



Australian Government

**Australian Institute of
Health and Welfare**

Incidence of insulin-treated diabetes in Australia

2014



Australian Government

**Australian Institute of
Health and Welfare**

*Authoritative information and statistics
to promote better health and wellbeing*

DIABETES SERIES

Number 25

Incidence of insulin-treated diabetes in Australia

2014

Australian Institute of Health and Welfare
Canberra

Cat. no. CVD 75

The Australian Institute of Health and Welfare is a major national agency which provides reliable, regular and relevant information and statistics on Australia's health and welfare. The Institute's mission is authoritative information and statistics to promote better health and wellbeing.

© Australian Institute of Health and Welfare 2016



This product, excluding the AIHW logo, Commonwealth Coat of Arms and any material owned by a third party or protected by a trademark, has been released under a Creative Commons BY 3.0 (CC-BY 3.0) licence. Excluded material owned by third parties may include, for example, design and layout, images obtained under licence from third parties and signatures. We have made all reasonable efforts to identify and label material owned by third parties.

You may distribute, remix and build upon this work. However, you must attribute the AIHW as the copyright holder of the work in compliance with our attribution policy available at <www.aihw.gov.au/copyright/>. The full terms and conditions of this licence are available at <<http://creativecommons.org/licenses/by/3.0/au/>>.

This publication is part of the Australian Institute of Health and Welfare's Diabetes series. A complete list of the Institute's publications is available from the Institute's website <www.aihw.gov.au>.

ISSN 2205-4790 (PDF)

ISSN 1444-8033 (Print)

ISBN 978-1-74249-928-4 (PDF)

ISBN 978-1-74249-929-1 (Print)

Suggested citation

Australian Institute of Health and Welfare 2016. Incidence of insulin-treated diabetes in Australia 2014. Diabetes series no. 25. Cat. no. CVD 75. Canberra: AIHW.

Australian Institute of Health and Welfare

Board Chair

Dr Mukesh C Haikerwal AO

Acting Director

Mr Andrew Kettle

Any enquiries about copyright or comments on this publication should be directed to:

Digital and Media Communications Unit

Australian Institute of Health and Welfare

GPO Box 570

Canberra ACT 2601

Tel: (02) 6244 1000

Email: info@aihw.gov.au

Published by the Australian Institute of Health and Welfare

Please note that there is the potential for minor revisions of data in this report. Please check the online version at <www.aihw.gov.au> for any amendments.

Contents

- Acknowledgments..... iv
- Summary v
- 1 Introduction..... 1**
- 2 New insulin users in 2014..... 5**
- 3 Type 1 diabetes 6**
 - Sex 6
 - Age..... 6
 - State and territory..... 7
 - Inequalities 7
 - Trends (2000–2014)..... 9
 - Comparing incidence of type 1 diabetes among children, young people and adults 10
- 4 Insulin-treated type 2 diabetes 13**
 - Sex 13
 - Age..... 13
 - State and territory..... 14
 - Inequalities 15
 - Trends (2000–2014)..... 17
- 5 Insulin-treated gestational diabetes 18**
- Appendix A: Supplementary tables..... 20**
- Appendix B: Statistical notes and methods..... 31**
 - Data sources 31
 - Data quality and issues..... 33
 - Statistical methods..... 35
- References 38**
- List of tables 39**
- List of figures 40**

Acknowledgments

This report was prepared by Sarah Bullock, James Pearce and Karen Byng of the National Centre for Monitoring Vascular Diseases at the Australian Institute of Health and Welfare (AIHW). Sushma Mathur, Lynelle Moon, Louise Catanzariti, Mark Cooper-Stanbury, Fadwa Al-Yaman and David Whitelaw at the AIHW provided valuable comments and guidance.

Valuable input was also received from the AIHW Diabetes Expert Advisory Group, whose members are Jonathan Shaw (Chair), Stephen Colagiuri, Maria Craig, Wendy Davis, Mark Harris, Greg Johnson, Glynis Ross and Sophia Zoungas.

The authors greatly appreciate the data and assistance provided in the ongoing development of the National (insulin-treated) Diabetes Register from Diabetes Australia and the Australasian Paediatric Endocrine Group.

The Australian Government Department of Health funded this report. The authors acknowledge the valuable comments from individual staff members at the Department.

Summary

This report uses data from the 2014 National (insulin-treated) Diabetes Register to examine the number of new cases (incidence) of insulin-treated diabetes in Australia.

In 2014 there were 29,436 people who began using insulin to treat their diabetes in Australia – 66% had type 2 diabetes, 23% had gestational diabetes, 9% had type 1 diabetes and 2% had other forms of diabetes.

Type 1 diabetes



In 2014, **2,509 people were diagnosed with type 1 diabetes** – 11 cases per 100,000 population, or 1 in every 9,000 Australians.



The incidence rate was **higher in males** than females – 13 in every 100,000 males, compared with 10 in every 100,000 females.



Almost **two in three (63%)** people diagnosed with type 1 diabetes were **under the age of 25**, with the **peak age of diagnosis at 10–14 years** (33 cases per 100,000 population).

Insulin-treated type 2 diabetes



In 2014, **19,390 people began using insulin** to manage type 2 diabetes – 75 cases per 100,000 population, or 1 in every 1,300 Australians.



The incidence rate was **1.5 times as high in males** as in females – 90 in every 100,000 males, compared with 61 in every 100,000 females.



Almost all (93%) new cases of insulin-treated type 2 diabetes occurred in those **over the age of 40**, with the peak among people aged 70–74 (278 per 100,000 population).



Incidence rates were **three times as high among Aboriginal and Torres Strait Islander Australians** than non-Indigenous Australians.



Incidence rates were at least **twice as high** among those **in the lowest socioeconomic group** than the highest group.

Insulin-treated gestational diabetes



In 2014, **6,625 women began using insulin** to manage gestational diabetes – 2,174 cases per 100,000 women who gave birth.



Among women who gave birth, **incidence rates increased with maternal age**; with the highest rates in women aged 45–49 (5,913 per 100,000 women who gave birth).

1 Introduction

This report examines new cases (incidence) of insulin-treated diabetes in Australia in 2014, and is part of the ongoing national reporting from the National (insulin-treated) Diabetes Register (NDR).

Diabetes and insulin use

Diabetes is a chronic condition marked by high levels of glucose in the blood. Insulin is a naturally occurring hormone that the pancreas produces, which helps to control blood sugar levels. People with diabetes are no longer able to produce or use insulin effectively, or both. The absence of insulin means glucose cannot be moved into the cells where it is used for energy, and blood glucose levels rise. There are various types of diabetes including type 1 diabetes, type 2 diabetes, gestational diabetes and other types.

Managing diabetes

All people with diabetes must manage their condition with healthy eating, regular physical activity and ongoing monitoring of blood glucose levels to avoid short-term and long-term health complications. Some people with diabetes may also require medications to maintain blood glucose levels within the optimum range. All people with type 1 diabetes, and a proportion of people with other forms of diabetes, will require insulin to manage their condition and keep blood glucose levels within an optimal range. Insulin replacement therapy involves multiple daily injections or continuous infusion using an insulin pump.

Complications of diabetes

The objective of diabetes management is to keep blood glucose levels within an optimal range. Poor glycaemic control – where blood glucose levels fluctuate beyond a recommended range – is associated with both short-term and long-term health complications. In some cases, poor management of diabetes can be fatal.

Short-term health complications of diabetes include diabetic ketoacidosis (a life-threatening condition due to inadequate insulin production or administration, leading to profound disturbance of the metabolism, and a build-up of acids in the blood), hypoglycaemia (low blood sugar), hyperglycaemia (high blood sugar), increased susceptibility to infections and reduced ability to heal.

Long-term complications of diabetes may progress to a range of health conditions such as cardiovascular disease (including heart attack and stroke), kidney disease, retinopathy (loss of vision), neuropathy (nerve damage) and lower limb amputation.

Type 1 diabetes

Type 1 diabetes is a chronic autoimmune disease that develops when the immune system destroys the insulin-producing cells in the pancreas. To control blood glucose levels, insulin replacement is essential for all people with type 1 diabetes and will be required every day throughout a person's life, except in cases where a pancreatic transplant occurs.

Type 1 diabetes most commonly has onset in childhood or adolescence and is difficult to manage, particularly in children, as it requires a careful balance of diet, exercise and insulin intake. Many children have suboptimal glycaemic control (Craig et al. 2002), which increases the risk of complications. Prolonged duration of type 1 diabetes, especially where blood glucose levels have fluctuated, results in diabetes-related complications becoming increasingly common over time (Craig et al. 2011). Therefore children diagnosed at a young age are at a greater risk of developing complications compared with those diagnosed later in life (Craig et al. 2002).

The cause of type 1 diabetes is unknown, although it is believed to result from genetic predisposition and environmental factors.

Type 2 diabetes

Type 2 diabetes is the most common form of diabetes, representing 85–90% of all cases of diabetes (Diabetes Australia 2015). Type 2 diabetes is a progressive condition which occurs when the body becomes resistant to insulin or insulin production is inadequate; because the condition tends to develop over a long period of time, it generally has later onset. Type 2 diabetes is usually managed through a combination of diet, exercise and medications, and is understood to be potentially reversible, particularly in the early stages of the condition (Taylor 2013). When blood glucose levels can no longer be maintained at optimum levels through diet, exercise and other medications, insulin replacement may be required. Around 1 in 5 (20%) people with type 2 diabetes require insulin (AIHW 2006; Davis et al. 2012). A person's age, blood glucose control, co-morbidities and the duration of diabetes affect whether their type 2 diabetes requires insulin treatment.

The condition is thought to be largely preventable, as many of its risk factors are modifiable such as physical inactivity, unhealthy diet, obesity, tobacco smoking, high blood pressure and high blood lipids. Age and family history can also predispose people to developing type 2 diabetes.

Gestational diabetes

Gestational diabetes is a transient form of diabetes where higher than normal blood glucose is first diagnosed in pregnancy. It occurs in around 6% of pregnancies (AIHW 2014), and insulin replacement is required in around 1 in 3 (32%) of these cases (AIHW 2008). Gestational diabetes can result in complications for both the mother and baby. While it usually alleviates after pregnancy, gestational diabetes increases the risk that both the mother and the baby may develop type 2 diabetes later in life; particularly when the mother has used insulin during pregnancy (Lee et al. 2007).

Other types of diabetes

Other types of diabetes are relatively uncommon, and are most typically related to certain conditions and syndromes which result in defects in insulin secretion, insulin action, or both. Other forms of diabetes include certain conditions and syndromes such as: genetic defects of the insulin-producing beta-cells and insulin action; other diseases of the pancreas; endocrine diseases; drug- or chemical-induced diabetes; and infections.

For some people with other types of diabetes, adequate glycaemic control can be achieved through diet and exercise or use of other medications. However, a proportion of people with other types of diabetes may also require insulin to manage their blood glucose.

Monitoring insulin-treated diabetes

Diabetes is a progressive condition. Even with effective management the condition progresses and treatment needs to be regularly reviewed and revised to maintain good management (Baker IDI Heart and Diabetes Institute 2012). Effective treatment of diabetes has been consistently shown to reduce the likelihood of complications. For people that require insulin to manage their diabetes, this progression requires close monitoring, including the onset of complications, to promote the best outcomes.

At a population level, monitoring the incidence of insulin-treated diabetes is an important indicator of the health of the Australian people. Rises in the incidence of type 1, type 2 and gestational diabetes have been predicted and validated globally, meaning there is the potential for the number of people requiring insulin in Australia to grow substantially.

It is for these reasons that monitoring insulin-treated diabetes on a population level is essential to improve Australia's capacity to plan preventive and treatment services, focus on priority population groups, track the impact of environmental change and of prevention and control strategies, and make decisions for cost-effective allocation of resources. As highlighted in the Australian Government's National Diabetes Strategy, research, evidence and data play an important role in strengthening broader diabetes prevention and care (Australian Government Department of Health 2015).

The National (insulin-treated) Diabetes Register

Results presented in this report are from the National (insulin-treated) Diabetes Register (NDR), which was established in 1999 and captures information about people who use insulin to treat and manage diabetes. The AIHW maintains the NDR and it is derived from 2 primary data sources: the National Diabetes Services Scheme (NDSS) and the Australasian Paediatric Endocrine Group (APEG).

The NDSS is an initiative of the Australian Government, administered by Diabetes Australia, to subsidise the supply of diabetes-related products to people who are registered with the scheme. A diagnosis of diabetes, that a health professional has substantiated, is required in order to register with, and purchase products through, the NDSS.

The APEG is a professional body that represents health professionals involved in the management and research of disorders of the endocrine system, including diabetes in children and adolescents. The APEG maintains clinic-based state and territory diabetes registers.

The capture of insulin-treated diabetes on the NDR is dependent on the coverage of these 2 primary data sources. For more information on the NDR, see 'Appendix B: Statistical notes and methods'.

This report

This report presents the latest available data on new cases (incidence) of insulin-treated diabetes in Australia from 1 January to 31 December 2014, as well as trend data from 2000, where feasible.

The report presents data by diabetes type (type 1 diabetes, insulin-treated type 2 diabetes, and insulin-treated gestational diabetes), comparing demographic characteristics,

geographical location and whether differences exist for subgroups of the population. Additionally, as type 1 diabetes is predominantly diagnosed in children, a comparative age analysis of type 1 diabetes is presented.

The AIHW has published several reports using earlier NDR data. The results presented in this report, however, cannot be compared with previous NDR incidence publications because the methods relating to the supply and processing of data have changed considerably to improve the accuracy of reporting.

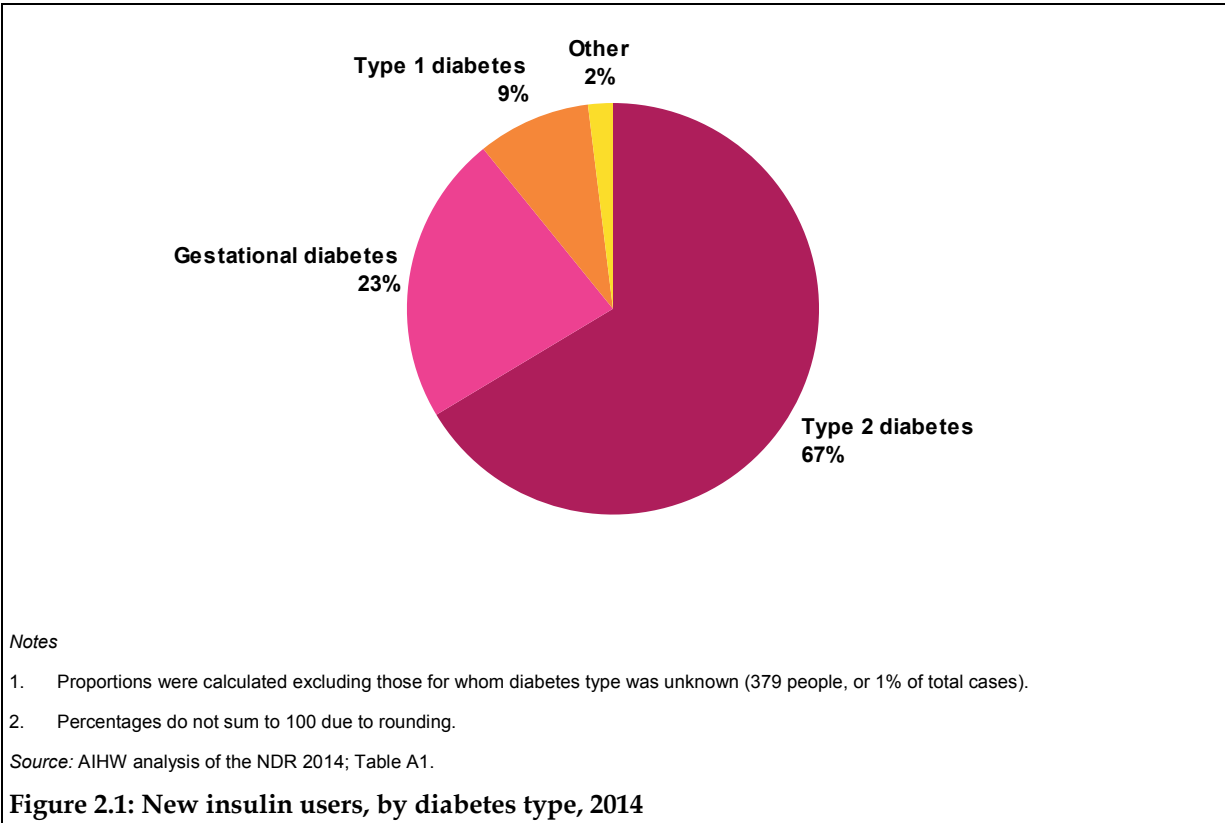
For more information, see 'Appendix B: Statistical notes and methods'.

2 New insulin users in 2014

Data from the latest NDR show that in 2014 there were a total of 29,435 people who began to use insulin to treat diabetes.

Of these, the majority of new insulin users, 19,390 (67%) people, started using insulin to treat type 2 diabetes. There were 6,625 (23%) women who began using insulin to treat gestational diabetes, and a further 2,509 (9%) people were diagnosed and began using insulin to treat type 1 diabetes.

The remaining 532 (2%) people had other forms of diabetes requiring insulin treatment in 2014 (Figure 2.1). Given the relatively low incidence of other types of diabetes, this group is not a focus of this report. For more information, see Table A11.



3 Type 1 diabetes

In 2014, there were 2,509 new cases of type 1 diabetes in Australia – this represented 11 cases per 100,000 population, or 1 in around 9,000 people.

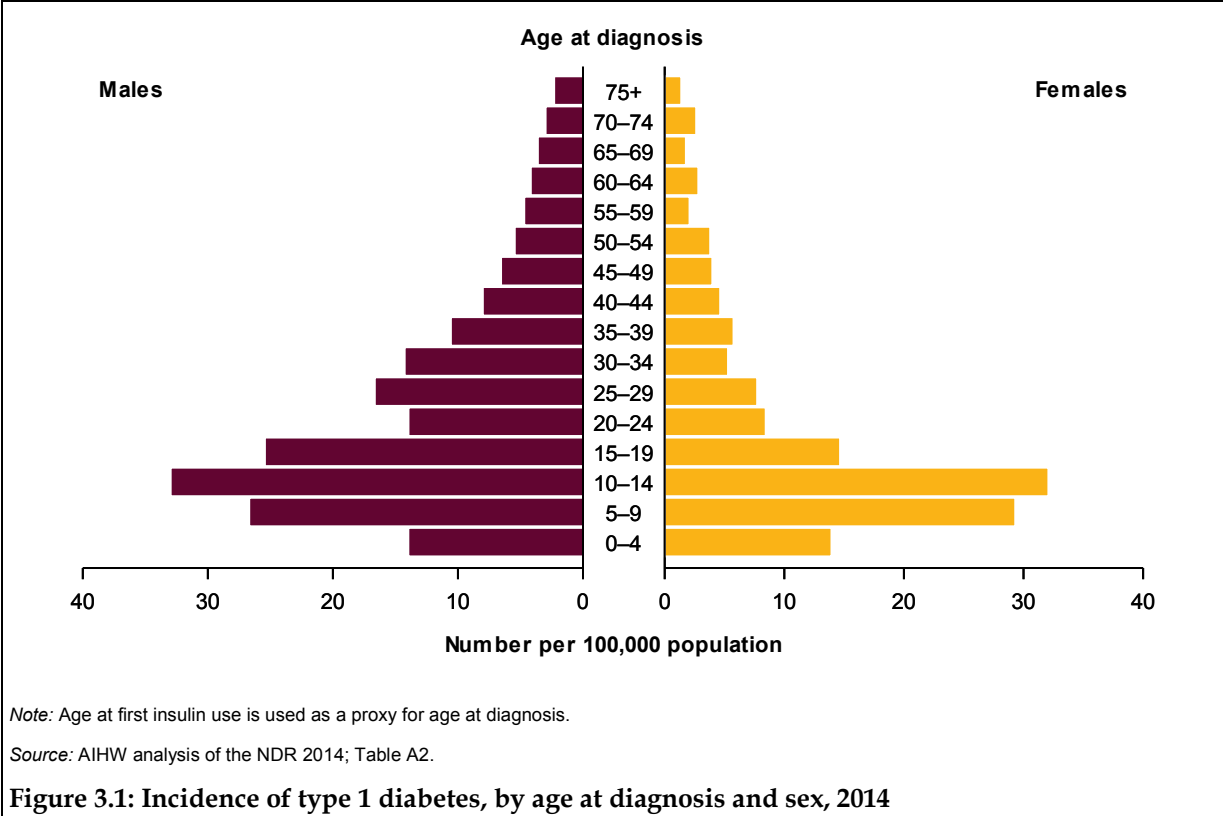
Sex

Among new cases of type 1 diabetes in 2014, there was a higher proportion of males than females – 1,477 (59%) were male and 1,032 (41%) were female.

The incidence rate of type 1 diabetes was also higher in males than females – 13 in every 100,000 males, compared with 9 in every 100,000 females.

Age

In 2014, almost 2 in 3 (63%) new cases of type 1 diabetes were diagnosed among children and young people aged under 25. The peak age of diagnosis was at age 10–14, at an incidence rate of 33 cases per 100,000 population in this age group. This was more than 3 times the rate at age 30–34 (10 per 100,000) and as much as 16 times the rate among those over 75 (2 per 100,000) (Figure 3.1).



State and territory

In 2014, the incidence rate of type 1 diabetes was highest in Tasmania, South Australia and the Australian Capital Territory, with 14 to 15 cases per 100,000 population living in each state or territory. Other states had rates ranging from 10 to 12 cases per 100,000 population.

Type 1 diabetes incidence rates in the Northern Territory have not been presented in this report because of the small number of cases in the Territory. The small number of cases in the Northern Territory may be influenced by the potentially lower capture of people living in remote and very remote areas on the NDR; there is a relatively high proportion of people living in remote and very remote areas in the Northern Territory compared with other jurisdictions. Furthermore, the lower incidence rate in the Northern Territory may be influenced by the relatively high proportion of Indigenous Australians living there who, for several reasons, may not be captured on the NDR. For more information on remoteness and Indigenous reporting, see 'Appendix B: Statistical notes and methods'. For detailed information by state and territory, see Table A3.

Inequalities

Remoteness

In 2014, the incidence rate of type 1 diabetes was lower in *Remote and very remote* areas (8 cases per 100,000 population living these areas) compared with other areas, where rates were 1.5–2 times as high (11–14 cases per 100,000 people living in these areas) (Figure 3.2).

The low rate in *Remote and very remote* areas may reflect the potentially lower capture of people living in these areas on the NDR. NDSS services may be limited in rural Australia and unavailable in *Remote* and *Very remote* communities. Where this is the case, other programs may be available to assist with the purchase of diabetes-related products. Consequently, the coverage of the NDSS may be lower in these areas, which may mean that the NDR will underestimate the number of people with type 1 diabetes in these areas. For more information on remoteness reporting, see 'Appendix B: Statistical notes and methods'.

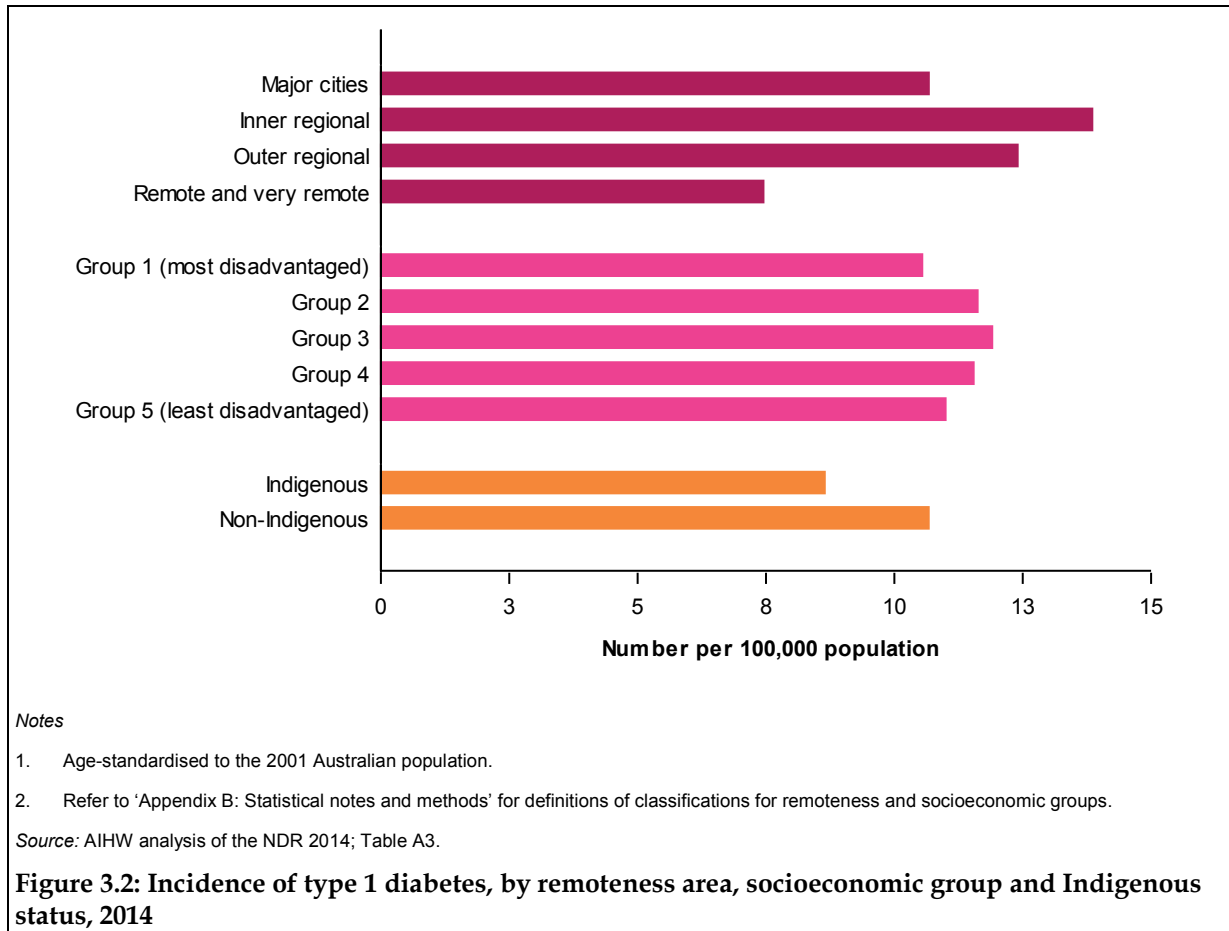
Socioeconomic disadvantage

In 2014, the incidence rate of type 1 diabetes was similar across all socioeconomic groups, with rates ranging from 11 to 12 cases per 100,000 population in each group (Figure 3.2).

Aboriginal and Torres Strait Islander people

In 2014, 75 of the 2,509 (3%) new cases of type 1 diabetes were among Aboriginal and Torres Strait Islander people. This represented 9 new cases per 100,000 Indigenous Australians, or 1 in every 1,100 Indigenous people. The incidence rate for non-Indigenous Australians was 11 cases per 100,000 population (Figure 3.2).

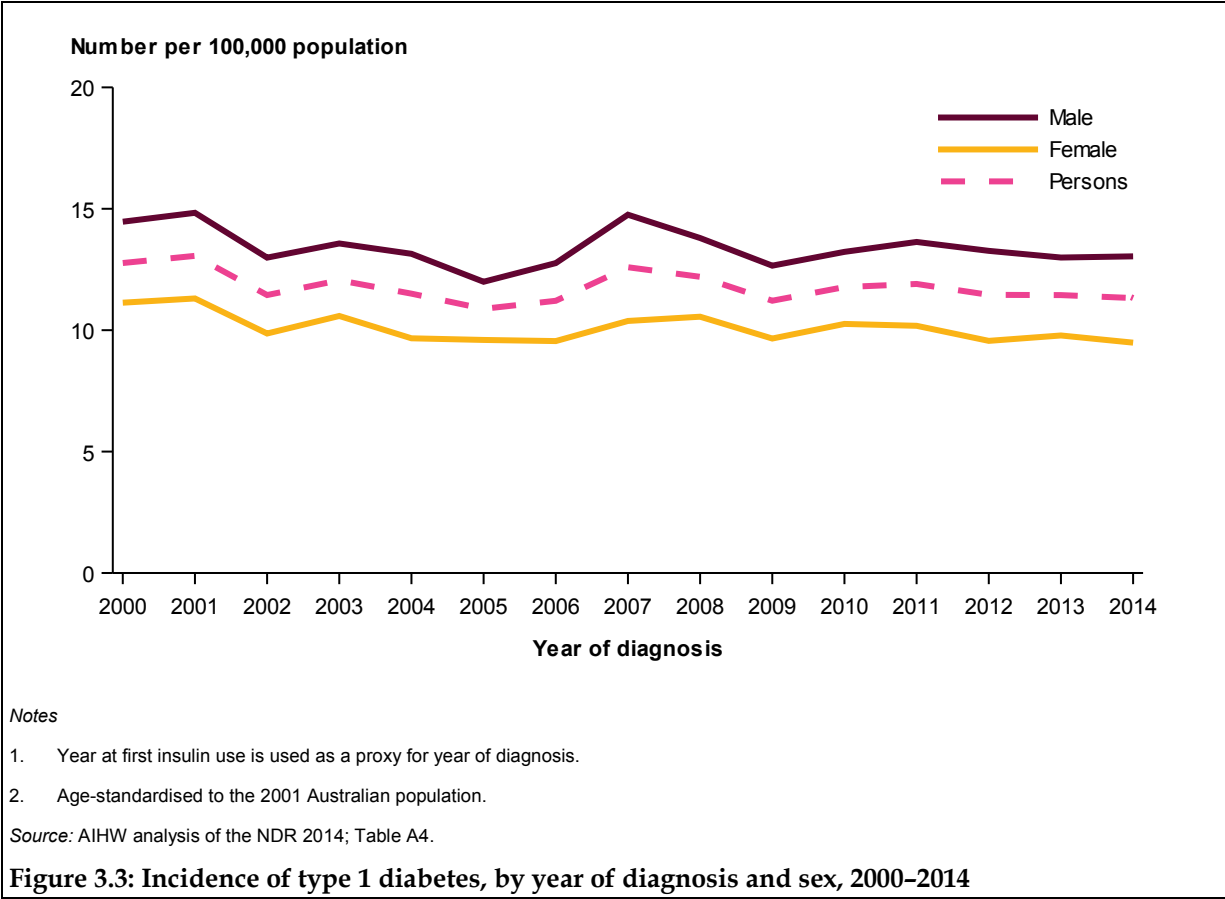
The NDR is likely to underestimate the number of Aboriginal and Torres Strait Islander registrants with type 1 diabetes due to a number of factors, including the voluntary nature of identifying Indigenous status on registration forms, limited access to NDSS services particularly in remote areas of Australia, and access to subsidised medicines through other programs. For more information on Indigenous reporting, see 'Appendix B: Statistical notes and methods'.



Trends (2000–2014)

From 2000 to 2014 there were 36,117 new cases of type 1 diabetes diagnosed in Australia. This was, on average, around 2,400 new cases each year, or almost 7 cases per day.

Incidence rates of type 1 diabetes remained relatively stable during 2000–2014, fluctuating between 11 and 13 cases per 100,000 population each year. Incidence rates for both males and females showed a similar stable pattern – the rate of new cases for males fluctuated between 12 and 15 cases per 100,000 population each year, and females between 10 and 11 cases (Figure 3.3).



Comparing incidence of type 1 diabetes among children, young people and adults

For the purposes of this section, the term *children* is used to refer to people aged 0–14, *young people* describes those aged 15–24 and *adults* includes all those aged 25 and over.

Age group

Of all new cases of type 1 diabetes in 2014, 43% were among children and 19% occurred among young people, leaving the adult population 25 years and over accounting for 37% of new cases. The incidence rate of type 1 diabetes for children (25 cases per 100,000 population) was around 1.5 times as high as for young people (16 per 100,000) and 4 times as high as for adults (6 per 100,000) (Table A5).

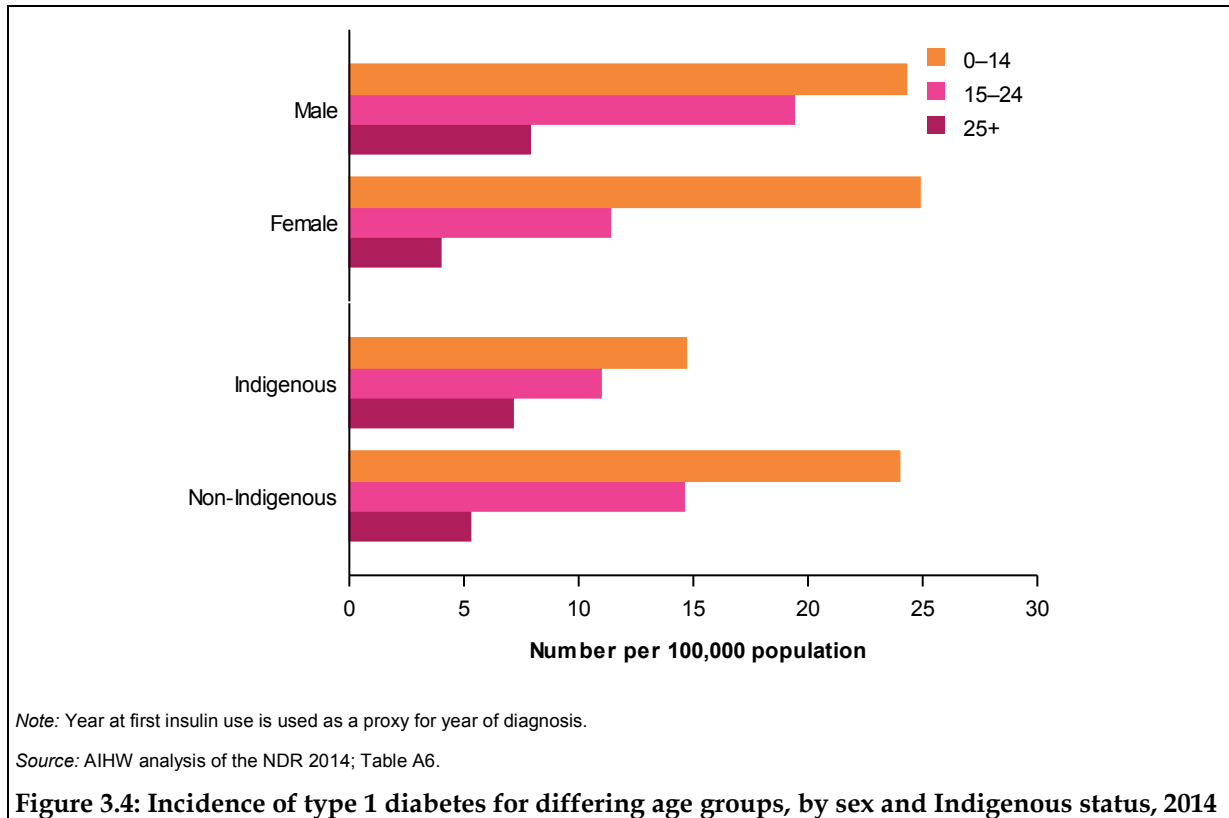
Sex

As people age, the incidence rate of type 1 diabetes becomes increasingly more common in males than females. For children, rates were similar for males and females (24 and 25 per 100,000 children, respectively), while among young people and adults incidence rates were higher for males than females (19 and 11 per 100,000 young people, and 8 and 4 per 100,000 adults, respectively) (Figure 3.4).

Aboriginal and Torres Strait Islander people

For children and young people, the incidence rate of type 1 diabetes was lower among Indigenous than non-Indigenous Australians – there were 15 and 24 cases per 100,000 children, and 11 and 15 cases per 100,000 young people, respectively. However, the opposite pattern was observed for adults, where rates of type 1 diabetes were slightly higher among Indigenous adults (7 per 100,000 population) compared with their non-Indigenous counterparts (5 per 100,000) (Figure 3.4).

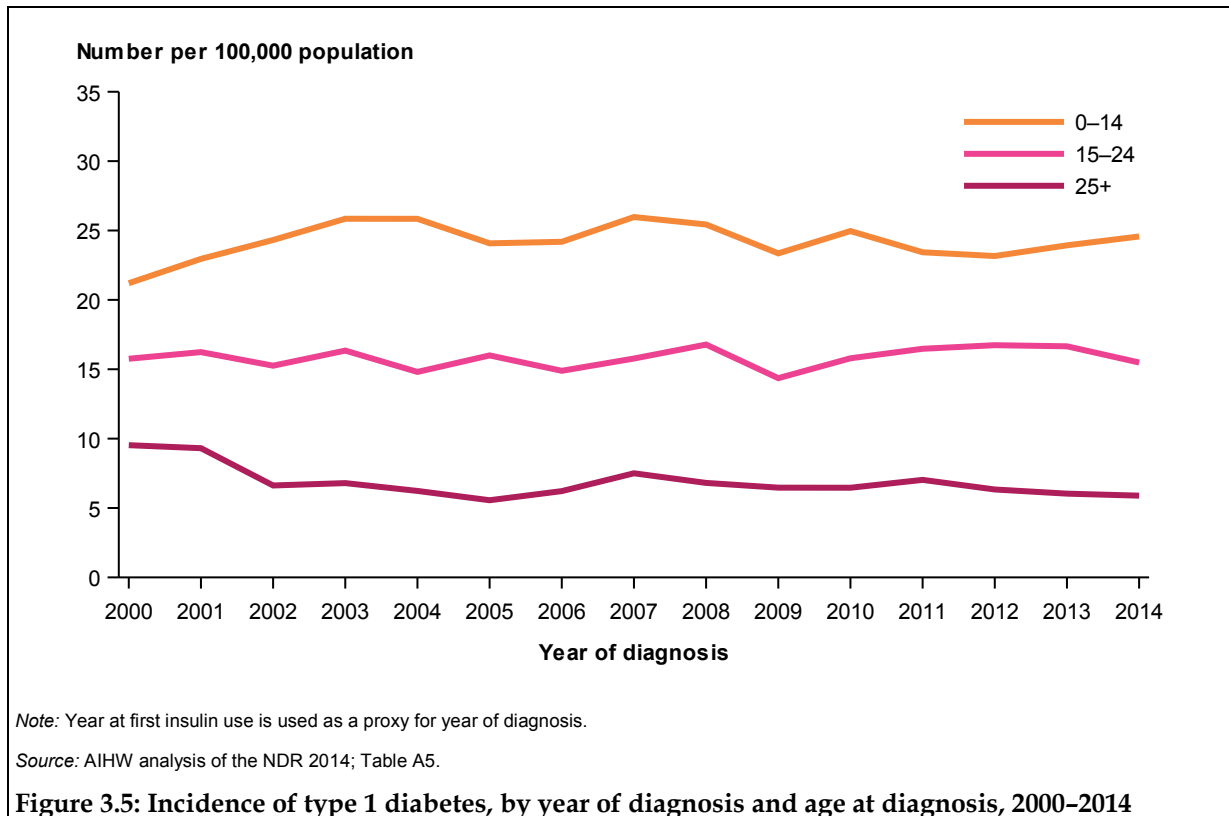
Data quality issues on the NDR for Aboriginal and Torres Strait Islander people, in terms of ascertainment and identification, mean further exploration is needed to interpret this pattern. For more information on Indigenous reporting see 'Appendix B: Statistical notes and methods'.



There was no clear difference in the type 1 diabetes incidence rate patterns for children, young people and adults by state or territory of residence, remoteness or socioeconomic group. For these factors, the patterns across all 3 age groups reflected the overall type 1 diabetes incidence rate patterns. However, across all ages the incidence rates of type 1 diabetes in *Remote and very remote* areas may be influenced by the potentially lower capture on the NDR of people living in these areas. For more information on remoteness reporting, see 'Appendix B: Statistical notes and methods'. For detailed information for children, young people and adults, see Table A6.

Trends (2000–2014)

Over the 2000–2014 period, the incidence rate of type 1 diabetes remained relatively stable for each age group. Over this period incidence rates among children remained up to 2 times as high as for young people and up to 4 times as high as for adults each year (Figure 3.5).



4 Insulin-treated type 2 diabetes

In 2014, 19,390 people began using insulin to treat and manage their type 2 diabetes – this represented 83 cases per 100,000 population, or 1 in around 1,200 Australians.

In the absence of national reliable annual data on the number of people diagnosed with type 2 diabetes in Australia (that is, the population at risk) incidence rates of insulin-treated type 2 diabetes are calculated using the total Australian population as the denominator. This should be considered when interpreting these results.

Sex

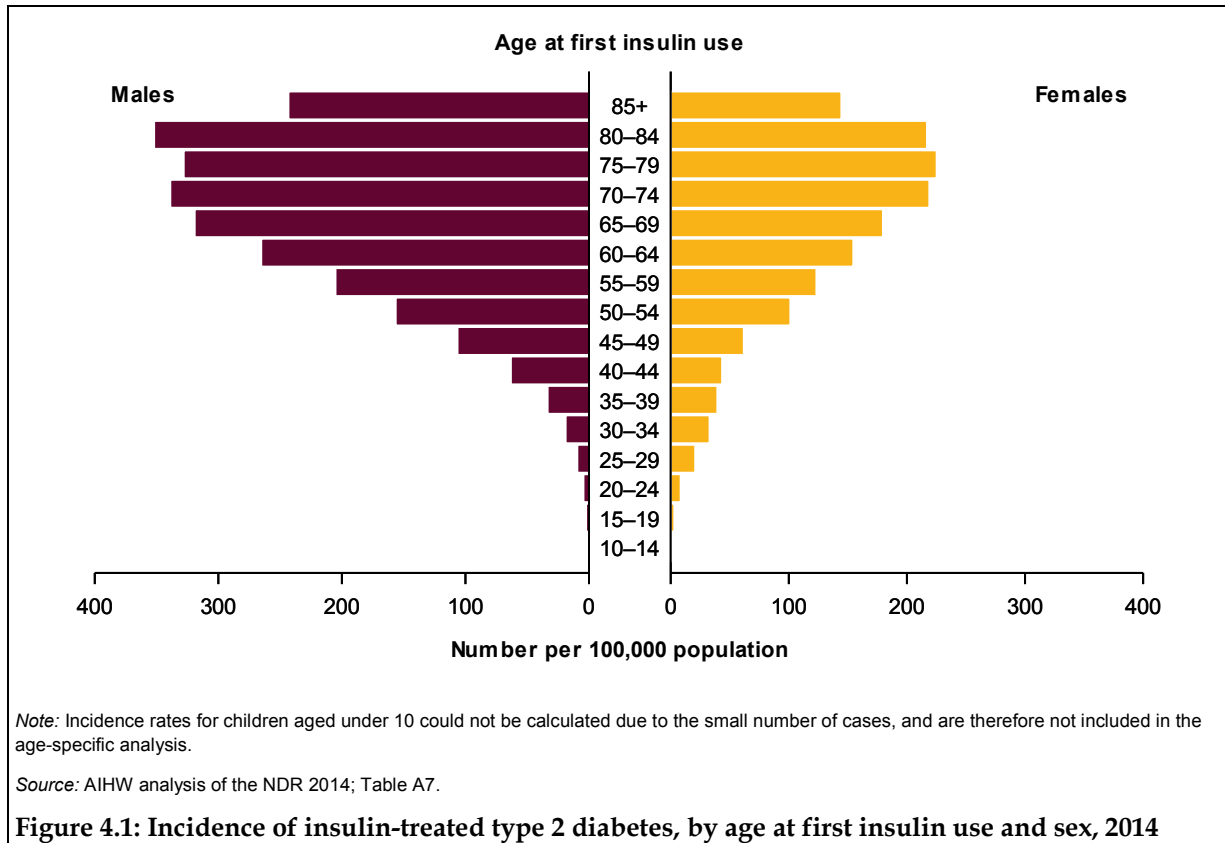
Among those who began using insulin to treat type 2 diabetes in 2014, 11,368 (59%) were male and 8,022 (41%) were female.

The incidence rate was 1.4 times as high in males as in females – 97 in every 100,000 males, compared with 68 in every 100,000 females

Age

In 2014, almost all (93%) new cases of insulin-treated type 2 diabetes occurred in those aged 40 and over, with less than 1% of new cases occurring among children and young people under the age of 25.

Incidence rates of insulin-treated type 2 diabetes were highest among the older age groups, with the peak age of first insulin use at age 70–74 – a rate of 278 cases per 100,000 population in this age group. This was more than twice the incidence rate at age 50–54 (129 per 100,000 population), 10 times the rate at age 30–34 (26 per 100,000) and more than 40 times the rate at age 20–24 (6 per 100,000) (Figure 4.1).



The incidence rate of insulin-treated type 2 diabetes was higher for females up to the age of 40, but thereafter males had higher rates in all age groups.

For people aged 10–39, around 1 in every 5,200 females started using insulin to treat their type 2 diabetes, compared with 1 in 8,300 males (19 and 12 per 100,000 females and males aged 10–39, respectively).

For those aged 40 and over, males were more likely than females to start using insulin to treat their type 2 diabetes – 1 in every 500 males compared with 1 in 800 females (204 and 127 per 100,000 males and females aged 40 and over, respectively).

State and territory

In 2014, the incidence rate of insulin-treated type 2 diabetes was lowest in the Australian Capital Territory, with 47 cases per 100,000 population. Incidence rates were highest in South Australia, the Northern Territory and Queensland, with 90, 89 and 87 cases per 100,000 population living in each state and territory, respectively. Other states had rates ranging from 68 to 72 per 100,000 population (Table A8).

The incidence rate of insulin-treated type 2 diabetes in the Northern Territory may be an underestimate due to the issues discussed previously, related to the potentially lower capture of people living in *Remote and very remote* areas and of Indigenous Australians on the NDR. Compared with other jurisdictions, the Northern Territory has a relatively high proportion of Indigenous Australians and people living in *Remote and very remote* areas. For more information on remoteness and Indigenous reporting, see 'Appendix B: Statistical notes and methods'. For detailed information by state and territory, see Table A8.

Inequalities

Remoteness

The incidence rate of insulin-treated type 2 diabetes increased with remoteness – from 72 per 100,000 population in *Major cities*, to 79 per 100,000 in *Inner regional* areas, and 86 and 88 per 100,000 in *Outer regional* and *Remote and very remote* areas, respectively (Figure 4.2).

The incidence rate in *Remote and very remote* areas may be influenced by the potentially lower capture on the NDR of people living in these areas. For more information on remoteness reporting, see 'Appendix B: Statistical notes and methods'.

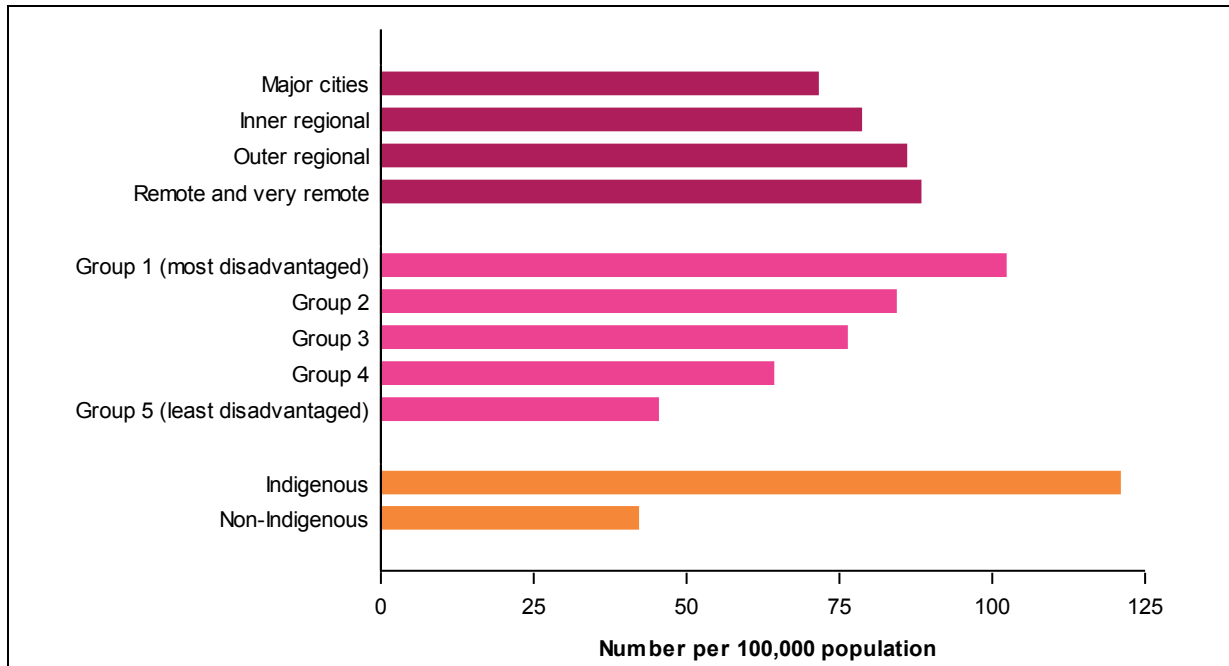
Socioeconomic disadvantage

In 2014, the incidence rate of insulin-treated type 2 diabetes increased with socioeconomic disadvantage – the rate in the lowest socioeconomic group was more than twice as high as in the highest socioeconomic group (102 and 45 cases per 100,000 population, respectively) (Figure 4.2).

Aboriginal and Torres Strait Islander people

In 2014, 555 of the 19,390 (3%) new cases of insulin-treated type 2 diabetes were among Aboriginal and Torres Strait Islander people – this represented 121 cases per 100,000 Indigenous Australians, or 1 in every 800 Indigenous people. This was around 3 times as high as the rate among non-Indigenous Australians, with 1 case occurring in every 2,400 people (or a rate of 42 per 100,000 non-Indigenous population) (Figure 4.2).

The NDR is likely to underestimate the number of Aboriginal and Torres Strait Islander registrants with insulin-treated type 2 diabetes due to a number of factors, including the voluntary nature of identifying Indigenous status on registration forms, limited access to NDSS services particularly in remote areas of Australia, and access to subsidised medicines through other programs. For more information on Indigenous reporting, see 'Appendix B: Statistical notes and methods'.



Notes

1. Age-standardised to the 2001 Australian population.
2. Refer to 'Appendix B: Statistical notes and methods' for definitions of classifications for remoteness and socioeconomic groups.

Source: AIHW analysis of the NDR 2014; Table A8.

Figure 4.2: Incidence of insulin-treated type 2 diabetes, by remoteness area, socioeconomic group and Indigenous status, 2014

Trends (2000–2014)

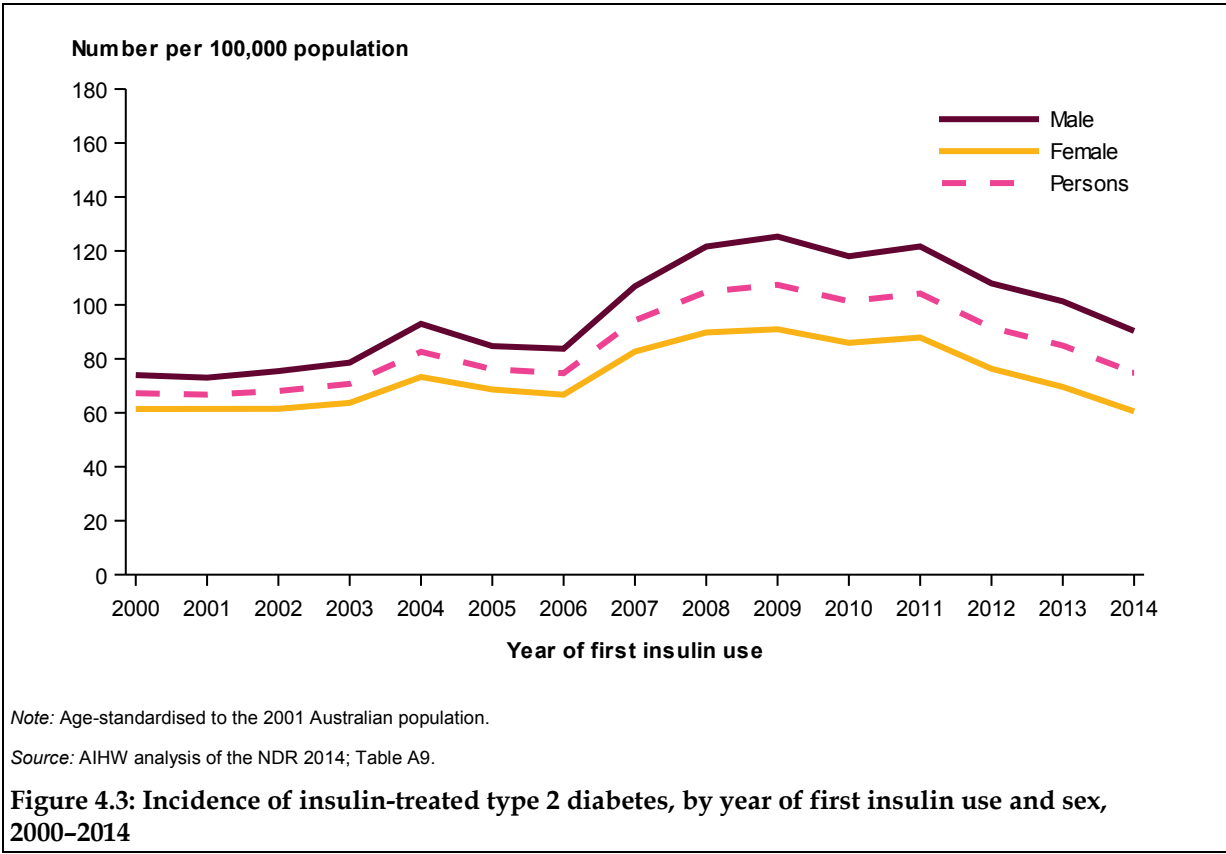
From 2000 to 2014, there were 283,779 new cases of insulin-treated type 2 diabetes. This was, on average, around 19,000 new cases each year, or 52 cases per day.

Incidence rates of insulin-treated type 2 diabetes remained relatively stable from 2000–2006, with rates fluctuating between 67 and 83 cases per 100,000 population, before rising to a peak of 107 cases per 100,000 population in 2009. From 2009 onwards, the incidence of insulin-treated type 2 diabetes declined to 75 cases per 100,000 population in 2014.

The incidence rates of insulin-treated type 2 diabetes remained consistently higher for males than females over the 2000–2014 period – the rate of new cases for males fluctuated between 73 to 125 cases per 100,000 males each year, and females between 61 and 91 cases for every 100,000 females (Figure 4.3).

A number of factors may drive the change the incidence rate of insulin-treated type 2 diabetes over time, including changes in the total number of people with type 2 diabetes; a shift in treatment patterns among the population with type 2 diabetes; structural and administrative changes to the data sources; or a combination of these factors.

Additional investigation is required to better understand the mechanisms influencing these trends. For more information on trend analyses, see ‘Appendix B: Statistical notes and methods’.



5 Insulin-treated gestational diabetes

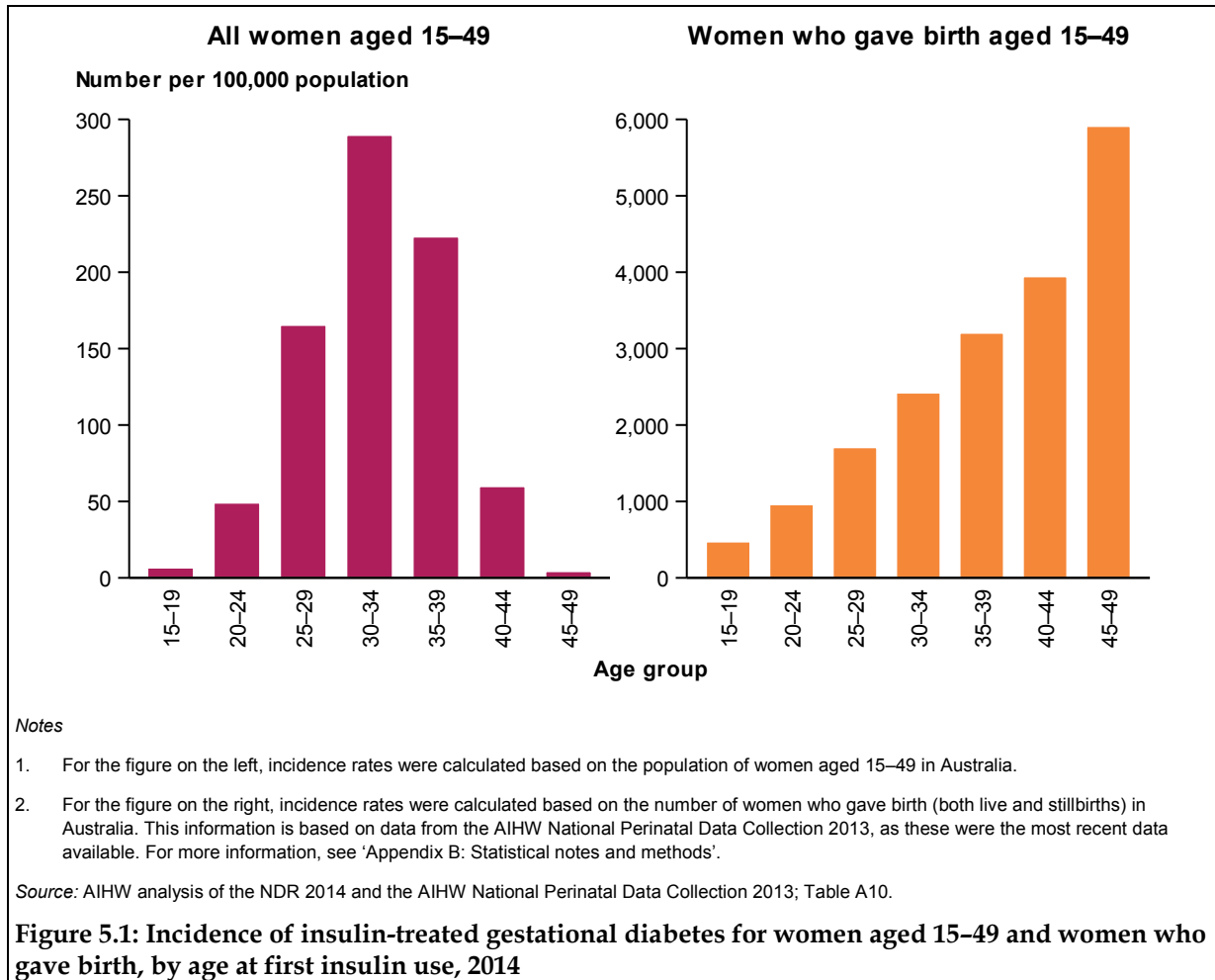
In 2014, 6,625 women aged 15–49 began to use insulin to treat gestational diabetes; of these, almost 2 in 3 (63%) were aged 30–39 years. The incidence rate was 2,174 cases per 100,000 women who gave birth, or 1 in around 46 women giving birth.

In this report, the incidence rates of insulin-treated gestational diabetes are calculated using 2 populations as the denominator – the Australian population of women of reproductive age (15–49), and the population of women who actually gave birth (according to the AIHW National Perinatal Data Collection 2013). These 2 populations are used in the absence of reliable annual data on the number of women diagnosed with gestational diabetes in Australia (that is, the population at risk). This should be considered when interpreting these results.

Age

The incidence rate of insulin-treated gestational diabetes among women who gave birth rose with maternal age, with the highest rates occurring in women aged 45–49 (5,913 per 100,000 women who gave birth). The incidence rate in this age group was almost 2.5 times as high as for those aged 30–34 (2,424 cases per 100,000 women who gave birth) and 6 times as high as for those aged 20–24 (962 cases per 100,000) (Figure 5.1).

This pattern differed when comparing insulin-treated gestational diabetes incidence rates with the general population of women of reproductive age, which shows that the peak age group is among women aged 30–34 (290 per 100,000 women aged 30–34), followed by those aged 35–39 (223 cases per 100,000 population) (Figure 5.1).



Appendix A: Supplementary tables

Table A1: Number of insulin users on the NDR 2014, by diabetes type and year of first insulin use

Diabetes type	2014	2000–2014
Type 1 diabetes	2,509	36,117
Type 2 diabetes	19,390	283,779
Gestational diabetes	6,625	45,810
Other diabetes	532	3,929
Unknown	379	8,705
Total	29,435	378,340

Source: AIHW analysis of the NDR 2014.

Type 1 diabetes

Table A2: Incidence of type 1 diabetes, by age at diagnosis and sex, 2014

Age group (years)	Number			Number per 100,000 population		
	Males	Females	Persons	Males	Females	Persons
0–4	110	104	214	14.0	13.9	14.0
5–9	204	212	416	26.7	29.3	28.0
10–14	238	220	458	33.0	32.1	32.5
<i>Subtotal (0–14)</i>	<i>552</i>	<i>536</i>	<i>1,088</i>	<i>24.3</i>	<i>24.9</i>	<i>24.6</i>
15–19	193	105	298	25.4	14.7	20.2
20–24	118	68	186	14.0	8.4	11.3
<i>Subtotal (15–24)</i>	<i>311</i>	<i>173</i>	<i>484</i>	<i>19.4</i>	<i>11.4</i>	<i>15.5</i>
25–29	146	67	213	16.7	7.7	12.2
30–34	122	45	167	14.3	5.3	9.8
35–39	82	45	127	10.6	5.8	8.2
40–44	66	39	105	8.0	4.6	6.3
45–49	50	31	81	6.6	4.0	5.3
50–54	42	30	72	5.5	3.8	4.6
55–59	33	15	48	4.7	2.1	3.4
60–64	26	18	44	4.2	2.8	3.5
65–69	20	10	30	3.6	1.8	2.7
70–74	12	11	23	3.0	2.6	2.8
75+	15	12	27	2.3	1.4	1.8
<i>Subtotal (25+)</i>	<i>614</i>	<i>323</i>	<i>937</i>	<i>7.9</i>	<i>4.0</i>	<i>5.9</i>
Total	1,477	1,032	2,509	12.7	8.8	10.7

Note: For those with type 1 diabetes, age at first insulin use is used as a proxy for age of diagnosis.

Source: AIHW analysis of the NDR 2014.

Table A3: Incidence of type 1 diabetes, by selected population characteristics and sex, 2014

	Number			Number per 100,000 population		
	Males	Females	Persons	Males	Females	Persons
State/territory of residence						
New South Wales	380	324	704	10.7	9.5	10.1
Victoria	414	253	667	15.0	9.5	12.2
Queensland	313	220	533	13.5	9.8	11.7
Western Australia	154	113	267	12.1	9.4	10.7
South Australia	128	79	207	16.3	10.7	13.5
Tasmania	44	25	69	18.4	11.1	14.7
Australian Capital Territory	37	14	51	19.1	7.9	13.6
Northern Territory	7	4	11	n.p.	n.p.	n.p.
Remoteness area						
Major cities	983	697	1,680	12.2	9.1	10.7
Inner regional	332	213	545	16.7	11.0	13.9
Outer regional	136	106	242	13.9	10.9	12.4
Remote and very remote	25	16	41	8.3	6.3	7.5
Socioeconomic group						
Group 1 (most disadvantaged)	264	203	467	11.7	9.3	10.5
Group 2	283	223	506	12.7	10.5	11.6
Group 3	334	191	525	14.9	8.9	11.9
Group 4	302	211	513	13.3	9.8	11.5
Group 5 (least disadvantaged)	291	204	495	12.8	9.2	11.0
Indigenous status						
Indigenous	41	34	75	10.3	7.1	8.6
Non-Indigenous	1,333	928	2,261	12.3	9.0	10.7
Not stated	102	66	168
Australia	1,477	1,032	2,509	13.1	9.5	11.3

n.p. data that are not publishable because of small numbers, confidentiality or other concerns about data quality.

.. not applicable.

Note: Rates are age-standardised to the 2001 Australian population.

Source: AIHW analysis of the NDR 2014.

Table A4: Incidence of type 1 diabetes, by year of diagnosis and sex, 2000–2014

Year	Number			Number per 100,000 population		
	Males	Females	Persons	Males	Females	Persons
2000	1,376	1,059	2,435	14.5	11.1	12.8
2001	1,428	1,089	2,517	14.9	11.3	13.1
2002	1,273	950	2,223	13.1	9.9	11.4
2003	1,333	1,022	2,355	13.5	10.6	12.1
2004	1,312	945	2,257	13.2	9.8	11.5
2005	1,211	940	2,151	12.1	9.7	10.9
2006	1,294	943	2,237	12.8	9.6	11.2
2007	1,512	1,038	2,550	14.8	10.4	12.6
2008	1,440	1,067	2,507	13.8	10.5	12.2
2009	1,347	998	2,345	12.7	9.7	11.2
2010	1,420	1,066	2,486	13.3	10.3	11.8
2011	1,481	1,073	2,554	13.6	10.2	11.9
2012	1,466	1,018	2,484	13.3	9.6	11.5
2013	1,454	1,053	2,507	13.1	9.8	11.4
2014	1,477	1,032	2,509	13.1	9.5	11.3
2000–2014	20,824	15,293	36,117	12.6	9.5	11.1

Notes

1. Rates are age-standardised to the 2001 Australian population.
2. For those with type 1 diabetes, year of first insulin use is used as a proxy for year of diagnosis.

Source: AIHW analysis of the NDR 2014.

Table A5: Incidence of type 1 diabetes, by year of diagnosis and age at diagnosis, 2000–2014

Year	Number			Number per 100,000 population		
	0–14	15–24	25+	0–14	15–24	25+
2000	836	409	1,190	21.2	15.8	9.5
2001	909	427	1,181	23.0	16.2	9.3
2002	964	407	852	24.3	15.3	6.6
2003	1,026	443	886	25.8	16.3	6.8
2004	1,027	407	823	25.8	14.8	6.2
2005	959	447	745	24.1	16.0	5.6
2006	968	423	846	24.2	14.9	6.2
2007	1,051	458	1,041	26.0	15.8	7.5
2008	1,043	499	965	25.4	16.8	6.8
2009	971	437	937	23.4	14.4	6.5
2010	1,048	484	954	25.0	15.8	6.5
2011	992	505	1,057	23.4	16.5	7.0
2012	996	516	972	23.2	16.7	6.3
2013	1,046	517	944	23.9	16.7	6.0
2014	1,088	484	937	24.6	15.5	5.9
2000–2014	14,924	6,863	14,330	22.8	14.9	6.4

Notes

1. For those with type 1 diabetes, year of first insulin use is used as a proxy for year of diagnosis.
2. For those with type 1 diabetes, age at first insulin use is used as a proxy for age at diagnosis.

Source: AIHW analysis of the NDR 2014.

Table A6: Incidence of type 1 diabetes, by population characteristics and age at diagnosis, 2014

	Number			Number per 100,000 population		
	0–14	15–24	25+	0–14	15–24	25+
Sex						
Male	552	311	614	24.3	19.4	7.9
Female	536	173	323	24.9	11.4	4.0
State/territory of residence						
New South Wales	335	119	250	23.7	12.1	4.9
Victoria	269	131	267	25.1	16.8	6.7
Queensland	238	111	184	25.4	17.2	5.9
Western Australia	105	48	114	21.4	14.0	6.6
South Australia	98	44	65	32.9	20.1	5.6
Tasmania	25	19	25	26.4	29.2	7.0
Australian Capital Territory	16	10	25	22.2	18.1	9.7
Northern Territory	2	2	7	n.p.	n.p.	n.p.
Remoteness area						
Major cities	429	982	268	20.3	13.9	3.6
Inner regional	136	310	99	25.0	20.4	4.5
Outer regional	52	138	53	18.8	18.2	5.1
Remote and very remote	13	17	10	16.8	7.6	4.5
Socioeconomic group						
Group 1 (most disadvantaged)	209	102	156	22.8	16.2	5.0
Group 2	227	85	194	26.2	13.7	6.0
Group 3	224	95	206	25.6	15.6	6.4
Group 4	228	99	186	26.1	15.6	5.8
Group 5 (least disadvantaged)	199	103	193	22.4	16.2	6.1
Indigenous status						
Indigenous	36	16	23	14.7	11.0	7.1
Non-Indigenous	1,002	435	824	24.0	14.6	5.3
Not stated	50	33	85
Australia	1,088	484	937	24.6	15.5	5.9

n.p. data that are not publishable because of small numbers, confidentiality or other concerns about data quality.

.. not applicable.

Note: For those with type 1 diabetes, age at first insulin use is used as a proxy for age of diagnosis.

Source: AIHW analysis of the NDR 2014.

Insulin-treated type 2 diabetes

Table A7: Incidence of insulin-treated type 2 diabetes, by age at first insulin use and sex, 2014

Age group (years)	Number			Number per 100,000 population		
	Males	Females	Persons	Males	Females	Persons
<i>Subtotal (0–9)</i>	<i>n.p.</i>	<i>n.p.</i>	<i>n.p.</i>	<i>n.p.</i>	<i>n.p.</i>	<i>n.p.</i>
10–14	9	10	19	1.2	1.5	1.3
15–19	18	22	40	2.4	3.1	2.7
20–24	38	68	106	4.5	8.4	6.4
25–29	83	180	263	9.5	20.8	15.1
30–34	162	280	442	18.9	32.9	25.9
35–39	260	309	569	33.5	39.5	36.5
<i>Subtotal (10–39)</i>	<i>570</i>	<i>869</i>	<i>1,439</i>	<i>11.8</i>	<i>18.5</i>	<i>15.1</i>
40–44	521	366	887	63.2	43.5	53.3
45–49	812	482	1,294	106.4	61.9	84.0
50–54	1,204	799	2,003	156.5	101.3	128.6
55–59	1,441	891	2,332	205.2	123.4	163.7
60–64	1,652	990	2,642	265.3	154.6	209.2
65–69	1,768	1,014	2,782	319.2	179.7	248.8
70–74	1,359	915	2,274	338.9	219.0	277.7
75–79	950	726	1,676	328.1	225.2	273.9
80–84	693	549	1,242	352.0	217.0	276.1
85+	398	420	818	243.3	144.5	180.1
<i>Subtotal (40+)</i>	<i>10,798</i>	<i>7,152</i>	<i>17,950</i>	<i>204.3</i>	<i>127.3</i>	<i>164.6</i>
Total	11,368	8,022	19,390	97.4	68.0	82.6

n.p. data that are not publishable because of small numbers, confidentiality or other concerns about data quality.

Source: AIHW analysis of the NDR 2014.

Table A8: Incidence of insulin-treated type 2 diabetes, by selected population characteristics and sex, 2014

	Number			Number per 100,000 population		
	Males	Females	Persons	Males	Females	Persons
State/territory of residence						
New South Wales	3,481	2,451	5,932	84.5	56.6	70.1
Victoria	2,716	1,942	4,658	87.6	57.8	72.0
Queensland	2,611	1,802	4,413	104.9	69.7	86.7
Western Australia	1,034	768	1,802	79.8	57.2	68.0
South Australia	1,075	727	1,802	111.1	70.4	89.9
Tasmania	264	167	431	84.5	53.1	68.4
Australian Capital Territory	93	82	175	52.7	41.3	46.5
Northern Territory	94	83	177	96.5*	82.0*	89.3*
Remoteness area						
Major cities	7,326	5,236	12,562	87.2	57.3	71.5
Inner regional	2,483	1,697	4,180	94.3	63.6	78.5
Outer regional	1,286	853	2,139	101.3	70.5	85.9
Remote and very remote	239	214	453	85.5	92.5	88.3
Socioeconomic group						
Group 1 (most disadvantaged)	3,103	2,293	5,396	119.4	86.1	102.2
Group 2	2,600	1,947	4,547	98.2	71.2	84.2
Group 3	2,324	1,633	3,957	92.2	61.3	76.2
Group 4	1,853	1,294	3,147	78.5	51.1	64.2
Group 5 (least disadvantaged)	1,446	830	2,276	60.1	31.9	45.3
Indigenous status						
Indigenous	269	286	555	122.9	119.1	120.9
Non-Indigenous	6,314	4,311	10,625	51.1	33.6	42.1
Not stated	1,086	758	1,844
Australia	11,368	8,022	19,390	90.3	60.5	74.8

* Incidence rates of insulin-treated type 2 diabetes in the Northern Territory may be an underestimate due to the potentially lower coverage of the NDR in the Territory. See 'Appendix B: Statistical notes and methods' for further information.

.. not applicable.

Note: Rates are age-standardised to the 2001 Australian population.

Source: AIHW analysis of the NDR 2014.

Table A9: Incidence of insulin-treated type 2 diabetes, by year of first insulin use and sex, 2000–2014

Year	Number			Number per 100,000 population		
	Males	Females	Persons	Males	Females	Persons
2000	6,678	5,996	12,674	74.0	61.4	67.3
2001	6,734	6,136	12,870	73.0	61.4	66.7
2002	7,150	6,268	13,418	75.5	61.5	68.1
2003	7,606	6,621	14,227	78.6	63.7	70.7
2004	9,202	7,775	16,977	93.0	73.3	82.6
2005	8,529	7,396	15,925	84.7	68.6	76.1
2006	8,631	7,327	15,958	83.7	66.7	74.7
2007	11,354	9,332	20,686	106.9	82.7	94.2
2008	13,235	10,373	23,608	121.6	89.8	104.9
2009	14,029	10,721	24,750	125.3	91.0	107.4
2010	13,549	10,381	23,930	118.0	85.9	101.3
2011	14,325	10,888	25,213	121.7	87.9	104.2
2012	12,982	9,648	22,630	108.0	76.3	91.6
2013	12,474	9,049	21,523	101.3	69.6	84.9
2014	11,368	8,022	19,390	90.3	60.5	74.8
2000–2014	157,846	125,933	283,779	93.1	69.7	80.9

Note: Rates are age-standardised to the 2001 Australian population.

Source: AIHW analysis of the NDR 2014.

Insulin-treated gestational diabetes

Table A10: Incidence of insulin-treated gestational diabetes, by age at first insulin use, 2014

Age group (years)	Number	Number per 100,000 population	
	Females	Females aged 15–49 ^(a)	Females who gave birth ^(b)
15–19	48	6.7	475.3
20–24	396	49.2	962.0
25–29	1,434	165.5	1,708.9
30–34	2,463	289.8	2,423.8
35–39	1,746	223.3	3,207.0
40–44	504	60.0	3,945.8
45–49	34	4.4	5,913.0
Total	6,625	117.5	2,173.7

(a) Incidence rates were calculated based on the population of women aged 15–49 in Australia.

(b) Incidence rates were calculated based on the number of women who gave birth (both live and stillbirths) in Australia. This information is based on data from the AIHW National Perinatal Data Collection 2013, as these were the most recent data available. For more information, see 'Appendix B: Statistical notes and methods'.

Source: AIHW analysis of the NDR 2014 and the AIHW National Perinatal Data Collection 2013.

Insulin-treated other types of diabetes

Table A11: Incidence of insulin-treated other types of diabetes, by age at first insulin use and sex, 2014

Age group (years)	Number			Number per 100,000 population		
	Males	Females	Persons	Males	Females	Persons
0–4	2	3	5	n.p.	n.p.	0.3
5–9	3	7	10	n.p.	1.0	0.7
10–14	11	12	23	1.5	1.7	1.6
15–19	8	6	14	1.1	0.8	0.9
20–24	5	7	12	0.6	0.9	0.7
25–29	8	7	15	0.9	0.8	0.9
30–34	9	18	27	1.1	2.1	1.6
35–39	18	16	34	2.3	2.0	2.2
40–44	22	14	36	2.7	1.7	2.2
45–49	19	12	31	2.5	1.5	2.0
50–54	21	14	35	2.7	1.8	2.2
55–59	37	28	65	5.3	3.9	4.6
60–64	38	29	67	6.1	4.5	5.3
65–69	36	26	62	6.5	4.6	5.5
70–74	28	9	37	7.0	2.2	4.5
75–79	21	15	36	7.3	4.7	5.9
80–84	10	5	15	5.1	2.0	3.3
85+	4	4	8	n.p.	n.p.	1.8
Total	300	232	532	2.6	2.0	2.3

n.p. data that are not publishable because of small numbers, confidentiality or other concerns about data quality.

Source: AIHW analysis of the NDR 2014.

Appendix B: Statistical notes and methods

Data sources

National (insulin-treated) Diabetes Register

The NDR collects information about people who began using insulin as part of their treatment for diabetes since 1999. The register includes most people diagnosed with type 1 diabetes since this time, as well as the proportion of those with type 2 diabetes, gestational diabetes and other less common forms of diabetes who use insulin to manage their condition (Table A1).

The AIHW maintains the NDR under contract with the Department of Health and it is derived from the following data sources:

- National Diabetes Services Scheme (NDSS)
- Australasian Paediatric Endocrine Group (APEG)
- National Death Index (NDI).

The NDSS, which was established in 1987 and is administered by Diabetes Australia, is an initiative of the Australian Government to subsidise the supply of diabetes-related products – such as pens and needles to administer insulin, blood glucose test strips and insulin pump consumables – to people who are registered with the scheme. A diagnosis of diabetes, that a health professional has substantiated, is required in order to register with, and purchase products through, the NDSS.

The APEG is a professional body that represents health professionals involved in the management and research of disorders of the endocrine system, including diabetes in children and adolescents. The APEG maintains clinic-based state and territory diabetes registers.

The NDI contains person-level records of all deaths occurring in Australia since 1980 obtained from the Registrars of Births, Deaths and Marriage in each state and territory.

The NDR 2014 was finalised in November 2015. For more information about the quality of the NDR 2014 data, please see the Data Quality Statement at:

<<http://meteor.aihw.gov.au/content/index.phtml/itemId/632137>>.

Who is on the NDR?

In order to create the NDR, eligible registrants on the NDSS – those using insulin – need to be determined. All APEG data submitted for the purposes of the NDR relate to people using insulin. However, the NDSS has multiple variables that indicate the use of insulin, not all of which are considered robust enough to determine insulin use.

Only those variables which provided a high degree of certainty of insulin use were used to determine eligibility for the NDR. This method may underestimate the number of people registered on the NDSS who are using insulin.

From the NDSS, records were eligible for inclusion if:

- the registrant had type 1 diabetes, or

- there was evidence of the purchase of insulin-related products from NDSS sales information, or
- a health professional had indicated that the registrant used an insulin pump for the delivery of insulin.

Based on the NDR, 29,435 people started using insulin to treat diabetes in 2014, and 378,340 people had started using insulin to treat diabetes during 2000–2014 (Table A1).

Coverage of the NDR

The coverage of insulin-treated diabetes on the NDR is dependent on the coverage of its primary data sources – the NDSS and APEG.

It is not possible to determine exactly how many people with insulin-treated diabetes are not registered with the NDSS. However, the AIHW has investigated this issue and, based on linked data from the NDSS and Pharmaceutical Benefit Scheme (PBS) insulin claims data, found that between 1 July 2002 and 30 June 2012 around 8% of people who purchased insulin through the PBS were not registered on the NDSS.

People must register with the NDSS to access subsidised products such as pens/needles, or insulin pump consumables to manage their diabetes. Because insulin is required for all people with type 1 diabetes, registering with the NDSS provides an incentive for people with type 1 diabetes to obtain these products at subsidised prices – it is for this reason that most people with type 1 diabetes are likely to be captured on the NDR.

The capture–recapture method (LaPorte et al. 1993) was used to determine the coverage of children with type 1 diabetes on the NDR. This method compares data from several independent, but overlapping, data sources (in this case, the NDSS and the APEG) to calculate the completeness of a data set. Based on capture–recapture, from 2000–2014 the NDR captured an estimated 99.8% of children with type 1 diabetes in Australia, 99.5% in 2014. However, it should be noted the capture–recapture method assumes that all individuals have the same probability of being captured by either data source. Therefore, if the NDSS and the APEG both provide a biased sample and do not capture particular subgroups of the population of children with type 1 diabetes, the coverage of the NDR will be exaggerated.

Only a proportion of people registered with the NDSS with type 2 diabetes, gestational diabetes and other forms of diabetes require insulin treatment; those who do not are excluded from the NDR.

National Perinatal Data Collection

In this report, the AIHW National Perinatal Data Collection (NPDC) was used to supply the number of women who gave birth (both live and stillbirths) in Australia to calculate the incidence rates per 100,000 women who gave birth.

The NPDC is a national population-based cross-sectional collection of data on pregnancy and childbirth. The data are based on births reported to the perinatal data collection in each state and territory in Australia. Midwives and other staff, using information obtained from mothers and from hospital or other records, complete notification forms for each birth. The AIHW compiles selected information annually into this national data set.

Who is in the NPDC?

Information is included in the NPDC on both live births and stillbirths of at least 400 grams' birthweight or at least 20 weeks' gestation, except in Western Australia where the births included were at least 20 weeks' gestation or (if gestation was unknown) the birthweight was at least 400 grams. It includes data items relating to the mother, including demographic characteristics and factors relating to the pregnancy, labour and birth; and data items relating to the baby.

Data quality and issues

Comparison with previous reports

The methods to create the NDR have changed from previous years, both in the way data are processed, as well as how eligibility for the NDR is determined. The derivation of the register applied these new methods retrospectively across all years. Because of these changes, results presented in this report and based on the NDR 2014 cannot be compared with earlier publications or results based on previous NDR data.

The NDR 2014 Data Quality Statement

The NDR 2014 Data Quality Statement is available on the AIHW website at:

<<http://meteor.aihw.gov.au/content/index.phtml/itemId/632137>>.

Trend analysis

The NDR 2014 records new cases of insulin-treated diabetes from 1999–2014. However, analysis of the NDR 2014 does not include 1999 due to data issues in the early stages of developing the register. As a result, any trend data reported in this publication pertains to 2000–2014 data only and excludes data from 1999.

Type 1 diabetes

The trend analysis presented for type 1 diabetes provides reliable and robust data on the incidence of type 1 diabetes over time. The absolute requirement of insulin for this type of diabetes means that it is more likely that people with type 1 diabetes will be actively purchasing products to administer insulin, and thus be registered on the NDSS and included on the NDR.

Insulin-treated type 2 diabetes

While trend analysis has been presented for insulin-treated type 2 diabetes, these results should be interpreted with caution. Several factors may have had an impact on the number of people using insulin with type 2 diabetes captured on the NDR, including:

- Changing treatment regimens for the administration of insulin for people with type 2 diabetes.
- Changes in the proportion of people with type 2 diabetes in the Australian population.
- Changes in classification of diabetes type in 2002–2003 from Insulin-Dependent Diabetes Mellitus (IDDM) and Non-Insulin-Dependent Diabetes Mellitus (NIDDM) to type 1 and type 2 diabetes in the NDSS database. All registrants that were registered as IDDM prior

to this date were classified as type 1 diabetes, resulting in people with insulin-treated type 2 diabetes being misclassified as having type 1 diabetes. Some records may remain misclassified, despite efforts to correct them, which may inflate the incidence of type 1 diabetes and subsequently reduce the incidence of insulin-treated type 2 diabetes prior to 2002–2003.

- The NDSS is an administrative database and undergoes change to improve the quality of the service, which may impact the data being provided for deriving the NDR and reporting on the incidence of insulin-treated diabetes. The system has undergone 2 major known structural changes: in 2002 a new system improved the collection of data fields; and in 2010 there was a change to the retention of historical information so that any change to information was not permanently overwritten, which resulted in an improved level of checking and information retention.

Insulin-treated gestational diabetes

Trends in the incidence of insulin-treated gestational diabetes have been excluded from this report due to concerns with data comparability.

There are several factors that may have influenced the trends in insulin-treated gestational diabetes, including: changing insulin treatment regimens; universal gestational diabetes screening; the establishment of the National Gestational Diabetes Register and corresponding educational campaigns increasing awareness and screening; and changes to NDSS administrative processes. In particular, changes in screening practices resulting in more women being screened for gestational diabetes, and changes to diagnostic criteria (International Association of Diabetes and Pregnancy Study Groups Consensus Panel 2010) likely to increase the incidence of gestational diabetes, have been implemented to a varying degree across jurisdictions.

Due to these changes, comparing gestational diabetes incidence rates over time is problematic and may lead to misinterpretation of results.

Remoteness data

NDSS Access Points assist in delivering support services and products to people with diabetes in all states and territories. These Access Points may be limited in rural Australia and unavailable in remote communities, with other programs being available in these areas to assist with the purchase of diabetes-related products.

As a result, the coverage of the NDSS may be lower in *Remote and very remote* areas or across states and territories with large remote communities, which may mean that the NDR underestimates the number of people with insulin-treated diabetes in these areas. This may particularly influence the coverage of the NDSS in the Northern Territory; in 2014 around 43% of the Northern Territory population lived in *Remote and very remote* areas, compared with 0–7% living in these areas in other states and the Australian Capital Territory.

Aboriginal and Torres Strait Islander information

The NDR may underestimate the number of Aboriginal and Torres Strait Islander registrants with insulin-treated diabetes for several reasons, as outlined below:

- Aboriginal and Torres Strait Islander status – identifying as being of Indigenous origin on both data sources of the NDR (APEG and NDSS) is voluntary.

- Accessing diabetes-related products through programs other than the NDSS—other programs that provide Indigenous Australians access to diabetes-related products may result in low registration rates for the NDSS, and subsequently the NDR, 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. In addition, NDSS Access Points are not always available in remote areas, limiting the access of many Australians to NDSS services.
- Missing data—according to the NDR 2014, from 2005–2014 Indigenous status was unknown for 10% of all registrants.

The potential underestimation of Aboriginal and Torres Strait Islander registrants on the NDR may influence incidence rates of insulin-treated diabetes in states or territories with large Indigenous populations. This may be particularly the case in the Northern Territory; in 2014, around 30% of the Northern Territory population self-identified as Indigenous, compared with 1–5% in other states and the Australian Capital Territory.

Statistical methods

Diabetes type on the NDR

As the symptoms of type 1 and type 2 diabetes may be similar, particularly in young adults, the recorded diabetes type is not always correct. Therefore, as part of processing information from the primary data sources to create the NDR, the reported diabetes type is checked against a set of criteria and revised where necessary. This algorithm (method of calculation) assesses and reclassifies reported diabetes type for some registrants on the NDSS.

The algorithm is based on age at diagnosis and the period between diagnosis and first insulin use because of the correlation with diabetes type. The algorithm has been updated several times over the years in consultation and agreement with the AIHW Diabetes Expert Advisory Group. Note that, with or without the algorithm, there will always be some level of misclassification.

For the 57,476 insulin users reported as having type 1 diabetes during 1999–2014:

- 39,391 (69%) remained categorised as type 1 after the algorithm was applied
- 7,309 (13%) were reclassified as type 2
- 10,776 (19%) diabetes type could not be determined.

Incidence

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

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

In this report incidence of insulin-treated diabetes is described over the calendar year—that is, the number of new cases from 1 January to 31 December in the year being reported.

Incidence rates

Throughout this report, incidence rates are calculated and presented based on the number of cases per 100,000 population.

For example, the incidence rate of type 1 diabetes among males is calculated as a rate per 100,000 males in the Australian population. Similarly, the rate of insulin use among people with type 2 diabetes in Victoria is calculated as a rate per 100,000 people living in Victoria.

Estimated resident populations

Throughout this report, population data were used to derive rates of insulin-treated diabetes incidence. Population data that the AIHW holds are sourced from the Australian Bureau of Statistics (ABS), and updated as revised or new estimates become available.

All population estimates that the ABS currently produces are based on usual residence. These estimated resident populations are derived from the ABS Census of Population and Housing, and adjusted for deaths, births and net migration. The estimated resident populations used in this report are based on the population estimates for 30 June 2014.

Australia's Aboriginal and Torres Strait Islander population is calculated from the Census, but because of the smaller Indigenous population, it is difficult to measure population changes accurately between census years using the method described above. Therefore, the ABS has developed experimental estimates and projections based on the 2011 Census. All calculations of rates for Aboriginal and Torres Strait Islander people use the Series B projected Indigenous 2013 populations.

Age-specific rates

Age-specific rates provide information on the incidence of a particular event in an age group relative to the total number of people at risk of that event in the same age group.

All age-specific rates in this report are presented as the number of cases per 100,000 population.

Age-standardised rates

Age-standardisation is a method used to eliminate the effect of differences in population age structures when comparing populations with different age structures, and where age affects the variable being compared.

All incidence rates presented in this report are age-standardised to the 2001 Australian population and presented as the number of cases per 100,000 population, unless presented for a particular age group (in which case they are age-specific rates).

Remoteness

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

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

Further information on the ASGS is available on the ABS website at:

<[http://www.abs.gov.au/websitedbs/D3310114.nsf/home/Australian+Statistical+Geography+Standard+\(ASGS\)](http://www.abs.gov.au/websitedbs/D3310114.nsf/home/Australian+Statistical+Geography+Standard+(ASGS))>.

Socioeconomic disadvantage

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

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

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

The SEIFA IRSD values used in this report are based on the 2011 Census. Further information is available on the ABS website at:

<<http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/2033.0.55.0012011?OpenDocument>>.

References

- AIHW 2006. Use of medicines by Australians with diabetes. Bulletin no. 47. AIHW cat. no. AUS 82. Canberra: AIHW.
- AIHW 2008. Gestational diabetes mellitus in Australia, 2005–06. Cat. no. CVD 44. Canberra: AIHW.
- AIHW 2014. Cardiovascular disease, diabetes and chronic kidney disease: Australian facts: prevalence and incidence. Cardiovascular, diabetes and chronic kidney disease series no. 2. Cat. no. CDK 2. Canberra: AIHW.
- Australian Government Department of Health 2015. Australian national diabetes strategy. Canberra: Department of Health.
- Baker IDI Heart and Diabetes Institute 2012. Diabetes: the silent pandemic and its impact on Australia. Melbourne: Baker IDI Heart and Diabetes Institute. Viewed 13 June 2013, <https://www.bakeridi.edu.au/Assets/Files/14814%20Diabetes%20management%20booklet%205%20Mar_FINAL.pdf>.
- Craig M, Handelsman P, Donaghue K, Chan A, Blades B, Laina R et al. 2002. Predictors of glycaemic control and hypoglycaemic in children and adolescents with type 1 diabetes from NSW and the ACT. *Medical Journal of Australia* 177:235–8.
- Craig M, Twigg S, Donaghue K, Cheung N, Cameron F, Conn J et al. 2011. National evidence-based clinical care guidelines for type 1 diabetes in children, adolescents and adults. Canberra: Australian Government Department of Health and Ageing.
- Davis TE, Hunt K, McAullay D, Chubb S, Sillars B, Bruce D et al. 2012. Continuing disparities in cardiovascular risk factors and complications between Aboriginal and Anglo-celt Australians with type 2 diabetes. *Diabetes Care* 35:2005–11.
- Diabetes Australia 2015. Type 2 diabetes. Canberra: Diabetes Australia. Viewed 13 January, <<https://www.diabetesaustralia.com.au/type-2-diabetes>>.
- International Association of Diabetes and Pregnancy Study Groups Consensus Panel 2010. International Association of Diabetes and Pregnancy Study Groups recommendations on the diagnosis and classification of hyperglycemia in pregnancy. *Diabetes Care* 33:676–82.
- LaPorte R, McCarty D, Bruno G, Tajima N & Baba S 1993. Counting diabetes in the next millennium: application of capture–recapture technology. *Diabetes Care* 16:528–34.
- Lee A, Hiscock R, Wein P, Walker S & Permezel M 2007. Gestational diabetes mellitus: clinical predictors and long-term risk of developing type 2 diabetes. *Diabetes Care* 30:878–83.
- Taylor R 2013. Type 2 diabetes: etiology and reversibility. *Diabetes Care* 36:1047–55.

List of tables

Table A1: Number of insulin users on the NDR 2014, by diabetes type and year of first insulin use.....20

Table A2: Incidence of type 1 diabetes, by age at diagnosis and sex, 2014.....21

Table A3: Incidence of type 1 diabetes, by selected population characteristics and sex, 201422

Table A4: Incidence of type 1 diabetes, by year of diagnosis and sex, 2000–2014.....23

Table A5: Incidence of type 1 diabetes, by year of diagnosis and age at diagnosis, 2000–201424

Table A6: Incidence of type 1 diabetes, by population characteristics and age at diagnosis, 201425

Table A7: Incidence of insulin-treated type 2 diabetes, by age at first insulin use and sex, 201426

Table A8: Incidence of insulin-treated type 2 diabetes, by selected population characteristics and sex, 2014.....27


Table A9: Incidence of insulin-treated type 2 diabetes, by year of first insulin use and sex, 2000–201428

Table A10: Incidence of insulin-treated gestational diabetes, by age at first insulin use, 201429

Table A11: Incidence of insulin-treated other types of diabetes, by age at first insulin use and sex, 201430

List of figures

Figure 2.1: New insulin users, by diabetes type, 2014	5
Figure 3.1: Incidence of type 1 diabetes, by age at diagnosis and sex, 2014.....	6
Figure 3.2: Incidence of type 1 diabetes, by remoteness area, socioeconomic group and Indigenous status, 2014.....	8
Figure 3.3: Incidence of type 1 diabetes, by year of diagnosis and sex, 2000–2014.....	9
Figure 3.4: Incidence of type 1 diabetes for differing age groups, by sex and Indigenous status, 2014	11
Figure 3.5: Incidence of type 1 diabetes, by year of diagnosis and age at diagnosis, 2000–2014	12
Figure 4.1: Incidence of insulin-treated type 2 diabetes, by age at first insulin use and sex, 2014	14
Figure 4.2: Incidence of insulin-treated type 2 diabetes, by remoteness area, socioeconomic group and Indigenous status, 2014	16
Figure 4.3: Incidence of insulin-treated type 2 diabetes, by year of first insulin use and sex, 2000–2014	17
Figure 5.1: Incidence of insulin-treated gestational diabetes for women aged 15–49 and women who gave birth, by age at first insulin use, 2014	19



Incidence of insulin-treated diabetes in Australia 2014 presents the latest available national data on new cases of insulin-treated diabetes from the 2014 National (insulin-treated) Diabetes Register.

In 2014, nearly 30,000 Australians began using insulin to treat their diabetes—67% had type 2 diabetes, 23% had gestational diabetes, 9% had type 1 diabetes, and 2% had other forms of diabetes.