Australian Government
Australian Institute of Health and Welfare

Incidence of insulin-treated diabetes in Australia 2000–2011

DIABETES SERIES NO. 22

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Authoritative information and statistics to promote better health and wellbeing

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Number 22

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Australian Institute of Health and Welfare
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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

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Abbreviations

ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
AIHW	Australian Institute of Health and Welfare
APEG	Australasian Paediatric Endocrine Group
ARIA	Accessibility/Remoteness Index for Australia
ASGS	Australian Statistical Geography Standard
GDM	Gestational diabetes
IRSD	Index of Relative Socio-Economic Disadvantage
NDDWG	National Diabetes Data Working Group
NDR	National (insulin-treated) Diabetes Register
NDSS	National Diabetes Services Scheme
NSW	New South Wales
NT	Northern Territory
OECD	Organisation for Economic Co-operation and Development
Tas	Tasmania
Qld	Queensland
SA	South Australia
SES	Socioeconomic status
Vic	Victoria
WA	Western Australia

Symbols

. .	not applicable
–	nil or rounded to zero

Summary

Diabetes results in a large health and economic burden for individuals, families and communities. There were around 53,500 people in Australia who began using insulin to treat their diabetes in 2011— 68% had type 2 diabetes, 12% had gestational diabetes, 4% had type 1 diabetes and 1% had other forms of diabetes requiring insulin (diabetes type was unknown for another 15%).

This report uses data from the National (insulin-treated) Diabetes Register to examine the incidence of insulin-treated diabetes in Australia for the three main types of diabetes.

Type 1 diabetes

- In 2011, there were 2,367 new cases of type 1 diabetes in Australia, equating to 11 new cases per 100,000 population. This rate has remained stable over the last decade, with between 10 and 12 new cases per 100,000 population per year.
- Half of all new cases of type 1 diabetes were among people aged 18 or under. Rates of type 1 diabetes peaked in the 10–14 age group at 32 per 100,000 population: a rate 5 times as high as for those aged 40–44.
- The incidence of type 1 diabetes was higher in males than in females—13 in every 100,000 males compared with 8 per 100,000 females.
- The incidence of type 1 diabetes did not vary considerably across the states and territories (10–13 per 100,000), except in the Northern Territory where the rate was considerably lower at 8 cases per 100,000. Rates of type 1 diabetes also did not vary by socioeconomic status.
- The incidence of type 1 diabetes was lower in *Remote and very remote* areas (compared with other areas in Australia) and was lower for Indigenous Australians compared with non-Indigenous Australians.

Insulin-treated type 2 diabetes

- In 2011, 36,263 people began using insulin to treat their type 2 diabetes, equating to 163 people per 100,000 population.
- The incidence of insulin use for type 2 diabetes increased rapidly with age, with rates increasing five–fold between ages 40–44 and 70–74 (100 compared with 550 per 100,000 population, respectively).
- Rates were higher among males than females at 185 compared with 140 per 100,000 population, respectively.
- Rates of insulin-treated type 2 diabetes were twice as high for those living in the lowest socioeconomic status (SES) areas compared with the highest SES areas.

Insulin-treated gestational diabetes

- There were 6,362 women aged 15–49 who began using insulin to treat gestational diabetes in 2011, equating to 117 per 100,000 women in this age group in Australia.
- Rates of insulin-treated gestational diabetes varied across states and territories and by socioeconomic and geographical areas.

1 Introduction

Diabetes is one of the leading threats to the health of Australians. Not only does it have an impact on individual health and wellbeing, but it also has social and economic ramifications for families and communities. 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 produced by the pancreas to control blood glucose levels), or by the body not being able to use insulin effectively, or both (see Box 1.1 for further details).

The main types of diabetes are: *type 1 diabetes*—a lifelong autoimmune disease that usually has onset in childhood but can be diagnosed at any age; *type 2 diabetes*—usually associated with lifestyle factors and largely preventable; and *gestational diabetes*—when higher than normal blood glucose is diagnosed in pregnancy (see Glossary for further details).

Diabetes can lead to a range of health problems, disability, poor quality of life and premature death, especially where the disease is not diagnosed or is poorly controlled (International Diabetes Federation 2006). Short-term health complications may include diabetic ketoacidosis, hypoglycaemia, increased susceptibility to infections and reduced ability to heal. Over the longer term, diabetes may progress to a range of health complications including heart disease, stroke, kidney disease, blindness and nerve damage, which may lead to lower limb amputation (AIHW 2009). Many studies around the world have shown an increase in the incidence of both type 1 and type 2 diabetes. Although the reasons behind increases in type 1 diabetes, which is an unpreventable autoimmune disease, remain largely unknown, the rise in type 2 diabetes has been linked to increasing obesity, the ageing population, dietary changes and sedentary lifestyles (Baker IDI Heart and Diabetes Institute 2012). The key modifiable risk factors for diabetes include physical inactivity, unhealthy diet, obesity, tobacco smoking, high blood pressure and high blood lipids.

Monitoring diabetes is essential to improve capacity to plan preventive and treatment services, to target priority population groups, to track the impact of environmental change and of prevention and control strategies, and to make decisions for cost-effective allocation of resources (AIHW 2006). The findings in this report provide important information on the incidence of insulin-treated diabetes to researchers, health professionals, service planners and policy makers to assist with this monitoring.

Box 1.1: Diabetes and insulin use

Diabetes occurs when the body is no longer able to produce enough insulin—a hormone made by cells in the pancreas—or use it properly. When people eat, insulin is released into the blood stream where it helps to move glucose from food into cells where it can be used as a source of energy.

Insulin injections are required when the body produces little or no insulin, as with type 1 diabetes. Insulin is also required for many people with type 2 diabetes when other diabetes medications, together with healthy eating and regular physical activity, are not enough to control blood glucose levels.

All people with type 1 diabetes use insulin and, in Australia, around 20% of those with type 2 diabetes use it to control blood glucose levels (AIHW 2006; Davis et al. 2012). The proportion of women with gestational diabetes who are treated with insulin is around 32% (AIHW 2008).

The aim of this report is to present the latest available data on new cases (incidence) of insulin-treated diabetes in Australia, using the National (insulin-treated) Diabetes Register (NDR) (see Box 1.2). The NDR, established in 1999, aims to record all new cases of people who use insulin to treat diabetes, including type 1, type 2, gestational and other forms of diabetes. Most people with type 1 diabetes in Australia are captured by the NDR because, almost without exception, people with type 1 diabetes require insulin for survival. However, only a proportion of people with type 2, gestational and other types of diabetes require insulin treatment; those who do not are excluded from the NDR.

This report examines the incidence of each type of insulin-treated diabetes—type 1, type 2 and gestational diabetes—by age and sex, geographic location and variations in population groups, such as remoteness, socioeconomic status and Aboriginal and Torres Strait Islander status. Trend information is presented for type 1 diabetes as these data are considered reliable and robust over time, given that almost all people with type 1 diabetes use insulin to manage their condition. For insulin-treated type 2 diabetes and gestational diabetes trend information has not been presented due to changes in treatment regimens for type 2 diabetes and screening of gestational diabetes over time. These factors are likely to influence trends, and make reporting of trends unreliable and difficult to interpret.

There were around 53,500 people in Australia who began using insulin to treat their diabetes in 2011— 68% had type 2 diabetes, 12% had gestational diabetes, 4% had type 1 diabetes and 1% had other forms of diabetes requiring insulin (for data relating to other types of diabetes requiring insulin refer to appendix tables A14 and A15). Diabetes type was unknown for 15% of people who began using insulin in 2011—see 'Appendix B: Statistical notes and methods' for further information.

The Australian Institute of Health and Welfare (AIHW) has published several reports from earlier NDR data. However, results presented in this report cannot be compared with previous publications because the methods relating to the supply protocol and processing of the data have changed considerably.

Box 1.2: The National (insulin-treated) Diabetes Register

The NDR is maintained by the AIHW under contract with the Department of Health. It was established to monitor the incidence and prevalence of insulin-treated diabetes in Australia (Colagiuri et al. 1998). The NDR is derived from two primary data sources: the National Diabetes Services Scheme and the Australasian Paediatric Endocrine Group.

National Diabetes Services Scheme (NDSS)

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.

Under a Memorandum of Understanding that specifies the data supply arrangements, Diabetes Australia provides the AIHW with data about the characteristics of people who are registered on the NDSS and products that they purchase, where these relate to insulin use. It is currently not possible to determine how many people with insulin-treated diabetes are not registered with the NDSS. However, the AIHW is progressing a project using Pharmaceutical Benefit Scheme data related to insulin claims, which may assist in furthering our knowledge in this area.

Australasian Paediatric Endocrine Group (APEG)

The APEG is a professional body that represents health professionals involved in the management and research of children and adolescents with disorders of the endocrine system including diabetes.

The APEG maintains clinic-based state and territory diabetes registers. Paediatricians, physicians, paediatric endocrinologists, endocrinologists, diabetes educators and nurses report incident cases to these registers. Although each jurisdiction established its database independently, and at varying times since 1985, they have all prospectively ascertained all forms of insulin-treated diabetes in people aged under 15 at diagnosis and diagnosed from 1999 onwards.

The APEG supplies the AIHW with information from these registers. These data are supplied under a consultancy agreement between the two organisations, with the APEG being paid by the Department of Health to provide the data.

National (insulin-treated) Diabetes Register (NDR)

The NDR is compiled from the NDSS and APEG state and territory-based registers.

In order to create the NDR, eligible NDSS registrants—those using insulin—need to be determined. It is likely that the methodology used to do this may overestimate the number of people who are using insulin. On the NDSS, there is no single variable indicating whether someone is using insulin to treat their diabetes, so a number of factors need to be considered in determining whether someone is using insulin.

As the symptoms of type 1 and type 2 diabetes may be similar, particularly in young adults, the recorded diabetes type is not always reliable in the NDSS or APEG data collections. Therefore, as part of processing information from the data sources, the reported diabetes is checked against a set of test criteria and revised where necessary. The algorithm, defined in Box B3, assesses and re-classifies reported diabetes type for some registrants on the NDSS. For example, if reported diabetes is a NDSS record only, reclassification my occur through the algorithm (that is, if reported diabetes is type 1 diabetes and the time for first insulin use is more than 1 year later, the derived diabetes type would be type 2 diabetes).

(continued)

Box 1.2: (continued) The National (insulin-treated) Diabetes Register

All analysis in this report is based on the type of diabetes that has been derived by applying the test criteria and not that which was reported at registration. It should be noted that there were 7,956 people (15% of all insulin users) for whom diabetes type could not be derived, and these people, although insulin users, were not included in the analysis.

2 Type 1 diabetes

Type 1 diabetes is an autoimmune disease that develops when the immune system destroys the insulin-producing cells of the pancreas. The subsequent absence of insulin means glucose cannot be transported into the cells, where it is used for energy, and blood glucose levels rise, which requires replacement insulin to be administered. The exact cause of type 1 diabetes is unknown, although it is believed to be an interaction of genetic predisposition and environmental factors.

Although type 1 diabetes can occur at any age, it mainly develops during childhood and adolescence (Craig et al. 2011). Currently, once a person is diagnosed, they will require insulin treatment every day throughout their life. The only exception to this is where a person has had a pancreatic transplant, but this is relatively rare.

This chapter presents the incidence of type 1 diabetes in Australia in 2011 and for the period 2000–11. Because all people with type 1 diabetes use insulin as the mainstay of treatment, they are well represented on the NDR, as this requirement acts as a driver for registration with the NDSS to obtain subsidised diabetes-related products essential for administering insulin. Additionally, for those aged under 15, two data sources are used to ascertain incidence (that is, newly diagnosed cases), resulting in a coverage rate of 99% (see 'Appendix B: Statistical notes and methods' for further information).

How many people were diagnosed with type 1 diabetes in 2011?

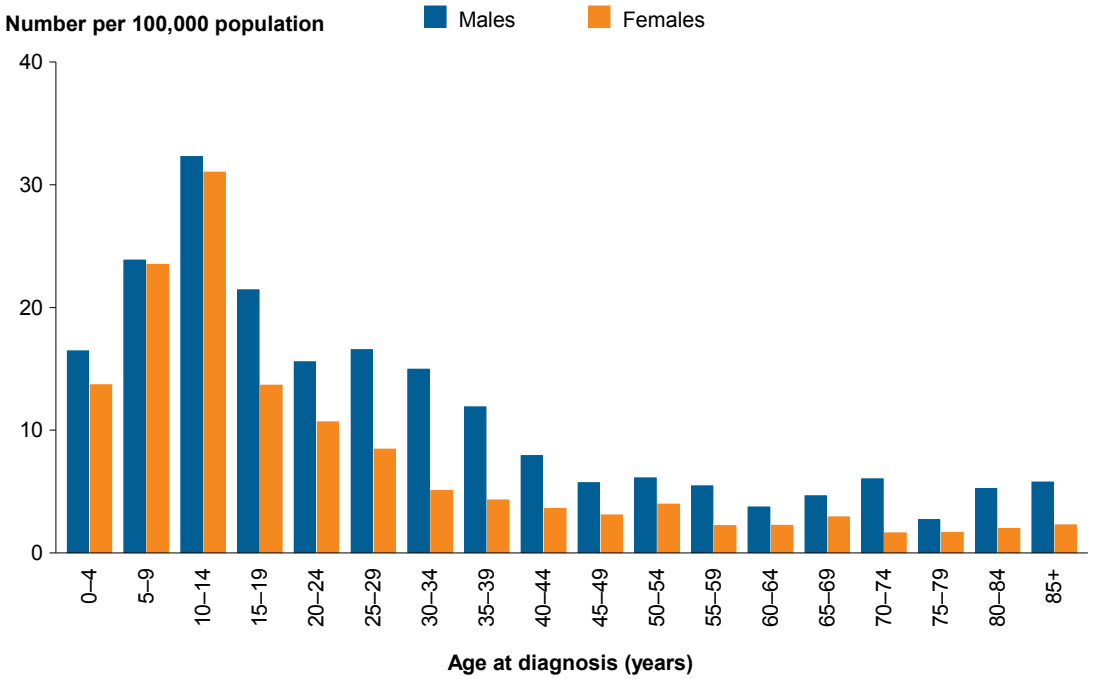
In 2011, there were 2,367 new cases of people with type 1 diabetes in Australia; this represents 11 cases per 100,000 population (Table A1).

Age and sex

The incidence of type 1 diabetes was higher in males than in females—13 in every 100,000 males compared with 8 per 100,000 females (Table A1).

Females were more likely to be diagnosed at a younger age than males—the mean age at diagnosis for females was 21 compared with 25 for males. However, in younger age groups there was no difference in the average age at diagnosis: for those under 15, the mean age was 8 for both males and females.

About half of those diagnosed with type 1 diabetes in 2011 were aged 18 or under, with the peak age of diagnosis at age 10–14. In this age group, incidence was 32 per 100,000 population, 3 times the rate at 30–34 (10 per 100,000) and 5 times the rate at age 40–44 (6 per 100,000 population) (Figure 2.1; Table A1).



Notes

1. Year of first insulin use is a proxy for year of diagnosis.
2. Some of those diagnosed in older age groups may have had late-onset autoimmune diabetes of adults: a condition that requires insulin relatively soon after diagnosis, but not necessarily immediately (Diabetes Australia 2012). If these people were reported as having type 1 diabetes and began using insulin within the first year of diagnosis, their diabetes type remained for this analysis as type 1.

Source: AIHW analysis of the NDR 2011 (Table A1).

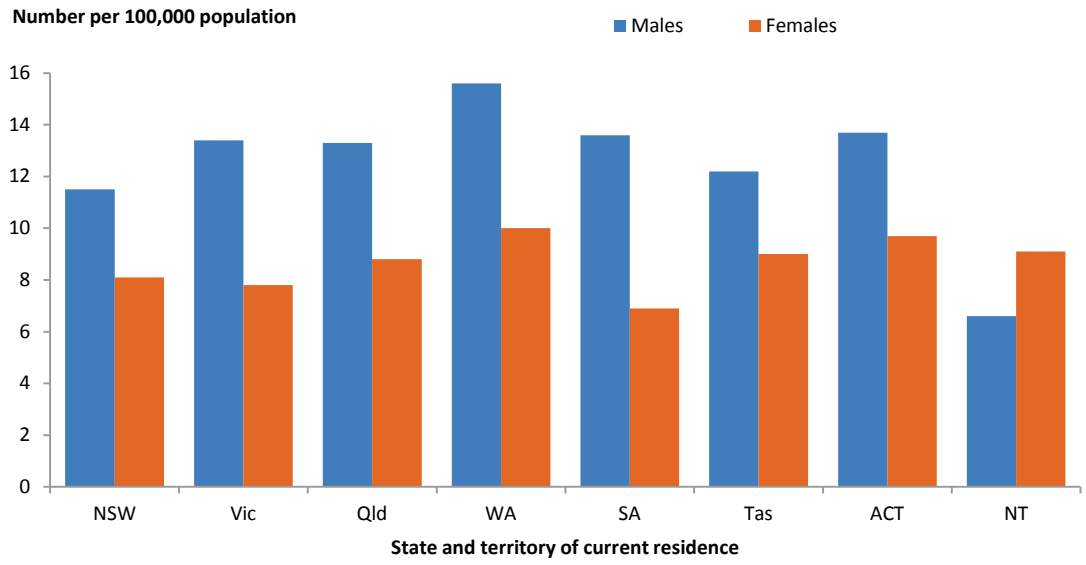
Figure 2.1: Incidence of type 1 diabetes by age at diagnosis and sex, Australia, 2011

State and territory

For most states and territories, the incidence of type 1 diabetes did not vary considerably, except for the Northern Territory (NT) where the incidence rate at 8 per 100,000 was comparatively low (Figure 2.2; Table A2). For all Australians, 11 in every 100,000 were diagnosed with type 1 diabetes in 2011, and the incidence rate (excluding the NT) ranged from 10 in every 100,000 people in both New South Wales (NSW) and South Australia (SA) to 13 per 100,000 in Western Australia (WA).

The lower incidence of type 1 diabetes in the NT may have been due to the high proportion of Aboriginal and Torres Strait Islander people living there, who not only have a lower incidence of type 1 diabetes than non-Indigenous people (Maple-Brown et al. 2008) but are possibly less likely to register with the NDSS (see 'Appendix B: Statistical notes and methods' for information).

Apart from the NT, the incidence rate was higher for males than for females across Australia (Figure 2.2). In the NT, the pattern was reversed in 2011 with a slightly higher incidence rate for females than males (9 compared with 7 per 100,000, respectively); however for the 2000–11 period as a whole, incidence rates were higher for males than females in the NT, reflecting the pattern seen across the other states and territories (Table A3).



Source: AIHW analysis of the NDR 2011 (Table A3).

Figure 2.2: Incidence of type 1 diabetes by state or territory of usual residence and sex, Australia, 2011

Does type 1 diabetes vary across population groups?

Remoteness

In 2011, the incidence of type 1 diabetes was slightly lower in *Remote and very remote* areas than in *Major cities* and regional areas — 8 per 100,000 people in *Remote and very remote* areas compared with respectively 10, 12 and 11 per 100,000 people in *Major cities, Inner regional* and *Outer regional* areas (Figure 2.3; Table A2).

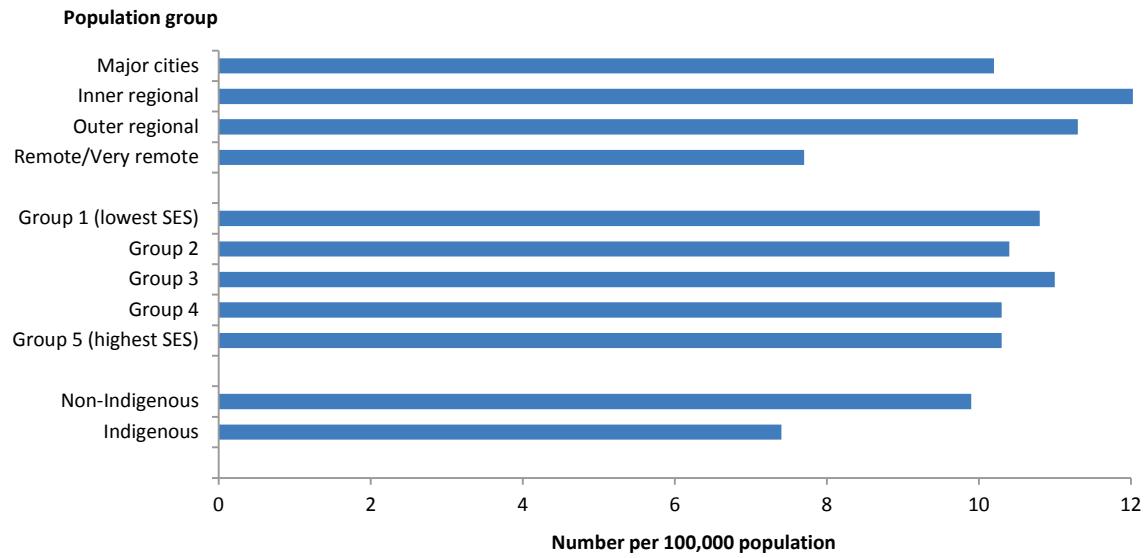
Socioeconomic status

In Australia, the incidence of type 1 diabetes in 2011 did not vary by SES, with incidence remaining around 10 to 11 new cases per 100,000 people across all SES groups (Figure 2.3; Table A2).

Aboriginal and/or Torres Strait Islander status

In 2011, there were 62 Aboriginal and Torres Strait Islander people diagnosed with type 1 diabetes (Table A2).

In 2006–2011, there were 294 Indigenous Australians diagnosed with type 1 diabetes: an average of 49 cases per year (Table A4). After adjusting for age and sex, Indigenous Australians were less likely to be diagnosed with type 1 diabetes than non-Indigenous Australians (incidence rate of 7 per 100,000 compared with 10 per 100,000) (Figure 2.3; Table A5).



Notes

1. Interpreting results for Indigenous status needs to consider that in 24% of cases no status was stated. The Indigenous results relate to the period 2006-2011.
2. Indigenous and non-Indigenous data refer to combined data for 2006-2011 and rates have been age and sex standardised to the 2001 Australian population.

Source: AIHW analysis of the NDR 2011 (Table A2; Table A5).

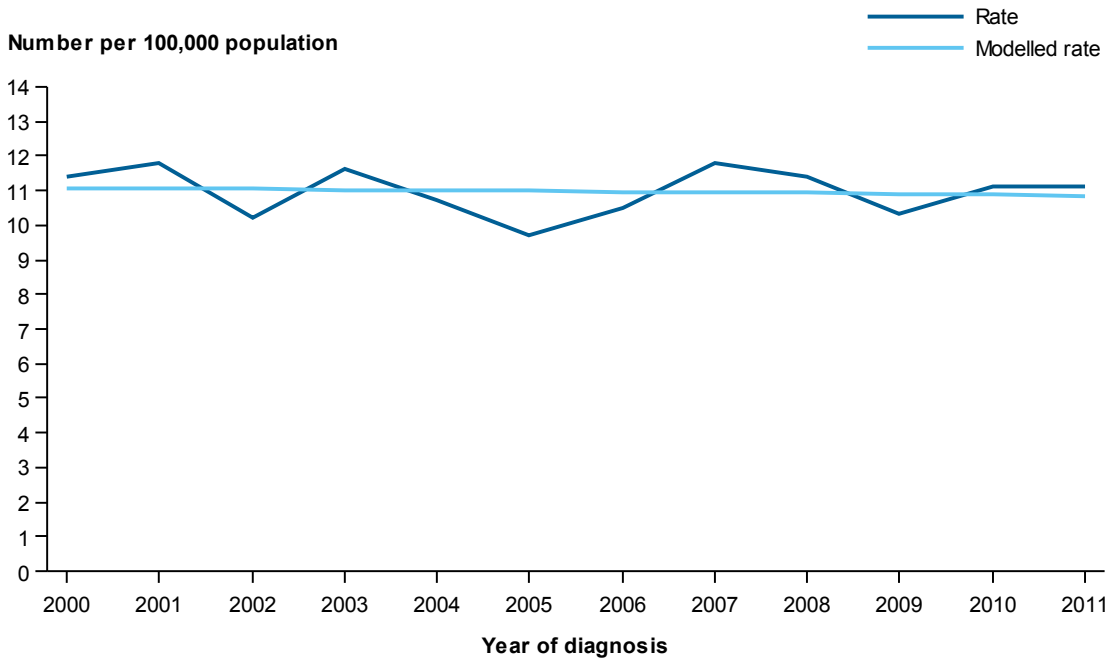
Figure 2.3: Incidence of type 1 diabetes by population groups, Australia, 2011

Are incidence rates changing over time?

Between 2000 and 2011, there were on average around 2,200 new cases of type 1 diabetes each year, equating to around 6 new cases per day over this period (Table A6).

The incidence of new cases of type 1 diabetes did not change significantly from 2000 to 2011. After taking into account differences in the age and sex structure, the incidence of type 1 diabetes fluctuated between 10 and 12 cases per 100,000 population each year. Similarly, there were no significant differences in the trends for males or females or across age groups over this period. The numbers of new cases for females ranged from 8 to 10 cases per 100,000 each year and for males, 11 to 14 (Table A7; Table A8).

These findings were also confirmed with joinpoint regression analysis, which showed that the slope of the fitted trend line was not statistically significantly different from zero (Figure 2.4). Joinpoint is used to assist in determining a linear trend, or a series of linear trends, by fitting lines that most closely represent the pattern of data points. The slope of the line provides a measure of the magnitude of the change in incidence over time.



Notes

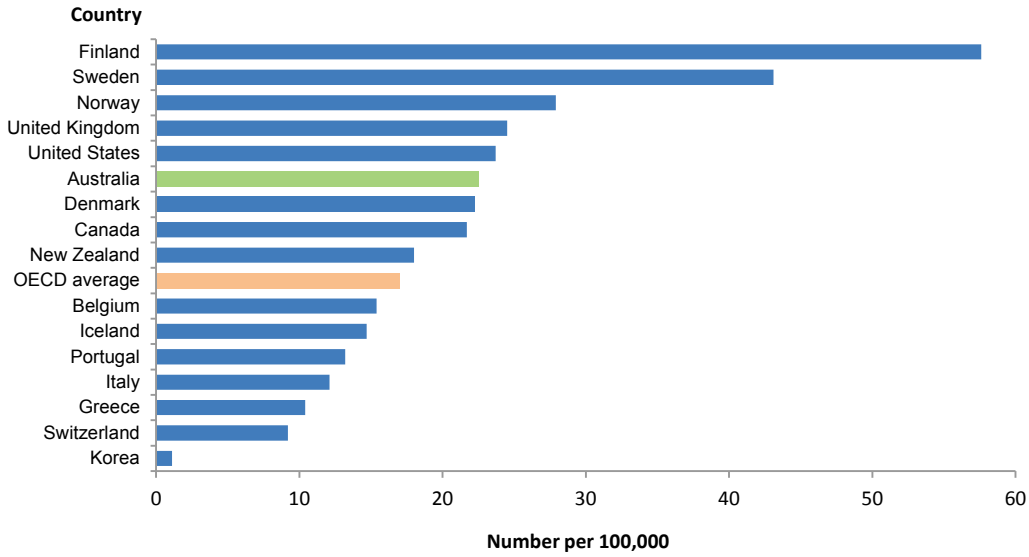
1. Diagnosis year is determined by year at first insulin use.
2. Age- and sex-standardised to the 2001 Australian population.
3. Modelled rate is determined using joinpoint analysis.

Source: AIHW analysis of the NDR 2011 (Table A9).

Figure 2.4: Trend in the incidence of type 1 diabetes by year of diagnosis, observed and modelled rates, Australia, 2000–11

How does Australia compare on rates of type 1 diabetes?

Because diagnosis is usually made in childhood, much of the international literature on the incidence of type 1 diabetes focuses on young people. Of the 30 Organisation for Economic Co-operation and Development (OECD) countries for which comparable data were available, Finland had the highest rate of incidence of type 1 diabetes among children aged 0–14 (58 per 100,000), while Korea had the lowest rate (1 per 100,00) (OECD 2013). The cause of the high rates of type 1 diabetes in Finland is attributed to a combination of genetic and lifestyle factors (Myers & Zimmet 2008). Australia's incidence rate of type 1 diabetes of 23 per 100,000 population aged 0–14 was high compared with other OECD countries: 6th highest and above the OECD average (17 per 100,000) for the 30 countries which data is available (Figure 2.5).



Notes

1. Incidence for Australia is the estimate provided by the OECD (23 per 100,000). This is slightly lower than the rate from the NDR (24 per 100,000)
2. OECD estimates are based on estimates from the International Diabetes Federation for 2011; the data were age standardised to the World Standard Population.

Source: OECD 2013.

Figure 2.5: Estimates of the incidence rate of type 1 diabetes for those aged 0–14, selected countries, 2011

In recent years, an increase in the incidence of type 1 diabetes has been observed in many countries, at a rate of around 3% annually on average (Moltchanova et al. 2009). However, this increase was not evident in the trend analysis relating to Australia from 2000 to 2011 presented in this chapter.

3 Insulin-treated type 2 diabetes

Type 2 diabetes is the most common form of diabetes. It occurs when the body becomes resistant to the insulin being produced by the pancreas and the amount produced is inadequate to meet the body's needs. Insulin is often used in the treatment of type 2 diabetes, but not in all cases. In addition to their insulin resistance, whether or not a person with type 2 diabetes requires insulin is often dependent on blood glucose control, comorbidities, duration of the disease, age at onset; and other risk factors that influence the development of the disease, such as age, family history and ethnic background (Shaw & Chisholm 2003).

Type 2 diabetes is largely preventable: up to 60% of cases can potentially be avoided by maintaining a healthy lifestyle (Diabetes Australia 2013a). However, rates of type 2 diabetes have doubled over the last 2 decades, paralleling increases in obesity (Fox et al. 2006; Holden et al. 2013; Tseng et al. 2006). Although type 2 diabetes is most commonly diagnosed in adulthood, in recent years there has been an increasing emergence of type 2 diabetes in younger age groups (Lammi et al. 2007; Taplin et al. 2005; Tseng et al. 2006). The AIHW have recently released a report *Type 2 diabetes in Australia's children and young people: a working paper,* which provides some preliminary work in this area.

This chapter covers only cases of type 2 diabetes that require insulin treatment, because the NDR captures people who use insulin to treat their diabetes. It is important to note that this does not capture all cases of type 2 diabetes, because many people with type 2 diabetes manage their condition by lifestyle modification or other medications.

How many people with type 2 diabetes started using insulin in 2011?

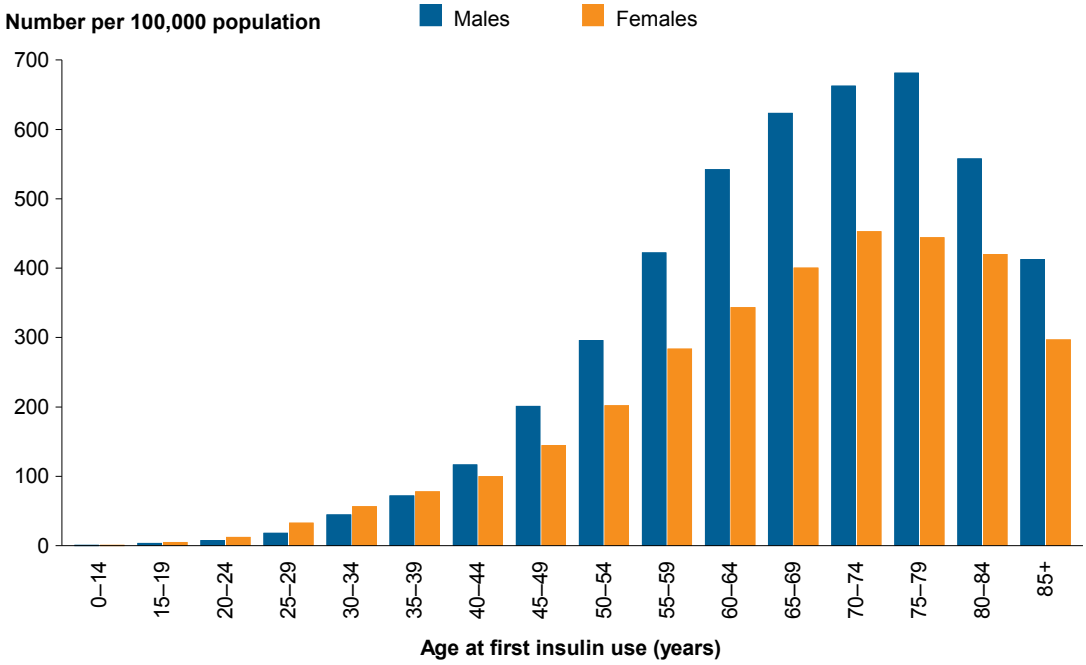
In 2011 in Australia, 36,263 people with type 2 diabetes began to use insulin to treat their condition; this represents 163 cases per 100,000 people (Table A10).

Age and sex

Rates of insulin-treated type 2 diabetes were higher among males than females at 185 per 100,000 population compared with 140 per 100,000, respectively (Table A10).

The incidence of insulin-treated type 2 diabetes increased rapidly with age from a rate of around 100 people per 100,000 population among those aged 40–44 to over 550 per 100,000 for those aged 70–74. Similar patterns were seen for males and females, although rates among females were lower and did not increase as rapidly as for males (Figure 3.1).

On average, both males and females were diagnosed with type 2 diabetes at a similar age and began to use insulin about 10 years after diagnosis. For males, the average age of diagnosis was 52 and the average age of first insulin use was 62. For females, the respective ages were 51 and 61.

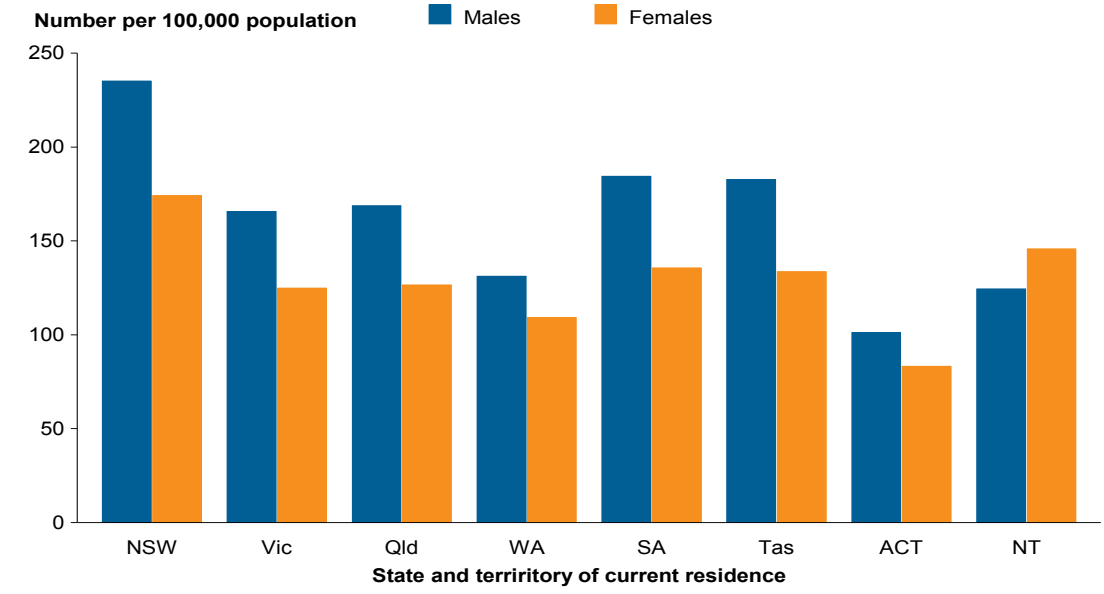


Source: AIHW analysis of the NDR 2011 (Table A10).

Figure 3.1: Incidence of insulin-treated type 2 diabetes by age at first insulin use and sex, Australia, 2011

State and territory

In 2011, the incidence of insulin-treated type 2 diabetes varied by state and territory of residence, ranging from 200 cases per 100,000 population in NSW to 92 per 100,000 in the Australian Capital Territory (ACT) (Figure 3.2; Table A11).



Source: AIHW analysis of the NDR 2011 (Table A11).

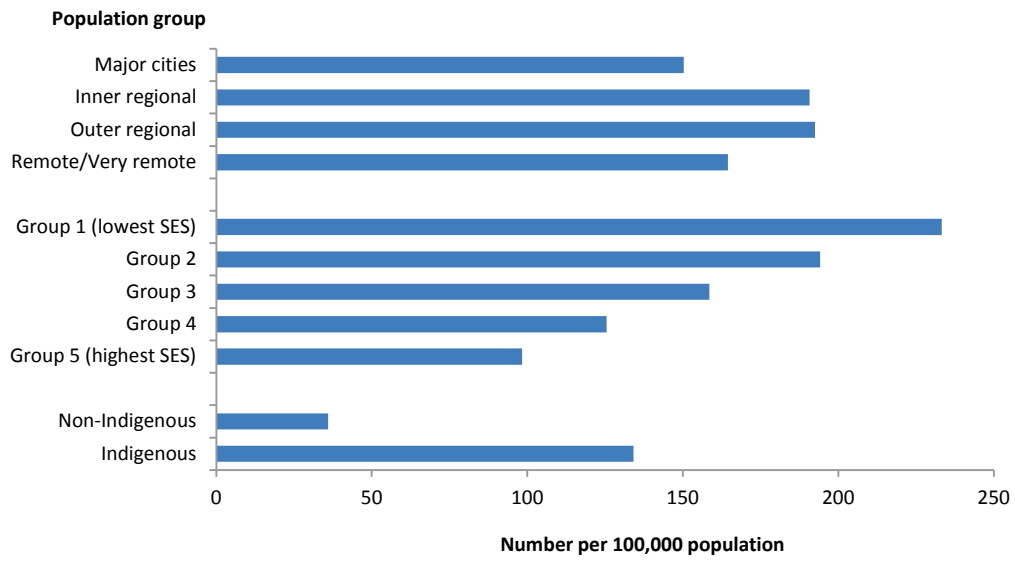
Figure 3.2: Incidence of insulin-treated type 2 diabetes by state or territory of usual residence and sex, Australia, 2011

Does insulin-treated type 2 diabetes vary across population groups?

This section examines how insulin use for type 2 diabetes varies across population groups that are often associated with differing levels of health.

Remoteness

The incidence of insulin-treated type 2 diabetes was lower in *Major cities* (150 per 100,000) than in *Remote and very remote* areas (165 per 100,000). Rates were higher in both *Inner regional* and *Outer regional* areas (191 and 193 per 100,000 population, respectively) (Figure 3.3; Table A11).



Notes

1. Interpreting results for Indigenous status needs to consider that in 54% of cases no status was recorded or the registration occurred before 2005.
2. Indigenous and non-Indigenous data refer to combined data for 2006–11 and rates have been age and sex standardised to the 2001 Australian population.

Source: AIHW analysis of the NDR 2011 (Table A11).

Figure 3.3: Incidence of insulin-treated type 2 diabetes by population groups, Australia, 2011

Socioeconomic status

The incidence of insulin-treated type 2 diabetes increased with increasing socioeconomic disadvantage. Rates of type 2 diabetes were twice as high in areas of lowest socioeconomic status compared with highest SES areas (233 compared with 98 per 100,000 population, respectively). This largely reflects the higher prevalence of type 2 diabetes in lower SES areas than in higher SES areas (Figure 3.3; Table A11).

Aboriginal and/or Torres Strait Islander status

There were 656 Aboriginal and Torres Strait Islander people who began using insulin to treat their type 2 diabetes in 2011 (Table A11). The incidence of insulin-treated diabetes was almost four times as high among Indigenous Australians compared with non-Indigenous Australians (134 compared with 36 per 100,000 population) (Figure 3.3; Table A11).

4 Insulin-treated gestational diabetes

Gestational diabetes (GDM), which occurs in about 1 in 20 pregnancies (AIHW 2010), generally develops in the second or third trimester. In Australia, women are routinely screened for GDM at about 24–28 weeks gestation (Nankervis et al. 2013). Women at highest risk of GDM include those who have had gestational diabetes previously, are from certain ethnic groups, are aged over 30, have a family history of diabetes, or commenced pregnancy being overweight or obese (AIHW 2010).

Complications from GDM can result for both the mother and baby. Complications for the mother involve higher risks of pregnancy-induced hypertension and pre-eclampsia, induced labour and operative delivery. Complications for the baby include increased fetal growth and perinatal morbidity, respiratory distress syndrome, jaundice and shoulder dystocia. GDM usually abates after pregnancy, but increases the risk that both the mother and the baby may develop type 2 diabetes later in life; this is more so where the mother has used insulin during pregnancy (Lee et al. 2007).

Some women can manage their GDM by changes to diet and exercise, but many will require medication, including insulin treatment. The proportion of GDM cases requiring insulin in Australia is about 32% (AIHW 2008), although this varies by factors such as ethnicity and diet, and can range from less than 30% to over 60% (Moses et al. 2009; Wong 2012; Wong & Jalaludin 2011).

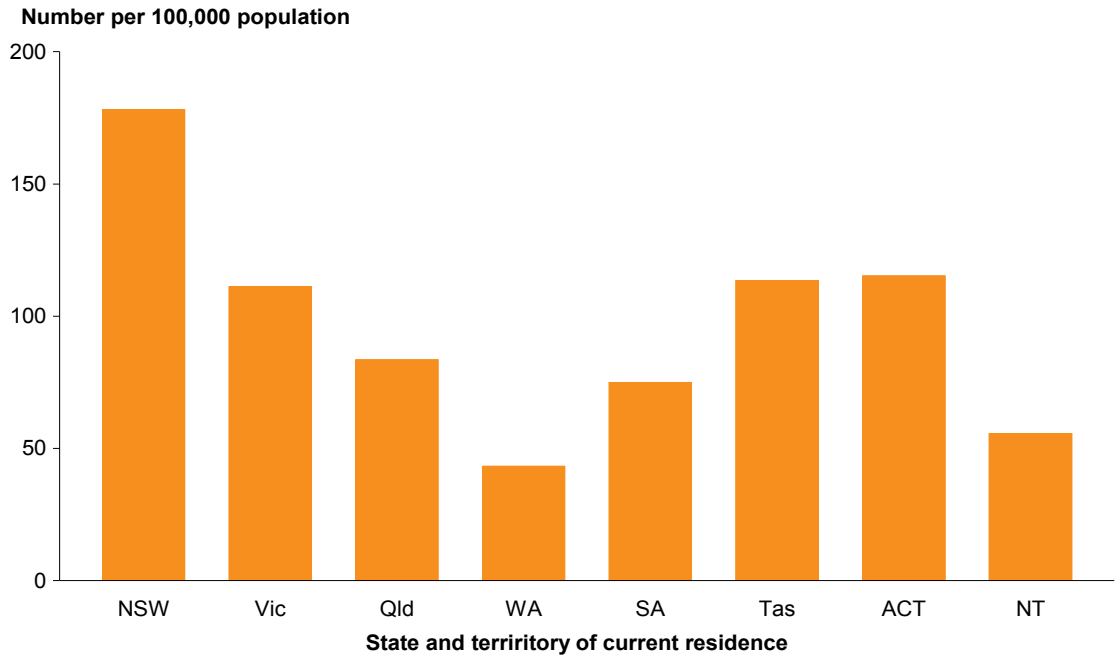
This chapter examines the incidence of insulin-treated GDM in 2011, but some caution needs to be exercised when interpreting these figures. The rates refer to the number per 100,000 of the female population aged 15–49, not to the population at risk: those who are pregnant. Additionally, as the propensity to be pregnant varies with age, rates could not be compared directly across age groups.

How many women had insulin-treated gestational diabetes in 2011?

In 2011 in Australia, 6,362 women aged 15–49, representing 117 per 100,000 women aged 15–49, began using insulin to treat their gestational diabetes. The mean age was 33 (Table A12).

State and territory

In 2011, the incidence of insulin-treated gestational diabetes varied by state and territory of residence, ranging from 178 per 100,000 women aged 15–49 in NSW to 43 per 100,000 in WA (Figure 4.1; Table A13).



Note: Population refers to all females aged 15–49, not only those who were pregnant.

Source: AIHW analysis of NDR 2011 (Table A13).

Figure 4.1: Incidence of insulin-treated gestational diabetes for women aged 15–49 by state or territory of usual residence, Australia, 2011

Does insulin–treated gestational diabetes vary across population groups?

This section examines how insulin use for gestational diabetes varies across population groups that are often associated with differing levels of health.

Remoteness

Women aged 15-49 living in *Major cities* were 2.5 times as likely to be using insulin to treat their gestational diabetes than those in living in *Remote and very remote* areas of Australia (incidence rate of 129 per 100,000 compared with 50 per 100,000 women, respectively) (Figure 4.2; Table A13).

This difference may be due to differing levels of diagnosis and/or access to services and GPs or specialist health professionals, such as endocrinologists or obstetricians, for women living in urban areas compared with those living in more remote areas of Australia.

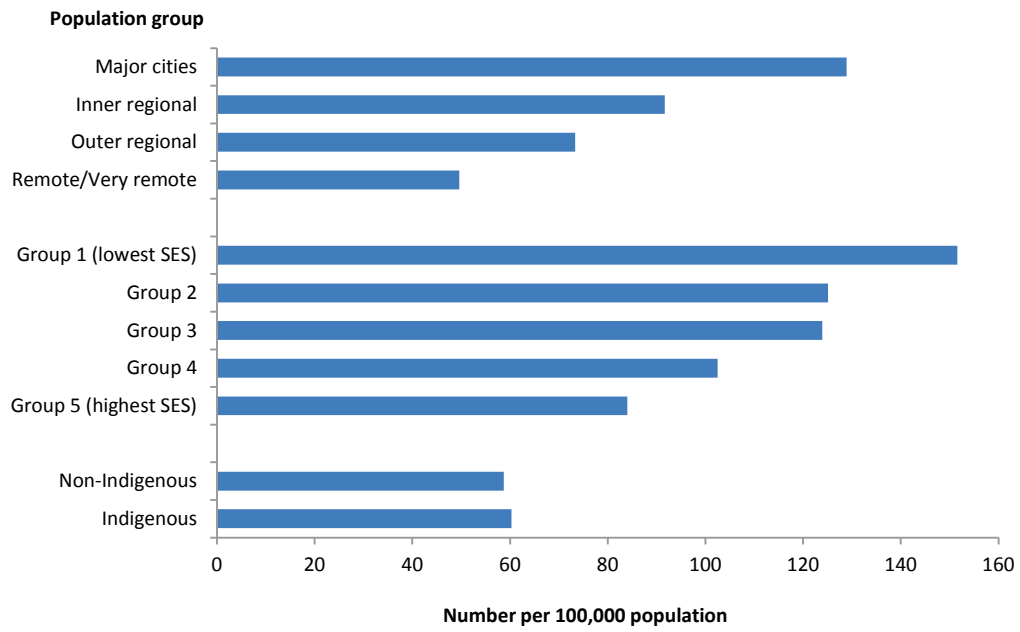
Socioeconomic status

The incidence of insulin-treated gestational diabetes increased with increasing socioeconomic disadvantage. Women living in areas of lowest SES were almost twice as likely to be using insulin to treat their gestational diabetes as those living in the highest SES areas (152 compared with 84 per 100,000 population, respectively). This partly reflects the

higher prevalence of gestational diabetes in lower SES areas compared with higher SES areas (Figure 4.2; Table A13).

Aboriginal and/or Torres Strait Islander status

There were 118 Indigenous women who commenced insulin use to treat gestational diabetes in 2011 (Table A13). Age– and sex–standardised incidence rates were similar for Indigenous and non-Indigenous Australians at 60 and 59 per 100,000, respectively (Figure 4.2).



Notes

1. Population refers to all females aged 15–49, not only those who were pregnant.
2. Interpreting results for Indigenous status needs to consider that in 26% of cases no status was recorded or the registration occurred before 2005.
3. Indigenous and non-Indigenous data refer to combined data for 2006–11 and rates have been age and sex standardised to the 2001 Australian population.

Source: AIHW analysis of NDR 2011.

Figure 4.2: Incidence of insulin-treated gestational diabetes for women aged 15–49 by population groups, Australia, 2011

Appendix A Detailed tables

Type 1 diabetes

Table A1: Incidence of type 1 diabetes by age at diagnosis and sex, Australia, 2011

	Number			Age-specific rate		
	Males	**Females**	**Persons**	**Males**	**Females**	**Persons**
0–4	123	97	220	16.4	13.7	15.1
5–9	168	157	325	23.8	23.5	23.7
10–14	229	209	438	32.3	31.0	31.7
Subtotal (0–14)	*520*	*463*	*983*	*24.1*	*22.6*	*23.3*
15–19	160	97	257	21.4	13.7	17.6
20–24	128	84	212	15.5	10.7	13.2
25–29	139	69	208	16.5	8.4	12.6
30–34	115	39	154	15.0	5.1	10.0
35–39	93	34	127	11.9	4.3	8.1
40–44	62	29	91	7.9	3.6	5.8
45–49	44	24	68	5.7	3.1	4.4
50–54	45	30	75	6.1	4.0	5.0
55–59	36	15	51	5.5	2.2	3.8
60–64	23	14	37	3.7	2.2	3.0
65–69	22	14	36	4.6	2.9	3.8
70–74	21	6	27	6.0	1.6	3.8
75–79	7	5	12	2.7	1.7	2.2
80–84	10	5	15	5.3	2.0	3.4
85+	8	6	14	5.8	2.3	3.5
Subtotal (15+)	*913*	*471*	*1,384*	*10.2*	*5.1*	*7.6*
Total	**1,433**	**934**	**2,367**	**12.9**	**8.3**	**10.6**

Notes

1. Year of first insulin use is a proxy for year of diagnosis.

2. Rates are number per 100,000 population.

Source: AIHW analysis of the NDR 2011.

Table A2: Incidence of type 1 diabetes by sex and population characteristics, Australia, 2011

	Number			Crude rate		
	Males	**Females**	**Persons**	**Males**	**Females**	**Persons**
State and territory[(a)]						
New South Wales	410	293	703	11.5	8.1	9.7
Victoria	367	219	586	13.4	7.8	10.6
Queensland	297	197	494	13.3	8.8	11.0
Western Australia	185	117	302	15.6	10.0	12.8
South Australia	110	57	167	13.6	6.9	10.2
Tasmania	31	23	54	12.2	9.0	10.6
Australian Capital Territory	25	18	43	13.7	9.7	11.7
Northern Territory	8	10	18	6.6	9.1	7.8
Remoteness[(b)]						
Major cities	960	634	1,594	12.4	8.0	10.2
Inner regional	297	199	496	14.6	9.7	12.1
Outer regional	149	81	230	14.5	8.1	11.3
Remote/Very remote	24	15	39	8.6	6.3	7.7
Socioeconomic status[(c)]						
Group 1 (lowest SES)	300	183	483	13.4	8.2	10.8
Group 2	276	186	462	12.4	8.3	10.4
Group 3	303	189	492	13.7	8.4	11.0
Group 4	280	177	457	12.7	7.9	10.3
Group 5 (highest SES)	269	194	463	12.1	8.5	10.3
Indigenous status						
Indigenous	37	25	62	12.9	8.7	10.8
Non-Indigenous	1,033	707	1,740	9.6	6.5	8.0
Not stated	363	202	565	—	—	—
Australia[(d)]	**1,433**	**934**	**2,367**	**12.9**	**8.3**	**10.6**

(a) State or territory of current usual residence.

(b) Remoteness is classified according to the Australian Statistical Geography Standard (ASGS) 2011 Remoteness Areas structure based on postcode of current usual residence.

(c) Socioeconomic status is classified into population-based quintiles according to the Index of Relative Socio-Economic Disadvantage (IRSD) based on postcode of current usual residence.

(d) Includes people for whom certain population characteristics could not be derived, so subcomponents may not add to Australian total.

Note: Rates are number per 100,000 population.

Source: AIHW analysis of the NDR 2011.

Table A3: Incidence of type 1 diabetes by state or territory of usual residence and sex, Australia, 2011 and 2000–11

	2011						2000–11					
	Males		Females		Persons		Males		Females		Persons	
	Number	Crude rate	Number	Crude rate	Number	Crude rate	Number	Crude rate	Number	Crude rate	Number	Crude rate
NSW	410	11.5	293	8.1	703	9.7	4,894	12.0	3,465	8.4	8,359	10.2
Vic	367	13.4	219	7.8	586	10.6	3,820	12.6	2,831	9.1	6,651	10.8
Qld	297	13.3	197	8.8	494	11.0	3,173	13.1	2,220	9.1	5,393	11.1
WA	185	15.6	117	10.0	302	12.8	1,698	13.6	1,103	8.9	2,801	11.2
SA	110	13.6	57	6.9	167	10.2	1,180	12.7	817	8.6	1,997	10.6
Tas	31	12.2	23	9.0	54	10.6	430	14.8	315	10.6	745	12.7
ACT	25	13.7	18	9.7	43	11.7	263	13.1	193	9.4	456	11.3
NT	8	6.6	10	9.1	18	7.8	102	7.7	70	5.8	172	6.8
Australia	**1,433**	**12.9**	**934**	**8.3**	**2,367**	**10.6**	**15,561**	**12.6**	**11,014**	**8.8**	**26,575**	**10.7**

Note: Rates are number per 100,000 population.

Source: AIHW analysis of the NDR 2011.

Table A4: Incidence of type 1 diabetes by Indigenous status and year of diagnosis, Australia, 2005–2011(a)

	Indigenous		Non-Indigenous		Not stated		
	Number	%	Number	%	Number	%	Total
2005	52	2.7	1,734	90.0	141	7.3	**1,927**
2006	41	1.9	1,860	88.2	208	9.9	**2,109**
2007	58	2.4	2,140	89.0	207	8.6	**2,405**
2008	46	1.9	2,196	93.0	119	5.0	**2,361**
2009	37	1.7	1,918	88.7	208	9.6	**2,163**
2010	50	2.1	2,018	86.3	271	11.6	**2,339**
2011	62	2.6	1,740	73.5	565	23.9	**2,367**
2005–2011	**346**	**2.2**	**13,606**	**86.8**	**1,719**	**11.0**	**15,671**

(a) Analysis excludes 26 NDSS registrations before 2005 due to data quality issues.

Note: Year of first insulin use is a proxy for year of diagnosis.

Source: AIHW analysis of the NDR 2011.

Table A5: Incidence of type 1 diabetes by Indigenous status and year of diagnosis, Australia, 2005–2011[(a)]

	Indigenous	Non-Indigenous	All Australians
	Age- and sex-standardised rate		
2006	6.0	9.6	10.5
2007	10.1	10.9	11.8
2008	7.0	11.0	11.4
2009	4.7	9.5	10.3
2010	8.4	10.0	11.1
2011	8.4	8.5	11.1
2006–2011	**7.4**	**9.9**	**12.6**

(a) Analysis excludes 10 NDSS registrations prior to 2005 due to data quality issues.

Notes

1. Year of first insulin use is a proxy for year of diagnosis.

2. Age- and sex-standardised to the 2001 Australian population.

3. Rates are number per 100,000 population.

Source: AIHW analysis of the NDR 2011.

Table A6: Incidence of type 1 diabetes by year of diagnosis and sex, Australia, 2000–11

	Males			Females			Persons	
	Number	%	Rate	Number	%	Rate	Number	Rate
2000	1,261	57.7	13.2	925	42.3	9.6	2,186	11.4
2001	1,308	57.1	13.6	982	42.9	10.0	2,290	11.8
2002	1,147	57.5	11.8	849	42.5	8.6	1,996	10.2
2003	1,301	56.8	13.3	987	43.2	9.9	2,288	11.6
2004	1,247	58.8	12.7	872	41.2	8.7	2,119	10.7
2005	1,110	57.1	11.2	833	42.9	8.3	1,943	9.7
2006	1,259	59.6	12.5	853	40.4	8.4	2,112	10.5
2007	1,451	60.2	14.2	959	39.8	9.4	2,410	11.8
2008	1,389	58.8	13.5	974	41.2	9.4	2,363	11.4
2009	1,293	59.7	12.4	872	40.3	8.3	2,165	10.3
2010	1,364	58.3	12.9	975	41.7	9.2	2,339	11.1
2011	1,433	60.6	13.4	934	39.4	8.7	2,367	11.1
2000–11	**15,561**	**58.6**	**12.9**	**11,014**	**41.4**	**9.0**	**26,578**	**10.9**

Notes

1. Year of first insulin use is a proxy for year of diagnosis.

2. Age- and sex-standardised to the 2001 Australian population.

3. Rates are number per 100,000 population.

Source: AIHW analysis of the NDR 2011.

Table A7: Incidence of type 1 diabetes by year of diagnosis, by sex and age at first insulin use, Australia, 2000–11

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2000–11[(a)]
	Age- and sex-standardised rate (number per 100,000 population)												
Males													
0–19	20.1	21.7	21.8	23.9	24.3	22.0	23.5	24.9	24.1	23.0	23.6	23.6	**23.0**
20–29	14.9	15.9	13.4	17.5	14.7	13.4	14.1	18.6	16.0	14.8	13.3	16.1	**15.2**
30–39	12.9	12.9	10.0	11.7	12.1	10.0	11.2	13.7	13.4	11.0	12.6	13.4	**12.1**
40+	8.2	7.5	5.2	5.4	4.4	3.6	5.1	5.8	5.5	4.9	5.7	5.7	**5.5**
Total	**13.2**	**13.6**	**11.8**	**13.3**	**12.7**	**11.2**	**12.5**	**14.2**	**13.5**	**12.4**	**12.9**	**13.4**	**12.9**
Females													
0–19	19.4	20.0	20.6	23.4	21.2	20.7	19.7	21.6	22.6	18.9	22.4	20.6	**20.9**
20–29	9.5	9.6	8.4	9.9	8.1	7.9	7.8	8.6	9.8	9.3	8.5	9.5	**8.9**
30–39	6.3	6.3	4.2	6.7	6.2	4.8	6.5	5.9	5.2	5.6	5.4	4.7	**5.6**
40+	4.8	5.5	3.0	3.0	2.4	2.2	2.5	3.5	2.8	2.6	2.9	2.8	**3.1**
Total	**9.6**	**10.0**	**8.6**	**9.9**	**8.7**	**8.3**	**8.4**	**9.4**	**9.4**	**8.3**	**9.2**	**8.7**	**9.0**
Persons													
0–19	19.7	20.9	21.3	23.6	22.8	21.3	21.7	23.3	23.4	21.0	23.0	22.1	**22.0**
20–29	12.2	12.8	10.9	13.8	11.4	10.7	11.0	13.7	12.9	12.1	10.9	12.8	**12.1**
30–39	9.6	9.6	7.1	9.2	9.1	7.4	8.8	9.8	9.2	8.3	9.0	9.0	**8.8**
40+	6.4	6.5	4.1	4.1	3.3	2.9	3.7	4.6	4.1	3.7	4.3	4.2	**4.3**
Total	**11.4**	**11.8**	**10.2**	**11.6**	**10.7**	**9.7**	**10.5**	**11.8**	**11.4**	**10.3**	**11.1**	**11.1**	**10.9**

(a) The rate for 2000–11 is the average annual rate for the 12 years.

Notes

1. Year of first insulin use is a proxy for year of diagnosis.

2. Age- and sex-standardised to the 2001 Australian population.

Source: AIHW analysis of the NDR 2011.

Table A8: Incidence of type 1 diabetes by year of diagnosis, by sex and age at first insulin use, Australia, 2000–11

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2000–11[(a)]
	Age- and sex-standardised rate (number per 100,000 population)												
Males													
0–14	21.2	23.3	23.1	25.2	25.9	23.2	24.4	26.5	25.2	24.9	24.2	24.3	**24.3**
15+	11.1	11.0	8.8	10.1	9.1	7.9	9.3	10.9	10.3	9.0	9.9	10.5	**9.8**
Total	**13.2**	**13.6**	**11.8**	**13.3**	**12.7**	**11.2**	**12.5**	**14.2**	**13.5**	**12.4**	**12.9**	**13.4**	**12.9**
Females													
0–14	20.8	21.5	23.8	26.2	24.4	23.4	22.1	24.2	25.0	21.1	25.3	22.9	**23.4**
15+	6.8	7.2	4.9	5.9	4.9	4.6	5.0	5.7	5.5	5.1	5.3	5.2	**5.5**
Total	**9.6**	**10.0**	**8.6**	**9.9**	**8.7**	**8.3**	**8.4**	**9.4**	**9.4**	**8.3**	**9.2**	**8.7**	**9.0**
Persons													
0–14	21.0	22.4	23.4	25.7	25.2	23.3	23.3	25.3	25.1	23.0	24.7	23.6	**23.8**
15+	8.9	9.0	6.8	8.0	7.0	6.2	7.1	8.3	7.9	7.0	7.6	7.8	**7.6**
Total	**11.4**	**11.8**	**10.2**	**11.6**	**10.7**	**9.7**	**10.5**	**11.8**	**11.4**	**10.3**	**11.1**	**11.1**	**10.9**

(a) The rate for 2000–11 is the average annual rate for the 12 years.

Notes

1. Year of first insulin use is a proxy for year of diagnosis.

2. Age- and sex-standardised to the 2001 Australian population.

Source: AIHW analysis of the NDR 2011.

Table A9: Incidence of type 1 diabetes by year of diagnosis, observed and modelled rates, Australia, 2000–11

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
	Age- and sex-standardised rate (number per 100,000 population)											
All ages												
Rate	11.4	11.8	10.2	11.6	10.7	9.7	10.5	11.8	11.4	10.3	11.1	11.1
Modelled rate	11.1	11.1	11.0	11.0	11.0	11.0	11.0	11.0	10.9	10.9	10.9	10.9
Aged 40 and over												
Rate	6.4	6.5	4.1	4.1	3.3	2.9	3.7	4.6	4.1	3.7	4.3	4.2
Modelled rate	6.6	5.7	4.9	4.1	3.2	3.4	3.6	3.7	3.9	4.1	4.3	4.4

Notes

1. Year of first insulin use is a proxy for year of diagnosis.

2. Age- and sex-standardised to the 2001 Australian population.

Source: AIHW analysis of the NDR 2011.

Insulin-treated type 2 diabetes

Table A10: Incidence of insulin-treated type 2 diabetes by sex and age at first insulin use, Australia, 2011

	Number			Age-specific rate		
	Males	**Females**	**Persons**	**Males**	**Females**	**Persons**
0–14	6	9	15	0.3	0.4	0.4
15–19	24	32	56	3.2	4.5	3.8
20–24	61	95	156	7.4	12.1	9.7
25–29	149	264	413	17.7	32.3	24.9
30–34	342	431	773	44.5	56.2	50.3
35–39	560	613	1,173	71.6	77.4	74.5
40–44	909	795	1,704	116.1	99.4	107.7
45–49	1,546	1,126	2,672	200.8	144.0	172.2
50–54	2,184	1,523	3,707	295.5	201.8	248.1
55–59	2,782	1,910	4,692	422.0	283.4	351.9
60–64	3,336	2,143	5,479	542.1	343.1	441.9
65–69	2,949	1,916	4,865	622.9	400.0	510.8
70–74	2,314	1,674	3,988	662.2	452.6	554.5
75–79	1,758	1,330	3,088	681.2	443.8	553.6
80–84	1,062	1,063	2,125	557.6	419.6	478.8
85+	573	784	1,357	412.4	296.6	336.5
Total	**20,555**	**15,708**	**36,263**	**185.2**	**139.9**	**162.4**

Note: Rates are number per 100,000 population.

Source: AIHW analysis of the NDR 2011.

Table A11: Incidence of insulin-treated type 2 diabetes by sex and population characteristics, Australia, 2011

	Number			Crude rate		
	Males	**Females**	**Persons**	**Males**	**Females**	**Persons**
State and territory[(a)]						
New South Wales	8,413	6,324	14,737	235.1	174.1	204.4
Victoria	4,534	3,492	8,026	165.7	124.8	145.0
Queensland	3,761	2,836	6,597	168.6	126.4	147.4
Western Australia	1,552	1,277	2,829	131.2	109.2	120.3
South Australia	1,494	1,122	2,616	184.4	135.5	159.7
Tasmania	465	343	808	182.8	133.6	158.1
Australian Capital Territory	185	154	339	101.2	83.2	92.2
Northern Territory	151	160	311	124.3	145.7	134.4
Remoteness[(b)]						
Major cities	13,372	10,178	23,550	172.5	128.5	150.3
Inner regional	4,486	3,334	7,820	220.0	161.7	190.7
Outer regional	2,204	1,709	3,913	214.2	170.3	192.5
Remote/Very remote	427	428	855	152.6	178.4	164.5
Socioeconomic status[(c)]						
Group 1 (lowest SES)	5,704	4,707	10,411	255.6	211.0	233.3
Group 2	4,785	3,856	8,641	215.8	172.5	194.1
Group 3	4,024	3,044	7,068	181.6	135.8	158.5
Group 4	3,302	2,271	5,573	149.5	101.7	125.5
Group 5 (highest SES)	2,662	1,758	4,420	120.0	77.2	98.3
Indigenous status[(d)]						
Indigenous	302	354	656	105.3	122.6	114.0
Non-Indigenous	7,605	5,458	13,063	70.3	49.9	60.1
Not stated	2,189	1,513	3,702	—	—	—
Australia[(e)]	**20,555**	**15,708**	**36,263**	**185.2**	**139.9**	**162.4**

(a) State or territory of current usual residence.

(b) Remoteness is classified according to the Australian Statistical Geography Standard (ASGS) 2011 Remoteness Areas structure based on postcode of current residence.

(c) Socioeconomic status is classified into population-based quintiles according to the Index of Relative Socio-Economic Disadvantage (IRSD) based on postcode of current usual residence.

(d) Indigenous status excludes 18,842 NDSS registrations before 2005 due to data quality issues.

(e) Includes people for whom certain population characteristics could not be derived, so subcomponents may not add to Australian total.

Note: Rates are number per 100,000 population.

Source: AIHW analysis of the NDR 2011.

Insulin-treated gestational diabetes

Table A12: Incidence of insulin-treated gestational diabetes among females aged 15–49 at first insulin use by age at first insulin use, Australia, 2011

	Number	Age-specific rate
15–19	42	5.9
20–24	359	45.6
25–29	1,380	169.0
30–34	2,195	286.3
35–39	1,772	223.8
40–44	566	70.8
45–49	48	6.1
Total	**6,362**	**116.7**

Note: Rates are number per 100,000 population.

Source: AIHW analysis of the NDR 2011.

Table A13: Incidence of insulin-treated gestational diabetes among females aged 15–49 at first insulin use by population characteristics, Australia, 2011

	Number	Crude rate
State and territory[(a)]		
New South Wales	3,097	178.1
Victoria	1,533	111.2
Queensland	917	83.5
Western Australia	252	43.3
South Australia	286	75.0
Tasmania	129	113.4
Australian Capital Territory	114	115.2
Northern Territory	34	55.6
Remoteness[(b)]		
Major cities	5,144	128.9
Inner regional	819	91.7
Outer regional	328	73.3
Remote/Very remote	60	49.6
Socioeconomic status[(c)]		
Group 1 (lowest SES)	1,552	151.6
Group 2	1,312	125.1
Group 3	1,366	123.9
Group 4	1,157	102.5
Group 5 (highest SES)	960	84.0
Indigenous status[(d)]		
Indigenous	118	78.7
Non-Indigenous	4,592	86.6
Not stated	1,500	—
Australia[(e)]	**6,362**	**116.7**

(a) State or territory of current usual residence.

(b) Remoteness is classified according to the Australian Statistical Geography Standard (ASGS) 2011 Remoteness Areas structure based on postcode of current usual residence.

(c) Socioeconomic status is classified into population-based quintiles according to the Index of Relative Socio-Economic Disadvantage (IRSD) based on postcode of current usual residence.

(d) Indigenous status excludes 152 NDSS registrations before 2005 due to data quality issues.

(e) Includes people for whom certain population characteristics could not be derived, so subcomponents may not add to Australian total.

Note: Rates are number per 100,000 population.

Source: AIHW analysis of the NDR 2011.

Insulin-treated other diabetes types

Table A14: Incidence of insulin-treated other diabetes types by sex and population characteristics, Australia, 2000–11

	Number		
	Males	**Females**	**Persons**
State and territory[(a)]			
New South Wales	484	353	837
Victoria	376	295	671
Queensland	255	221	476
Western Australia	129	102	231
South Australia	100	84	184
Tasmania	35	35	70
Australian Capital Territory	18	22	40
Northern Territory	9	3	12
Remoteness[(b)]			
Major cities	997	788	1,785
Inner regional	255	214	469
Outer regional	126	98	224
Remote/Very remote	23	12	35
Socioeconomic status[(c)]			
Group 1 (lowest SES)	317	238	555
Group 2	285	226	511
Group 3	276	223	499
Group 4	266	223	489
Group 5 (highest SES)	254	201	455
Indigenous status[(d)]			
Indigenous	13	10	23
Non-Indigenous	720	614	1,335
Not stated	200	145	345
Australia[(e)]	**1,406**	**1,115**	**2,521**

(a) State or territory of current usual residence.

(b) Remoteness is classified according to the Australian Statistical Geography Standard (ASGS) 2011 Remoteness Areas structure based on postcode of current usual residence.

(c) Socioeconomic status is classified into population-based quintiles according to the Index of Relative Socio-Economic Disadvantage (IRSD) based on postcode of current usual residence.

(d) Indigenous status excludes 818 NDSS registrations before 2005 due to data quality issues.

(e) Includes people for whom certain population characteristics could not be derived, so subcomponents may not add to Australian total.

Source: AIHW analysis of the NDR 2011.

Table A15: Incidence of insulin-treated other diabetes types by sex and year of first insulin use, Australia, 2000–11

	Number		
	Males	**Females**	**Persons**
2000	20	46	96
2001	78	47	125
2002	70	43	113
2003	78	58	136
2004	81	64	145
2005	89	75	164
2006	112	89	202
2007	107	77	184
2008	120	93	213
2009	116	112	228
2010	199	163	362
2011	305	248	553
2000–11	**1,406**	**1,115**	**2,521**

Source: AIHW analysis of the NDR 2011.

Appendix B: Statistical notes and methods

Data sources: NDR

The Data Quality Statement

Information about limitations and issues regarding the NDR are found in the Data Quality Statement: National (insulin-treated) Diabetes Register 2011, which is located at: <http://meteor.aihw.gov.au/content/index.phtml/itemId/563407>.

Determining who is on the NDR

In order to create the NDR, eligible NDSS registrants—those using insulin—need to be determined. It is likely that the method used to do this may have overestimated the number of people who are using insulin. On the NDSS, there is no single variable that indicates someone is using insulin to treat their diabetes, so inclusion on the NDR was determined by a number of factors as outlined in Box B1.

The uncertainties mainly relate to the reliability of certification of insulin use by health professionals. The practicalities of registering with the NDSS, which require certification specifically for insulin use in addition to diabetes diagnosis, suggest that, in some instances, people diagnosed with type 2 or gestational diabetes are indicated as insulin-treated to cover the possibility that they may require insulin sometime in the future. This means that they can appear as an insulin user by the indications used to derive the NDR, but may in fact not actually have started using, insulin.

Additionally, some people may choose not to comply with a health professional's recommendations or, in the case of women with gestational diabetes, deliver their baby before any treatment is undertaken.

Box B1: Factors indicating insulin use status

From APEG:

- All records from APEG were included, as all those supplied to the AIHW related to insulin use.

From the NDSS, records were eligible for inclusion if:

- the registrant had type 1 diabetes (this was determined by applying the algorithm that checked the diabetes type reported at registration—see 'Diabetes type on the NDR' and Box B3), or
- there was evidence of the purchase of insulin-related products from NDSS sales information, or
- the registrant had been certified as an insulin user by a doctor, endocrinologist or Credentialled Diabetes Educator on the NDSS registration/change in medication status form, or
- a date of first insulin injection was recorded for the registrant.

On the NDR a person's insulin use status was considered to be certain if their information was from APEG, or they had type 1 diabetes, or there was evidence they have purchased an insulin-related product through the NDSS. Uncertain insulin users were those who were certified by a doctor as using insulin or had a date of first injection recorded.

For most years between 2000 and 2009, the insulin use status of around 70% of registrants is certain and in 2010 and 2011 the proportion of definite insulin users to all potential insulin users increased to 86% and 92%, respectively (Table B1).

The AIHW is in the process of further verifying the insulin use of NDSS registrants, and has been granted ethical approval to access Pharmaceutical Benefit Scheme data relating to prescriptions for insulin. This project aims at improving the certainty of insulin use status, and consequently the understanding of the accuracy of the number of people on the NDR.

Table B1: Insulin user status among NDR registrants by year of first insulin use, 2000–11

	Certain insulin users[(a)]		Uncertain insulin users[(b)]		
Year of first insulin use	Number	%	Number	%	Total
2000	7,492	69.9	3,226	30.1	**10,718**
2001	7,792	71.6	3,091	28.4	**10,883**
2002	7,593	70.1	3,233	29.9	**10,826**
2003	23,858	79.9	5,998	20.1	**29,856**
2004	17,272	68.5	7,951	31.5	**25,223**
2005	14,364	62.9	8,490	37.1	**22,854**
2006	14,058	64.0	7,891	36.0	**21,949**
2007	16,450	66.9	8,124	33.1	**24,574**
2008	18,662	70.7	7,739	29.3	**26,401**
2009	20,507	72.2	7,881	27.8	**28,388**
2010	39,540	85.6	6,651	14.4	**46,191**
2011	49,260	92.1	4,243	7.9	**53,503**
2000–11	**236,848**	**76.1**	**74,518**	**23.9**	**311,366**

(a) Certain insulin users have type 1 diabetes, evidence of insulin-related product purchase and/or record sourced from APEG.

(b) Uncertain insulin users have an indication of insulin use, but not those described for certain insulin users above.

Note: The increase in the number of people beginning to use insulin in 2003 and 2010 is partly related to structural changes to the NDSS database in 2002 and 2010 resulting in improved levels of checking and information retention.

Source: AIHW analysis of the NDR 2011.

Children with type 1 diabetes

Information about children with type 1 diabetes is derived from two data sources—NDSS and APEG. The concordance between these and the estimated coverage of children with type 1 diabetes is presented below.

Concordance between the NDSS and APEG

Table B2 shows the concordance between the NDSS and APEG data sets for new cases of type 1 diabetes in those diagnosed aged under 15. On average, from 2000 to 2011, about two-thirds of children with type 1 diabetes were registered with both the NDSS and APEG.

Table B2: NDR registrants with type 1 diabetes and aged under 15 at diagnosis by year of diagnosis and data source of record, 2000–11

	APEG only		APEG and NDSS		NDSS only		Total NDR registrants
	Number	%	Number	%	Number	%	
2000	15	1.8	565	67.8	253	30.4	**833**
2001	17	1.9	639	71.5	238	26.6	**894**
2002	16	1.7	682	72.8	239	25.5	**937**
2003	14	1.4	749	72.7	267	25.9	**1,030**
2004	14	1.4	690	68.2	308	30.4	**1,012**
2005	14	1.5	638	68.0	286	30.5	**938**
2006	10	1.1	616	65.2	319	33.8	**945**
2007	13	1.3	652	63.3	365	35.4	**1,030**
2008	10	1.0	612	59.7	403	39.3	**1,025**
2009	11	1.2	661	69.9	273	28.9	**945**
2010	11	1.1	697	68.4	311	30.5	**1,019**
2011	15	1.5	636	64.7	332	33.8	**983**
2000–11	**160**	**1.4**	**7,837**	**67.6**	**3,594**	**31.0**	**11,591**

Note: Year of first insulin use is a proxy for year of diagnosis.

Source: AIHW analysis of the NDR 2011.

NDR coverage of type 1 diabetes in children

The capture–recapture method (Box B2) was used with the two independent data sources (NDSS and APEG) to determine coverage of those aged 0–14 with type 1 diabetes on the NDR. Over the period 2000–11 it was estimated to be 99.4% (Table B.3). Based on this estimate it is expected that 73 cases were missed by both sources.

Table B3: Coverage of NDR registrants with type 1 diabetes and aged under 15 at diagnosis by year of diagnosis, 2000–11

	Total NDR registrants	Missing cases[(a)]	Coverage rate[(b)] (%)
2000	833	7	99.2
2001	894	6	99.3
2002	937	6	99.4
2003	1,030	5	99.5
2004	1,012	6	99.4
2005	938	6	99.3
2006	945	5	99.5
2007	1,030	7	99.3
2008	1,025	7	99.4
2009	945	5	99.5
2010	1,019	5	99.5
2011	983	8	99.2
2000–11	**11,591**	73	99.4

(a) Estimated number of missing cases using the capture–recapture method with the two independent data sources: NDSS and APEG.

(b) Coverage rate = (NDR registrants/[NDR registrants + Estimated missing cases]) x100.

Source: AIHW analysis of the NDR 2011.

Box B2: Capture–recapture method

The capture–recapture method as described by LaPorte et al. (1993) can be applied to the calculation of incidence rates of insulin-treated diabetes when multiple sources are being used to identify new cases. In capture–recapture, the cases provided by both sources (that is, the duplicates) provide important information about the degree to which cases may have been missed. The duplicates represent 'recaptured' people who have diabetes, and the degree of under-count can be estimated. The formula used to calculate ascertainment is below (see LaPorte et al. 1993 for more information).

$$N = \frac{(M+1)(n+1)}{m+1} - 1$$

where

N = estimate of Number

M = number in first sample (those marked)

n = number in second sample

m = number of 'marked' items in second sample

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 data sources, the reported diabetes is checked against a set of criteria and revised where necessary. The following algorithm (method of calculation) assesses and re-classifies reported diabetes type for some registrants on the NDSS (Box B3).

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 National Diabetes Data Working Group (NDDWG). Note that, with or without the algorithm, there will always be some level of misclassification.

Additionally, in preparing the data for the NDR, 131 cases of type 2 diabetes in children diagnosed before 1990, and who started using insulin from 1999 onwards, were identified. The NDDWG advised that, in Australia, type 2 diabetes was unlikely to have been diagnosed in children before 1990 because at this time diabetes type was classified as either insulin-treated or non-insulin-treated and as juvenile-onset or adult-onset. Therefore, if the reported diabetes type was type 2 and the age at diagnosis was under 15 for anyone diagnosed before 1990, the diabetes type was considered not derivable.

Box B3: Algorithm to derive diabetes type

APEG only or APEG and NDSS records

- If the record is sourced from APEG only, or from both APEG and NDSS, then the derived diabetes type is equal to the reported diabetes type.

NDSS-only records

If the record is sourced from NDSS only, if:

- the reported diabetes type is type 1 and the age at diagnosis is missing, then the derived diabetes type is unable to be derived
- the reported diabetes type is type 1 and the age at diagnosis is under 15:
  - if the time between diagnosis and first insulin use is missing, then the derived diabetes type is unable to be derived
  - if the time between diagnosis and first insulin use is more than 1 year, then the derived diabetes type is unable to be derived
  - if the time between diagnosis and first insulin use is less than or equal to 1 year, then the derived diabetes type equals type 1; that is, the reported diabetes type
- the reported diabetes type is type 1 and the age at diagnosis is greater than or equal to 15:
  - if the time between diagnosis and first insulin use is missing, then the derived diabetes type is unable to be derived

(continued)

Box B3 (continued): Algorithm to derive diabetes type

- if the time between diagnosis and first insulin use is more than 1 year, then the derived diabetes type equals type 2
- if the time between diagnosis and first insulin use is less than or equal to 1 year, then the derived diabetes type equals type 1; that is, the reported diabetes type

• the reported diabetes type is type 2:

- if age at diagnosis is less than 10, then the derived diabetes type is unable to be derived (apart from individual cases that were confirmed by hospital records)
- if the age at diagnosis is greater than or equal to 10, then the derived diabetes type equals type 2; that is, the reported diabetes type

• the reported diabetes type is gestational diabetes:

- if the age at diagnosis is under 14, then the derived diabetes type is unable to be derived
- if the age at diagnosis is greater than or equal to 14 and under 50, then the derived diabetes type equals gestational diabetes; that is, the reported diabetes type
- if the age at diagnosis is greater than or equal to 50, then the derived diabetes type equals type 2

• the reported diabetes type is other diabetes, then the derived diabetes type equals other diabetes; that is, the reported diabetes type.

Table B4 shows how applying the algorithm to reported diabetes type has re-classified the type for the 311,366 people who began using insulin between 2000 and 2011.

Table B4: Reported and derived diabetes type of NDR registrants, 2000–11

Reported diabetes type	Derived diabetes type					
	Type 1	Type 2	Gestational	Other	Not derived	Total
Type 1	26,578	9,693	. .	. .	34,425	**70,696**
Type 2	. .	208,755	. .	. .	49	**208,804**
Gestational	. .	54	29,119	. .	15	**29,188**
Other	. .	. .	. .	2,521	. .	**2,521**
Missing	. .	. .	. .	. .	157	**157**
Total	**26,578**	**218,502**	**29,119**	**2,521**	**34,646**	**311,366**

Source: AIHW analysis of the NDR 2011.

Derivation of variables

When data were missing, inconsistent or illogical in the NDSS and APEG data sets, variables were derived using the process outlined in Box B4.

Box B4: Derivation of variables used on the NDR

Date of first insulin injection

To derive a single date of first insulin injection using the APEG date of first insulin injection and the NDSS date of first insulin injection:

- use APEG date of first insulin injection, or
- if APEG date of first insulin injection is missing, use NDSS date of first insulin injection, or
- if both dates are missing, then date is missing.

Date of registration

To derive a single date of registration using the APEG date of registration and the NDSS date of registration:

- if two dates are the same, use either date, or
- if one date is missing, use the other date, or
- if two dates differ by less than 1 year, use the earlier date, or
- if two dates differ by more than 1 year but one date of registration is within 1 year of the date of first insulin injection, use that date of registration, or
- if two dates differ by more than 1 year and neither date is within 1 year of the date of first insulin injection, then date is missing.

Date of first insulin use

To derive a date of first insulin use for all people identified as insulin users using the derived date of first insulin injection and the date of first insulin purchase from the NDSS sales data:

- if two dates are the same, use either date, or
- if one date is missing, use the other date, or
- if two dates are different, use the earlier date, or
- if two dates are missing, then date is missing.

(continued)

Box B4 (continued): Derivation of variables used on the NDR

Date of diagnosis

To derive a single date of diagnosis using the derived date of first insulin use, derived date of registration and NDSS date of diagnosis:

APEG only or APEG and NDSS records

- use date of first insulin injection, or
- if date of first insulin injection is missing, use date of registration, or
- if date of registration is missing, use NDSS date of diagnosis, or
- if NDSS date of diagnosis is missing, then date is missing.

NDSS only records

- use NDSS date of diagnosis, or
- if NDSS date of diagnosis is missing and reported diabetes type is gestational diabetes, use date of registration, or
- if NDSS date of diagnosis is missing, then date is missing.

Age at diagnosis

To calculate age at diagnosis using the derived date of birth and derived date of diagnosis:

- if date of birth is not missing and date of diagnosis is not missing, and date of birth is earlier than or equal to date of diagnosis, then age at diagnosis is calculated as the number of years between date of birth and date of diagnosis
- otherwise, if date of diagnosis is earlier than date of birth by less than 1 month, then age at diagnosis is zero
- otherwise, if date of diagnosis is earlier than date of birth by greater than or equal to 1 month, or either date is missing, age at diagnosis is unable to be calculated.

Time between diagnosis and first insulin use

To calculate the time, in years, between the derived date of diagnosis and derived date of first insulin use:

- if date of diagnosis is not missing and date of first insulin use is not missing, and date of diagnosis is earlier than or equal to date of first insulin use, then time between diagnosis and first insulin use is calculated as the number of years between date of diagnosis and date of first insulin use
- otherwise, if date of first insulin use is earlier than date of diagnosis by less than 1 month, then time between diagnosis and first insulin use is zero
- otherwise, if date of first insulin use is earlier than date of diagnosis by greater than equal to 1 month, or either date is missing, time between diagnosis and first insulin use is unable to be calculated.

Data sources: Population data

Estimated Resident Populations

Throughout this report, population data were used to derive rates of diabetes incidence. Population data held by the AIHW are sourced from the Australian Bureau of Statistics (ABS) and are updated as revised or new estimates become available. All population estimates currently produced by ABS are based on a usual residence concept; that is, where people usually reside. These Estimated Resident Populations (ERPs) are derived from the ABS Census of Population and Housing and adjusted for deaths, births and net migration. The ERPs used in this report are based on the 2006 Census and include revised estimates for 2007 to 2011.

Australia's Aboriginal and Torres Strait Islander population is calculated from the Census. However, 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 developed experimental estimates and projections based on the 2006 Census. All calculations of rates for Aboriginal and Torres Strait Islander people in this report use the Series B projected Indigenous populations for 2006 to 2011.

Statistical methods

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. It is calculated by dividing the number of events occurring in each specified age group by the corresponding 'at risk' population in the same age group, and then multiplying the result by a constant (for instance, 100,000) to derive the rate.

Age- and sex-standardised rates

Standardisation is a technique used to enhance the comparability of data from different populations or time periods by making adjustments for the confounding effects of compositional differences in structure between the populations or subpopulations being compared (Earyes 2008). In this report, age- and sex-standardised rates facilitate comparisons between populations at different time periods when trends in incidence of insulin-treated diabetes is analysed. This standardisation process effectively removes the influence of age and sex structure on the summary rate.

This report uses the direct method of standardisation, whereby standardised rates are derived by applying the specific rates observed in the study population to a single standard population. The Australian population at 30 June 2001 (ABS 2013) was used for all age- and sex-standardisation analyses in this report. Five-year age groups were used for all age- and sex-standardisation analyses, with an upper age group of 85 and over.

The calculation of direct age- and sex-standardised rates consists of three steps:

- calculate the age specific rate for each age group by sex
- calculate the expected number of cases in each age group by sex by multiplying the age-specific rates by the corresponding standard population for each age group by sex

- sum the expected number of cases in each age group by sex and divide this sum by the total of the standard population to give the age- and sex-standardised rate.

Population groups

Australian Statistical Geography Standard

Geographic location was classified according to the ABS's Australian Statistical Geography Standard (ASGS) 2011 Remoteness Areas, which groups geographic areas into categories. These categories are defined using the Accessibility/Remoteness Index for Australia (ARIA+). ARIA+ is a measure of the remoteness of a location from the services provided by large towns or cities. Accessibility is judged purely on distance to one of the metropolitan centres, so it provides a relative indication of how difficult it might be for residents to access certain services such as health care and education.

The categories used in this publication are:

- *Major cities*
- *Inner regional*
- *Outer regional*
- *Remote and very remote*.

It should be noted that some postcodes may not map to the 2011 Census-based concordances and were not included in relevant tables. Further, some postcodes may have changed remoteness area since the 2011 Census; however, they will still be included under the area they were assigned in 2011.

Index of Relative Socio-Economic Disadvantage

Socioeconomic classifications were based on the ABS Index of Relative Socio-Economic Disadvantage (IRSD). Geographic areas are assigned a score based on attributes such as low income, low educational attainment, high unemployment and jobs in relatively unskilled occupations. It does not refer to the socioeconomic situation of a particular individual, but instead refers to the area in which a person lives. 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. Areas with high index scores may be considered less disadvantaged relative to other areas. It is important to note that high scores reflect a relative lack of disadvantage, rather than advantage, and that the IRSD relates to the average disadvantage of all people living in a geographic area and cannot be presumed to apply to all individuals living within the area.

In this report, a person's socioeconomic status was classified using their residential postcode according to the IRSD for 2011. Five population-based socioeconomic groups (fifths), based on the level of the index, were used for analyses, where group 1 represents the lowest SES fifth of the population and group 5 the highest SES.

Geographic areas may be excluded where no score is determined due to low populations or high levels of non-response in the underlying census. Additionally, some postcodes may not map to these 2011 Census-based concordances and were also excluded. Lastly, some postcodes may have changed socioeconomic group since the 2011 Census; however, they will still be included under the area they were assigned in 2011.

Aboriginal and Torres Strait Islander status

The NDR may underestimate the number of Aboriginal and Torres Strait Islander registrants with insulin-treated diabetes for a number of reasons including:

- non-identification of Aboriginal or Torres Strait Islander origin
- limitations in the collection of Indigenous status on the NDSS form before 2005
- Indigenous people with diabetes not registering with the NDSS because they can access programs other than the NDSS to access diabetes-related products.

Non-identification of Indigenous Aboriginal or Torres Strait Islander origin

Identifying as being of Indigenous origin on both data sources of the NDR (APEG and NDSS) is voluntary. Among those who began using insulin in 2005–2011 and registered on the NDSS from 2005 onwards, the Indigenous status was not stated or inadequately described in 16% of cases. Note that there were 112,764 registrants who began to use insulin in the 2005–2011 period, but registered with the NDSS before 2005 and were excluded from analysis due to data quality issues.

NDSS form limitations before 2005

On the NDSS registration form before 2005, if the response to the Indigenous status question was not completed the registrant was recorded as non-Indigenous, rather than not stated. This may have overestimated the number of non-Indigenous registrants and consequently underestimated the number of Indigenous registrants.

In early 2005, the NDSS database was amended so that an additional category indicated where the Indigenous status of the registrant was not-stated or was not well enough described so as to make a determination. Therefore, in the absence of information, 'not stated' became the default value (Health Data Standards Committee 2006).

Accessing programs other than the NDSS

Low registration rates for the NDSS, and subsequently the NDR, among Aboriginal and Torres Strait Islander people may be due to the ability of Indigenous people to access other programs. For example, programs such as Section 100 of the *National Health Act 1953*, Aboriginal Medical Services and the National Aboriginal Community Controlled Health Organisation are designed to provide access to the diabetes-related products that people with insulin-treated diabetes require.

In addition, NDSS Access Points are not always available in remote areas, limiting access to NDSS services.

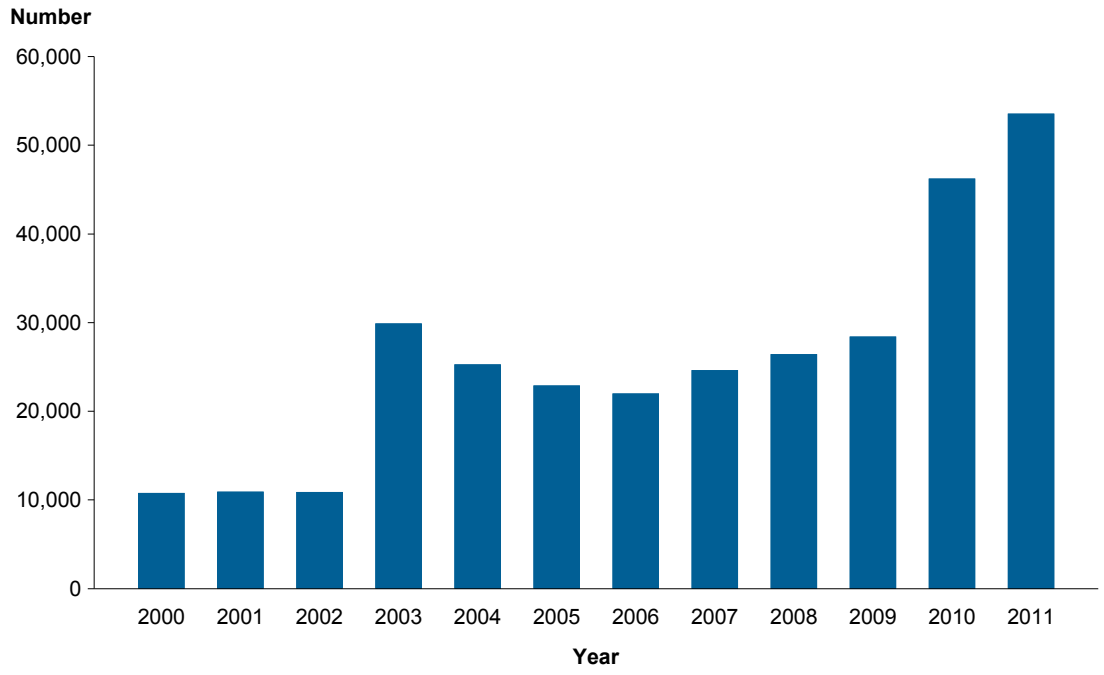
Trend analysis

Trend analysis has been presented only for type 1 diabetes because the requirement of insulin for this type of diabetes means that it is more likely that people with type 1 diabetes will be registered on the NDSS and actively purchasing products to administer insulin.

Initial examination of the incidence of insulin-treated type 2 diabetes and insulin-treated gestational diabetes highlighted that interpretation of trends may be problematic because there were substantial increases in both type 2 diabetes and GDM in 2003 and 2010 (Figure B1). Several factors may have had an impact on the number of people captured by the database, resulting in the increases in insulin-use observed:

- changing treatment regimens for the administration of insulin.

- a move towards universal screening for GDM escalating from 2005. In addition, from 2009 to 2011 the NDSS initiated a GDM register accompanied with an educational campaign (Diabetes Australia 2013b). The implementation of these projects may have resulted in an increasing number of people being screened for GDM, and consequently registering with the NDSS.
- the NDSS registration process itself, whereby health professionals may indicate on NDSS registration forms that a person is insulin-requiring in anticipation for the commencement of insulin treatment in future, which may not eventuate. See 'Determining who is on the NDR' for more information about this.
- potential impact of changes to the NDSS database system. The NDSS database has undergone two major structural changes: the new system implemented in 2002 improved the data fields collected and in 2010, there was a change to the retention of historical information so that any alteration to information was not permanently overwritten.



Note: The increase in the number of people beginning to use insulin in 2003 and 2010 is partly related to structural changes to the NDSS database in 2002 and 2010 resulting in improved levels of checking and information retention.

Source: AIHW analysis of the NDR 2011.

Figure B1: Derived incidence of insulin-treated diabetes, Australia 2000–11

Joinpoint analysis

A joinpoint regression model describes changing trends over successive segments of time and the amount of change within each segment. Trends are characterised by joined linear segments; a joinpoint is created where 2 segments meet, thus representing a statistically significant change in the trend. It is important to note that, although the joinpoint analysis identifies a particular point in time where a trend changes, in reality changes in trends are not usually abrupt, depending on the underlying cause of the change.

The joinpoint software takes trend data in the form of age-standardised rates and fits the simplest joinpoint model possible, where there is a minimum number of segments necessary to characterise a trend. The software begins with a model with zero joinpoints (that is, no changes in trend) and incrementally tests whether more joinpoints are statistically significant. The number of significant joinpoints is identified through performing several permutation tests and each *p*-value is found using Monte Carlo methods.

The software used to perform joinpoint analysis was Joinpoint Version 3.4.3, developed by the Statistical Research and Applications Branch of the National Cancer Institute in the United States of America (National Cancer Institute 2011). This software has been used frequently in the diabetes field to examine trends (Eurich et al. 2008; Wang et al. 2006; Yangfeng et al. 2012).

Glossary

blood glucose: The main sugar that the body makes from food. Glucose is carried though the bloodstream to provide energy to all cells in the body. Cells cannot use glucose without the help of insulin.

diabetes: A chronic condition in which the body is unable to regulate its blood glucose (sugar), the main source of energy for the body's cells. The pancreas makes the hormone insulin, which controls the amount of glucose in the blood and moves it from the blood into the cells where it is converted into energy or stored until needed. When glucose is absorbed into the bloodstream, it stimulates the pancreas to produce insulin. Diabetes occurs when the pancreas is unable to make sufficient insulin, or when the body does not respond adequately to insulin.

diabetic ketoacidosis: in the absence of insulin, glucose is unavailable as an energy source for the body's needs and fat is broken down for use as an alternative energy source. This breakdown of fat results in an accumulation of ketones, and an increased acidity of the blood, which can be life-threatening if not treated.

gestational diabetes: Gestational diabetes mellitus (GDM) develops in some women during pregnancy but usually passes when the pregnancy is over. However, women who have had GDM are at greater risk of developing *type 2 diabetes* later in life. GDM also increases the risk of perinatal morbidity and mortality. Women who had their diabetes diagnosed before a pregnancy do not fall into this category.

hypoglycaemia: Low blood glucose level, which occurs if the person with diabetes has injected too much insulin, eaten too much food, had too much alcohol or exercised without additional food.

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

insulin: A hormone produced by the pancreas, its main action is to enable body cells to absorb glucose from the blood and use it for energy.

insulin-treated diabetes: All types of diabetes treated with insulin; includes type 1, type 2, gestational and other types of diabetes. It is a term used to describe those on the NDR and is not a standard classification used in clinical practice.

other types of diabetes: There are a number of conditions or syndromes that come under this category, such as genetic defects of beta-cell function, endocrine diseases and infections; these are relatively uncommon.

type 1 diabetes: Mostly arises in childhood or young adults, though it can occur at any age. It is marked by the inability to produce insulin. People with type 1 diabetes need insulin replacement for survival. Most cases are caused by an autoimmune condition that destroys the pancreatic cells that produce insulin.

type 2 diabetes: The most common form of diabetes, and occurs mostly in people aged 40 and over. People with type 2 diabetes produce insulin but may not produce enough or cannot use it effectively. Some cases may be managed with changes to diet along with increased exercise and weight loss. Many cases require drugs as well, namely oral glucose-lowering drugs that work on the pancreas. Many others require insulin in addition to other treatments.

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Incidence of insulin-treated diabetes in Australia 2000–2011 presents the latest available national data on new cases of insulin-treated diabetes from Australia's National Diabetes Register.

In 2011, there were 2,367 new cases of type 1 diabetes in Australia, equating to 11 new cases per 100,000 population. This rate has remained stable over the last decade, with between 10 and 12 new cases per 100,000 population per year.