000, with a slight increase of 3.7% between 2020 and 2021.

Between 2000 and 2021:

- total deaths related to diabetes increased from 5,400 to 10,900 for males and 4,700 to 8,400 for females.
- age-standardised diabetes mortality rates (underlying and/or associated cause) were consistently 1.6–1.7 times as high among males as females (Figure 2).

Note: The Australian Bureau of Statistics (ABS) *Provisional Mortality Statistics* focus on monitoring patterns of mortality and highlight any changes potentially associated with the COVID-19 pandemic. According to ABS *Provisional Mortality Statistics*, in 2022, the number of doctor-certified deaths due to diabetes (as the underlying cause) was 17.3% above the baseline average (comprising the years 2017–2019 and 2021). See Diabetes deaths during COVID-19 for more information.

Figure 2: Diabetes death rates by cause of death type and sex, 2000-2021

The chart shows the trend in diabetes death rates, by cause of death type between 2000 and 2020. Diabetes death rates (as any cause of death) peaked overall in 2008 and have gradually declined since then with rates in 2020 slightly below those seen in 2008. Though death rates are around 1.7 times higher among males than females, the trends are similar among the sexes.
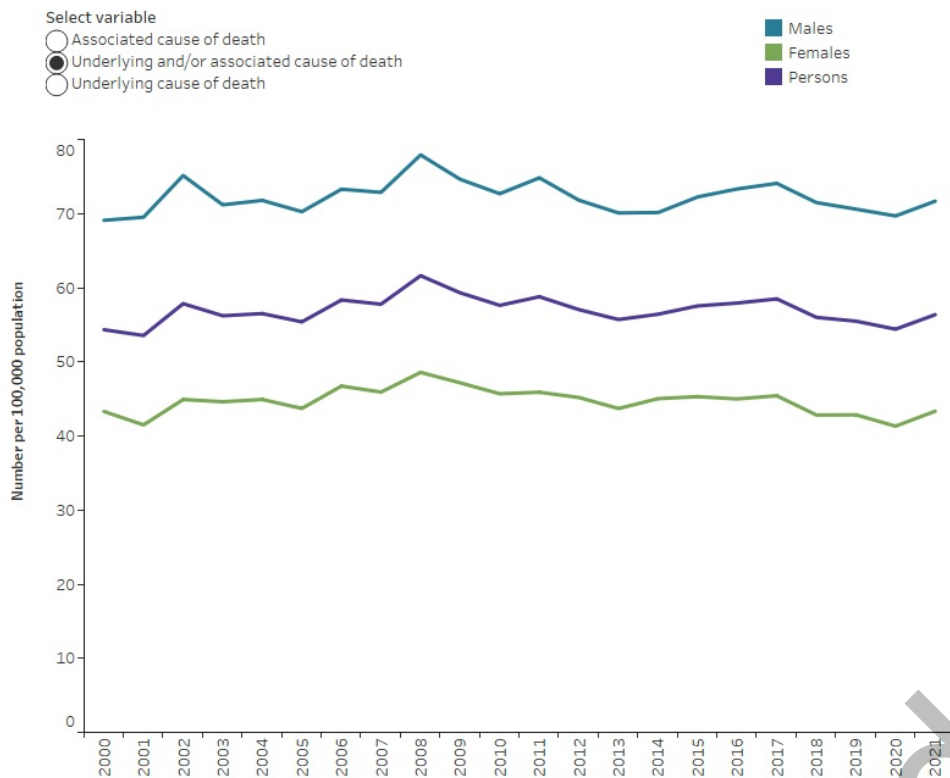
Select variable
○ Associated cause of death
◉ Underlying and/or associated cause of death
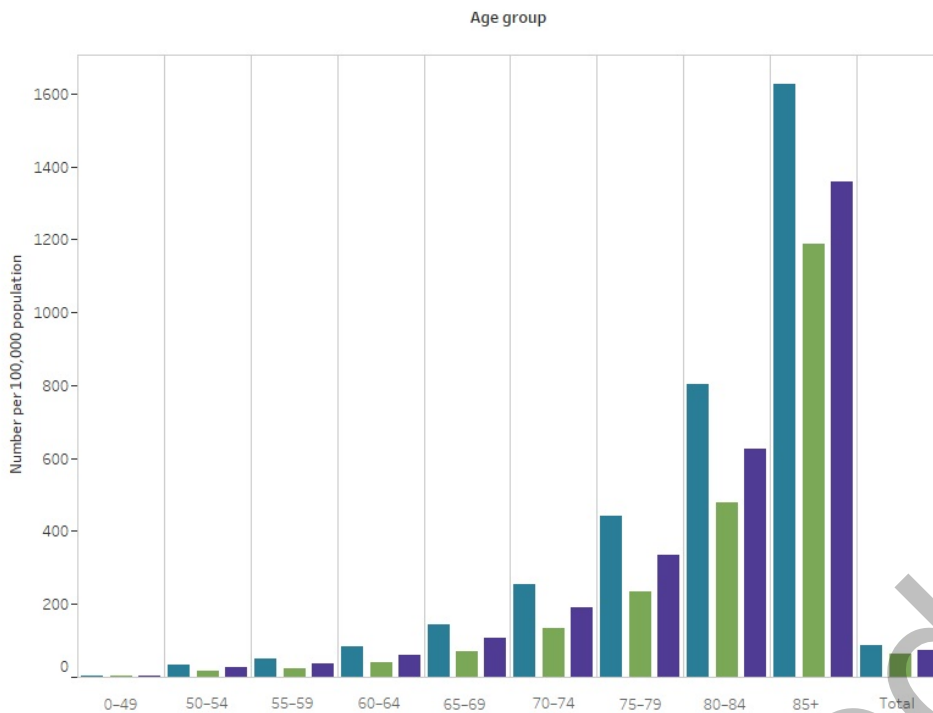○ Underlying cause of death

■ Males
■ Females
■ Persons

Figure 2: Diabetes death rates by cause of death type and sex, 2000–2021

Notes:
1. Age-standardised to the 2001 Australian Standard population.
2. Includes persons with missing or unassigned information on age and/or sex.
Chart: AIHW. Source: National Mortality Database.
https://www.aihw.gov.au

Variation between population groups

Aboriginal and Torres Strait Islander people

There were 833 deaths from diabetes (as the underlying and/or associated cause) among Aboriginal and Torres Strait Islander people in 2021, a rate of 108 per 100,000 population. Almost half (46%) of Indigenous Australian deaths from diabetes occurred in those aged under 65. Indigenous males and females aged 85 and over had the highest mortality rate across all age groups (3,700 and 4,200 cases per 100,000 population, respectively) (Figure 3).

After adjusting for differences in the age structure of the populations, diabetes death rates were 4.4 times as high among Indigenous Australians as non-Indigenous Australians (Figure 4).

Note: Data for diabetes deaths among Aboriginal and Torres Strait Islander people are reported for 5 jurisdictions, including New South Wales, Northern Territory, Queensland, South Australia and Western Australia. Data quality issues and the small number of Indigenous deaths makes the data less reliable in the other jurisdictions.

Figure 3: Diabetes death rates for Aboriginal and Torres Strait Islander people, underlying and/or associated cause of death, by age group and sex, 2021

The chart shows the diabetes deaths rates as an underlying and/or associated cause of death for Aboriginal and Torres Strait Islander people by age group and sex in 2020. Death rates increased with increasing age peaking among males at age 80–84 and females at age 85 and over (2,444 and 2,201 per 100,000 population, respectively). Rates were higher among males than females from age 65–69 to 80–84, were similar among the sexes for those aged below 60 and higher among females from age 85 and over.
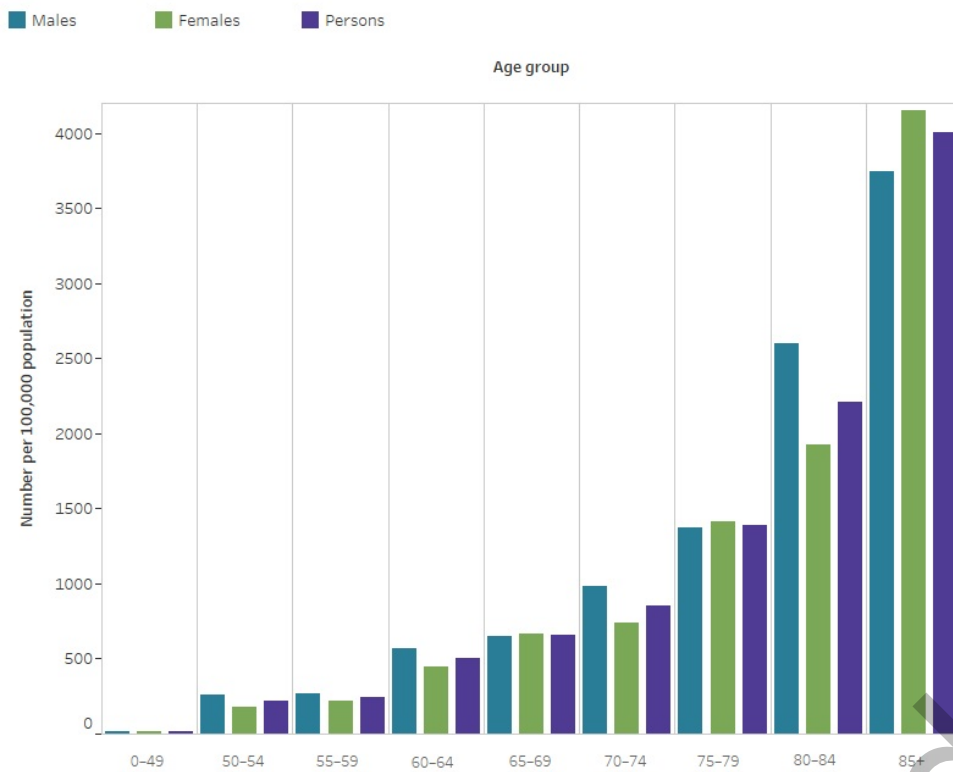
Figure 3: Diabetes death rates for Aboriginal and Torres Strait Islander people, underlying and/or associated cause of death, by age group and sex, 2021

[Notes]

Chart: AIHW. Source: National Mortality Database.
https://www.aihw.gov.au

Remoteness area

In 2021, after adjusting for differences in the age profile of the populations, diabetes death rates (as the underlying and/or associated cause) increased with the level of remoteness with rates being 2.2 times as high in *Remote and very remote* areas as in *Major cities*. This disparity was more pronounced among females than males (2.7 and 1.8 times as high, respectively) (Figure 4).

Socioeconomic area

In 2021, diabetes death rates (as the underlying and/or associated cause) increased with increasing levels of socioeconomic disadvantage. After adjusting for differences in the age structure of the populations, rates were 2.4 times as high among those living in the lowest socioeconomic areas as those living in the highest socioeconomic areas. This disparity was slightly higher among females than males (2.5 and 2.2 times as high, respectively) (Figure 4).

Figure 4: Diabetes death rates, underlying and/or associated cause of death, by selected population group and sex, 2021

The chart shows the age-standardised diabetes death rates as the underlying and/or associated cause by selected population group and sex in 2020. Overall, diabetes death rates increased with increasing levels of socioeconomic disadvantage being 2.4 times as higher among those living in the most disadvantaged areas as those living in the least disadvantaged areas. Diabetes death rates also increase with the level of remoteness being 1.8 times as high among those living in Remote and very remote areas as Major cities. Indigenous Australians were 5 times as likely to die from diabetes as non-Indigenous Australians.
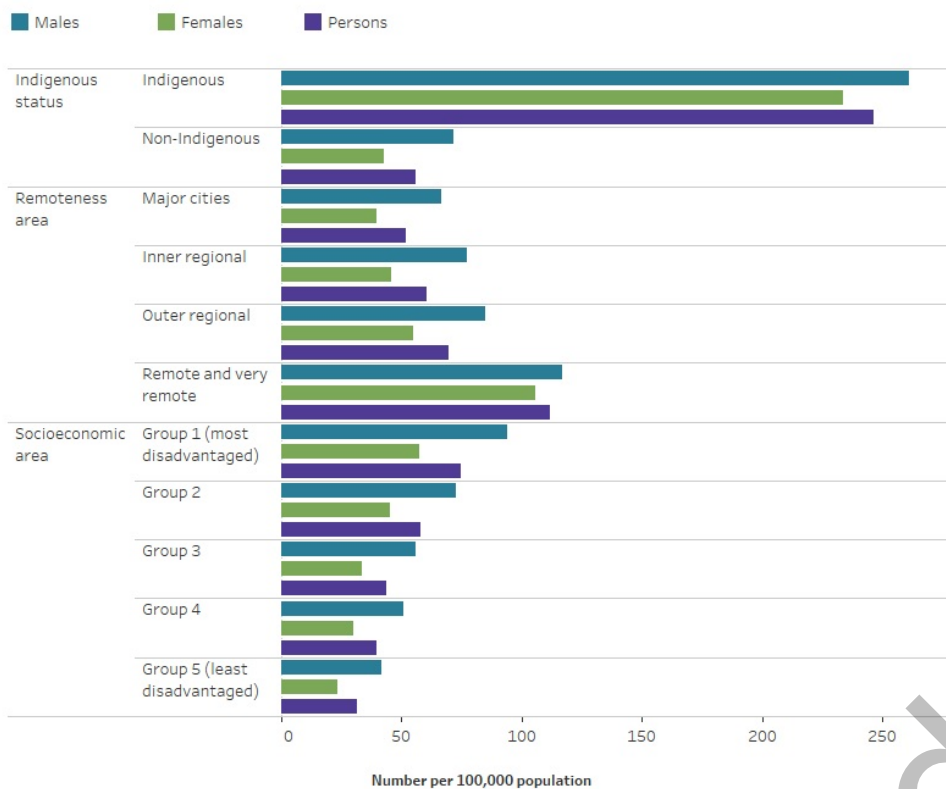
Figure 4: Diabetes death rates, underlying and/or associated cause of death, by selected population group and sex, 2021

[Notes]

Chart: AIHW. Source: AIHW National Mortality Database.
https://www.aihw.gov.au

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Impact of diabetes

Page highlights:

How much is spent on diabetes?

- In 2019–20, an estimated $3.1 billion of expenditure in the Australian health system was attributed to diabetes, representing 2.2% of total disease expenditure.

Type 1 diabetes

- In 2019–20, an estimated $323.7 million of health system expenditure was attributed to type 1 diabetes with 47% ($152.1 million) spent on hospital services.

Type 2 diabetes

- $2.0 billion of expenditure in the Australian health system was attributed to type 2 diabetes in 2019–20 with hospital services accounting for 42% ($838.5 million).

Gestational diabetes

- In 2019–20, an estimated $63.6 million of health system expenditure was attributed to gestational diabetes with hospital services accounting for 84% ($53.4 million).

What is health system expenditure on diabetes?

This section provides recent data on health system expenditure on diabetes, with details by diabetes type, health-care service, age group, and sex. It includes expenditure by the Australian Government, state, territory and local governments and the non-government sector (including private health insurance and individual contributions). These estimates report direct, allocated and recurrent expenditure only. They do not account for the total amount spent on diabetes health.

Further information on how the estimates were derived is available from *Disease expenditure in Australia*.

How much is spent on diabetes?

Of the $3.1 billion health system expenditure attributed to diabetes in 2019–20, an estimated:

- $323.7 million was attributed to type 1 diabetes.
- $2.0 billion was attributed to type 2 diabetes.
- $63.6 million was attributed to gestational diabetes.
- $767.1 million was attributed to 'other/unknown' diabetes (AIHW 2021).

Note: Due to the high number of 'other/unknown' diabetes caution should be used when interpreting data by diabetes type.

Where is the money spent?

In 2019–20, 39% ($1.2 billion) of total health system expenditure attributed to diabetes was for hospital services. This included expenditure on public hospital admitted patients ($758.0 million), public hospital outpatients ($374.2 million), private hospital services ($86.4 million), and public hospital emergency departments ($20.4 million). Medications dispensed through the Pharmaceutical Benefits Scheme (PBS) was the single highest area of spending with just over a quarter of total diabetes expenditure ($827.7 million) (Figure 1).

Figure 1: Health care expenditure on diabetes, by diabetes type and area of expenditure, 2019-20

The chart shows health care expenditure on diabetes by type and area of expenditure in 2019–20. For all diabetes, type 1 and type 2 diabetes medications dispensed through the Pharmaceutical Benefits Scheme was the highest area of expenditure followed by public hospital admitted patients. For other diabetes, the highest area of health care expenditure were public hospital outpatients followed by medications dispensed through the pharmaceutical benefits scheme.
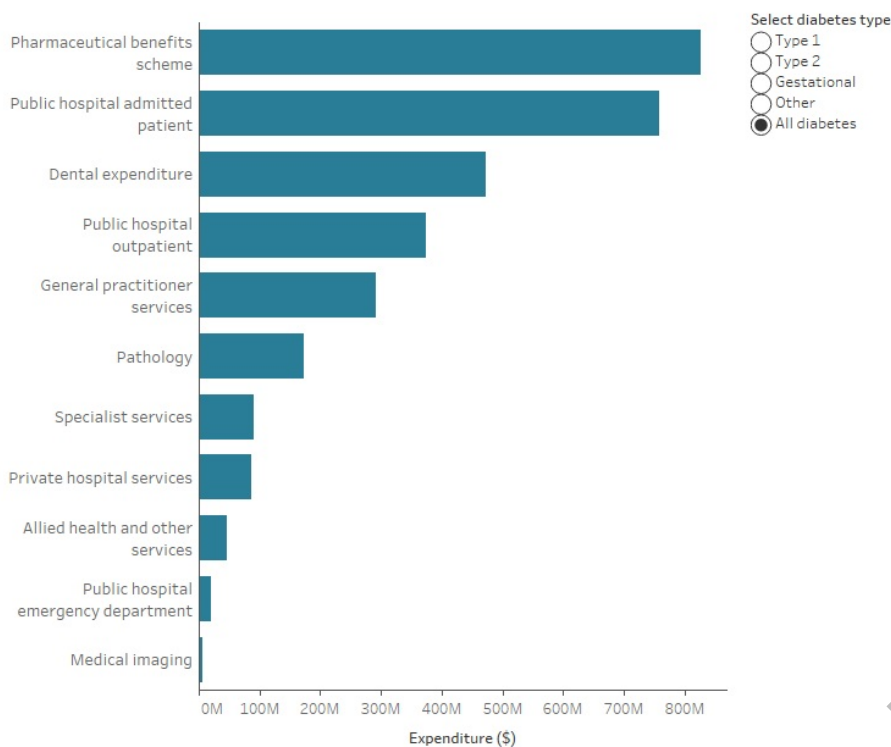
Figure 1: Health care expenditure on diabetes, by diabetes type and area of expenditure, 2019–20

Note: Pharmaceutical benefit expenditure includes over and under copayment prescriptions.
Chart: AIHW. Source: AIHW Disease Expenditure Database.
https://www.aihw.gov.au

Who is the money spent on?

The health system expenditure attributed to all diabetes varies significantly according to age and sex.

In 2019–20:

- total disease expenditure was about 1.3 times as high in males compared with females ($1.5 billion and $1.2 billion, respectively).
- total diabetes expenditure generally increased with increasing age with 63% being spent on people aged 55 and over and peaking in the 70–74 age group at $387.4 million (Figure 2).

Figure 2: Health care expenditure on diabetes (all areas), by diabetes type, age and sex, 2019-20

The chart shows the overall health care expenditure on diabetes by 5-year age group and sex in 2019–20 by diabetes type. Expenditure increased with increasing age for all diabetes types except for type 1 diabetes, where expenditure was highest among the younger age groups between 10 and 34 years, increasing again among those aged 50 and over.

Figure 2: Health care expenditure on diabetes (all areas), by diabetes type, age and sex, 2019–20

Chart: AIHW. Source: AIHW Disease Expenditure Database.
https://www.aihw.gov.au

Type 1 diabetes

Where is the money spent?

In 2019–20, 47% of allocated type 1 diabetes expenditure ($152.1 million) was spent on hospital services. This included expenditure on public hospital admitted patients ($96.6 million), private hospital services ($9.0 million), public hospital outpatients ($42.6 million) and public hospital emergency departments ($3.9 million).

Another 30% of expenditure ($96.7 million) related to medications dispensed through the PBS and 11% to dental services ($35.5 million).

The remaining 12% ($39.4 million) of expenditure was related to non-hospital medical services (primary care), comprising general practitioner (GP) services ($18.5 million), specialist services ($9.3 million), medical imaging ($1.1 million), pathology ($8.2 million) and allied health and other services ($2.3 million) (Figure 1).
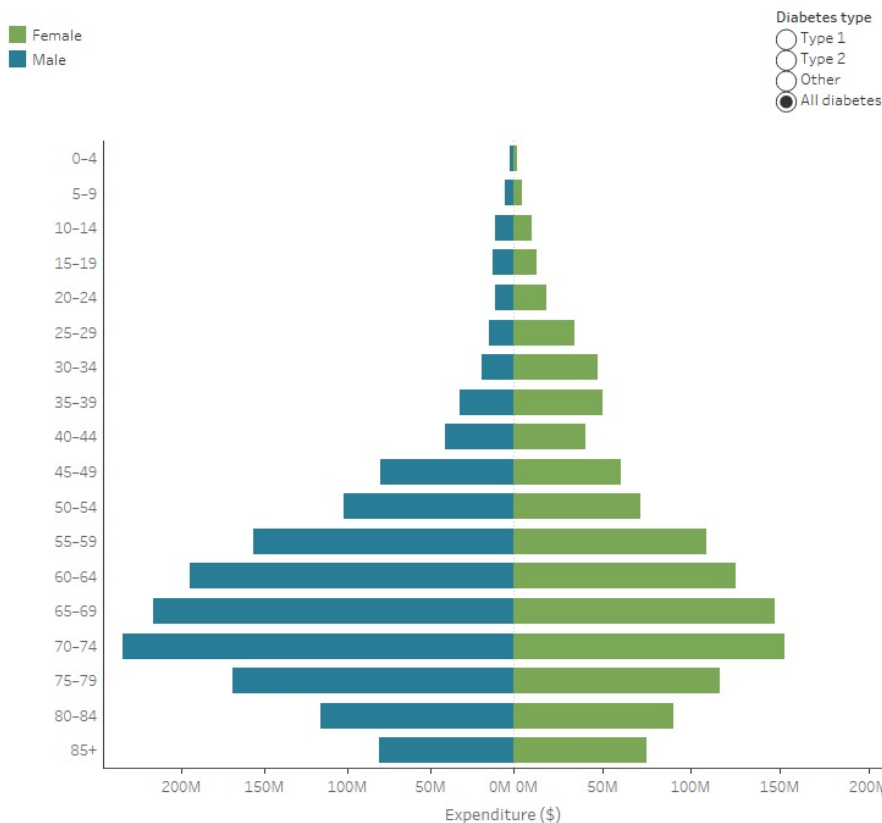
Who is the money spent on?

The economic burden attributed to type 1 diabetes varies significantly according to age, sex and area of expenditure. In 2019–20:

- total disease expenditure was higher for males than females ($151.6 million and $135.6 million, respectively).
- expenditure on medical imaging, PBS items and public hospital outpatients was 1.3 times higher for males as females while expenditure on medications dispensed through the PBS and specialist services were 1.2 times as high for males compared with females.
- expenditure for females with type 1 diabetes was highest in those aged 30–34 ($11.9 million). Notably, this expenditure is 1.5 times as high for males aged 30–34 ($8.2 million). Expenditure for males with type 1 diabetes was highest in those aged 60–64 ($13.7 million) (Figure 2).

Type 2 diabetes

Where is the money spent?

In 2019–20, 29% ($575.2 million) of type 2 diabetes expenditure was spent on medications dispensed through the PBS and 14% on dental programs and services ($286.4 million).

Hospital services accounted for 42% (838.5 million) of the expenditure allocated to type 2 diabetes. This included expenditure on public hospital admitted patients ($605.0 million), private hospital services ($75.9 million), public hospital outpatients ($155.1 million) and public hospital emergency departments ($2.5 million).

The remaining 15% ($293.6 million) of expenditure was attributed to GP services ($144.3 million), specialist services ($36.8 million), medical imaging ($2.1 million), pathology ($86.4 million) and allied health and other services ($24.0 million) (Figure 1).

Who is the money spent on?

The health system expenditure attributed to type 2 diabetes varies substantially according to age, sex and area of expenditure. In 2019–20:

- total disease expenditure was 1.4 times as high in males compared with females ($1.0 billion and $697.4 million, for males and females, respectively).
- total disease expenditure for persons with type 2 diabetes generally increased with increasing age, with more than 70% attributed to people aged 60 and over. The expenditure was highest amng those aged 70–74 for both males and females ($169.6 million and $103.4 million, respectively) (Figure 2).

Gestational diabetes

Where is the money spent?

In 2019–20, 84% ($53.4 million) of the health system expenditure for gestational diabetes was attributed to hospital services including $37.5 million of which was spent on public hospital admitted patients, $15.2 million on public hospital outpatients, $585,000 on private hospital services and $4,400 on public hospital emergency department presentations.

The remaining 16% ($10.2 million) of expenditure was related to allied health and other services ($723,000), general practitioner services ($1.8 million), medical imaging ($25,000), pathology ($1.1 million), medications dispensed through the PBS ($26,000) and specialist services ($6.6 million) (Figure 1).

Who is the money spent on?

The health system expenditure attributed to gestational varied with age.

In 2019–20:

- women aged 30–34 accounted for almost one-third of health system expenditure attributed to gestational diabetes
- expenditure attributed to specialist services was nearly 1.4 times as high in women aged 35–39, compared with those aged 30–34 ($2.6 million and $1.9 million, respectively) (AIHW 2022).

Further detail by demographics and area of expenditure is available in the Disease expenditure in Australia 2018–19: data tables.

Aboriginal and Torres Strait Islander People

In 2015–16, expenditure on potentially preventable hospitalisations (PPH) was 2.2 times as high in Aboriginal nad Torres Strait Islander people compared with non-Indigenous Australians ($392 and $176, respectively). Notably, the greatest difference in expenditure is attributed to diabetes, a gap of $33 per person (AIHW and NIAA 2020).

References

Australian Institute of Health and Welfare (2022) *Disease expenditure in Australia 2019-20*, AIHW, Australian Government, accessed 13 April 2023.

AIHW and NIAA (National Indigenous Australians Agency) (2020) *3.21 Expenditure on Aboriginal and Torres Strait Islander health compared to need - AIHW Indigenous HPF*, AIHW and NIAA, Australian Government, accessed 24 March 2022.

Explore the data

The interactive dashboard displays diabetes prevalence, incidence and deaths by sex, age group and selected population groups including Indigenous status, remoteness area and socioeconomic area. Trends data are displayed from 2000 to 2021.
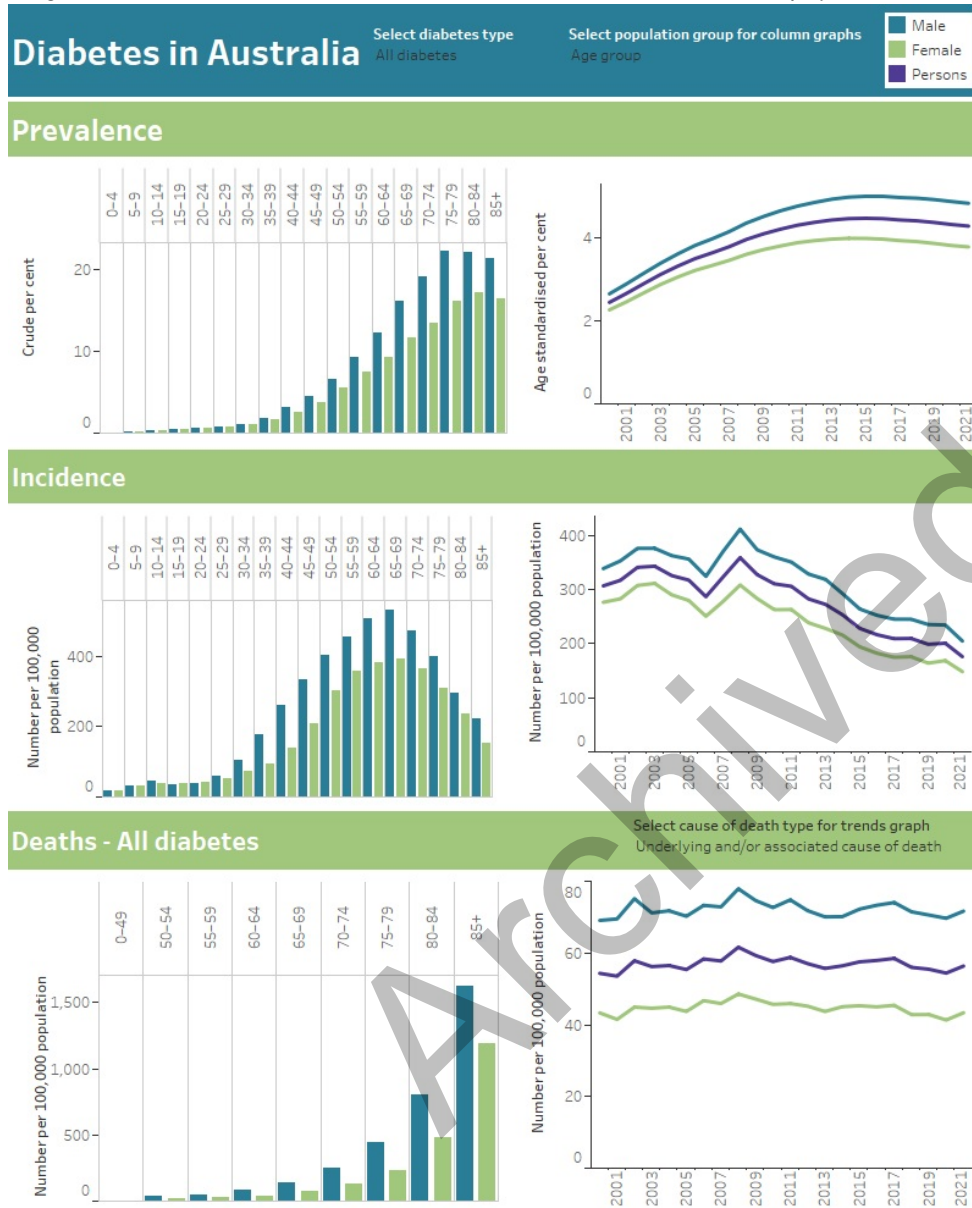
Notes

1. Population groups and trends data age-standardised to the 2001 Australian Standard Population.
2. Excludes persons where remoteness area and/or socioeconomic area was missing and persons whose Indigenous status was not stated or inadequately described.
3. Remoteness is classified according to the Australian Statistical Geography Standard 2016 Remoteness Areas structure based on postcode of current residence.
4. Socioeconomic areas are classified according to population-based quintiles using the Index of Relative Socio-Economic Disadvantage (IRSD) based on Statistical Area Level 2 (SA2) current residence.
5. Prevalence and incidence rates may be influenced by the lower capture of Indigenous Australians and people living in Remote and very remote areas or across states and territories with large remote communities on the National Diabetes Services Scheme.

Chart: AIHW. Sources:

- Prevalence and Incidence: National Diabetes Services Scheme and Australasian Paediatric Endocrine Group state-based registers.
- Deaths: National Mortality Database.

AIHW website

Archived

Impact of COVID-19

Page highlights:

Risk factors

- Results from the Australian Bureau of Statistics (ABS) Household Impacts of COVID-19 Survey, suggest a varied effect on health behaviours during the early pandemic period.

Diabetes incidence

- The National Diabetes Services Scheme (NDSS) registrations for the 12 months to December 2021 and December 2022 were 18% and 14% higher than the equivalent period prior to the pandemic in 2019.

Hospitalisations

- Comorbidity with diabetes is associated with more severe outcomes for people hospitalised with COVID-19.

Other health service use

- The use of telehealth services rose rapidly at the start of the pandemic, with patterns of use later corresponding to new outbreaks.

Deaths

- According to ABS *Provisional Mortality Statistics,* the age standardised diabetes death rate for 2022 (doctor-certified deaths) was 10.5% higher than the baseline average.

Diabetes Monitoring

- Temporary guidelines likely influenced a sharp decline in the number of women receiving an oral glucose tolerance test (OGTT) or oral glucose challenge test (OGCT) for the screening of gestational diabetes throughout April to June 2020 with an overall 11% drop between 2019 and 2020.

Diabetes medicine use

- An unusually high volume of diabetes scripts was dispensed in March 2020 (1.6 million), coinciding with the introduction of national restrictions, followed by a decrease in April 2020 (1.2 million)

The **COVID-19 pandemic** has affected Australia's population and health-care system in many ways, including economic expenditure, mortality, disability, the health workforce and disease surveillance.

Diabetes is one of many conditions correlated with greater health consequences throughout the COVID-19 pandemic including increased risk of complication and mortality (Peric and Stulnig 2020). Further, there is growing evidence that COVID-19 increases the risk of new-onset diabetes (Xie and Al-Aly 2022). This section explores the impact of COVID-19 in Australia on diabetes risk factors, new onset diabetes and people living with diabetes.

Continued monitoring will assess the evolving impact of the COVID-19 pandemic on diabetes in Australia with updates made to this report as new data become available.

Risk factors

Maintaining a healthy lifestyle, including healthy dietary patterns and being physically active, is important for reducing type 2 diabetes risk and improving outcomes for people living with diabetes. Many aspects of the COVID-19 pandemic and Australia's response to it, including household lockdowns, had the potential to affect these lifestyle factors.

Results from the Australian Bureau of Statistics (ABS) Household Impacts of COVID-19 Survey, suggest a varied effect on health behaviours during the early pandemic period. Overall, compared with before the pandemic, slightly more people reported an increase in the consumption of snack foods, personal screen time, consumption of alcohol and the smoking of tobacco products than those who reported a decrease in these health behaviours. Similar proportions of people reported increasing exercise and other physical activity as those who reported decreasing this activity (AIHW 2021b).

Diabetes incidence

There is growing evidence indicating a link between COVID-19, hyperglycaemia and new onset diabetes (Sathish et al 2021; Xie and Al-Aly 2022). A recent systematic review and meta-analysis found a 1.8-fold increased risk of developing diabetes in the post-acute phase of COVID-19 compared to the general population (Zhang et al. 2022).

In Australia, over the 12-month periods to December 2021 and December 2022, the National Diabetes Services Scheme (NDSS) recorded 121,070 and 116,864 new registrants, respectively. Registrations were higher in both periods than any previous 12 months recorded and were 18% and 14% higher than the equivalent period prior to the pandemic in December 2019. The largest increase in registration was found among women with gestational diabetes, with registrations up 18% between December 2019 and December 2022 (Diabetes Australia 2022).

However, these new registrations may be, at least in part, people who were previously diagnosed with diabetes and only registering with the NDSS during the pandemic. The increase in registrations also may be influenced by changes to the NDSS to simplify the usual processes to register (Andrikopoulos and Johnson 2020). Further monitoring is required to assess increases in diabetes diagnosis during the COVID-19 pandemic.

Hospitalisations

According to the National Hospital Morbidity Database (NHMD), the number of diabetes hospitalisations fell in April 2020 (both as a principal and/or additional diagnosis), which may be associated with aspects of the early COVID-19 period and Australia's response to it, which had an impact on the provision of healthcare services and hospital activity generally (AIHW 2022b).

Compared with the pre-pandemic baseline (average monthly hospitalisations between 2015–16 and 2018–19), the number of hospitalisations in April 2020 with a principal diagnosis of diabetes was down 14% while the number with an additional diagnosis was down 28%. Similar results were found across type 1, type 2 and other diabetes. The corresponding period in 2021 showed the number of diabetes hospitalisations had returned to the pre-pandemic level recorded in 2018–19 with increases of 11.3% and 9.8% in hospitalisations for diabetes as a principal and additional diagnosis, respectively, compared to the baseline average (Figure 1).

Figure 1: Diabetes hospitalisations by diagnosis type and month, COVID-19 period compared to baseline average

The chart shows the number of diabetes hospitalisations by diagnosis type and month between 2015–16 and 2019–20. Hospital separations fell in March–April 2020 for both principal and additional diagnosis of diabetes, with a more notable drop in hospitalisations with an additional diagnosis of diabetes.
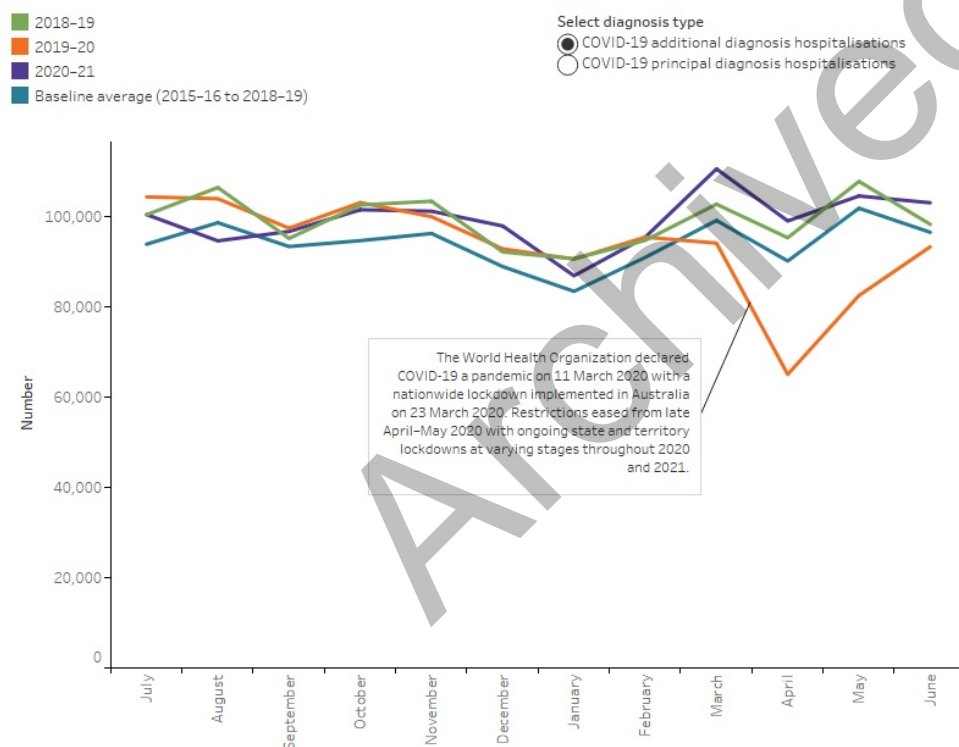
Figure 1: Diabetes hospitalisations, by diagnosis type and month, COVID-19 period compared to baseline average

Notes:
1. Includes people hospitalised with type 1, type 2, gestational and other diabetes.
2. Covid period: 2019–20 and 2020–21
3. Basline average: 2015–16 to 2018–19
Chart: AIHW. Source: AIHW National Hospital Morbidity Database (NHMD).
https://www.aihw.gov.au

COVID-19 hospitalisations

Comorbidity with diabetes is associated with more severe outcomes for people hospitalised with COVID-19. Of the more than 4,700 hospitalisations in Australia that involved a COVID-19 diagnosis in 2020–21:

- Around 42% had one or more diagnosed comorbid conditions, an increase from 25% in 2019–20.
- The most common comorbid conditions were type 2 diabetes (20%) and cardiovascular disease (which includes coronary heart disease and a range of other heart, stroke and vascular diseases) (20%) (AIHW 2022a).

- 12% of hospitalisations involved time spent in an intensive care unit, compared with 7.0% of all COVID-19 hospitalisations.
- 7.1% involved continuous ventilatory support, compared with 3.8% of all COVID-19 hospitalisations.

- 19% had a separation mode indicating the patient died in hospital, compared with 10.3% of all COVID-19 hospitalisations.

These results may be impacted by people with type 2 diabetes being more likely to be older and therefore more likely to have severe COVID-19.

Emergency department presentations

The average number of monthly diabetes-related ED presentations remained largely unchanged between 2018–19 and 2020–21 at around 1,500. The rate of monthly diabetes-related ED presentations:

- ranged between 4.7 and 6.6 presentations per 100,000 population between July 2019 and June 2020. This rate was lowest in April 2020 (4.7 per 100,000 population) and highest in June 2020 (6.6 per 100,000 population).
- was relatively stable throughout 2019–20, with the exception of April 2020 when there was a decline in presentations of almost one fifth (20%) when compared to the previous month (March 2020) (Figure 2).

Figure 2: Emergency department (ED) presentations with a principal diagnosis of diabetes, July 2019 to June 2021

The chart shows emergency department (ED) presentations per 100,000 population by month between July 2018 and June 2021. The rate of presentations per 100,000 population ranged from a low of 4.7 in April 2020 to a high of 6.6 in June 2020.
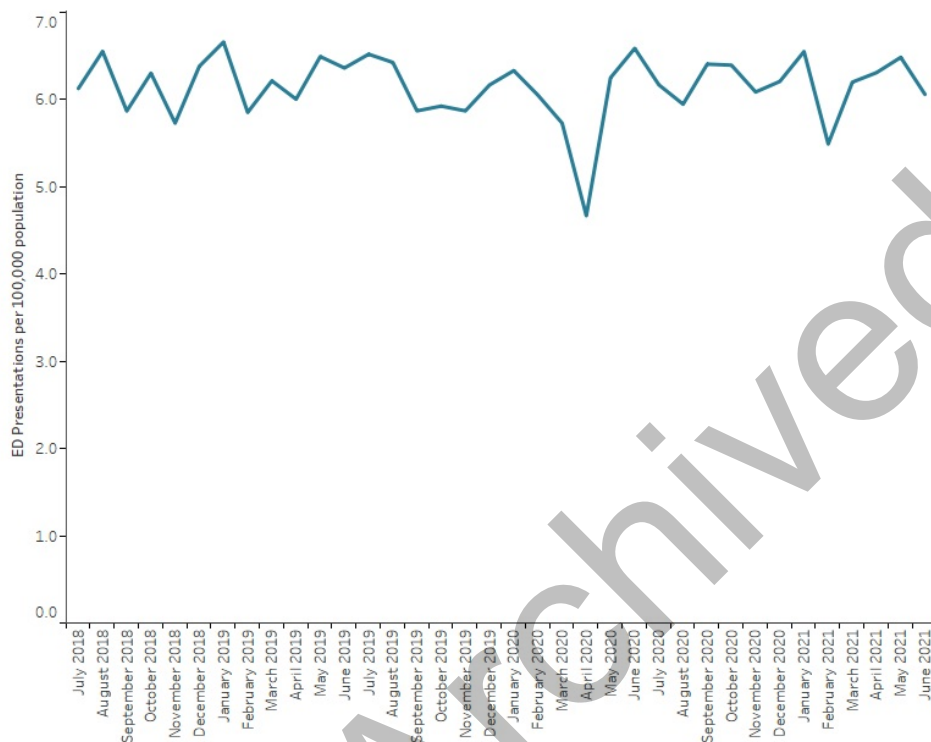

Figure 3: Emergency department presentations with a principal diagnosis of diabetes, July 2018 to June 2021.

Chart: AIHW. Source: AIHW National Non-Admitted Patient Emergency Department Care database.

https://www.aihw.gov.au

Other health service use

People living with diabetes require regular contact with GPs, endocrinologists and allied health services including dietitians and podiatrists to optimise glucose control and reduce risk of diabetes complications. To limit the spread of COVID-19, restrictions were put in place to contain its impact in the community. By the end of March 2020, non-essential businesses and activities had shut down, with people urged to stay at home. As part of these restrictions, many health services were suspended or required to operate in new or different ways. While this may have limited people's access to and use of these services, in some cases, new or additional services were made available through changes to health service delivery models, policies and programs (AIHW 2021b).

The initial temporary changes to telehealth items in the Medicare Benefits Schedule (MBS) and bulk billing criteria have bridged these issues, but these services were less suitable for complex care which often require face-to-face consultations. The scope of telehealth services was refined over time to make them more suitable for complex care, however, the scope of telephone services has been reduced since July 2021 to focus on more straightforward services.

People avoiding and/or delaying medical care for diabetes during the COVID-19 pandemic has been an emerging global issue. Research has already shown a significant increase in the frequency of severe diabetic ketoacidosis (DKA) at presentation of type 1 diabetes during the initial period of COVID-19 restrictions in Australia. Comparing the initial period of COVID-19 restrictions (March to May 2020) with the equivalent period of the previous 5 years, the proportion of type 1 diabetes presentations with severe DKA increased from 5% to 45% in an Australian tertiary centre (Lawrence et al. 2021).

Primary health care

MedicineInsight is a longitudinal general practice dataset managed by NPS MedicineWise which was established in 2011. NPS MedicineWise undertook a study looking at the 6 months period from March to August 2020 (COVID period) compared with the same period in 2019 (pre-COVID period) to assess changes to general practice attendance.

Over the 6-month early COVID-19 period, the mean number of clinical encounters among patients without a record of diabetes increased when compared with the pre-COVID-19 period. However, there was no significant change in the mean number of clinical encounters among patients with a record of type 2 diabetes when comparing the 6-month early pandemic period to the corresponding 6-month period in 2019. Although the monthly rate of encounters where the patient had a record of type 2 diabetes initially decreased by around 25% between March and April 2020 (from 80 to 60), the rate increased to over 80 per 1000 encounters in subsequent months – higher than the equivalent pre-COVID-19 period (Figure 1) (NPS MedicineWise 2020).

Figure 3: Proportion of clinical encounters per month in which the patient had a record of type 2 diabetes: Early COVID and pre-COVID periods

The chart shows the proportion of clinical encounters per month in which the patient had a record of type 2 diabetes during the early COVID and pre-COVID periods. The monthly rate of encounters where the patient had a record of type 2 diabetes fell from 79 to 60 per 1000 encounters in April 2020 before increasing to approximately 80 per 1000 encounters by June 2020, above the levels recorded in the equivalent pre-COVID period in 2019.
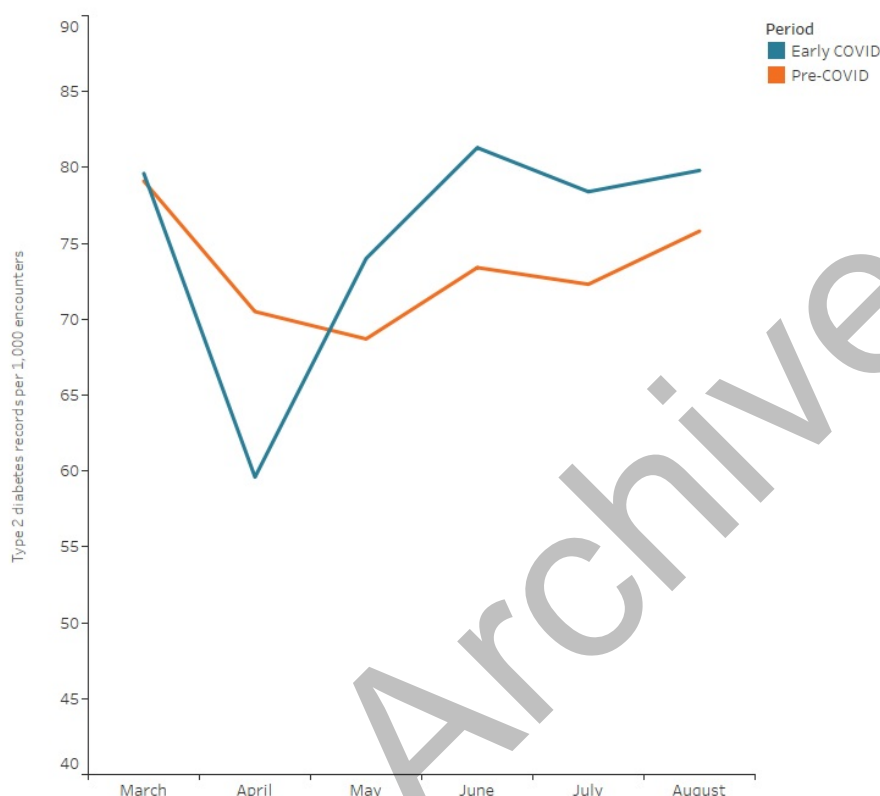
Figure 3: Proportion of clinical encounters per month in which the patient had a record of type 2 diabetes: Early COVID and pre-COVID periods

Note: Early COVID period (March–August 2020); pre-COVID period (March–August 2019)
Chart: AIHW. Source: NPS MedicineWise (2020).

https://www.aihw.gov.au

Telehealth service use

The Australian Government introduced new Medicare Benefits Schedule (MBS) telehealth items on 13 March 2020 enabling patients to consult with their health professional by telephone or video. The use of telehealth services rose rapidly at the start of the pandemic, with patterns of use later corresponding to new outbreaks.

Overall rates of telehealth use were higher in the major cities than in remote areas with no evidence of variation by socioeconomic status. Of a list of selected chronic conditions ('ever recorded' for each patient), diabetes (excluding gestational diabetes) had the third-highest rate of telehealth consultations behind chronic kidney disease and cardiovascular disease (Figure 4) (NPS MedicineWise 2022).

Figure 4: Rate of telehealth billed items per 1,000 patients by recorded chronic condition (total telehealth), by quarter 2020-2021

The chart shows the rates of telehealth use between January 2020 and December 2021. diabetes (excluding gestational diabetes) had the third-highest rate of telehealth consultations behind chronic kidney disease and cardiovascular disease

Visualisation not available for printing

Allied health use

No data are available on the use of allied health services for people living with diabetes, but total attendance for the Australian population are available. According to the MBS:

- Overall allied health attendance increased during the early pandemic period, resulting in a 19% increase between 2019 and 2020.
- Optometry services decreased in April 2020 but had returned to the usual level of service provision by the end of August 2020 (though had not yet compensated for services not conducted in the earlier months). This led to an overall 8.1% fall in the number of services in 2020 compared with 2019 (AIHW 2021b).

Deaths

Australia recorded substantially lower-than-expected mortality during the first year of the COVID-19 pandemic in 2020 with decreases across key causes and most notably, deaths from respiratory disease. The mortality rate remained low during 2021 with the top 5 leading causes of death unchanged and coronary heart disease at the top of the list (ABS 2022).

However, well into the third year of the pandemic, to February 2023, *ABS Provisional Mortality Statistics* show that Australia had recorded a 15.3% increase in the total number of deaths (registered by 28 February 2023), compared to the baseline average (2017–2019 and 2021) (ABS 2023b).

Since the start of the pandemic, a total of 16,810 people have died with or from COVID-19 (registered by 31 March 2023). Of these, COVID-19 was the underlying cause of death for 80% (13,456 people) (ABS 2023a).

Diabetes deaths during COVID-19

There is international evidence that diabetes mortality has increased during the COVID-19 pandemic for other countries (Barron et al. 2020; Lv et al. 2022) and a growing number of studies showing that diabetes is an important risk factor in determining the clinical severity of COVID-19 due to weakened immune response and other factors (Erener 2020).

According to ABS *Provisional Mortality Statistics*, in 2022, doctor-certified deaths due to diabetes (registered by 28 February 2023) 19.2% above the baseline average (comprising the years 2017–2019 and 2021). The age-standardised diabetes death rate for 2022 was 10.5% higher than the baseline average (ABS 2023b).

Most COVID-19 deaths (96%) have other conditions listed on the death certificate (either pre-existing or conditions caused by COVID-19 and its complications). According to ABS *COVID-19 Mortality in Australia*, pre-existing chronic conditions were reported on death certificates for 10,850 (80.6%) of the 13,456 deaths due to COVID-19. Diabetes was a pre-existing condition in 15.7% of deaths that had a chronic condition listed on the death certificate (ABS 2023a).

Diabetes monitoring

Glycated haemoglobin, haemoglobin A1c or HbA1c, is the main biomarker used to assess long-term glucose control in people living with diabetes. Haemoglobin is a protein in red blood cells which can bind with sugar to form HbA1c. It is directly related to blood glucose levels and strongly related with the development of long-term diabetes complications.

Rate of HbA1c testing

According to NPS MedicineWise analysis of MedicineInsight, the rate of HbA1c tests among all regularly attending patients over the 6-months from 1 March 2020 to 31 August 2020 was not significantly different from the pre-COVID period (Table 1). However, the rate of HbA1c testing did fall significantly among regularly attending patients with a record of type 2 diabetes despite the rate of type 2 diabetes encounters remaining similar in both time periods. In the pre-COVID period, the average monthly rate of HbA1c testing among patients with a record of type 2 diabetes was 126.1 per 1000 clinical encounters, which fell to 109.0 tests per 1,000 clinical encounters in the COVID period (NPS MedicineWise 2020).

In April 2020, there was a significant decline in the rate of HbA1c tests performed. The rate of tests for all patients fell from 32 tests per 1,000 clinical encounters in April 2019 to 21 tests per 1,000 clinical encounters. The rate of testing for patients with a record of type 2 diabetes fell from 120 tests per 1,000 clinical encounters in April 2019 to 77 tests per 1,000 clinical encounters in April 2020 (NPS MedicineWise 2020).

Table 1: Rate of HbA1c testing and diabetes encounters per 1,000 clinical encounters in the covid period compared with the same period in 2019

|	1 March–31 Aug 2019 (pre-COVID period)*	1 March–31 Aug 2020 (COVID-period)*	p-value
Rate of HbA1c testing (all patients)	32.3 (29.8, 34.8)	30.4 (5.0, 35.8)	0.43
Median all patients	31.5 (Q1 30.6, Q3 33.1)	32.1 (Q1 29.6, Q3 33.1)	-
Rate of HbA1c testing (type 2 diabetes patients)	126.1 (118.6, 133.7)	109.0 (92.1, 125.9)	0.04
Median (type 2 diabetes patients)	123.7 (Q1 120.8, Q3 129.9)	113.4 (Q1 111.3, Q3 115.4)	-
Rate of type 2 diabetes encounters	73.3 (69.4, 77.2)	75.4 (66.9, 84.0)	0.57
Median	72.9 (Q1 70.5, Q3 75.8)	79.0 (Q1 74.0, Q3 79.8)	-

Source: NPS MedicineWise (2020).

HbA1c testing frequency

Imai et al. (2020) studied the impact of COVID-19 on HbA1c monitoring using data from over 800 general practices (456 from Victoria and 347 from New South Wales) from January 2018 to December 2020. The volume of HbA1c monitoring in 2020 during the weeks of the first wave of COVID-19 (approximately March–May) decreased by 19.1% in New South Wales and 25.6% in Victoria, compared to the average volume of 2018–2019. Although it was not as large as the first wave, there was another fall in the total HbA1c testing volume in 2020 during the weeks of the second wave (approximately June–September).

The study also examined the number of patients living with type 2 diabetes who had records of HbA1c testing in both 2018 and 2019 (n=22,804 in Victoria, n = 15,399 in New South Wales) and their HbA1c testing frequencies. Approximately 14%-15% of these patients did not have HbA1c testing in 2020 (15.3 in Victoria, 14.1% in New South Wales). The number of patients who had multiple HbA1c tests also decreased in 2020 in both states (Figure 4).

Figure 5: Number of subgroup patients by HbA1c testing frequency. The subgroup patients were those who had records of HbA1c tests in both 2018 and 2019
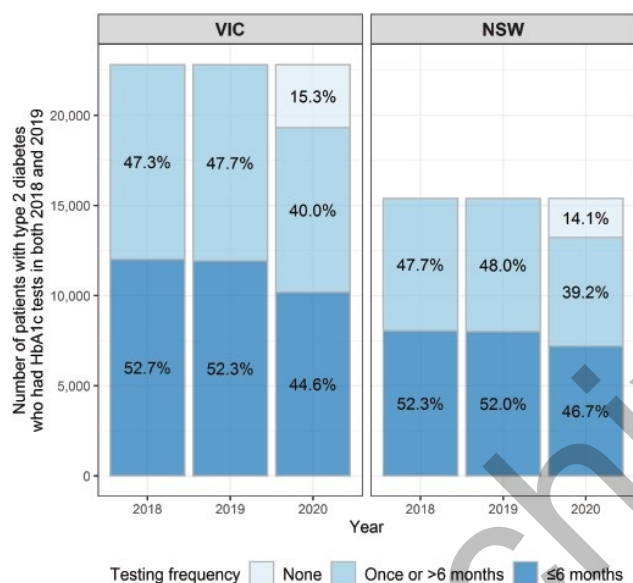
Source: Imai et al. 2020.

Gestational diabetes screening

In 2020, the Australasian Diabetes in Pregnancy Society, the Australian Diabetes Society, the Australian Diabetes Educators Association and Diabetes Australia, jointly provided temporarily revised guidelines for gestational diabetes screening in response to the COVID-19 pandemic. The guidelines aim to reduce both the number of women attending and the amount of time spent at pathology collection centres during times of elevated contagion risk.

The revised guidelines replace the oral glucose tolerance test (OGTT) with HbA1c testing in the first trimester and Fasting Blood Glucose (FBG) between 24 and 28 weeks for those not diagnosed with gestational diabetes from the initial HbA1c result. For those with a resulting FBG of 4.7-5.0 mmol/L, an OGTT is recommended while an FBG ≥5.1mmol/L is diagnostic of gestational diabetes (Diabetes Australia 2020).

These guidelines (and other COVID-related factors) likely influenced a sharp decline in the number of women receiving an OGTT or oral glucose challenge test (OGCT) for the screening of gestational diabetes throughout April to June 2020 with an overall 11% drop in the annual numbers between 2019 and 2020 (from 184,000 to 163,000, respectively) (Figure 5). This drop coincided with a 25% increase in HbA1c testing for the management of pre-existing diabetes where the patient is pregnant and a 2% increase in claims for HbA1c testing for the diagnosis of diabetes – both MBS items likely used as a substitute for the use of the OGTT for the detection of gestational diabetes during COVID.

> While recent retrospective studies have suggested the temporarily revised guidelines could lead to an under detection of gestational diabetes of between 25%-29% (van Gemert et al. 2020; Zhu et al. 2021), the latest 2020-21 incidence numbers (from the NHMD) indicate a continued rise in gestational diabetes incidence in Australia (see Gestational diabetes). While MBS data processed to 1 August 2021 indicates the number of women receiving the OGTT and OGCT had returned to pre-COVID levels, further monitoring will determine the impact of successive waves of the COVID-19 pandemic on gestational diabetes screening and subsequent incidence numbers.

Figure 6: Number of women who received MBS-subsidised services for the diagnosis of gestational diabetes and management of pre-existing diabetes in pregnancy, by month, April 2019 to August 2021

The chart shows the number women who received MBS-subsidised services for the diagnosis of gestational diabetes and management of pre-existing diabetes in pregnancy, by month, April 2019 to August 2021. There was a sharp decline in the number of women receiving the oral glucose tolerance test for the screening of gestational diabetes throughout April to June 2020 with an overall 11% drop in the annual numbers between 2019 and 2020 (from 184,000 to 163,000, respectively). By January 2021, the numbers had returned to pre-COVID levels.
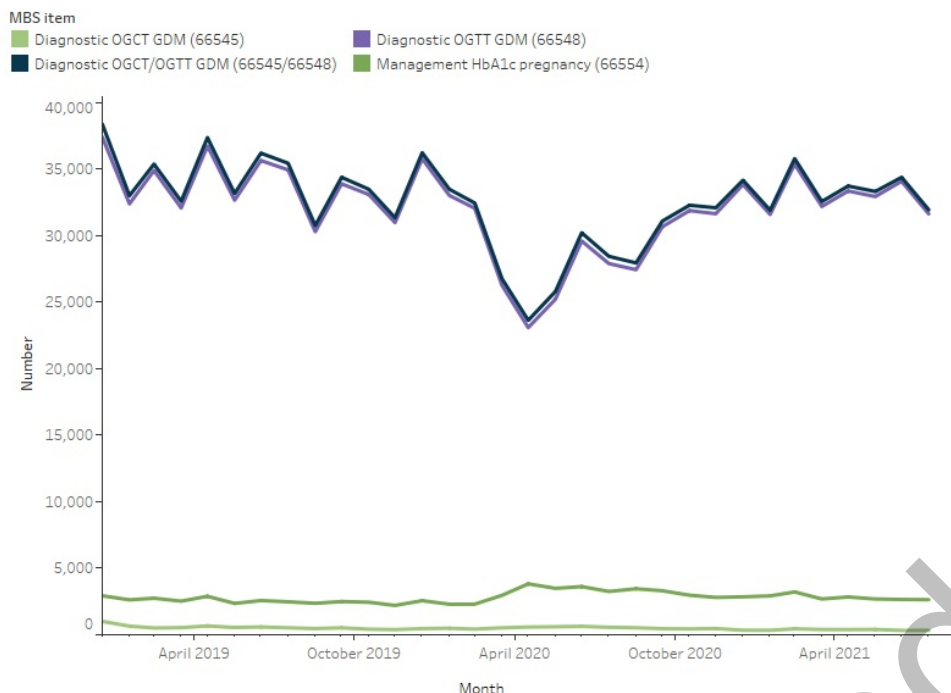

Figure 6: Number of women who received MBS-subsidised services for the diagnosis of gestational diabetes and management of pre-existing diabetes in pregnancy, by month, April 2019 to August 2021

Notes:
1. GDM (gestational diabetes mellitus); OGCT (oral glucose challenge test); OGTT (oral glucose tolerance test); HbA1c (quantitation of glycated haemoglobin). Date of processing – up to 23/11/2021.
2. Only data for females aged 15–49 are reported for these items.

Chart: AIHW. Source: AIHW analysis of Medicare Benefits Schedule Data.

https://www.aihw.gov.au

Diabetes medicine use

The COVID-19 pandemic has affected both patients and health practitioners in terms of the number of medical services, type of services and the way in which services are delivered (Sutherland et al. 2020). Medication access and supply has also been affected.

Analysis of the total volume of Pharmaceutical Benefits Scheme (PBS) prescriptions dispensed for ATC group A10, *Drugs used in diabetes* dispensed during 2019-20 and 2020-21 shows little change from 2018-19 when accounting for the expected increase in prescriptions dispensed over time. During 2019-20 and 2020-21, 15.4 and 16.5 million scripts for group A10 were dispensed, compared with 14.3 million for 2018-19 (Figure 6), a 7.8% increase from 2018-19 to 2019-20, and a 7.6% increase from 2019-20 to 2020-21.

Figure 7: Prescriptions dispensed for diabetes medicines, by quarter, 2017-18 to 2020-21

The chart shows the number of prescriptions dispensed for diabetes medicines by quarter between 2017-18 and 2020-21. During 2019-20 and 2020-21, 16.5 and 15.4 million scripts for group A10 were dispensed, compared with 14.3 million for 2018-19, a 7.8% increase from 2018-19 to 2019-20, and a 7.6% increase from 2019-20 to 2020-21.
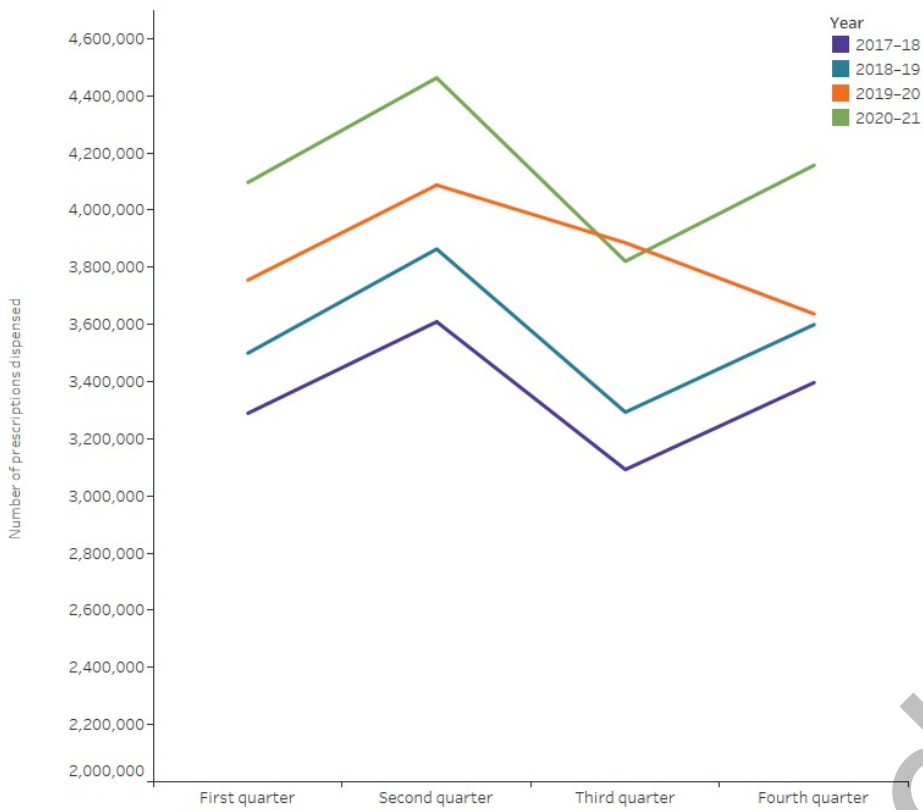
Figure 7: Prescriptions dispensed for diabetes medicines, by quarter, 2017–18 to 2020–21

Note: Includes PBS and RPBS Section 85 prescriptions supplied in Australia.
Chart: AIHW. Source: PBS and RPBS Section 85 Supply Data Report maintained by the Department of Health.
https://www.aihw.gov.au

There were, however, changes in consumer behaviour. An unusually high volume of diabetes scripts was dispensed in March 2020 (1.6 million), coinciding with the introduction of national restrictions, followed by a decrease in April 2020 (1.2 million) (Figure 7).

In March 2020, the Australian Government implemented temporary changes to medicines regulation to support Australians' continued access to PBS medicines during the COVID-19 pandemic. Some of these changes were in response to the dramatic increase in demand for medicines during early March, which resulted in pharmacies and wholesalers reporting medicine shortages.

The measures included a restriction on the quantity of medicines purchased to discourage unnecessary medicine stockpiling, continued dispensing emergency measures to allow one month supply of a patient's usual medicines without a prescription, a home delivery service for eligible patients, digital image-based prescriptions to support telehealth medical services, and arrangements for medicine substitution by pharmacists without prior approval from the prescribing doctor (AIHW 2020).

Figure 8: Prescriptions dispensed for diabetes medicines, by month, 2017-18 to 2020-21

The chart shows the number of prescriptions dispensed for diabetes medicines by month between 2017–18 and 2020–2021. An unusually high volume of diabetes scripts was dispensed in March 2020 (1.6 million), coinciding with the introduction of national restrictions, followed by a decrease in April 2020 (1.2 million).
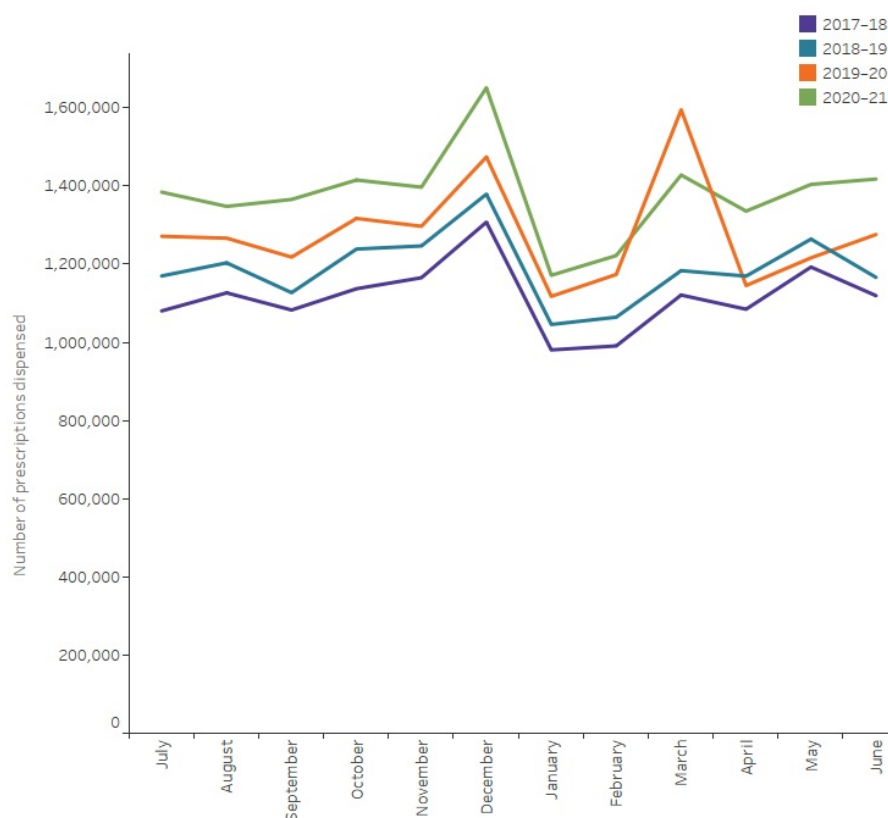
Figure 8: Prescriptions dispensed for diabetes medicines, by month, 2017–18 to 2020–21

Note: Includes PBS and RPBS Section 85 prescriptions supplied in Australia.
Chart: AIHW. Source: PBS and RPBS Section 85 Supply Data Report maintained by the Department of Health.
https://www.aihw.gov.au

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Data gaps and opportunities

On this page:

Comprehensive, accurate and timely data are necessary for effective population health monitoring of diabetes with Goal 7 of the *Australian National Diabetes Strategy 2021-2030* outlining the need to '*Strengthen prevention and care through research, evidence and data*'.

Although national health information collections continue to develop and improve, there are still gaps and the information that is collected is not always used to its full potential (AIHW 2020). There are also instances where data may be available but are not brought together efficiently for analysis.

Increasing digitisation of health information means more detailed data are being collected, expanding the possibilities for analysing and reporting. There is greater demand for information that is:

- available in real time and at small geographic levels for service planning and delivery
- easily accessible, flexible and interactive
- comparable at national and sub-national levels
- that maintains privacy and confidentiality.

Gaps and limitations

Current gaps on the health of people living with diabetes include:

- regular national data on biomedical risk factors including blood glucose management, pre-diabetes and undiagnosed people living with diabetes in the Australian community
- national, comparable and reportable data on primary health care activity and outcomes
- person-centred data, including social and economic factors that affect health and wellbeing, and a person's pathways through the health system, across jurisdictional boundaries and between sectors
- information on some population groups, including Aboriginal and Torres Strait Islander people, people with disability, culturally and linguistically diverse populations, refugees and LGBTQI+ populations
- longitudinal data relating to diabetes and mental health which can explore the causal pathway between these conditions and the impact of medications on the development of diabetes
- routine data for smaller geographical areas to identify variations in health status and care by location. An example of this can be see in *Geographical variation in disease: diabetes, cardiovascular and chronic kidney disease*.
- measures of health system efficiency and cost-effectiveness
- indicators of health system safety and quality, including outcomes of interventions and person-rated outcome and experience measures.

Data developments and opportunities

Goal 7 of the *Australian National Diabetes Strategy 2021-2030* identifies the need to '*Strengthen prevention and care through research, evidence and data*'.

Commonwealth investment in diabetes research

The National Health and Medical Research Council (NHMRC) expended around $43.0 million on diabetes disease expenditure in 2021 with over $1.0 billion expended since 2000.

From its inception in 2015 to 31 March 2023, the Medical Research Future Fund (MRFF) has invested $101.29 million in 17 grants with a focus on diabetes research.

Examples include:

- $25.0 million to the Juvenile Diabetes Research Foundation Australia to positively impact the lives of people with type 1 diabetes through the support and translation of research.
- $2.92 million to the Menzies School of Health Research for the project 'A life course approach to reduce intergenerational diabetes risk in remote Northern Australia through improved systems of care and consumer engagement'.

Digital health

Digital health is the use of technology by individuals and by clinicians and administrators to collect and share health information (ADHA 2021). Digital health technology has the potential to remove barriers to service access, for example through the use of telemedicine to provide specialist care to remote or isolated communities.

Digital health records can improve continuity in patient care through the use of electronic health records, such as My Health Record. They can also enhance clinical decision-making and system-wide responses with real-time access to health information by services, sectors and jurisdictions.

Data linkage and integration

Data linkage, also known as data integration, brings together information from more than one source. Matching disparate pieces of information together can fill gaps in our knowledge on specific diseases, effectiveness and quality of health services and population groups, as well as knowledge gaps across the health and welfare sectors (Jensen 2022).

Two examples of recently linked data sets include the National Integrated Health Services Information Analysis Asset (NIHSI) developed by the Australian Institute of Health and Welfare (AIHW), and the Multi-Agency Data Integration Project (MADIP) developed by the Australian Bureau of Statistics (ABS).

The AIHW is currently working towards the development of the Kidney and Diabetes Data Integration (KADDI) project, a national linked dataset providing information on individuals with diabetes and kidney disease, their treatment, health service usage, diabetes related complications and comorbidity over time. The AIHW and researchers will use this dataset to develop new methodology to refine national monitoring of diabetes.

The AIHW is also working with the Communicable Diseases Network Australia (CDNA) and states and territories to develop a national person-based research linked data set of all people who have tested positive for COVID-19 (along with a control group) in Australia since the start of the pandemic. The COVID-19 linked data set will enable linkage at the national level to administrative data, including MBS, PBS, deaths, immunisation, hospitals and aged care data.

The aim of the project is to support current data needs arising from the COVID-19 pandemic, by providing an evidence base for research into the medium and long-term effects of COVID-19.

Person-centred data

Data on the Australian health system are largely organised around occasions of service. Goal 7 of the Australian National Diabetes Strategy 2021–2030 calls for integrated national health care data linkage to improve population health monitoring and to provide an evidence base for strategic planning for health policy and services. Linking national health-care data together with other data, including data from surveys, allows for a richer understanding of how people and population groups interact with services and their health outcomes.

Following individuals from a diagnosis of diabetes, through interactions with the health system, to recovery, further illness or death improves our ability to analyse the development and trajectory of disease; the interaction of determinants and interventions; and the role and performance of the health system in managing, treating and preventing disease.

Current opportunities for improving person-centred diabetes data include:

- improving national, comparable and reportable data on primary health care activity and outcomes, particularly for allied health professionals not included on the National Registration and Accreditation Scheme
- collecting comprehensive general practitioner (GP) data from the primary health care setting, which could provide a fuller picture of chronic disease management, associated comorbidities, and long-term outcomes. A National Primary Health Care Data Collection is currently under development (AIHW 2021)
- linkage between clinical quality registries and other administrative health databases allows for detailed investigation of the relationships between clinical measures and long-term health outcomes. An investment in scoping work will determine the benefits of establishing national enduring linkage to clinical quality registers to identify and assess data improvement opportunities
- conducting health surveys measuring clinical biomarkers of diabetes, other markers of chronic disease and nutrition status will allow for the determination of population health trends and better understanding of the number of people living with pre-existing and previously undiagnosed diabetes. The ABS is undertaking a comprehensive multi-year Intergenerational Health and Mental Health Study in 2020–2024, which will include a biomedical component (ABS 2021).

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Data sources, methods and classifications

Archived

Data sources, methods and classifications

AIHW Disease Expenditure Database

The AIHW Disease Expenditure Database provides a broad picture of the use of health system resources classified by disease groups and conditions.

It contains estimates of expenditure by the Australian Burden of Disease Study diseases and injuries, age group, and sex for admitted patient, emergency department and outpatient hospital services, out-of-hospital medical services, and prescription pharmaceuticals.

It does not allocate all expenditure on health goods and services by disease – for example, neither administration expenditure nor capital expenditure can be meaningfully attributed to any particular condition due to their nature.

For more information see Disease expenditure in Australia.

Australian Burden of Disease Study

The Australian Burden of Disease Study undertaken by the AIHW provides information on the burden of disease for the Australian population. Burden of disease analysis measures the impact of fatal (years of life lost, YLL) and non-fatal burden (years lived with disability, YLD), with the sum of non-fatal and fatal burden equating to the total burden (disability-adjusted life year, DALY).

The Australian Burden of Disease Study 2022 includes national estimates for 220 diseases and injuries. The 2018 study builds on the AIHW's previous burden of disease studies and disease monitoring work and provides Australian-specific estimates for 219 diseases and injuries, including comparisons with 2003, 2011 and 2015. It also provides estimates of how much of the burden can be attributed to 40 different risk factor exposures.

For further information see Burden of disease.

Australian National Diabetes Audit - Australian Quality Clinical Audit

The Australian National Diabetes Audit - Australian Quality Clinical Audit (ANDA-AQCA) is an annual diabetes audit open to all services providing diabetes services across Australia, from primary to tertiary care centres.

ANDA–AQCA provides an overview of the clinical status of people with diabetes attending services for diabetes care.

Linked National Diabetes Services Scheme and Australasian Paediatric Endocrine Group state-based register data

The National Diabetes Services Scheme (NDSS) is an initiative of the Australian Government administered by Diabetes Australia. People with a diagnosis of diabetes by a health professional can register with the scheme. Once registered, they can access diabetes self-management information, services, and subsidised products – such as pens and needles to administer insulin, blood glucose test strips, insulin pump consumables, and continuous glucose monitoring products.

The Australasian Paediatric Endocrine Group (APEG) is a professional body that represents health professionals involved in managing and researching disorders of the endocrine system, including diabetes in children and adolescents. The APEG maintains clinic-based state and territory diabetes registers of children.

The AIHW holds information derived through the linkage of the NDSS and APEG datasets on the broader population of people living with type 1 diabetes, type 2 diabetes, gestational diabetes and other less common forms of diabetes. Unlike the NDR, this broader dataset contains information about all people with diabetes and not just those taking insulin for their diabetes. The data contained in this linked dataset includes people registered with the NDSS from 1987 onwards and people registered with APEG from 1999 onwards. These data were used to report on incidence and prevalence for people living with diabetes, including type 1, type 2 and other diabetes.

The NDSS registration forms and database have changed over time. Between 2 December 2002 and 28 February 2003, the clinical terminology used to describe diabetes types was updated from juvenile-onset diabetes, Insulin Dependent Diabetes Mellitus (IDDM) and Non-Insulin Dependent Diabetes Mellitus (NIDDM), to type 1 and type 2 diabetes. Prior to this, people registering with the NDSS with insulin-treated type 2 diabetes may have been incorrectly recorded as type 1 so that their insulin using needs could be met. This occurred because the NDSS registration form did not have an option for insulin-treated type 2 diabetes, reflecting diabetes classification at that time. All registrants that were classified as IDDM were reclassified as type 1 diabetes as there was no effective way to differentiate between diabetes types, resulting in misclassification for some people with insulin-treated type 2 diabetes. Some records can be checked against APEG registrations, as is done with the NDR, but older records may be prone to misclassification. Due to this issue, an algorithm has been applied to check diabetes status based on insulin use, age at diagnosis and the lag time between insulin diagnosis and initiating insulin therapy. The following criteria was applied:

- Type 1 diabetes status was assigned to registrants recorded as type 1 who were diagnosed at age <45 and taking insulin.

- Registrants with type 2 diabetes who were diagnosed before age 30 and were taking insulin within 1 year of the diagnosis date were reclassified as having type 1 diabetes.

The registration date was used as a proxy for the diagnosis date due to a high level of missing diagnosis date information for older registrants.

Medicare Benefits Schedule

Statistics in this release were extracted by the AIHW from the Medicare Benefits Schedule (MBS) claim records data in the Australian Government Department of Health Enterprise Data Warehouse.

The MBS provides a subsidy for services listed in the MBS, for all Australian residents and certain categories of visitors to Australia. The major elements of Medicare are contained in the *Health Insurance Act 1973*. See details of the services covered by the MBS. The statistics in this release are reported using date of processing up to 23 November 2021 and date of service up to 31 August 2021.

Items 66554, 66545 and 66548 are pregnancy related. The data contains some males and also persons in the 0–5 or 10–15 age groups. This can be attributed to a number of reasons, such as the medical services being attributed to the wrong member of the family, the sex or age information in the Medicare enrolment file being wrong or persons reporting their gender at the time of claiming the Medicare service, as male. These data were excluded from the analysis.

MBS items for pathology tests are subject to episode coning. Episode coning is an MBS funding arrangement that applies to general practitioners ordering more than three items in an episode for a non-hospitalised patient on the same day. Under the coning rule, Medicare benefits are only payable for the three most expensive items. The remaining items are coned out. As a result of the application of this rule, MBS data for some items will not reflect the number of tests performed for non-hospitalised patients.

Pathology services requested for hospitalised patients, or ordered by specialists, are not subject to these coning arrangements. Episode coning was introduced to prevent over servicing by doctors.

National (insulin-treated) Diabetes Register

The National (insulin-treated) Diabetes Register (NDR) holds information about people who use insulin as part of their treatment for diabetes. The NDR was established in 1999 and includes most people diagnosed with type 1 diabetes since this time, as well as those who use insulin to manage type 2 diabetes, gestational diabetes and other, less common forms of diabetes. Almost all people with type 1 diabetes who were diagnosed from 1999 onwards are captured on the NDR. This is because all people with type 1 diabetes require insulin to treat their condition and this need for insulin acts as a driver to register with the National Diabetes Services Scheme (NDSS) where the products for administering insulin (pens/needles, or insulin pump consumables) can be obtained at subsidised prices. Additionally, the coverage rate of the NDR is high for those diagnosed under 15 years as data are also obtained from the Australasian Paediatric Endocrine Group (APEG) state-based registers.

Due to the scope of data collected on the NDR, prevalence estimates can only be reported for people aged up to 21 as of the NDR 2021.

For more information see the NDR 2021 data quality statement.

National Aboriginal and Torres Strait Islander Health Survey

The National Aboriginal and Torres Strait Islander Health Survey (NATSIHS) is conducted by the ABS to obtain national information on the health of Indigenous Australians, their use of health services and health-related aspects of their lifestyle. The most recent NATSIHS was conducted in 2018–19.

The NATSIHS collects information from Aboriginal and Torres Strait Islander people of all ages in non-remote and remote areas of Australia, including discrete Indigenous communities.

Further information can be found in ABS National Aboriginal and Torres Strait Islander Health Survey, 2018–19.

National Health Survey

The National Health Survey (NHS) is conducted by the Australian Bureau of Statistics (ABS) to obtain national information on the health status of Australians, their use of health services and facilities, and health-related aspects of their lifestyle. The most recent NHS was conducted in 2020–21. It is important to note that the 2020-21 NHS data should be considered a break in time series from previous NHS collections and used for point-in-time national analysis only. The survey was collected during the COVID-19 pandemic, via an online, self-complete form, which significantly changed the data collection and survey estimates. For this report, the 2017-18 NHS was used as the latest available data for time series.

The NHS collects self-reported data on whether a respondent had one or more long-term health conditions; that is, conditions that lasted, or were expected to last, 6 months or more.

When interpreting data from the 2017–18 NHS, some limitations need to be considered:

- Data that are self-reported rely on respondents knowing and providing accurate information.
- The survey does not include information from people living in nursing homes or otherwise institutionalised.

- Residents of *Very remote* areas and discrete Aboriginal and Torres Strait Islander communities were excluded from the survey. This is unlikely to affect national estimates, but will impact prevalence estimates by remoteness.

Further information can be found in National Health Survey: First results, 2017–18.

National Hospital Morbidity Database

The National Hospital Morbidity Database (NHMD) is a compilation of episode-level records from admitted patient morbidity data collection systems in Australian hospitals.

Reporting to the NHMD occurs at the end of a person's admitted episode of care (separation or hospitalisation) and is based on the clinical documentation for that hospitalisation.

The NHMD is based on the Admitted Patient Care National Minimum Data Set (APC NMDS). It records information on admitted patient care (hospitalisations) in essentially all hospitals in Australia, and includes demographic, administrative and length-of-stay data, as well as data on the diagnoses of the patients, the procedures they underwent in hospital and external causes of injury and poisoning.

The hospital separations data do not include episodes of non-admitted patient care given in outpatient clinics or emergency departments. Patients in these settings may be admitted subsequently, with the care provided to them as admitted patients being included in the NHMD.

The following care types were excluded when undertaking the analysis: 7.3 (newborn – unqualified days only), 9 (organ procurement – posthumous) and 10 (hospital boarder).

Further information about the NHMD can be found in Admitted patient care NMDS 2020–21 and Admitted patient care NMDS 2021–22 (2021–22 update for incidence of gestational diabetes only).

National Mortality Database

The National Mortality Database (NMD) comprises information about causes of death and other characteristics of the person, such as sex, age at death, area of usual residence and Indigenous status. The cause of death data are provided to the AIHW by the Registries of Births, Deaths and Marriages and the National Coronial Information System (managed by the Victorian Department of Justice) and include cause of death coded by the ABS. The data are maintained by the AIHW in the NMD.

In this report, deaths registered in 2018 and earlier are based on the final version of cause of death data; deaths registered in 2019 are based on the revised version; and deaths registered in 2020 are based on the preliminary version. Revised and preliminary versions are subject to further revision by the ABS.

For data by Indigenous status, the level of identification of Indigenous status is considered sufficient to enable analysis in 5 jurisdictions – New South Wales, Queensland, Western Australia, South Australia and the Northern Territory. These jurisdictions are considered to have adequate levels of Indigenous identification in mortality data.

This report adjusts for Victorian additional death registrations of deaths that were registered in Victoria in 2017 and 2018 but were not provided to the ABS for compilation until 2019. As a result, the number of diabetes deaths reported for 2017 to 2019 may differ from previously reported numbers. For more detail, see the Technical note: Victorian additional registrations and time series adjustments in Causes of death, Australian methodology.

The NMD includes information on people's area of usual residence prior to death. For 2021, this was their SA2 based on the 2021 ASGS. This location information from the NMD, along with IRSD values based on the ABS 2016 Census of Population and Housing, and estimated resident populations, have been used to approximate statistics for 2016 ASGS Remoteness Areas and 2016 IRSD SEIFA quintiles. This may result in a lower number of people being matched to an area due to differences in 2021 and 2016 ASGS. It is anticipated that future updates will transition to deriving these estimates purely from 2021 ASGS and Census information.

The data quality statements underpinning the AIHW NMD can be found in the following ABS publications:

- ABS quality declaration summary for Deaths, Australia.
- ABS quality declaration summary for Causes of death, Australia.

For more information see National Mortality Database (NMD).

National Non-admitted Patient Emergency Department Care Database

The AIHW National Non-admitted Patient Emergency Department Care Database (NNAPEDCD) is a compilation of episode-level records (including waiting times for care) for non-admitted patients registered for care in emergency departments in selected public hospitals. The database only captures information for physical presentations to emergency departments and does not include advice provided via telehealth or videoconferencing.

Patients being treated in emergency departments may be subsequently admitted, including admission in the emergency department, another hospital ward or to hospital-in-the-home. For this reason, there is an overlap in the scope of the NNAPEDCD NMDS and the APC NMDS.

Principal diagnoses for episodes of care in the NNAPEDCD 2020–21 are coded according to the <u>Emergency Department ICD-10-AM Principal Diagnosis Shortlist.</u>

Further information about the NNAPEDCD can be found in <u>Non-admitted patient emergency department care NMDS 2020–21</u>.

NPS MedicineWise MedicineInsight

MedicineInsight is a database managed by NPS MedicineWise containing de-identified electronic health records (EHRs) from over 700 Australian general practices.

MedicineInsight data include information on people living with diabetes and their interaction with the primary health care system through general practice.

Patient population percentages have been weighted to adjust for an over-representation of registered GP sites in Tasmania.

Pharmaceutical Benefits Scheme

The Australian Government subsidises the cost of a wide range of medicines through the Pharmaceutical Benefits Scheme (PBS) and the Repatriation Pharmaceutical Benefits Scheme (RPBS). Claims for reimbursement for the supply of PBS- or RPBS-subsidised medicines are submitted by pharmacies through Services Australia for processing and are provided to the Australian Government Department of Health. Subsidies for prescription medicines are available to all Australian residents who hold a current Medicare card, and overseas visitors from countries with which Australia has a Reciprocal Health Care Agreement. In general, patients pay a contribution to the cost of the medicine (co-payment), and the Australian Government covers the remaining cost. This remaining cost is referred to as the benefit paid.

PBS data in this report are from records of prescriptions dispensed under the PBS and RPBS, where either:

- the Australian Government paid a subsidy
- The prescription was dispensed at a price less than the relevant patient co-payment (under co-payment prescriptions) and did not attract a subsidy.

PBS data cover all PBS prescriptions dispensed by approved suppliers, including community pharmacies, public and private hospital pharmacies and dispensing doctors.

Data sources, methods and classifications

Age-standardised rates

Age-standardisation is a method of removing the influence of age when comparing populations with different age structures – either different populations at one time or the same population at different times.

Direct age-standardisation was used in this report. The Australian estimated resident population as at 30 June 2001 has been used as the standard population.

Significance testing

The observed value of a rate may vary because of the influence of chance and natural variation. To provide an indication of whether 2 rates are statistically different, 95% confidence intervals can be calculated and statistically significant differences highlighted.

A 95% confidence interval describes a span of numbers around the estimate which has a 95% chance of including the true value. When comparing 2 groups, if the 2 confidence intervals do not overlap, the reader can be confident that the difference between the groups is real, and not due to chance.

Confidence intervals were calculated for survey data in this report.

Remoteness

Comparisons of regions in this report use the ABS Australian Statistical Geography Standard (ASGS) 2016 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.

In some instances, data for remoteness areas have been combined because of small sample sizes.

Further information on the ASGS is available on the ABS website.

Socioeconomic areas

Socioeconomic classifications in this report are based on the Australian Bureau of Statistics (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. 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 analyses in this report, the population is divided into 5 socioeconomic areas, 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 areas with the highest levels of relative disadvantage (referred to as Group 1, most disadvantaged), while the last group includes the 20% of areas with the lowest levels of relative disadvantage (referred to as Group 5, least disadvantaged).

The IRSD values used in this report are based on the ABS 2016 Census of Population and Housing with the exception of the National Mortality Database. Further information is available on the ABS website.

Country of birth

Country of birth is reported based on the Standard Australian Classification of Countries (SACC) which provides guidelines for consistent collection, aggregation and dissemination of statistics by country. The country names within the SACC reflect country titles recognised by the Australian Government.

People born in Australia are identified using country level classification (1100–1199), with the remainder of the classifications coming from major groups (1–9).

The country of birth values used in this report are based on the 2016 Census. Further information is available on the ABS website.

Aboriginal and Torres Strait Islander persons

In this report, comparisons are made between Aboriginal and Torres Strait Islander persons and people who do not identify as Indigenous.

People with 'not-stated' Indigenous status are excluded from any analysis by Indigenous status.

Populations used

National populations

Population data are used in this report to calculate the majority of rates. The population data used are estimated resident populations (ERPs) derived from the ABS Census of Population and Housing.

The COVID-19 pandemic and the resulting Australian Government closure of the international border from 20 March 2020, caused significant disruptions to the usual Australian population trends. This report uses Australian Estimated Resident Population (ERP) estimates that reflect these disruptions.

In the year July 2020 to June 2021, the overall population growth was much smaller than the years prior – in particular there was a relatively large decline in the population of Victoria. ABS reporting indicates these were primarily due to net-negative international migration.

This may complicate interpretation of statistics calculated from these ERPs. For example, rates and proportions may be greater than in previous years due to decreases in the denominator (population size) of some sub-populations.

For more information: National, state and territory population, June 2021.

Throughout this report, rates of deaths and hospitalisations are age-standardised. In these cases, the standard population used to calculate the age-standardised rate is the Australian ERP as at 30 June 2001.

Throughout this report, rates are age-standardised to enhance comparison across groups where the age structure of the population may influence or confound interpretation. In these cases, the standard population used to calculate the age-standardised rate is the Australian ERP as at 30 June 2001.

Aboriginal and Torres Strait Islander populations

The ABS 2016 Census base series B Indigenous population projections were used to derive rates (ABS 2019). To calculate non-Indigenous estimates, the Indigenous projections was subtracted from the total Australian ERP data.

Pregnancy population

The population of live births was based on the number of hospitalisations (pregnancies) with a birth event code (ICD-10-AM code Z37) in the year of interest. All pregnancies, regardless of outcome (that is, stillbirth or live birth) are counted by this method.

The number of new cases of gestational diabetes 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.

Pre-existing diabetes in pregnancy was calculated using two sets of diabetes codes in ICD-10-AM: diabetes 'E-codes' and diabetes in pregnancy 'O24-codes' (see Classifications section)

Type 2 diabetes population

The linked NDSS and APEG data were used to identify the prevalent population with living with type 2 diabetes to calculate incidence rates for the initiation of insulin treatment. The denominator population included all registrants with type 2 diabetes with no record of insulin use in the year of analysis. The population included all people with type 2 diabetes who were diagnosed between 2000 and 2020 and were still alive on 31 December of each year of analysis.

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Data sources, methods and classifications

International Classification of Disease and Related Health Problems

Australia uses the International Statistical Classification of Diseases and Related Health Problems (ICD) to code causes of death (WHO 2019). In this report, deaths were coded using the 10th Revision (ICD-10) (Table 1).

Table 1: International Classification of Disease (ICD) codes

Disease	ICD-10 Codes
Diabetes mellitus	E10, E11, E13, 14, O24
Type 1 diabetes	E10
Type 2 diabetes	E11
Other or unspecified diabetes	E13–14
Gestational diabetes	O24

Source: WHO 2019.

For hospital diagnoses and procedures, a classification modified for Australia is used. Hospital data were coded using the ICD-10-AM classification (International Statistical Classification of Diseases and Related Health Conditions, 10th Revision, Australian Modification).

Diagnosis and procedure data for 2019–20 were reported to the NHMD using the 11th edition of the ICD-10-AM (ACCD 2018a), incorporating the Australian Classification of Health Interventions (ACHI) (ACCD 2018b) (Tables 2 and 3).

Table 2: ICD-10-AM codes

Disease	ICD-10-AM codes	ICD-10-AM shortlist
Diabetes mellitus	E10, E11, E13, 14, O24	E10, E11, E14
Type 1 diabetes	E10, O24.0	E10
Type 2 diabetes	E11, O24.1	E11
Other or unspecified diabetes	E13–14, O24.2, O24.3, O24.5, O24.9	E14
Gestational diabetes	O24.4	
Treated with insulin	O24.42	
Treated with oral hypoglycaemic agents	O24.43	
Treated with diet and/or exercise	O24.44	
Unspecified treatment	O24.41, O24.49	

Diabetes complications associated with hospitalisation	E10.0–E10.8, E11.0–E11.8, E13.0-E13.8, E14.0-E14.8	
Hyperosmolarity	E10.0, E11.0, E13.0, E14.0	
Acidosis	E10.1, E11.1, E13.1, E14.1	
Ketoacidosis	E10.11-E10.12, E10.15-E10.16, E11.11 E11.12, E11.15-E11.16, E13.11-E13.12, E13.15-E13.16, E14.11-E14.12, E14.15-E14.16	E10.11, E11.11, E14.11
Kidney complication	E10.2, E11.2, E13.2, E14.2	
Eye complication	E10.3, E11.3, E13.3, E14.3	
Neurological complication	E10.4, E11.4, E13.4, E14.4	
Circulatory complication	E10.5, E11.5, E13.5, E14.5	
Other specified complication	E10.6, E11.6, E13.6, E14.6	
Hypoglycaemia	E10.64, E11.64, E13.64, E14.64	
Poor diabetes control	E10.65, E11.65, E13.65, E14.65	E10.65, E11.65, E14.65
Multiple complications	E10.7, E11.7, E13.7, E14.7	
Foot ulcer due to multiple cause	E10.73, E11.73, E13.73, E14.73	
Unspecified complications	E10.8, E11.8, E13.8, E14.8	E10.8, E11.8, E14.8
Without complication		E10.9, E11.9, E14.9
Outcome of delivery in pregnancy	Z37	
Stillbirth	Z37.1, Z37.3, Z37.4, Z37.6, Z37.7	
Pre-existing hypertension	O10	
Gestational hypertension	O13	
Pre-eclampsia	O11, O14	

Maternal care for poor fetal growth	O365
Maternal care for excessive fetal growth	O366
Perineal laceration	O70.0–O70.9
Preterm birth	O60
Failed induction	O61
Shoulder dystocia	O66.0
Large fetus labour	O66.2
Spontaneous delivery	O80
Caesarean section	O82
Pregnancy puerperium complication	O85–O90

Source: ACCD 2018b, IHACPA 2022.

Table 3: Australian Classification of Health Interventions (ACHI) codes

Health intervention	ACHI code
Induced labour	Block no: 1334
Augmentation labour	Block no: 1335
Caesarean section	Block no: 1340
	Block no: 621–638
	Block no: 650
	Block no: 653
	Block no: 660
	Block no: 670, 671
	Block no: 672–679
	Procedure code: 33500-00
Any obesity surgery	Procedure codes: 3051101 3051100 3051200 3051201 3051202 9095000 3051109 3051110 3051103 3051104 3051105 3051203 3051200 3051201 3051202 3051106 3051107 3051108 9094000 9094100 9095000 3051102 1421500 3051400 9095001 9094201 9094202 9094200 1421501 3144100 3144101 9094301 9094302 9094300
Lower limb amputation	Block number: 1533
	Procedure codes: 4433800 4435800 4436100 4436101 4436400 4436401

Source: ACCD 2018b.

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) (Table 4).

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 4: 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
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

Anatomical Therapeutic Chemical classification

Anatomical Therapeutic Chemical (ATC) codes are used in this report to classify medicines. This classification groups medicines according to the body organ or system they act upon, their therapeutic characteristics, and their chemical characteristics.

A list of the medicine groups included in this report is shown in Table 5.

More information on the ATC classification system can be found at the WHO Collaborating Centre for Drug Statistics Methodology.

Table 5: Anatomic Therapeutic Chemical medicine groups

ATC code	Description
A10A	Insulin
A10BA	Biguanides
A10BA02	Metformin
A10BB	Sulfonylureas
A10BC	Sulphonamides
A10BD	Combinations of oral blood glucose lowering drugs
A10BF	Alpha glucosidase inhibitors
A10BG	Thiazolidinediones
A10BJ	Glucagon-like peptide-1 (GLP-1) analogues
A10BK	Sodium-glucose co-transporter 2 (SGLT2) inhibitors

| A10BX | Other blood glucose lowering drugs, excluding insulins |

References

ACCD (Australian Consortium for Classification Development) (2018a) International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) –11th edition, tabular list of diseases and alphabetic index of diseases, Adelaide: Independent Hospital Pricing Authority.

ACCD (2018b) Australian Classification of Health Interventions (ACHI) – 11th edition, tabular list of interventions, and alphabetic index of interventions, Adelaide: Independent Hospital Pricing Authority.

WHO (World Health Organization) (2019) International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10), Geneva: WHO.

Acknowledgements

Glossary

abnormal blood lipid levels: Abnormal levels of fats in the blood, such as cholesterol or triglycerides. Here it has been defined as total cholesterol ≥5.5 mmol/L, LDL cholesterol ≥3.5 mmol/L, HDL cholesterol <1.0 mmol/L in men or <1.3 mmol/L in women, triglycerides ≥2mmol/L, or use of lipid-modifying medication.

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.

additional diagnosis: The diagnosis of a condition or recording of a complaint – either coexisting with the principal diagnosis or arising during the episode of admitted patient care (hospitalisation), episode of residential care or attendance at a health care establishment – that requires the provision of care. Multiple diagnoses may be recorded.

age-standardisation: A way to remove 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.

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

associated cause(s) of death: A cause(s) listed on the Medical Certificate of Cause of Death, other than the underlying cause of death. They include the immediate cause, any intervening causes, and conditions that contributed to the death but were not related to the disease or condition causing death.

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

body mass index (BMI): The most commonly used method of assessing whether a person is normal weight, underweight, overweight or obese (see *obesity*). It is calculated by dividing the person's weight (in kilograms) by their height (in metres) squared – that is, kg ÷ m2. For both men and women, underweight is a BMI below 18.5, normal weight is from 18.5 to less than 25, overweight but not obese is from 25 to less than 30, and obese is 30 and over. Sometimes overweight and obese are combined – defined as a BMI of 25 and over.

burden of disease and injury: The term that refers to the quantified impact of a disease or injury on an individual or population, using the *disability-adjusted life year* (DALY) measure.

cardiovascular disease (CVD): Any disease of the circulatory system, namely the heart (cardio) or blood vessels (vascular). Includes *heart attack*, *angina*, *stroke* and *peripheral arterial disease*. CVD is also known as *circulatory disease*.

cause(s) of death: All diseases, morbid conditions or injuries that either resulted in or contributed to death – and the circumstances of the accident or violence that produced any such injuries – that are entered on the Medical Certificate of Cause of Death. Causes of death are commonly reported by the underlying cause of death. See also *associated cause(s) of death* and *multiple causes of death*.

chronic diseases: Term applied to a diverse group of diseases, such as heart disease, cancer and arthritis, that tend to be long-lasting and persistent in their symptoms or development. Although these features also apply to some communicable diseases, the term is usually confined to non-communicable diseases.

circulatory disease: Alternative name for *cardiovascular disease*.

comorbidity: Defined in relation to an index disease/condition, comorbidity describes any additional disease that is experienced by a person while they have the index disease. The index and comorbid disease/condition will change depending on the focus of the study. Compare with multimorbidity.

confidence interval: A range determined by variability in data, within which there is a specified (usually 95%) chance that the true value of a calculated parameter lies.

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

disability-adjusted life year (DALY): A year of healthy life lost, either through premature death or equivalently through living with disability due to illness or injury. It is the basic unit used in *burden of disease and injury* estimates.

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

glycated haemoglobin: is the main biomarker used to assess long-term glucose control in people living with diabetes. Haemoglobin is a protein in red blood cells which can bind with sugar to form HbA1c. It is directly related to blood glucose levels and strongly related with the development of long-term diabetes complications.

HbA1c: see glycated haemoglobin.

high blood cholesterol: Total cholesterol levels above 5.5 mmol/L.

high blood pressure/hypertension: The definition of high blood pressure (also known as hypertension) can vary but a well-accepted one is from the World Health Organization: a systolic blood pressure of 140 mmHg or more or a diastolic blood pressure of 90 mmHg or more, or [the person is] receiving medication for high blood pressure. Also see *blood pressure*.

hospitalisation: Synonymous with admission and separation; that is, an episode of hospital care that starts with the formal admission process and ends with the formal separation process. An episode of care can be completed by the patient's being discharged, being transferred to another hospital or care facility, or dying, or by a portion of a hospital stay starting or ending in a change of type of care (for example, from acute to rehabilitation).

hypertension: See *high blood pressure*.

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

lipids: Fatty substances, including cholesterol and triglycerides, that are in blood and body tissues.

median: is based on the value(s) of the observation(s) at the midpoint of a list of observations ranked from the smallest to the largest.

Metformin: a medication that lower blood glucose levels by reducing the amount of stored glucose released by the liver, slowing the absorption of glucose from the intestine, and helping the body to become more sensitive to insulin so that it works better.

multiple causes of death: All the causes listed on the Medical Certificate of Cause of Death. These include the underlying cause of death and all associated cause(s) of death. See also *cause(s) of death*.

other diabetes: a name for less common diabetes resulting from a range of different health conditions or circumstances.

prevalence: The number or proportion (of cases, instances, and so forth) in a population at a given time. For example, in relation to cancer, refers to the number of people alive who had been diagnosed with cancer in a prescribed period (usually 1, 5, 10 or 26 years). Compare with *incidence*.

principal diagnosis: The diagnosis established after study to be chiefly responsible for occasioning an episode of patient care (hospitalisation), an episode of residential care or an attendance at the health care establishment. Diagnoses are recorded using the relevant edition of the International statistical classification of diseases and related health problems, 10th revision, Australian modification (ICD-10-AM).

procedure: A clinical intervention that is surgical in nature, carries a procedural risk, carries an anaesthetic risk, and requires specialist training and/or special facilities or equipment available only in the acute-care setting.

remoteness: A system which classifies geographical locations into groups (Major cities, Inner regional, Outer regional, Remote, Very remote) according to distance from major population centres and services. In these analysis, remoteness is based on Accessibility/Remoteness Index of Australia (ARIA) and defined as Remoteness Areas by the Australian Statistical Geographical Standard (ASGS) (in each Census year). Remoteness is a geographical concept and does not take account of accessibility which is influenced by factors such as the socioeconomic status or mobility of a population.

risk factor: Any factor which represents a greater risk of a health disorder or other unwanted condition or event. Some risk factors are regarded as causes of disease, others are not necessarily so. Along with their opposites, protective factors, risk factors are known as *determinants*.

socioeconomic areas: Is an indication of how 'well off' a person or group is. Socioeconomic areas are reported using the Australian Bureau of Statistics' Socio-Economic Indexes for Areas (SEIFA), whereby areas are classified on the basis of social and economic information (such as low income, low educational attainment, high levels of public sector housing, high unemployment and jobs in relatively unskilled occupations) collected in the Census of Population and Housing. Socio-Economic Indexes for Areas, are divided into 5 groups, from the most disadvantaged (worst off) to the least disadvantaged (best off). Note, that this index refers to the average disadvantage of all people living in an area, not to the level of disadvantage of a specific individual.

type 1 diabetes: a lifelong autoimmune disease that can be diagnosed at any age. The exact cause is unknown, but it is believed to be the result of an interaction of genetic and environmental factors.

type 2 diabetes: The most common form of diabetes, is a condition in which the body becomes resistant to the normal effects of insulin and gradually loses the capacity to produce enough insulin in the pancreas. The condition has strong genetic and family-related (non-modifiable) risk factors and is also often associated with modifiable risk factors.

underlying cause of death: The disease or injury that initiated the train of events leading directly to death, or the circumstances of the accident or violence that produced the fatal injury. See also *cause(s) of death* and *associated cause(s) of death*.

Notes

Latest data update

30 June 2023

- New 2021 diabetes incidence, prevalence and deaths data. Updates to Burden of Disease, Disease expenditure and information relating to COVID‑19.
- Data table: Diabetes Australian Facts added to <u>data</u>.

Data

The data tables present the latest available data on diabetes in Australia as reported in the *Diabetes: Australian facts* report.

Related material

Related topics

- Chronic disease

Report editions

This release

Diabetes: Australian facts | 30 Jun 2023

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Note: request access to archived data tables via diabetes@aihw.gov.au.